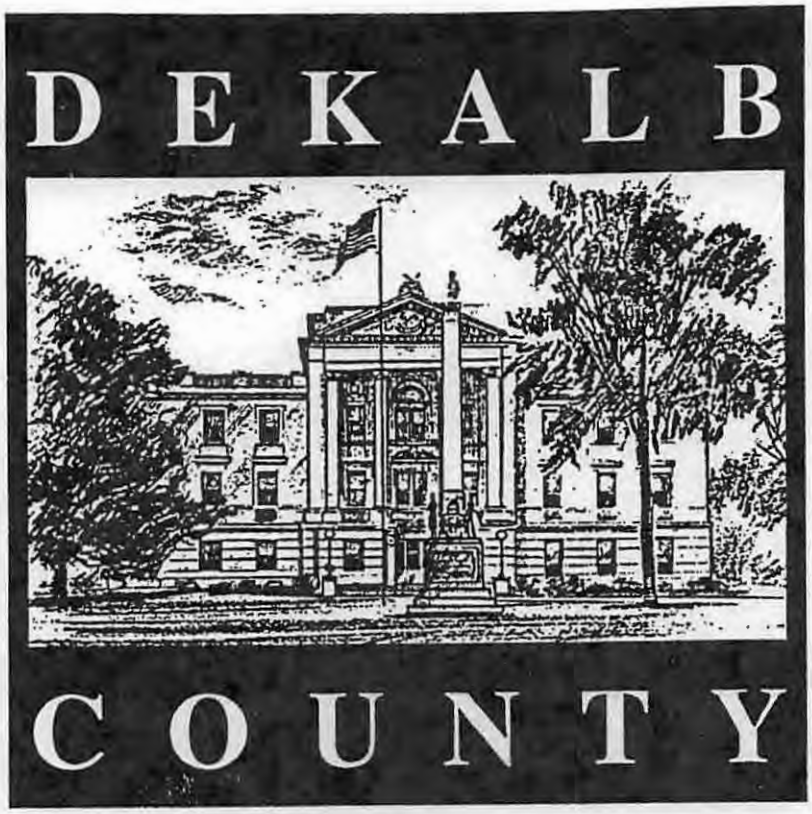
DEKALB COUNTY

VOLUME I - SOLID WASTE MANAGEMENT ALTERNATIVES



Prepared By:

PATRICK
ENGINEERING INC.

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CHAPTER 1
INTRODUCTION

This report is the first volume of DeKalb County's Phase II Solid Waste Management Plan (the Plan). This report presents technical analyses of the various options available to the County for the management of its solid waste during the next 20 years. Data from the DeKalb County Phase I Waste Management Needs Assessment is utilized in these analyses. The Needs Assessment and this report provide the foundation upon which policy recommendations are made in Volume II of the Plan. The remainder of this chapter discusses briefly how this Volume I report is organized.

Chapter 2 presents an overview of legislation which relates to solid waste planning. The chapter discusses: 1) general federal, state and local solid waste legislation; and 2) the roles and responsibilities of county, municipal, township, state, and federal government, as well as private enterprise and citizens.

Chapter 3 presents an analysis of source reduction and reuse options for DeKalb County. The chapter discusses: 1) the background on source reduction and reuse; 2) source reduction and reuse methods; 3) barriers that inhibit voluntary source reduction and reuse; 4) policies to encourage source reduction and reuse; and 5) recommendations on source reduction and reuse policy for the County.

Chapter 4 presents an analysis of the reduction and management of hazardous waste generated by households and exempt businesses of the County. The chapter discusses the following: 1) the background of toxicity reduction and hazardous waste; 2) the presence and impact of toxic materials in the waste management system; 3) alternative products and management methods for household hazardous waste; 4) policies to encourage toxicity reduction and responsible disposal of toxic materials; and 5) recommendations for the County to encourage toxicity reduction and ensure proper disposal of toxic materials from households and conditionally exempt small quantity generators.

Chapter 5 presents an analysis of recycling options. The chapter discusses: 1) background on recycling; 2) the existing recycling systems in the County; 3) recycling collection and processing alternatives; 4) recycling markets; 5) policies to encourage recycling; and 6) recommendations for the County's recycling system to meet the State's recycling goals.

Chapter 6 presents an analysis of intermediate facilities. The chapter discusses: 1) background; 2) transfer station technology; 3) mixed waste processing facilities; 4) refuse-derived (RDF) technology; 5) siting considerations; 6) permitting and environmental impacts; 7) transportation alternatives; 8) facility sizing; 9) economic analysis; 10) implementation and 11) recommendations.

Chapter 7 presents an analysis of municipal waste (MW) composting, green waste composting, landscape waste composting and wet/dry collection systems. The chapter discusses: 1) background; 2) the existing landscape waste management system in the County; 3) landscape waste collection and management; 4) mixed municipal waste (MW) composting); 5) green waste composting; 6) wet/dry collection systems; 7) siting and permitting considerations; 8) environmental concerns; 9) economics of MW composting; 10) advantages and disadvantages of technologies; 11) implementation; and 12) recommendations.

Chapter 8 presents an analysis of incineration options. The chapter discusses: 1) trends in incinerator development in Illinois; 2) technology and configuration; 3) waste stream composition and quantification; 4) air pollution control regulations; 5) permitting process; 6) air pollution control technology; 7) ash management; 8) energy recovery; 9) implementation issues; 10) economic analysis; and 11) recommendations.

Chapter 9 presents an analysis of landfilling options. This chapter discusses pertinent information about the County's landfill options including: 1) existing landfill capacity and the impact of new regulations; 2) projected disposal capacity requirements; 3) regulatory overview; 4) landfill site selection; 5) solid waste processing evaluation; 6) landfill design; 7) landfill economics; and 8) landfill recommendations for the County.

Chapter 10 presents an analysis of public involvement and education. The chapter discusses: 1) technical background of public involvement and education; 2) the status of existing public involvement and educational efforts in DeKalb County; 3) the need for public involvement and education; 4) steps to develop a public involvement/education strategy; 5) public involvement methods; 6) education methods; and 7) recommendations.

Chapter 11 presents an analysis of Illinois' statutes concerning implementation options available to the County. The chapter discusses: 1) the Solid Waste Planning and Recycling Act; 2) the Local Solid Waste Disposal Act; 3) the Intergovernmental Cooperation Act; 4) the Solid Waste Disposal District Act; 5) advantages and disadvantages of the implementation options authorized by State statute; and 6) recommendations.

The appendices provide information to supplement chapter 9.

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CHAPTER 2
PLANNING BACKGROUND

Until the 1970's, the management of solid waste throughout Illinois, and the entire nation, was largely unregulated. Open dumping, littering and burning were methods commonly used to manage solid wastes. Waste management was primarily a local problem and few states had enacted any type of solid waste laws. Municipal ordinances, rather than state or federal regulatory controls, were the only solid waste regulations for most of the nation's history. During the 1960's and 1970's, however, municipal, environmental, public interest and industry groups pressured state and federal governments to act to avoid the potential problems posed by shrinking landfill capacity and the improper disposal of waste, and prompted them to enact solid waste management legislation and regulations. Thus, in 1970 the State of Illinois enacted the Illinois Environmental Protection Act and in 1976 the federal government enacted the Resource Conservation and Recovery Act (RCRA). These pieces of legislation, among others, have fundamentally affected the management of solid waste in Illinois and have begun to define the roles for federal, State and local governments, as well as private industry and citizens, to effectively plan for and manage solid waste. This section reviews the primary federal and state legislation and regulations affecting solid waste planning and implementation, and outlines the roles and responsibilities of counties, municipalities, townships, state government, federal government, private enterprize and citizens in the solid waste management planning and implementation process. Further discussion on solid waste legislation and regulations, as it relates to each solid waste management component, is provided in the following chapters of this report.

LEGISLATIVE/REGULATORY BACKGROUND

Federal Government. The environmental movement in the 1960's and 1970's led to the passage of the Solid Waste Disposal Act of 1965 and the Resource Conservation and Recovery Act of 1976. These federal legislative acts are briefly discussed below.

Solid Waste Disposal Act of 1965. The Solid Waste Disposal Act, as amended by the Resource Recovery Act of 1970, is known to be the first significant piece of federal legislation which addressed solid waste management. The Act provided technical and financial assistance to states and local governments in the planning and development of resource recovery and other solid waste disposal technologies, although it is important to note that the Act did not provide any regulatory control for the management of solid waste. The purposes of this Act, as amended, included:

- To promote the demonstration, construction, and application of solid waste management and resource recovery systems which preserve and enhance the quality of air, water and land resources;
- To provide technical and financial assistance to states and local governments and interstate agencies in the planning and development of resource recovery and solid waste disposal programs
- To promote a national research and development program for improved management techniques, more effective organizational arrangements, and new and improved methods of collection, separation, recovery, and recycling of solid wastes, and environmentally safe disposal of nonrecoverable residues;
- To provide for the promulgation of guidelines for solid waste collection, transport, separation, recovery, and disposal systems; and
- To provide for training grants in occupations involving the design, operation, and maintenance of solid waste disposal systems.

Resource Conservation and Recovery Act (RCRA) of 1976. RCRA is considered to be the single most important piece of federal legislation affecting the management of solid waste. Although RCRA was passed as comprehensive solid waste management legislation, its main focus has been on the management of hazardous waste, landfill disposal and procurement of materials made from recovered wastes. RCRA has been amended twice since 1976; once in 1980 and most recently in 1984. The 1984 amendment, called the Hazardous and Solid Waste Amendment significantly expanded both the scope and detailed requirements of RCRA. RCRA is presently up for reauthorization and numerous bills have been introduced which may place more emphasis on waste reduction and recycling.

Solid waste is regulated under Subtitle D of RCRA. The primary goal the of Subtitle D program is to encourage solid waste management practices that promote environmentally sound disposal methods, maximize the utilization of resources recovered from waste and foster resource conservation. The USEPA is charged with implementing RCRA.

RCRA Subtitle D strongly encourages states to develop and adopt statewide solid waste management plans which foster intergovernmental and public/private cooperation. Generally, the state plans attempt to comprehensively assess solid waste generation and management within the State and spell out the State's anticipated direction toward managing its waste during a specific time period. The USEPA's role has been limited to setting the minimum regulatory requirements that states must follow in designing their plans and approving plans that comply with these requirements. The development of state plans is voluntary and the responsibility for developing and implementing plans lies with each state. Federal financial and technical assistance to states was offered as an incentive to develop the plans. However, the availability of federal funding ended in the early 1980's, and as a result it is unlikely that several state plans will be formally approved by the EPA. Despite the lack of federal funding, many states have continued the planning process for their own purposes. Since a variation among state plans exists, future RCRA reauthorization could require that States submit uniform plans which address certain issues with national implications. Some issues to be addressed by these plans could include disposal capacity assurances, siting processes and reporting requirements for composition and generation data.

State Government. The power to regulate solid waste remains essentially local, rather than federal. The great majority of rules that regulate municipal waste are state environmental agency rules, adopted under enabling laws that deal with solid waste. This section will discuss Illinois legislation relative to solid waste management planning, including the Illinois Environmental Protection Act, statewide solid waste planning, the Solid Waste Management Act, the Local Solid Waste Disposal Act, the Solid Waste Planning and Recycling Act and Title 35, Subtitle G of the Illinois Administrative Code.

Illinois Environmental Protection Act of 1970 ("Act"). The Act set forth the basic environmental regulatory structure for the State of Illinois. Although the Act has been amended by the Illinois legislature many times since it was first enacted in 1970, its purpose has essentially remained the same:

> To establish a unified, state-wide program supplemented by private remedies, to restore, protect and enhance the quality of the environment, and to assure that adverse effects upon the environment are fully considered and borne by those who cause them.

The Act created three agencies to administer environmental regulation and enforcement in Illinois. The Illinois Pollution Control Board ("Board") promulgates administrative regulations, which may be proposed by any state agency or interested person, and adjudicates enforcement actions, permit appeals, variance requests, and petitions for site-specific relief from Board regulations. The Illinois Environmental Protection Agency ("IEPA") is responsible for monitoring contaminant sources; issuing permits; developing and proposing regulations; and collecting various waste disposal and permit fees imposed by the Act. While the Act also empowers the IEPA to bring complaints for violations of the Act, IEPA must rely upon the Illinois Attorney General's Office to file and prosecute these actions. The third agency created by the Act, the Illinois Department of Energy and Natural Resources ("DENR"), originally known as the Institute for Environmental Quality, was initially responsible for technical research, although its role has gradually expanded since 1978 when the agency was renamed. These agencies are given specific authority in the Act to deal with all types of environmental pollution, including pollution of air, water, drinking water and land, as well as pollution by noise.

Statewide Solid Waste Planning. Responding to federal encouragement to develop a statewide solid waste management plan, the State of Illinois developed and released a study in 1981 entitled Municipal Waste Management Alternatives Including Resource Recovery for the State of Illinois. This report, which was primarily an alternatives analysis, was used to provide background data for the IEPA to use in its future programmatic strategies concerning municipal waste and resource recovery in Illinois. Although the State of Illinois has not developed or adopted an official statewide solid waste management plan meeting the minimum requirements

of RCRA, the Alternatives Report is viewed as an important first step for the State of Illinois to assess its role in the planning and implementation of solid waste management programs. Subsequent to the report, the State legislature, realizing that solid waste management is largely a local issue, delegated the primary authority of solid waste planning and implementation to counties and local government units.

The Solid Waste Management Act of 1986 (415 ILCS 20/1 et seq.). The purpose of this Act is to reduce reliance on land disposal of solid waste, to encourage and promote alternative means of managing solid waste and to assist local governments with solid waste planning and management. In furtherance of those aims, while recognizing that landfills will continue to be necessary, the Act establishes the following waste management hierarchy, in descending order of preference, as State policy:

1. Volume reduction at the source;
2. Recycling and reuse;
3. Combustion with energy reduction;
4. Combustion for volume recovery;
5. Disposal in landfill facilities.

Provisions of the Act include the following:

- Required the Department of Central Management services to establish a pilot state recycling program and to determine the feasibility of expanding the State's program.
- Requires the IEPA to publish a report regarding the projected disposal capacity available for solid waste in sanitary landfills subject to surcharge fee requirements.
- Requires DENR, in cooperation with the IEPA, to maintain a central clearinghouse of information.
- Authorizes DENR to provide recycling grants for the purposes of increasing the quantity of materials recycled.

- Created the Solid Waste Management Fund comprised from funds collected from the owner or operator of each sanitary landfill permitted or required to be permitted by the IEPA to dispose of solid waste pursuant to the Act. The fee amounts to $0.60 per cubic yard, or $1.27 per ton, prior to 1994, and to $0.45 per cubic yard, or $0.95 per ton, beginning in 1994.

- Authorizes the IEPA to provide financial assistance to units of government in planning for the management of solid waste.

- Authorizes the IEPA to provide financial assistance to units of government for the performance of inspecting, investigating and enforcement activities of disposal sites.

- Authorizes the IEPA to support the operations of an industrial materials exchange service.

- Allows units of local government to establish a fee with regard to the receipt or disposal of solid waste to be utilized for waste management purposes. this fee amounts to $0.45 per cubic yard, or $0.95 per ton to 1994, and to $0.60 per cubic yard, or $1.27 per ton, beginning in 1994.

Local Solid Waste Disposal Act (LSWDA) of 1986 (415 ILCS 10/1 et seq.). It is the purpose of this Act and the policy of the State to protect the public health and welfare and the quality of the environment by providing local governments with the ability to properly dispose of solid waste within their jurisdictions by preparing and implementing, either individually or jointly, solid waste management plans for the disposal of solid waste and, to the extent technically and economically feasible, to efficiently use by-products generated using the disposal process. It should be noted, however, this Act is considered to be more enabling legislation than a legislative mandate. Provisions of the LSWDA, as amended, include:

- Units of local government may, on their own behalf or pursuant to an intergovernmental agreement, prepare solid waste management plans for the disposal of solid waste generated within their jurisdiction. Such plans are to include certain provisions.

- If a incinerator shall be the means used by a facility to meet waste disposal needs within a jurisdiction, the facility shall be deemed a qualified solid waste energy facility if it meets certain provisions.

- A unit of local government may enter into intergovernmental agreements to prepare and implement solid waste management plans, and may adopt those

procedures for the preparation and implementation of plans the contracting parties deem appropriate.

- An annual report, including specific provisions, shall be prepared on the implementation, review and updating of the solid waste management plan.

- Units of local government may provide by ordinance, license, contract or other means that the methods of disposal of solid waste shall be the exclusive methods of disposal to be allowed within their respective jurisdictions, notwithstanding the fact that competition may be displaced or that such ordinance, license, contract or other measure may have an anti-competitive effect.

In effect, the LSWDA grants units of local government the authority to develop and implement solid waste management plans. An important part of that authority is the ability of the local government to specify exclusive methods of waste disposal, regardless of the fact that competition may be displaced or that such an action may have an anti-competitive effect. Thus, the LSWDA grants units of local government the power to control the flow of waste that is generated within their jurisdiction, and to direct waste to a particular business.

Solid Waste Planning and Recycling Act of 1988 (415 ILCS 15/1 et seq.). The purposes of this Act, as amended, were to provide incentives for decreased generation of municipal waste, to require counties to develop comprehensive waste management plans that place substantial emphasis on recycling and other alternatives to landfills, to encourage municipal recycling and source reduction, and to promote composting of yard waste. Provisions of the Act are summarized below.

Waste Management Plans:

- By March 1, 1991 each county with a population of 100,000 or more and each municipality with 100,000 or more, and by March 1, 1995, each county with a population less than 100,000 shall submit to the agency an officially adopted plan for the management of municipal waste generated within its boundaries. Such a plan shall conform with the waste management hierarchy established by the State.

- The IEPA shall review each county waste management plan to ensure consistency with this Act and, if warranted, return it to the county with recommendations for improving the plan.

- Each plan shall contain at a minimum, the following provisions: description of the origin, content and weight or volume of municipal waste currently generated within the county's boundaries, and the origin, content, weight or volume of municipal waste that will be generated within the county's boundaries during the next 20 years, including an assessment of the primary variables affecting this estimate and the extent to which they can reasonably be expected to occur; a description of the facilities where municipal waste is currently being processed or disposed of and the remaining available permitted capacity of such facilities; a description of the facilities and programs that are proposed for the management of municipal waste generated within the county's boundaries during the next 20 years, included but not limited to their size, expected cost and financing method; an evaluation of the environmental, energy, life cycle cost and economic advantages and disadvantages of the proposed waste management facilities and programs; a description of the time schedule for the development and operation of each proposed facility or program; the identity or potential sites within the county where each proposed waste processing, disposal and recycling program will be located or an explanation of how the sites will be chosen. For any facility outside the county that the county proposes to utilize, the plan shall explain the reasons for selecting such facility; the identity of the governmental entity that will be responsible for implementing the plan on behalf of the county and explanation of the legal basis for the entity's authority to do so; and any other information that the Agency may require.

- Any county may delegate power to a municipality for the specific purpose of preparing the waste management plan.

- Counties may, by intergovernmental agreement, jointly create and administer their solid waste management plans, provided that such joint plans fulfill the requirements of the Act.

Advisory Committee/Plan Development/Review and Comment/Adoption/Updates:

- Prior to adopting a solid waste plan, the county shall form an advisory committee, which shall include representatives from municipalities within the county, citizen organizations, industry, the private solid waste management industry operating within the county and local recyclers. The advisory committee shall review the plan during its preparation, make suggestions and propose any changes it believes appropriate.

- The County should provide public written notice to all municipalities and interested members of the public when plan development begins and should provide written progress reports to such entities concerning the preparation of the Plan.

- The County must go through a review, comment and adoption process specified by the Plan. More specifically "the Plan submitted to the governing body of the county for adoption shall be accompanied by a document containing written

responses to substantive comments made during the comment period". In addition "the governing body of the county shall adopt a plan within 60 days from the end of the public comment period".

- The plan shall be updated and reviewed every 5 years.

- The IEPA should assist counties in formulating plans and make grants available for units of local government for planning purposes.

Recycling Program:

- The plan is required to include a recycling program with the following summarized provisions: shall be implemented throughout the county and include a time schedule for implementation of the program; shall provide for the designation of a recycling coordinator to administer the program; shall be designed to recycle, by the end of the third and fifth years, respectively 15% and 25% of the municipal waste generated in the county, subject to the existence of viable markets for recycled material based on measurements of recycling and waste generation in terms of weight; may provide for the construction and operation of one or more recycling facilities by a unit of government, or for contracting with other public or private entities for the operation of recycling centers; may require residents of the county to separate recyclable materials at the time of disposal or trash pick-up; may make special provisions for commercial and institutional establishments that implement their own specialized recycling programs, provided that such establishments provide written documentation of the total number of tons of materials recycled; shall provide for separate collection and composting of leaves; shall include public education and notification programs to foster understanding of and encourage compliance with the recycling program; shall include provisions for compliance, including incentives and penalties; shall include provisions for recycling the collected materials, identifying potential markets for at least 3 recyclable materials and promoting the use for products made from recovered or recycled materials among businesses, newspapers and local governments in the county; and may provide for the payment for recycling diversion credits to public and private parties engaged in recycling activities.

Implementation Plans and Programs:

- Each county shall begin implementation of its plan, including the recycling program, within one year of adoption of the plan.

- In implementing the recycling program, consideration for the collection, marketing and disposition of recyclable materials shall be given to persons engaged in the business of recycling within the county whether or not the persons were operating for profit.

- DENR shall assist counties in implementing recycling programs under this Act, and may make grants or loans available from the Solid Waste Management Fund to counties of other local units of government that are implementing approved waste management plans.

Plastic Containers/Coding:

- Beginning, January 1, 1992, no person shall offer for sale any single use plastic bottle with a capacity of 16 fluid ounces or more, nor any other single use rigid plastic containers with a capacity of 8 fluid ounces or more, that is not coded in a manner to assist recyclers in sorting such containers by resin composition as specified in the Act.

Sale of Beverages in Plastic Cans:

- No person may sell or offer for sale at retail to consumers in this State any beverage packaged in a plastic can unless such person has first demonstrated to the satisfaction of the Agency certain provisions specified in the Act.

Violations:

- Violations of the act include failure to adhere to the schedule set forth for adopting and reviewing a waste management plan and failure to implement the recycling component of an adopted plan.

Civil Penalty:

- Any person that violates any provision of this Act shall be liable for a civil penalty not to exceed $5,000 for such violation.

- The State's Attorney, any person of the County, or the Attorney General at the request of the IEPA may institute a civil action against any violator of the Act.

- Any funds collected shall be deposited in the Solid Waste Management Fund.

Title 35, Subtitle G, Illinois Administrative Code. Title 35, Subtitle G outlines the State's rules and regulations of the Pollution Control Board regarding waste disposal. The rules and regulations include provisions for the following: general provisions, permits, hazardous waste operating requirements, underground injection control program, special waste operating requirements, general waste operating requirements, certifications, Illinois "Superfund" program, solid waste and special waste hauling, used and waste tires.

ROLES AND RESPONSIBILITIES

Decision makers must develop the best possible alternatives for local solid waste management by ensuring that all local, state and federal legislative factors, as well as private enterprise and concerned members of the larger community, are accounted for in the planning process. Considering the complexity and legal requirements of solid waste management, it is important to clarify the roles and responsibilities of government units, the private sector and citizens in managing the County's solid waste. This section will review the roles and responsibilities of the county, municipal, township, state and federal government, as well as private enterprise and citizens.

County Government. County government has the primary responsibility for planning for the ultimate disposal of waste generated within the county and implementing a comprehensive and integrated waste management plan. In effect, the county is responsible for providing or otherwise assuring that a system is in place to manage the County's solid waste for the next 20 years as well as designing and implementing a recycling system which will meet the State's recycling goals. It is critical that County government attempt to work in partnership with other units of government, industry and citizens to effectively plan and implement the County's solid waste management plan.

The LSWDA provides the County with the authority to regulate and control the disposal of solid waste generated in the county once a County Board adopts a solid waste plan, although the County does not have the authority to control the collection of waste within a municipality. The General Attorney has issued an opinion which states that a county is generally authorized to require implementation of recycling programs in both incorporated and unincorporated areas of the county. This interpretation states that the SWPRA grants the County authority to mandate that residents of the County separate recyclable materials at the time of disposal or refuse pick-up recycling throughout the County, even in the unincorporated areas of the County.

County government will be largely responsible for coordinating local programs with State and federal programs and funding sources. County government may play an active role in conducting the public education programs and disseminating information to foster public participation during the planning and implementation process. The County government should strive to set a good example by purchasing recycled and recyclable products whenever possible, and by handling their own wastes in a way that facilitates source reduction, reuse and recycling.

Municipal Government. Municipal governments historically have had the responsibility to coordinate, provide or otherwise assure that a collection system for refuse, recyclables and landscape waste is in place for municipal residents. Municipal governments either offer a range of public services from curbside collection to drop-off services; contract services partially or entirely to a non-profit or for-profit service organization(s); or have residents privately arrange for services. The four types of contractual arrangements typically used for collection within Illinois municipalities are described below:

- **Municipal Service.** Under this arrangement, municipal employees collect waste with municipally owned equipment.
- **Municipal Contract.** Under this arrangement, one or more private haulers operate under contract to the municipality. The municipality collects fees or taxes and then pays the waste hauler(s) for contracted services.
- **Franchise Contract.** Under a franchise structure, the municipality grants or sells hauling privileges (franchises) to one or more private haulers for waste collection services in the municipality. The fees are collected directly from the customer by the waste hauler(s).
- **Private Contract.** Under private contract collection, the individual resident or business contracts directly with the private waste hauler for waste collection services. The only involvement by the municipality is the possible licensing of solid waste haulers.

In order to effectively manage collection programs, it may be advantageous for municipal governments to develop and adopt local ordinances to encourage or facilitate specific solid waste programs. Municipal governments may also find it necessary to personalize education and information programs for their communities and residents to maximize awareness

and stress the importance of individual participation. Municipal governments should demonstrate leadership through incorporating model solid waste programs within their operations.

Municipal governments should attempt to work in partnership with other units of government, industry and citizens to effectively plan and implement an integrated waste management system which is consistent with the County's solid waste management plan.

Township Government. Historically, township governments have had a limited role in developing or implementing collection programs for unincorporated township residents, other than perhaps providing a drop-box on township property for the collection of recyclables or handling resident's landscape waste. In most cases, collection services in unincorporated areas of townships are privately arranged by residents. To encourage recycling within unincorporated areas of townships, 60 ILCS 120/1 et seq. permits township governments to adopt, by ordinance, rules or regulations relating to recycling programs as deemed necessary in unincorporated areas of the township. Furthermore, 415 ILCS 15/7 states that a township within the county may continue to operate a recycling program which substantially conforms with or exceeds the requirements of the recycling program included in the county's waste management plan and that a township may at any time adopt and implement a recycling program that is more stringent than the County's recycling program. The provision of a recycling service may require coordination between county, township and municipal officials.

Township governments may find it necessary to personalize education and information programs for their communities and residents to maximize awareness and stress the importance of individual participation. Township governments should demonstrate leadership through incorporating model solid waste programs within their operations.

Township governments should attempt to work in partnership with other units of government, industry and local citizens to effectively plan and implement an integrated waste management system which is consistent with the County's solid waste management plan.

State Government. The State of Illinois, through departments including the Illinois Environmental Protection Agency and the Department of Energy and Natural Resources, may assist in developing and implementing the County's integrated waste management program by providing technical and financial assistance, issuing regulations, demonstrating leadership and developing education programs. The state agencies may provide the County with technical assistance on collection, hauling, processing, marketing, disposal or procurement. The agencies may also encourage certain types of local waste management practices by making solid waste grant funding available. The IEPA has made funds available to counties for Phase I and Phase II solid waste planning studies and is expected to fund Phase III implementation projects to some extent as well. DENR currently has established recycling grant programs that address local needs of recycling.

Federal Government. The United States Government, through several departments including the Environmental Protection Agency, may take a role in waste management by establishing national goals, demonstrating leadership, developing education programs, providing technical and financial assistance and issuing regulations. The federal government also has a role in establishing a framework for State and local planning; setting minimum standards for solid waste facilities; and encouraging the manufacturing industry to design products and packaging for effective waste management, as well as to utilize secondary materials in manufacturing.

Historically, local and state governments have taken a lead in solid waste management and the federal government has had a limited role. However, the federal government's role may expand as the national implications of increased solid waste generation become more evident. Areas where federal action is likely to occur includes interstate transport of waste and a national materials usage policy.

Private Enterprise. Waste management companies, including local haulers, recyclers, processors, end markets and disposal facilities, have a responsibility for planning and implementing waste management systems that are consistent with their County's solid waste management plan. Private enterprise should attempt to work in partnership with units of

government, industry and citizens to effectively plan and implement integrated waste management systems and to educate the public.

Citizens. Citizens, as well as private and public entities, have a responsibility to learn how their purchasing, usage, handling and disposal of products and materials impacts the waste management system. Citizens should assume responsibility for the waste they create and attempt to recognize the true costs of disposing of their waste. Citizens should strive to stay apprised of local solid waste management initiatives; provide input throughout the planning and implementation process; and make educated decisions regarding the local management of solid waste.

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CHAPTER 3
SOURCE REDUCTION AND REUSE

Source reduction is a front-end approach to waste management that attempts to prevent waste from being generated in the first place, thus avoiding the expenses involved in collecting, recycling, treating and disposing of waste after it has been generated. Reuse, is also a front-end approach to waste management, which attempts to prevent wastes from being discarded. This chapter deals primarily with the source reduction of waste and the reuse of materials. Although toxicity reduction is a form of source reduction, this topic is more thoroughly discussed in Chapter 4. This chapter discusses: 1) background on source reduction and reuse; 2) source reduction and reuse methods; 3) barriers that inhibit voluntary source reduction and reuse; 4) policies to encourage source reduction and reuse; and 5) the recommended source reduction and reuse program for DeKalb County.

BACKGROUND

In order to provide some background information regarding source reduction and reuse for the development of policy alternatives, this section reviews definitions, source reduction priorities and related concepts pertaining to source reduction and reuse.

Definitions. Definitions regarding source reduction and reuse are provided below to assist the reader. Since legal definitions have not been adopted by the State Legislature for these terms, the definitions provided have been developed from language used from a combination of professional sources.

On-site Composting. On-site composting is the controlled biodegradation of leaves, grass clippings, and/or other yard wastes on the site where they are generated.

Source Reduction. Source reduction is the process of reducing the quantity of waste before the products are manufactured, packaged, distributed, purchased, used and discarded. In

essence, source reduction is the prevention of waste or the reuse of materials before they become "waste". It can also include "on-site recycling" or the use of in-house scrap in the manufacturing process. Source reduction occurs primarily through six methods: redesign of manufacturing processes, redesign of products, redesign of product packaging for distribution and display, changes in consumers' purchasing decisions, changes in consumers' use and disposal habits and the on-site management of landscape waste.

Reuse. Reuse is the process of using a product in its same form as much as possible before the product reaches the end of its useful life and is discarded. Reuse attempts to recapture the value and usefulness of materials which remains after their original use has been exhausted.

Volume-Based Collection. Volume-based collection refers to a system in which fees for solid waste services are based on the volume of refuse discarded.

Waste Reduction. Waste reduction is generally defined more broadly than source reduction as an activity which reduces the volume of waste which must be landfilled. Waste reduction can occur through source reduction, reuse, recycling, shredding, compacting, baling or incineration of waste before landfilling. Source reduction is the most preferred alternative among these.

Source Reduction Priorities. Determining the most beneficial source reduction method is difficult because an action to decrease one type of waste may cause an increase in waste of a different type or during a different stage of the product's life cycle. For instance, an action to reduce the toxicity of waste during consumption may also result in an increase in the volume of waste or an increase in the toxicity of waste during manufacture. These effects must be weighed against each other to determine whether the action would have a net benefit.

In order to make such judgments, the Illinois Department of Energy and Natural Resources defines the following order of priorities for source reduction in Solid Waste Management Alternatives: Review of Policy Options to Encourage Waste Reduction:

1. Reduction of wastes that are toxic or immediately dangerous to humans or to other life forms.

2. Reduction of wastes that pose gradual health or environmental risks.

3. Reduction of wastes with no health or environmental effects but which have other costs such as early landfill closures.

4. Reduction of wastes that have a negative aesthetic environmental effect, such as litter.

STATUS OF EXISTING SOURCE REDUCTION/REUSE PROGRAMS IN DEKALB COUNTY

Little quantitative information is available on the source reduction and reuse activities occurring within DeKalb County in terms of the extent that these activities are practiced and the impact that these activities may have on the overall municipal waste stream.

Collection programs in DeKalb County are primarily privately arranged subscription services funded by flat rates, in which residents pay a monthly rate for unlimited refuse collection. The two largest population centers, DeKalb and Sycamore, are serviced under municipal contract. There are two volume-based collection programs, in which residents pay a rate based on each bag of refuse discarded, operating in DeKalb County. Refuse collection is funded primarily directly by residents through hauler billing, although some residents have municipal billing or collection is funded through the municipality's tax fund. If residents are not directly billed for the refuse collection services, they may not be fully aware of the actual costs of collection services.

Landscape waste is collected separately from the refuse and is funded primarily on a volume-based system, although "modified" volume-based systems (defined more thoroughly on page 3-20) are also used.

Several organizations provide services which allow residents to donate unwanted items or purchase second hand materials in the DeKalb County region, as listed in Table 3-1. In

addition, several rental service stores and yards are also located within the DeKalb County region, which may prevent the unnecessary purchase of products which serve limited needs. Many repair services are also available throughout the DeKalb County region, which may be helpful to residents in extending the useful lives of their household products. Local telephone directories typically list many of these service establishments.

SOURCE REDUCTION AND REUSE METHODS

It is helpful to discuss the methods of source reduction and reuse in order to analyze what policies can be the most effective in increasing source reduction and reuse. The six methods primarily utilized to encourage source reduction and reuse include the redesign of manufacturing processes; the redesign of products; the redesign of packaging for distribution and/or display; changes in consumers' purchasing decisions; changes in consumers' use and disposal of products; and the on-site management of landscape waste. This section briefly discusses these source reduction and reuse methods, some of which pertain to toxic waste. The reduction of toxic waste is more thoroughly discussed in Chapter 4.

Changes in the Manufacturing Process. Manufacturers can redesign their production processes to reduce the volume and/or toxicity of waste. Changes might include the use of different raw materials, more efficient technology, better housekeeping practices and on-site recycling. These design changes often save money for the manufacturer in addition to reducing waste. Some specific changes include the following:

TABLE 3-1. REUSE OPPORTUNITIES IN THE DEKALB COUNTY AREA

Facility*	Location & Phone Number	Hours of Operation	Reuse/Resale Materials[1]	Type of Services[2]
Country Store	625 E. Lincoln Hwy, Dekalb, 756-2378	MWF 11a - 5p Th 11a - 2p	CL, HI, SA	DO, RE
DeKalb Area Food Pantry - Salvation Army	830 Grove Street, DeKalb, 756-4308	Pantry: M -- F 9a - 11:45p Office: M - F 8:30 a - 12p & 1p - 4:30p	CS, HI, KI, NP	DO - primarily, PU - only under special circumstances for large quantities, plan ahead. RE
It's New To Me	229 W. State Street, Sycamore, 895-6077	M - Sat 10a - 5p	CL, J/A	DO, CT
Open Closet - Seventh Day Adventist Church	300 E. Taylor Street, DeKalb, 758-1388	Tu 6p - 8p	CL	DO, DN
Salvation Army Adult Rehab. Center	1706 18th Ave, Rockford, 397-0440	M - F 7a - 3:30 p	CL, C/A, FN, HI, J/A, KI, MA, MSC, SA	DO, PU, RE, interested in discussing CPU services.
Salvation Army Red Shield Store	1714 Sycamore Road, DeKalb, 758-3814	M - F 10a - 6p Sat 9 - 5p	CL, C/A, HI, J/A, KI, MSC, SA	DO, PU, RE
Voluntary Action Center	1606 Bethany Road, Sycamore	M - F 8a - 4:30p	LP, NP, OS	DO, PU

KEY

1. Reuse/Resale Materials: **BK** - books; **CL** - clothing and textiles; **CS** - cleaning supplies **C/A** - collectibles/antiques; **FN** - furniture; **HI** - household items; **J/A** - Jewelry/Accessories; **KI** - kitchen items; **LP** - limited perishable food (non-prepared); **MA** - mattresses **MSC** - miscellaneous; **NP** - non-perishable food (commercially processed only); **OS** - office supplies; **SA** - small appliances.
2. Type of Services: **DO** - accepts drop-off donations; **PU** - schedules pick-up requests by phone; **CPU** - offers special curbside pick-ups; **CT** - sells materials on consignment; **RE** - resale only; **DN** - declared need (items given away based on emergency need).

* Note: Users are encouraged to call ahead to verify hours of operation and to discuss potential donations, and in some cases, and eligibility for some of the services (e.g. declared need).

Using Alternative Raw Materials. Manufacturers can substitute toxic or bulky materials with other less harmful materials. Some examples include the following:

- Wholesalers and distributors can substitute polystyrene packaging peanuts with recycled polystyrene peanuts or cornstarch peanuts, which are less toxic to produce, made from 100% biodegradable raw materials and are cost competitive. (It should be noted that cornstarch peanuts, due to their physical properties, are not a suitable alternative in every packaging situation).

- Printers can substitute soy-based inks for petroleum-based inks, thereby decreasing the release of volatile organic compounds (VOC) into the air during the printing process and reducing the toxicity of paper in the waste stream. Many printers have used soy-based inks for years and depend on them for providing quality color.

More Efficient Technology. Manufacturers can modify equipment to produce minimal waste and to have greater operating efficiency. Some examples include the following:

- Paint recirculation systems and water curtains can be used to reduce and contain waste during paint application in industrial operations.

- Pallets can be made more durable so that fewer need to be disposed.

Better Housekeeping Practices. Manufacturers can reduce waste by improving their housekeeping practices. Some practical suggestions for manufacturers include:

- Inventory and trace raw materials in order to identify and eliminate wasteful practices or leaks.

- Maintain a regular preventative maintenance program to reduce unscheduled downtime, maintain optimum efficiency and extend operating life.

- Train employees in proper materials handling practices, such as using lids to reduce the evaporation of solvents and other liquids.

On-site Scrap Recycling. Manufacturers may redirect excess materials back into their original processes as another means of source reduction. Some examples include:

- The "cuttings" or "trimmings" from industrial mills can often be reused as feedstock.

- Solvent recovery technologies can be used by dry cleaners, repair shops and other businesses to capture and reuse solvents, thereby reducing the toxicity of the waste stream and saving money as well.

- Identify waste materials which may be eligible for the Industrial Materials Exchange Service (Discussed in Chapter 4).

Redesign of Products. Manufacturers can also reduce the toxicity or volume of waste by redesigning their products. These design changes can include using less material and making products reusable and/or more durable. Some specific changes include the following:

Using Less Material. Manufacturers can reduce waste by using less materials in production. Some suggestions for manufacturers include:

- Change the shape and/or thickness of products and packaging to use less material (A process known as "light weighting"). For example, half-pint milk cartons for school lunches have been redesigned to be slimmer and to use less paper and less plastic coating. This design change has proven to be both economical and convenient. Aluminum and glass beverage containers have also been redesigned to use much less material today than 15 years ago.

- Design concentrated versions of products to decrease packaging waste (e.g., concentrated pesticides, concentrated soaps).

Making Products Reusable. Manufacturers can reduce waste by designing products and packaging to be reusable. Some suggestions for manufacturers include:

- The invention of rechargeable household batteries allows batteries to be used hundreds of times, thereby reducing the consumption and disposal of non-rechargeable batteries containing mercury or other heavy metals.

- The bottling industry can reduce waste significantly by making containers to be refillable and by designing refilling systems for the product that goes in the container. This design change could have beneficial applications for the distribution of some toxic materials such as agricultural pesticides and herbicides.

Making Products More Durable. Manufacturers can design products to have longer useful lives. Some suggestions for manufacturers include:

- Make products that are easier to repair.
- Make products that are easier to refurbish.
- Make products that are easier to remanufacture.

Redesign of Packaging. Manufacturers can also reduce the toxicity or volume of waste by redesigning their packaging materials used for distribution and retail display. These design changes can include using less material in the packaging and making packages more reusable and/or more durable. Some specific changes include the following:

Using Less Material. Manufacturers can reduce waste by using less materials in packages. Some suggestions for manufacturers include:

- An electronics company in Illinois worked closely with local suppliers to redesign a package for a delicate electronic tube which the firm manufactures. The result was a 92% reduction in packaging. Other changes have resulted in increased use of recycled-content packaging and reduced breakage on some products.
- Redesign distribution methods and product displays to reduce or eliminate entire levels of packaging from the transaction of commerce. Many retailers have found that consumers often prefer to actually see and feel products, especially clothes, before making a purchase. Eliminating packaging from the display of products can save valuable shelf space and reduce the cost of the products by reducing packaging and transportation costs.

Changes in Consumers' Purchasing Decisions. Encouraging manufacturers to redesign products for source reduction and reuse will not be effective if consumers prefer short-lived disposable products. Manufacturers make what consumers want to buy and unless it can be demonstrated that there is a potential market for durable or reusable products, manufacturers will not even offer these products to consumers. In A Business Guide for Reducing Municipal Solid Waste, the U.S. EPA defines "Demand-side Waste Management" as the process whereby a consumer, through purchasing decisions, communicates to manufacturers his or her desire to buy

environmentally sound products that are packaged with the least amount of waste, are made of recycled and recyclable materials, and do not contain hazardous substances. Some specific choices that can decrease waste are the following:

Choose Non-Toxic Alternatives. Consumers can reduce the toxicity of waste through choosing non-toxic alternatives. Some practical suggestions for consumers include:

- Purchase rechargeable household batteries.
- Purchase water-based paint.
- Purchase non-toxic cleaners, such as vinegar and baking soda (use more "elbow grease").
- Use pesticides that are not petroleum-based (such as fatty acid-based pesticides).
- Practice integrated pest management to reduce the need for pesticides.
- When toxic products must be bought, buy only the amount that is needed and use it up completely.

This topic is discussed more thoroughly in Chapter 4.

Choose Durable and Reusable Products. Consumers can reduce waste through purchasing durable and reusable products. Some practical suggestions for consumers include:

- Avoid disposable products.
- Use your own mesh or cloth bags when shopping.
- Use an erasable marker board or chalkboard instead of paper notes.
- Replace paper towels and napkins with cloth napkins and towels.
- Use cloth rags and sponges for clean up.
- Use reusable mugs, glasses and cups for beverages.

- Use permanent plates, flatware and glassware instead of disposable items. If necessary, buy extremely durable plastics able to be used many times for having a party or picnic.

- Use permanent containers for food storage.

- Replace single-use, disposable products with durable, reusable products. (e.g. replace disposable tape dispensers with a permanent dispenser and use refills, use rechargeable batteries, maintain your own mug and/or glass at the office for consuming beverages).

- Save and reuse packing material and boxes.

- Make rags out of old clothes to use for cleaning in the home and garage.

Choose Products Packaged with the Least Amount of Waste. Consumers can reduce waste through choosing products packaged with the least amount of waste. Some practical suggestions for consumers include:

- Avoid unnecessary and excessive packaging, purchase products with the least amount of packaging. If you don't need a bag at check-out, leave it behind.

- Buy in bulk - get the largest size of the product available (if it will be utilized) to save money, reduce the number of trips to the store and lower the volume of waste disposed.

- Replace individually packaged items with bulk size products.

- Skip packaged produce for loose fruits and vegetables and bag it with a durable bag instead.

- Buy block cheese and slice it at home instead of buying individually wrapped slices.

- Purchase products with refills available. When available, use refillable beverage systems to reduce packaging waste.

- If there is no intention to reuse packaging, buy products with packaging that contains recycled materials and can be recycled.

Encourage Retailers and Manufacturers to Provide Alternatives. Manufacturers and store owners will not make source reduction or reuse alternatives available unless they know that

consumers have an interest in buying them. Several grocers are beginning to provide a better selection of products which are packaged in minimal or recyclable or recycled materials. In fact, a new type of grocery store, Whole Foods in Chicago and Fresh Fields in Naperville, has arisen to reflect the environmental desires of consumers. These environmentally conscious stores, which appear to be regular grocery stores from the outside, are based on providing organic foods, non-toxic cleaning products, bulk items, recycled or minimal packaging, refillable products. While these stores may not be available in every community, some practical suggestions to encourage retailers to sell items which are conducive to source reduction and reuse include:

- Ask manufacturers and local store owners to provide products with less toxic material and less packaging.
- Request retailers to provide refillable beverage systems, bulk items.
- Ask retailers or service providers to take back certain types of packaging for reuse or recycling, such as hangers at dry cleaners or plastic grocery bags at grocery stores.

Changes in the Consumption and Use of Products. Consumers can reduce and reuse waste by changing the ways in which they use and dispose of products. Some specific changes include the following:

Exchange or Donate Unwanted Materials. Consumers can reduce waste through exchanging or donating unwanted materials. Some practical suggestions for consumers include:

- Exchange or sell unwanted items at community materials exchange events, garage sales, rummage sales and second-hand consignment shops. In many cases, unwanted items can be locally advertised and sold through public swap boards or newspaper listings.
- Donate unwanted items to resale and thrift shops, clothes closets and charitable organizations, such as Country Store and Salvation Army. Often, arrangements can be made to donate goods to local schools, libraries, senior citizen centers and social service organizations.

Maintain and Repair Items. Consumers can reduce waste through maintaining and repairing items. Some practical suggestions for consumers include:

- Practice preventative maintenance to extend the lifetime of products.
- Repair or mend appliances, toys, furniture, clothing and other items when they break or become worn. Numerous businesses exist that refinish, repair, reupholster, rewire, retain and resell a variety of goods making them available for their original purpose or a new use.

Consider Alternatives to Buying. Consumers can reduce waste through considering the alternatives to buying. Some practical suggestions for consumers include:

- Borrow or rent equipment and products that are used infrequently (e.g., books at the library, recreational equipment, tools). Renting offers many benefits over buying - it can save home and garage space, make materials affordable, cater to one-time use needs, allow joint-users to share rented equipment and costs, allow one to "try before buying" to determine if purchase is best choice and reduce waste at the source. (This practice often entirely eliminates packaging waste.)
- Purchase items secondhand, such as clothing, furniture, appliances, musical instruments, toys, books, etc..
- Consider whether a particular product is really needed at all. If the product is not really needed, or can be borrowed or rented, don't buy it.

Get the Full Potential Use Out of Products. Consumers can reduce waste by extending lives of products once they have exceeded their original purpose. Some practical suggestions for consumers include:

- When photocopying documents of two or more pages, use both sides of paper.
- If only one side of a piece of paper has been used, and it is no longer needed, use the unprinted side for scratch paper. Discarded junk mail is a good source for scratch paper.
- Save and reuse packing material and boxes and suggest the next person reuse them too.

- Use newspaper or shredded office paper as a packing material when shipping packages.
- Make rags out of old clothes to use for cleaning in the home and garage.
- Reuse plastic grocery bags over and over again at the grocery store or as garbage can liners.
- Use brown kraft paper bags to wrap packages for mailing.

Manage Landscape Waste On-site. Currently, residents may have their grass clippings and leaves collected by local governments and/or haulers to be composted, land applied or burned. However, residents should be encouraged to manage their own landscape waste to alleviate the costs associated with collecting this waste, such as transportation, processing and operational costs. Some practical suggestions include:

Start an on-site compost pile. Composting is a simple, efficient way to recycle leaves, grass clippings, plants, small twigs and other organic materials. By composting, yard waste decomposes and results in a rich soil amendment full of valuable nutrients. If properly managed, the finished compost makes an excellent soil conditioner for your lawn, vegetable gardens, shrubbery, trees and flower beds.

Mulch grass clippings back into your lawn. Residents and businesses can mulch their grass clippings by just leaving them on the lawn. Mulching is beneficial to the lawn if the clippings are not too long. Special mulching lawnmowers may be rented or purchased to chop grass into small pieces to remain in the lawn. The short clippings will act as a natural fertilizer for the lawn. Residents who don't collect grass clippings can save time and money while maintaining an attractive lawn.

Chip woody wastes. A chipper, which may be rented, borrowed or jointly purchased with friends or family, can be used to recycle wood such as fallen or pruned tree branches. The chips can be used to spread on walkways, play areas and landscapes. Larger pieces of wood make good firewood when they are dried. A shredder can be used to run leaves through it to reduce volume and speed up composting time.

BARRIERS TO SOURCE REDUCTION AND REUSE

Policies to encourage source reduction and reuse must overcome several barriers. First, individual consumers and producers may not be fully aware of or responsible for the true costs of their waste disposal. Second, the benefits of source reduction and reuse actions are not immediately apparent and are difficult to measure. Third, there is a pervasive attitude in society that constant consumption is the norm and that source reduction and reuse must necessarily result in a decreased standard of living. These barriers to source reduction are described below.

True Disposal Costs. In the past, individual consumers and businesses have not been aware of or responsible for the true cost of their waste disposal. This is partly because waste collection, in many communities, is paid through non-direct user fees (via the municipality) or is subsidized through the municipality's general tax fund or property taxes. In addition, some of the costs of waste disposal are "external" costs that are not recognized in market exchange between individuals but still are incurred by the public at large.

External costs include potential damages to water quality, air quality and aesthetics caused by landfilling, incineration and other methods of waste management. The external costs of waste disposal are still "paid" by society in two ways. First, the potential damages of waste disposal can be indirectly paid for through the deleterious effects they have on public health and the quality of life. Second, expensive remediation and waste management techniques can be used to mitigate the damage caused by improper waste disposal (e.g., Superfund remediation). The true cost of disposal consists of the recognized market cost for disposal and these additional external costs. The individual waste generator is often not fully aware of external costs and does not consider these costs in his or her decision-making.

Source reduction can be used to reduce external costs and can be more cost-effective than more traditional waste management techniques or remediation. However, source reduction will remain limited as long as individual consumers and producers do not take responsibility for the full cost of waste disposal. If this barrier to source reduction is to be overcome, consumers and producers need to become aware of the full costs of their actions and need to incorporate these

costs into their decision-making. Unfortunately, the true costs of excessive packaging and other wasteful actions are difficult to assess.

Measuring Source Reduction. Just as the true costs of wasteful actions are difficult to assess, the benefits of source reduction and reuse actions are not immediately apparent and are difficult to measure. The lack of a standard definition for source reduction and reuse has contributed to this problem. Also, the public is prone to latch on to simple solutions such as increased degradability that may in fact be less preferable than source reduction and reuse. The most appropriate methods to reduce and reuse waste are not always clear to people in the waste management industry, let alone the public, because source reduction and reuse is a relatively new concept, and some misguided efforts to reduce waste may have a net cost rather than benefit. Based on this premise, education and research may increase source reduction and reuse efforts and results. Environmental impact studies may be used to investigate the true benefit of source reduction and reuse methods.

Societal Attitudes. Many people believe that any attempt to reduce waste or reuse materials will necessarily also mean a reduction in the quality of life. Current social and cultural values seem to favor convenience, time savings and newness of consumer products. Reducing consumption or reusing products may sometimes even be considered crude and unsophisticated. This attitude persists partly because people often do not fully consider the trade-offs involved with so-called "convenience" consumption practices and are not aware of or responsible for the true costs of waste disposal.

In addition, many people believe that source reduction and reuse (and conservation in general) is a rejection of today's technological advances and is a regressive and counterproductive movement toward old technologies. This is a misconception. "High" tech and "low" tech are not mutually exclusive paths and can be compatible with each other. A modern energy-efficient home is an example of such compatibility, combining modern innovations with simple cost-effective measures such as proper insulation and the capture of passive solar heat. The quality of life in such a home is not less than in an older and less energy-efficient home. A home of this type could save energy as well as money. In the same

way, source reduction and reuse can increase the quality of life and save money by decreasing the disposal costs of unnecessary waste.

Curbing excessive waste generation will require changes in not only the attitudes, but also the behavior of consumers. Although there are signs that changes in attitudes are already taking place, such attitude changes have not translated into significant changes in behavior. Policies to encourage source reduction and reuse will have to bring about further changes in attitude, and will also have to provide a "bridge" by which these attitudes can be translated into behavioral changes. A necessary component of such a bridge will be education.

SOURCE REDUCTION AND REUSE ALTERNATIVES

Because of the barriers that inhibit source reduction and reuse, effective changes may occur slowly without programs and policies designed to encourage source reduction and reuse. This section will discuss the following alternatives to promote source reduction and reuse: education programming; collection and exchange programs for reusable materials; volume-based disposal rates; waste audit assistance; on-site management of landscape waste; model source reduction programs; local policies; state and national economic incentives and penalties; and state and national regulations.

Education Programming. If people are shown that changes in their behavior are in their own best interests, they are more likely to make significant changes. Education can promote source reduction and reuse by making people and businesses more aware of the consequences of waste generation and by showing them new alternatives to their old behaviors. To be effective, education efforts should be sustained on a long term basis and should provide practical and easy-to-use information that can be incorporated into everyday activities. Consumers and producers should be made aware of their individual impact on the local waste stream and should be given feedback on the results of their efforts to reduce waste. Education programs should be targeted to residents, school children, consumers and businesses. The overall success of an education program will depend on how well the program can rally the support and enthusiasm

of the community. Since education programming is an integral function of overall solid waste management program, Chapter 10 has been dedicated to review Solid Waste Education Systems. Chapter 10 will discuss a variety of education program components which may be used to communicate important source reduction and reuse information including information clearinghouse/reference center, publicity campaign, public outreach/speaker's bureau, local directory, school curriculum, in-store shopper awareness, on-site landscape waste management, waste audit, model source reduction programs, and public achievement awards.

Collection/Exchange Programs. Collection/exchange programs are other approaches utilized to encourage source reduction and reuse. This section will discuss community swap boards/exchanges, special collection days and regular curbside collections for reusable materials.

Community Swap Boards/Exchanges. The County can take several steps to facilitate the exchange of reusable goods. Communities may designate bulletin boards to display swap information, coordinate one-day waste exchanges in conjunction with "spring clean-up" days, or provide space to operate a materials exchange. For example, in Wellesley, Massachusetts, the recycling drop-off center in this small city provides a "swap shop" board where the residents can advertise their unwanted products from furniture to prom dresses to paint. In addition there is also a book exchange and a "take it or leave it" area where people may deposit materials or acquire deposited goods. Recycle Signal, a citizens advisory group that promotes recycling in Signal Mountain, Tennessee, operates a recycling center which has a swap board where citizens can exchange paint or other materials by posting a notice on a 3" x 5" card. The center also allocated space for Welfare Council and Goodwill bins to collect used clothing and household items and designated an area for a book swap. (See Table 3-1 for DeKalb County Exchange/Reuse Opportunities.)

Curbside Collection. Drop boxes are no longer the only way to donate reusable items to charitable organizations. The Salvation Army, Goodwill Industries and the Juvenile Diabetes Foundation are three organizations known to collect reusable goods such as clothing, linens, furniture, small appliances, kitchenware and toys from the curbs of residents. In most cases, curbside collections are performed on a monthly basis, however, special one day collections have

also been arranged. Although the collections are typically sponsored by units of local government, the donations of goods by residents are strictly voluntary and the materials are collected at no expense to the residents or the community. Communities in northern Illinois with curbside collection of reusable goods include Elmhurst, Glen Ellyn, Hanover Park, Lisle, Naperville, Schaumburg, Westmont and Wood Dale.

Volume-Based Disposal Rates. With volume-based disposal rates, the level of payment varies with the volume or weight of the waste disposed. Therefore, volume based pricing is more equitable, since residents only pay for the amount of service they use. Those who dispose more waste pay a higher bill, and those who dispose less pay less. Most businesses already receive service based on variable disposal rates, but most residences do not, paying for their waste disposal either through property taxes or through a flat fee paid directly to the hauler for unlimited refuse collection. Neither of these methods gives residents any incentive to reduce their waste. A volume-based rate system, however, provides an economic incentive for residents to reduce or recycle their waste.

Over 40 municipalities in Illinois are known to have implemented volume-based rate systems. Approximately 20 of these communities are known to utilize the modified volume-based program. General data on traditional and modified volume-based programs available in communities with approximately 3,000 single family households or less is presented in Table 3-2.

TABLE 3-2. DATA ON VOLUME-BASED RATE PROGRAMS IN ILLINOIS				
Municipality	Hauler	Households Served	Recycling (lbs/hh/mo)	Collection Fee
Capron, Boone Co.	Harvard Waste Hauling	250	N/A	$1.32/bag
Chatham, Sangamon Co.	Chatham Disposal & Lake Area Disp.	2,500	N/A	$8.50/mo 1 bag $1.00/bag extra
Clarendon Hills, DuPage Co.	BFI	2,200	67	$10.50/mo 2 bags $1.30 bag extra
Coal City, Grundy Co.	C & A Disposal	1,600	52	$5.75/mo 3 bags/week $0.75 bag extra
Diamond, Grundy Co.	C & A Disposal	250	N/A	$7.00/mo 2 bags
Harvard, McHenry Co.	Harvard Waste Hauling	2,100	28	$1.50/bag $1.00/mo
Marseilles, LaSalle Co.	Illinois Valley Recycling	1600	N/A	$10.00/mo 2 bags $1.25/sticker extra
McHenry, McHenry	Northshore Waste	3,300	77	$1.45/bag
Mendota, LaSalle Co.	Wirth Disposal	2,400		$8.85/mo, $3.50/mo $0.90/sticker
Morrison, Whiteside Co.	Moring Disposal	1,725	21	$6.00/mo 5 bags/mo $7.00/5 bags extra
Rock Falls, Whiteside Co.	BFI	3,120	15	$10.25/mo 5 bags/mo
Seneca, LaSalle Co.	Illinois Valley Recycling	735		$9.20/mo 1 bag $1.25/bag extra
Swansea, St. Clair Co.	Bill's Sanitation	2,600	26	$1.30/bag
West Chicago, DuPage Co.	Speedway Disposal	3,100	42	$1.25/bag
Winfield, DuPage Co.	BFI	2,500	30	$1.20/sticker
Woodstock, McHenry Co.	Marengo Disposal	3,000	67	$1.36/bag
SOURCE: Patrick Engineering Inc. surveys, 1993-94.				

Types. There are a variety volume-based rate structures that are utilized to encourage source reduction, which include the following:

- Traditional Volume-Based Collection/Bag and Tag - In a traditional volume-based or "bag and tag" program, consumers must either purchase a special bag or sticker for each bag or container of refuse in order to have it collected. Bags or stickers are typically purchased at municipal offices, haulers offices or local merchants. With this type of program, there may be a need for some municipal involvement to distribute the bags, stickers or tags. Volume-based programs may make it more difficult for haulers to forecast revenues.

- Modified Volume-Based - In a modified volume-based program, consumers pay a base fee that allows them to set out a fixed amount of refuse each week. Any bags set out in excess of this floor amount will need to have a sticker attached to have it collected. Bags or stickers are typically purchased at municipal offices, haulers' offices or local merchants. With this type of program, there may be a need for some municipal involvement to distribute the bags, stickers or tags. Modified volume-based programs enable the haulers to better anticipate revenues.

- Variable Container System - In a variable container system, the consumer selects a container sized to fit the average amount of refuse collected. The container size selected will dictate the cost that the consumer will be charged. Bulky items that do not fit in the container are subject to additional fees. Generally, the municipality or the hauler owns the containers. Initial program costs may be high due to procurement of containers. Variable container systems enable haulers to better anticipate revenues while reducing or eliminating the need for special bags or stickers.

- Weight Programs/Refuse by the Pound. In a weight-based program, the consumer pays a set rate for each pound of refuse set out for collection. This type of program works best with containers of a known tare weight. This program would require more time at the curb to determine and register the weights for the set out refuse, which could in effect diminish the productivity of sanitation crews. A weight system could alleviate problems with excessive compaction of refuse, but haulers would have a more difficult time anticipating revenues.

A crucial element to developing a successful volume-based program is determining the appropriate size and weight limits on refuse that is set out that will effectively reduce the amount of refuse disposed but will not create any undue hardships on residents. If the price per bag is too much or monthly allowance on bags is too little, some residents may try to compact as much as possible into bags. If the size and weight limits are too much, there may be no incentive or

need to try to reduce the amount, size or weight of the refuse set out. Furthermore, consideration must be given to charges for bulky items such as white goods, furniture, carpet and other household debris that will not readily conform to the usual weight or size requirements.

Recycling Alternatives. For a volume-based program to be truly successful, residents need to have real alternatives to disposing of their waste. A recycling alternative, such as a curbside recycling program and/or drop-off recycling opportunities, should be made available to provide residents with a viable alternative to disposing of refuse. Most volume-based programs are coupled with unlimited curbside recycling service at no direct charge to the resident. In other words, the cost of the recycling service is tied into the refuse bag or sticker price, therefore there is an illusion that recycling is free. The incentive, therefore, is to recycle as much waste as possible since it is "free" and dispose of as little refuse as possible since it costs money to do so. For this reason, volume-based fees have been attributed to increased participation and diversion rates of recycling programs.

Distribution of Bags/Stickers. Another important issue in the design of a volume-based rate program is whether bags, tags or stickers should be used and how they should be distributed. Stickers and tags require less storage than bags and are probably preferable. Bags or stickers should be made available through convenient and highly accessible outlets. In most programs, stickers may be purchased through the municipality, hauler or local merchants. Since stores are sometimes slow to pay haulers for the bags/stickers sold, some communities, such as Lisle, allow stores to keep a small percentage of the revenue from the sale of the bags/stickers. This has reportedly increased the cooperation of area stores in Lisle. In some cases, mail order purchases are made available or the hauler may even drop off stickers or bags at the time refuse is picked up.

Benefits. Communities with volume-based programs have experienced great success in reducing the amount of materials being sent to landfills, although it is difficult to say how much of this decrease can be attributed to the source reduction of refuse or landscape waste, or an increase in recycling or composting. Since implementation of volume-based programs (and the

ban on landscape waste from landfills), communities which have reported a drop in the amount of residential waste collected for disposal include Morrison (26%), Quincy (30%), Rock Falls (55%), Sterling (55%), and Swansea (35%).

Volume-based pricing provides residents an opportunity to control their costs through improved management of their waste stream. For example, in Swansea, the previous cost for refuse collection was about $120 per household per year. Under the new system, if the residents practice source reduction, reuse and recycling and need to set out only one bag per week, the annual cost is $62.40, a savings of $57.60 per year.

Problems Experienced. Resource Recycling reported on a survey of ten Illinois pay-per-bag programs in which the program coordinator was asked to rank the significance of five problems often experienced by volume-based rate programs on a scale of "one" (definitely not a problem) to "five" (definitely a problem). Table 3-3 shows that respondents considered illegal dumping and insufficient revenues to be significant problems in their programs, while excessive compaction was not considered to be a serious problem. Illegal dumping can be minimized by requiring a minimum level of service and a minimum fee for all households as is done in Chatham, Rock Falls and Sterling. In addition, businesses and government agencies can install lids and locks on their dumpsters or place the dumpsters in a location inaccessible to the public.

TABLE 3-3. RANKING OF PROBLEMS ASSOCIATED WITH VOLUME-BASED RATES

Problem	Ranking
Illegal dumping in commercial or government dumpsters	2.90
Insufficient revenues to cover costs	2.88
Illegal dumping of wastes along roadsides	2.39
Uneven cash flow	2.29
Excessive compaction	1.88

In an effort to evaluate the problem of illegal dumping associated with the introduction of volume-based programs, PEI conducted an informal survey of fourteen individuals representing government and private industry. These individuals were selected based on their familiarity with volume-based programs and diversity of responsibilities in the context of local municipal waste management. Interviews were conducted with representatives of two haulers, four municipalities, six townships, one County and the Department of Energy and Natural Resources.

One of the haulers, Illinois Valley Recycling, operates primarily in a rural setting and the other, BFI-Rots, operates primarily in a suburban setting. The municipalities included Downers Grove (DuPage County), which is a large suburban community, and the smaller towns of McHenry (McHenry County), Marseilles (LaSalle County) and Swansea (St. Clair County). Township highway officials interviewed included representatives of Manlius Township which borders Marseilles, Dorr Township which borders Woodstock and Marengo Township which surrounds Marengo (both in McHenry County). While there are no "traditional" volume-based programs in DeKalb County, local township highway officials from Genoa, Kingston and Cortland were interviewed on their experiences with landscape waste and white goods. The Solid Waste Coordinator for McHenry County was also interviewed to obtain a county-wide perspective. Particular attention was given to McHenry County due to its proactive approach to waste management issues, its leadership in volume-based collection strategies and its reliance on traditional volume-based systems.

According to the solid waste coordinator for McHenry County, initially, there was quite a bit of concern over the introduction of volume-based programs. Rural roadsides, commercial dumpsters and roll-off containers at construction sites are frequent targets of illegal dumping, without what many would consider the added incentive to illegally dump provided pay-per-bag programs. Part of this concern was expressed through humor as in the description of employees dumping household waste at work as taking advantage of the newest "employee benefit." However, based on the results of the interviews conducted for this section, it appears that these concerns were either unfounded or, perhaps better stated, they were appropriately addressed by local officials so as to be minimized or eliminated.

The survey revealed a virtual consensus among those interviewed that volume-based programs accounted for an "insignificant", or "immeasurable" increase in illegal dumping problems. Any dumping problems that did arise were typically associated with program start-up and were usually the result of residents' confusion regarding where to obtain the necessary bags and/or stickers. Most respondents acknowledged that a very small percentage of the population participated in illegal dumping activities and would probably continue that practice regardless of the collection system utilized. To curtail illegal dumping, most indicated that either the hauler, a local municipal waste official, the township maintenance crew or local code enforcement official would endeavor to identify the perpetrator by sifting through the evidence. Typically household waste will include junk mail or some other evidence of its point of origin. None expressed any regrets for having begun the programs and most indicated that consumers seemed to prefer them.

While no increase in illegal dumping was directly attributed to volume-based programs by any of those interviewed, the township officials indicated that there has been a noticeable increase in the dumping of grass and leaves along roadsides and in creeks and ditches since the landfill ban of landscape waste went into effect in 1990. Also, white goods such as refrigerators and other bulky items such as furniture have also been appearing along rural roadsides in greater quantities than in the past. Most haulers charge extra for collecting these items ranging from the cost of one volume-based sticker up to $35. None of the township officials were alarmed over the increased dumping of white goods at this point, but all indicated that they would be watching as new laws come into effect. (White goods disposal and recycling are covered in Chapter 5.)

Solutions. Requiring a minimum service level and minimum fee is one of the most important rate design considerations, not only to reduce dumping, but also to ensure sufficient revenues, stable cash flow and less bookkeeping for the sale of stickers or bags. In Rock Falls and Sterling, the minimum service fee is added to each household's monthly sewer bill and the resident receives a coupon that can be redeemed for five garbage bags. Additional bags or stickers can be purchased as needed. In Chatham, the basic monthly fee charged by the hauler

covers the weekly pickup and disposal of one 32-gallon garbage container or one 33-gallon bag of waste, not to exceed 60 pounds.

Volume-Based Programs In DeKalb County. Currently, only two haulers provide volume-based collection programs within DeKalb County. These subscription funded programs are limited in their availability due to the limited service area of one hauler and a limited target population serviced by the other hauler. Tri-County Disposal (TCD), a Waste Management, Inc. company, provides a modified volume-based program on a subscription basis in the communities of Sandwich and Somonauk and the surrounding unincorporated areas. For a flat monthly fee of $10.95, TCD provides a 64 gallon toter cart for refuse collection and will pick-up recyclables via a blue plastic bag collection program for no extra charge, although customers must purchase blue plastic bags from retailers. For $11.95 per month, residents get the toter cart for refuse collection and a permanent bin for recycling. In either case, refuse collection and recycling are provided on a weekly basis. Recyclables from the blue bags and bins are collected together in a dedicated recycling vehicle. Extra refuse must be placed in a bag which must have a standard pre-paid sticker attached. Stickers are available from the hauler or local retailers for $1.00 each. Bulky items that do not fit in a bag must also have a standard pre-paid sticker attached. A separate landscape waste collection is also available on a bag and tag basis. Residents must purchase kraft paper bags from retailers and place 2 standard $1.00 stickers (total $2.00) on each bag of landscape waste.

Waste Management-West (WMW) also offers a volume-based program in at least part of its service area. WMW developed a volume-based program to provide relief for its senior citizen/fixed income customers in the unincorporated areas of Malta, Cortland, and Sycamore, but makes the program available to all its residential customers in these areas. The program is funded through a pay per bag fee. Pre-printed bags are sold to the customers directly by the hauler in packages of 10 for $15.00 ($1.50/bag). The price of the bag supports a "free" curbside bin recycling program which accepts an extensive list of materials. Bulky items such as white goods are subject to a separate charge upon pick-up. A separate collection program for landscape waste is provided for residents of the unincorporated areas of DeKalb and Sycamore and residents of the incorporated areas of Cortland and Malta. Residents must

purchase kraft paper bags from retailers and attach a pre-paid sticker to each bag. Stickers are purchased from the hauler in groups of 10 for $7.50 ($.75/sticker). All other WMW customers are eligible to use a landscape waste drop-off center in DeKalb at 115 Simmons Street.

While the County is fortunate to have these two volume based programs serving its residents, it is difficult to argue that in their current form these programs are providing incentives adequate to promote source reduction. In the first program, the toter cart provided by the hauler is quite large by "variable container system" standards. (e.g. It is twice as large as the container used in Chatham, Illinois, as cited in the case study previously discussed). The second program offers more compelling incentives to reduce waste, especially through a comprehensive recycling program, but it is really designed to assist those on fixed incomes. Those who generate large quantities of waste can opt for a flat monthly fee for unlimited collection service rather than taking steps to limit waste generation. In all fairness to the haulers that designed these programs, however, they must be flexible in the face of competition. Programs intended to encourage source reduction would be most effective in situations where the hauler had a franchise service agreement or where all eligible haulers had to provide the same services at the same cost.

Two other haulers serving residential areas of the county offer volume-based programs to residential customers in other counties, but not to their customers in DeKalb County. Marengo Disposal serves primarily rural areas in the northern portion of DeKalb County. A representative of the company indicated that due to the wide dispersion of its customer base, it could not offer an economical volume-based program at this time. Another hauler serving the southeastern portion of the county, Illinois Valley Disposal, is just making in-roads into the market and also has not established a large enough customer base to support a volume-based collection program.

Under state statute, the DeKalb County Board is authorized to enter into contracts for the collection and final disposal of refuse. Similarly, municipalities are granted the authority to enter into contracts for the collection of refuse. In addition, municipalities are given the authority to levy a tax while the county statute does not authorize taxing authority.

Development Factors. Overall, factors that must be considered by the County and municipalities before implementing volume-based rate systems include the following:

- Political and legal feasibility and community relations
- Changes in local ordinances
- Rate analysis, including estimation of demand, revenue requirements and cost allocation
- Rate design, including options for low income residents
- Operational changes in collection and billing
- Resources and needs of the hauler(s)
- Schedule for implementation
- Financing

In the spring of 1994, ENR will be releasing the results of a project it commissioned to research the effect of volume-based collection program on waste reduction practices. This study will be made available to the public through it's Solid Waste Information Clearinghouse.

On-site Landscape Waste Management. Since the ban of landscape waste from landfills was enacted in 1990, many DeKalb County residents have begun to manage their landscape waste on-site. By encouraging on-site composting, the need for developing collection and disposal systems for landscape waste can be reduced. Through a county-wide education program DeKalb County may encourage residents to take responsibility for their own landscape waste. Instruction should be provided to eliminate health, odor or pest problems which may be associated with improper composting techniques. Several methods used to stimulate on-site composting have included the provision of informational hand-outs and educational workshops on composting techniques; the distribution of information on, or the demonstration of, consumer composting bins, mulching or chipping equipment; the distribution of free or subsidized compost bins, and the development of compost demonstration sites. In Illinois, many Cooperative

Extension Services have established composting demonstration sites and "Master Composter" programs, which help educate people on how to reduce and recycle landscape waste.

For instance, residents attending a home composting workshop in Glendale, California were furnished with a free composting bin. Southeastern Oakland County in California started a successful citizen-based Master Composter education program. Several communities within Southeastern Oakland County purchased recycled plastic compost bins for less than $10 and resold them to citizens at cost. The State of Georgia has also taken progressive steps to encourage on-site composting by sponsoring 15 demonstration sites throughout the state and passing legislation which requires all schools to have working compost bins on site. Demonstrations held throughout the country have included working compost piles, mulching equipment, composting toilets and composting worms for food waste.

Waste Audit Assistance. Waste audits are a means to encourage source reduction among local businesses and institutions. A typical waste audit identifies the major components of the waste stream and estimates volumes generated based on a number of factors including on-site observations, waste characterization studies, and a review of procurement records, processing information and disposal records. Source reduction options are then identified based on the advice of an experienced technician; information provided by employees who have first-hand knowledge of the waste-generating processes at the site; and industry-specific information that is available. A detailed evaluation of these options is then performed in order to assess the potential effectiveness and costs of the various options. Based on this evaluation and on the input of personnel and management, final recommendations are made. A waste audit for a business operation can often identify options that not only reduce waste, but also reduce costs. The County may wish to provide technical or financial assistance for waste audits to businesses which are considered to be generating large quantities of wastes or potentially harmful wastes.

Source reduction audits should first be performed at County and municipal offices and facilities. These audits would promote public awareness, provide a testing ground for source reduction methods and set an example for local businesses. Local businesses will be more eager to participate if they see the County has reduced its waste and waste-related costs through the

audit procedure. An audit done for Itasca County in Minnesota enabled the County to reduce waste at its offices and facilities by a large percent and save more than $10,000 per year with some simple changes in the purchasing and use of materials. The most beneficial recommendation of the audit was the purchase of reusable air filters for furnaces and air conditioners. Previously, the filters had been replaced every week, but the reusable filters can typically be cleaned and reused for more than ten years. Other changes that Itasca County made included using ceramic coffee mugs instead of plastic disposables, photocopying both sides of each sheet of paper, buying cleaners and solvents in reusable five gallon containers and replacing paper towels with cloth towels in restrooms. An additional recommendation that could reduce waste and save money is the use of oil filtration systems in County vehicles and equipment.

An auditing manual may be developed to enable residents and/or businesses to perform "do-it-yourself" waste audits in their homes or businesses. A waste audit manual could provide step-by-step instructions on how to determine waste generation quantities and collection/disposal costs. The manual could provide specific cost-saving, waste-reducing recommendations. The manual could be used in conjunction with a local reuse/recycling directory, which could list the local reuse and recycling opportunities available to residents and businesses.

Model Source Reduction Programs. Model source reduction programs identify businesses within the community which are successfully reducing their waste streams to serve as "models" for the community. In order to serve as models, businesses may be assisted to develop and incorporate source reduction (and often recycling) procedures into their existing operations.

Model Community is a non-profit program operating in Illinois which trains volunteers to help transform ordinary businesses, schools,. governments and civic organizations into "models" of waste reduction and recycling. Model Community is an on-going program where a community is certified as a model by meeting standards in the areas of source reduction, toxicity reduction, purchasing recycled products and recycling. The Central States Education Center in Champaign is the program's core. The center provides training services, materials and other resources to help in establishing a Model Community program.

To date over 80 businesses, offices and shops in eight Illinois communities have participated with Model Community to become models for the community. The models working in partnership range from florists to supermarkets and from bait shops to manufacturers. For example, in the Urbana community, Record Service recycles cardboard and paper including CD box packaging. Jerry's IGA stores in Urbana and Champaign label products for least waste, recyclable packaging and non-toxic products. Illinois Power sends old power poles to the Department of Conservation to be reused as fences and ships out asphalt and concrete to be crushed and reused on highways.

Local Policies. There are a number of policies which may be implemented on a local level to encourage or facilitate source reduction and reuse including anti-dumping ordinances, anti-burning ordinances, minimum service requirements and procurement standards for units of local government.

Anti-Dumping Ordinance. An anti-dumping ordinance may need to be adopted, especially if volume based rates are implemented, to discourage dumping of refuse or landscape waste along roadsides, public and private dumpsters and other inappropriate places.

Anti-Burning Ordinance. An anti-burning ordinance may also need to be adopted, especially if volume based rates are implemented, to discourage burning of refuse and/or landscape waste as an alternative to discarding of these wastes in a volume-based rate system.

Minimum Service Requirements. Minimum service requirements, which typically require all single family households to arrange regular collection services with a hauler, are often adopted to prevent dumping, burning or other illegal or undesirable waste handling activities by residents which would not otherwise have regular collection services.

Samples of Ordinances. The August 1992 issue of the Illinois Recycling Association Newsletter (Vol. 12 - No. 6), identifies 53 examples of local ordinances covering subjects ranging from flow control to volume-based fees.

Procurement Standards. Procurement standards can also be used to reduce waste by requiring government agencies or businesses to purchase products that have less toxicity per unit, less material use per unit or higher durability. For instance, a county could require that all of the county government's heavy vehicles install oil filtration units or that all of its facilities procure reusable air filters for their furnaces and air conditioners. Procurement standards are also used to stimulate markets for recyclable materials through criteria requiring minimum recycled-content (and sometimes more specifically "post-consumer" recycled-content), especially for paper products.

State and National Economic Incentives and Penalties. Another option to increase source reduction and reuse is the use of economic incentives and penalties, although these initiatives are typically more state or national in scope. A central principle of economic incentives is that individual consumers and producers need to weigh the full social costs and consequences of their decisions before acting. An effective policy of this type helps consumers and producers to take responsibility for their actions by attaching market costs to the hidden or "external" costs of disposal - potential damages to water quality, air quality and aesthetics. Economic incentives and penalties "internalize" these costs by bringing them within the bounds of market exchange and by placing them within the system of incentives that the market entails.

Economic incentive policies can frequently be effective if there is a feasible means of implementation. The most effective incentive policies will not impede the market and will allow monitoring of the impacts of the policy. Economic incentive policies are sometimes politically infeasible, however, especially for smaller units of government. Three types of economic incentives and penalties designed to encourage source reduction are described below: advanced disposal charges, tax credits or exemptions, and beverage container deposits.

Advanced Disposal Charges. The use of advanced disposal charges on products is one means of encouraging source reduction and reuse. Disposal charges can be applied at the point of purchase to products and packaging that have a high cost of disposal compared to other viable alternatives. These charges may encourage decreased consumption or the use of lower-waste alternatives. For example, one of the bills considered by the Illinois legislature in the spring of

1991 was to place a tax on disposable diapers. Such a tax would give an incentive to consumers to purchase reusable diapers instead of disposable diapers, based on the assumption that reusable diapers have a lower disposal cost. Disposal charges might also be applied to disposable batteries, petroleum-based pesticides, and other wastes for which there are alternatives that have a lower "true" disposal cost.

Tax Credits and Exemptions. Tax deductions, exemptions, and credits can also be used to encourage source reduction and reuse. For example, sales tax exemptions could be granted for purchases of certain reusable products or of products in reusable containers. Property tax exemptions, income tax deductions, or investment tax credits could be granted to businesses that invest in waste reducing equipment or that provide waste reducing products or services such as bottle refilling systems.

Beverage Container Deposits. Beverage container deposit systems can play an important role in the waste management system because beverage containers comprise nearly six percent of the waste stream by weight, according to a 1992 Franklin Associates report for the U.S. Environmental Protection Agency. In a container deposit system, a deposit is charged at the time of purchase and is refunded when the container is brought back for reuse or recycling. Reuse is an important method of source reduction. Currently the states of Connecticut, Delaware, Iowa, Maine, Massachusetts, Michigan, Oregon, New York, and Vermont all have deposit legislation for beverage containers. California has a modified system. Beverage container deposits are a controversial form of waste reduction because of their impact on the existing beverage distribution, retailing and recycling collection systems. The primary points of conflict in the beverage container deposit debate center around the question of what is the most economical method for removing recyclable containers from the waste stream and who will bear the cost.

According to the Container Recycling Institute, a Washington D.C.-based proponent of deposit legislation (bottle bills), the collection system required by container deposits (i.e. return to point of purchase) is the fairest method of sharing the cost to recycle, because it requires the participation of everyone involved in the use of such containers. Consumers must return

containers they use to retailers who benefitted from the sale who can, in turn, return them to distributors who can, in turn, return them to manufacturers. If the return system is unworkable for distributors and manufacturers, they can share in the cost of recovery with the retailer in a variety of ways including direct subsidy. Additionally, proponents point to beverage container recovery rates in bottle bill states ranging from 85-93%, and the materials collected are cleaner and more marketable, because of reduced contamination. Since materials are not commingled, there is no need for extensive sorting after collection. (One of the largest fractions of residual wastes generated from material recycling facilities (MRFs) is broken glass which has become cross-contaminated with and inseparable from other colors of glass, becomes part of the unrecoverable grit fraction or has contaminated other materials. Moreover, broken glass can accelerate wear of mechanical processing equipment.)

According to the National Soft Drink Association, an industry group, opponents of bottle bills, primarily manufacturers, distributors and retailers, believe that container deposits are a punitive form of government intervention in their businesses. Opponents claim that container return systems are impractical, because retail systems are designed for one way through-put. Goods enter the rear of a store and exit the front. The accommodations required for collecting returnables would cost retailers valuable floor space and wages lost to managing the returns. And, while retailers must maintain records, collect deposits and make refunds, they receive no benefits - not even to cover administrative costs. Furthermore, opponents point to an overall recovery rate for beverage containers reaching 60% in 1992, because of the growth in the recycling infrastructure nationally. Moreover, according to the National Soft Drink Association, beverage containers can comprise up to 73% of revenues generated through recycling programs. These revenues are mainly from aluminum cans and help subsidize the collection of other materials, keeping overall program costs down. Since 1972, over 2,000 bottle bills have been defeated in state houses across the country.

State and National Regulations. There are a number of legislative and regulatory policies, which are typically more state or national in scope, which may be implemented to encourage or facilitate source reduction and reuse. In general, regulatory policies should only be used in a situation where the market cannot maintain "efficiency" by itself. In most

situations, regulatory policies will not be effective or will be very costly because they usually need to be very specific and thus will have a limited effect; they are prone to "snowballing" legislation which discourages compliance and provides ample leverage room for special interests; regulatory policies are often unenforceable and easy to circumvent; and they can impede the market and make it less efficient. Three types of regulatory policies are described below: product and packaging bans; product and packaging standards and labelling standards; and disclosure of environmental impact.

Product or Packaging Bans. Some states have instituted bans on the sale of certain products or types of packaging that are perceived to be significant contributors to the volume or toxicity of waste. Some of the materials that have been targeted for bans include plastic cans, polyvinyl chloride, fast-food polystyrene containers and mixed material or mixed plastic containers.

The actual benefit of a ban depends in part on the nature of the material targeted. Bans of some materials such as polystyrene packaging may have limited benefits because they may be based on misperceptions or inconclusive research on the true environmental effects of the materials. Polystyrene that has been manufactured without the use of chlorofluorocarbon (CFC) gases may not be more harmful to public health or to the environment than paper packaging. Thus, to ban the material would not provide much public benefit but would harm the market by limiting the choices available to the consumers of packaging. Environmental and economic impact studies should be done prior to banning in order to determine if the ban will have a net benefit. This also provides some protection against possible law suits by product or packaging manufacturers.

One of the first jurisdictions in the nation to institute a packaging ban for the purpose of municipal waste reduction was Suffolk County, New York. The County banned plastic grocery bags and food packaging made from polystyrene and polyvinyl chloride in 1988. The Society of the Plastics Industry successfully challenged these bans in court on the grounds that an environmental impact study was not done. The New York Supreme Court, however, ruled in favor of Suffolk County in May, 1991. Several other counties and municipalities across the

nation also enacted bans on plastic packaging in 1988 and 1989. Fewer such bans have been enacted in recent years, however.

In addition to bans on the sale of certain products, bans can be placed on the disposal of certain materials in order to encourage source reduction. For instance, the State of Illinois has instituted a ban on the disposal of landscape waste. This has resulted in greater mulching and on-site composting of landscape waste. The State has also placed a ban on the landfilling of lead-acid batteries and has required that retail outlets that sell lead-acid batteries also accept the return of these batteries after they have been used. This has resulted in greater recycling of these batteries.

Product and Packaging Standards. Product and packaging standards are another type of regulatory policy that can be used to reduce waste. Such standards may specify toxicity level per unit, material use per unit, or a durability standard. For example, a policy to establish a durability standard for washing machines could require the manufacturer to offer a warranty period of a specific number of years. Policies to standardize material usage or toxicity levels, however, would have to be much more complex. All policies of this type would have to be very specific and therefore would have limited effectiveness.

Labeling Standards and Disclosure of Environmental Impact. A variation of this type of policy would institute labeling standards for products in order to inform consumers about the impacts of their purchasing decisions. This type of policy would also have to be very specific, perhaps defining labeling standards for each type of product.

RECOMMENDATIONS

Described below are the recommended initiatives DeKalb County should take to encourage source reduction and reuse. The recommendations include measuring source reduction, educational efforts, collection/exchange programs, volume-based disposal rates, waste audit assistance, on-site landscape waste management, creation of model source reduction

programs and awards/recognition program for success stories, local policies, State and Federal legislative and regulatory initiatives and a County government in-house source reduction and reuse program.

Measuring Source Reduction. The County should not adopt a specific percentage source reduction goal to reduce the waste stream, since a precise goal would be essentially arbitrary and difficult, if not impossible, to measure. The County should, however, establish measurable goals for the recommended source reduction and reuse program components to monitor progress.

- To gain the support and active involvement of five or more community organizations in educating the public and conducting survey research.
- To distribute waste audit information to 90 percent of the businesses in the County that have more than 20 employees or that have a high ratio of pounds of waste per capita per day or that generate potentially toxic waste (e.g., dry cleaning shops, auto repair shops).
- To convince 10 percent of these businesses to conduct a waste audit and to implement some or all of the audit recommendations.
- To sign up 10 or more businesses of various types to participate in waste reduction seminars to educate other members of the business community on effective waste reduction techniques.

Educational Efforts. Educational efforts will be the cornerstone of the source reduction program. Specific educational components will be outlined in Chapter 10.

Collection/Exchange Programs. The County should investigate the feasibility of implementing collection/exchange points for reusable materials, such as community swap boards, waste exchanges and curbside collection of donated materials.

- Grocery stores, hardware stores and other businesses often provide community bulletin boards as a service to their customers. Identifying and promoting these "exchange" opportunities, particularly for businesses that have successful waste reduction programs in place, may be all that is necessary to increase their use.

- The Salvation Army has a pick-up collection service for donated goods based out of Rockford. This reuse opportunity could also be promoted to increase its use. The County could encourage municipalities to consider setting up a curbside collection of donated goods through the Salvation Army, either on a regular monthly basis or on a less frequent basis.

Volume-Based Disposal Rates. If the overall recycling rate falls below State mandated goals, the County may consider volume-based collection programs, among other alternatives, as a means of increasing the recycling rate.

Waste Audit Assistance. The County should offer waste audit assistance to interested businesses, both large waste generators and small businesses, to develop or expand source reduction and reuse. In addition, the County should develop or provide a self-help manual for businesses with an emphasis on local success stories, local markets for materials collected and local waste reduction opportunities. The County should coordinate this effort with local recycling service providers and encourage businesses to discuss these issues with their haulers.

On-site Landscape Waste Management. The County should encourage residents and businesses to manage landscape waste on their own property through composting, mulching or chipping.

- An education program should be provided to increase participation and reduce or eliminate potential problems associated with on-site landscape waste management.

Model Source Reduction Programs. The County, in conjunction with local business associations, should identify and highlight commercial/institutional and industrial establishments serving as models for the County.

Local Policies. The County should review and modify its existing ordinances and codes related to solid waste management to reflect new and proposed programs and Plan recommendations.

State & Federal Legislative and Regulatory Initiatives. The County should support legislation and regulations at the state and national levels to reduce the volume of products and packaging if such measures are supported by environmental and economic impact studies.

County Government Source Reduction & Reuse Program. The County should conduct waste audits of its facilities. These waste audits should attempt to pinpoint source reduction and reuse opportunities.

- The County should implement a source reduction and reuse program as an example to local businesses and units of local government.
- The County should establish procurement standards that favor source reduction, reuse, durability and recyclability where practical and economically feasible as an example to local businesses and units of local government.
- The County should encourage other units of local government to conduct waste audits, implement source reduction and reuse programs, and establish procurement standards that favor source reduction, reuse, durability and recyclability for their public facilities.

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CHAPTER 4
TOXICITY REDUCTION AND THE MANAGEMENT OF HOUSEHOLD AND CESQG HAZARDOUS WASTE

Toxicity reduction and the management of household hazardous waste (HHW) and conditionally exempt small quantity generator (CESQG) waste are given special attention in this report since hazardous products are widely used and may have significant impacts on the waste management system. Although household hazardous waste and CESQG waste make up only a small fraction of the municipal waste stream, their improper disposal can pose a serious problem for any waste management effort. This chapter will discuss toxicity reduction and the management of hazardous wastes from households and conditionally exempt small quantity generators. More specifically, this chapter will discuss the following: 1) background; 2) presence and impact on the waste management system; 3) alternative products and management methods for household hazardous wastes; 4) policies to encourage toxicity reduction and responsible disposal; and 5) recommendations for DeKalb County to encourage toxicity reduction and the proper management of toxic materials from households and conditionally exempt small quantity generators. Much of the information in this chapter builds on the information presented in Chapter 3, which should be read for additional insight on toxicity reduction.

BACKGROUND

In order to provide some background information for the development of policy alternatives, this section reviews definitions and legislation/regulations regarding toxicity reduction and hazardous waste generated by households and conditionally exempt small quantity generators.

Definitions. Definitions concerning household hazardous waste, conditionally exempt small quantity generators and toxicity are provided below to assist the reader. Since legal definitions have not been adopted by the Illinois Legislature for all of these terms, the definitions provided have been developed from language used from a combination of professional sources.

Household Hazardous Waste. As defined by the Household Hazardous Waste Collection Act (415 ILCS 90/3), household hazardous waste is a consumer-disposed waste product intended for household use generally containing constituents that make its disposal in municipal waste landfills or incinerators undesirable. Household hazardous waste includes, but is not limited to the following; waste oil; solvents; liquid paint; paint removers and paint thinners; and herbicides and pesticides. In other words, household hazardous waste is the discarded, unused or leftover portions of household products which have hazardous properties. Any household product which is corrosive, flammable, reactive, caustic, toxic, poisonous, explosive and/or radioactive is considered to be hazardous. Examples of household hazardous waste includes automotive products, solvents and paints, pesticides, certain cleaning products, batteries, cosmetics, pharmaceuticals, fireworks and other products found in the home.

Conditionally Exempt Small Quantity Generator (CESQG). A conditionally exempt small quantity generator is a commercial, institutional or industrial establishment which generates no more than 220 pounds of hazardous waste per month or 2 pounds of acutely hazardous waste per month. CESQG's may include printing shops, commercial pesticide users, construction contractors, furniture and wood finishers, laundries and dry cleaners, vehicle maintenance shops, metal working shops, chemical laboratories and chemical formulators.

Acute Toxicity. Acute toxicity refers to the damage to a living system resulting from a large dose through exposure to a substance over a short period of time.

Chronic Toxicity. Chronic toxicity refers to the damage to a living system resulting from the repeated exposure to a substance over a long period of time.

Corrosive/Caustic. A corrosive/caustic substance eats away materials or living tissues through chemical action. Examples include lye, oven cleaner and drain opener.

Flammable/Ignitable. A flammable/ignitable substance easily ignites. Examples include paint solvents, gasoline, kerosene and aerosols.

Reactive. A reactive substance easily reacts with other substances to a produce a chemical change and may produce heat, gases or additionally reactive substances. Examples include pool chemicals, bleach and ammonia.

Toxic. A toxic substance is poisonous or lethal when ingested, absorbed by the skin or inhaled, even in small amounts. Examples include window washer solvent, pesticides and antifreeze.

Toxicity Reduction. Toxicity reduction is the process of reducing or eliminating the amount of toxic constituents in materials or products entering the waste stream.

Legislation and Regulations. Although hazardous waste is heavily regulated, federal and state legislation is limited concerning the hazardous waste generated by households and CESQG's. Legislation concerning hazardous waste is described below.

Resource Conservation and Recovery Act (RCRA). This Federal Act, enacted in 1976, formed the basis for regulation of hazardous waste disposal by creating guidelines for prudent hazardous waste management and disposal. It provides a set of very comprehensive regulations for industrial and commercial hazardous waste, but specifically **exempts** household hazardous waste from those regulations.

Large Quantity Generators. Generators of large quantities of hazardous waste (more than 2,200 pounds per month) are regulated under the authority of the Resource Conservation and Recovery Act (RCRA). Large quantity generators must comply with stringent rules for managing hazardous waste, including accumulation, treatment, storage and disposal requirements.

Small Quantity Generators (SQG's). Those businesses that generate lesser quantities of hazardous waste (220 pounds to 2,200 pounds per month) are defined as small quantity generators. SQG's were brought under the RCRA umbrella by the Hazardous and Solid Waste

Amendments of 1984 (HSWA), which authorized regulations for SQG's similar to the regulations for large quantity generators.

Conditionally Exempt Small Quantity Generator (CESQG). A businesses that generates less than 220 pounds per month or 2 pounds of acutely hazardous materials per month is classified as a conditionally exempt small quantity generator. The regulations for CESQG's (as authorized by HSWA) require that a CESQG determine the types and quantities of hazardous wastes it generates. A CESQG may send this waste to a non-hazardous solid waste facility so long as the CESQG never accumulates more than 2,200 pounds of hazardous waste on its property, in which case the CESQG would become subject to all requirements applicable to SQG's.

Household Hazardous Waste (State Regulations). Although household hazardous waste is largely unregulated in Illinois, recent legislative acts have established disposal restrictions for certain types of household hazardous waste in order to separate these wastes from the municipal waste system. Future legislation may include a bill proposed during the 1991 legislative session that would have required each county in the State to develop a household hazardous waste plan. Although this bill was not passed during the 1991 session, it is likely to be reintroduced for consideration. Another bill proposed during the 1993 legislative session called for an end to the landfilling of household batteries and liquid paint by 1996. This legislation was placed on the study calendar of the House Energy and Environment Committee. Future regulations may also institute special waste taxes or deposits for certain types of household hazardous waste.

Household Hazardous Waste Collection Act (Public Act 87-0735). This State Act, enacted in 1991, finds that there is a need for household hazardous waste collection centers throughout the state. The IEPA is required to formulate and update a plan for collecting small quantities of household hazardous waste, which will encourage county and municipal collection projects and provide for the development and distribution of public information materials. A statewide plan that will ensure comprehensive collection and proper management of household hazardous waste is to be submitted to the General Assembly for approval by March 1, 1995. The Act also requires the IEPA to establish a grant program for local governments which desire

to provide a local or regional household hazardous waste collection center. The grants shall be authorized to cover collection center costs associated with capital outlay for preparing or siting a facility to safely serve as a collection center and to cover costs of administration, public awareness and local amnesty day programs. The Act only pertains to hazardous wastes generated by households. An amendment to the Act (P.A. 88-163) includes within the definition of household hazardous waste petroleum distillate-based solvents, oil-based liquid paint, paints strippers, and certain agricultural pesticides.

Illinois Public Act 88-474. This legislation, effective January 1, 1994, provides that collection centers for household hazardous waste are not subject to local siting approval if the local governing authority agrees to waive this approval.

STATUS OF EXISTING HOUSEHOLD AND CESQG HAZARDOUS WASTE MANAGEMENT IN DEKALB COUNTY

The disposal of hazardous waste generated by households and CESQG's is primarily unregulated in Illinois, and is most often left to the discretion of the generator. However, Household Hazardous Waste disposal may be managed at the County level through IEPA sponsored collections. DeKalb County has participated in the IEPA's single event collection program. These one-day collections allow for the safe disposal of Household Hazardous Waste, but are only available to a limited population in a small time frame. On April 6, 1991, DeKalb County hosted a Household Hazardous Waste Collection Event for its 75,000 residents. DeKalb County provided an appropriate site and pre-event publicity, while the IEPA provided the funding for a collection contractor to handle, identify, package, transport, manifest, and provide final disposal for all waste delivered to the collection. Of the 25,500 County households eligible to use the drop-off site, 639 attended the event, a 2.51% attendance rate. The total cost to the IEPA for the event was $90,317, which is equal to $141.34 per attending household. The results of the one-day collection event are listed below in Table 4-1.

TABLE 4-1. DEKALB COUNTY ONE-DAY HOUSEHOLD HAZARDOUS WASTE COLLECTION April 6, 1991 DeKalb, IL			
Type of Waste Collected	Amount Collected (#55 gal drums)	Percent of Total	Disposal Methods
Oil Based Paint	49.00	30.6%	Fuel Blended/Incinerated
Latex Paint	54.00	33.7%	Fuel Blended/Incinerated
Flammable Solvents	17.58	11.0%	Fuel Blended/Incinerated
Corrosives	7.00	4.4%	Aqueous Treatment
Organic Poisons & Pesticides	7.01	4.4%	Landfilled/Incinerated
Oil	14.54	9.1%	Fuel Blended
Oxidizers	1.00	0.6%	Incinerated
Aerosols	10.00	6.0%	Incinerated
Other	0.00	0.0%	Landfilled/Incinerated
Total	160.13	100.0%	

PRESENCE AND IMPACT ON WASTE MANAGEMENT SYSTEM

Since hazardous waste generated by households and CESQG's is typically not characterized in local waste management needs assessments, it is important to review the presence and impact of this specialized waste stream as they relate to the Counties. Most haulers do not prohibit the collection of these materials and few supply guidelines on the disposal of these materials.

Presence of Hazardous Waste from Households in the Waste Stream. Consumers currently have two primary methods to conveniently dispose of their hazardous waste. The first method is the disposal of empty or partially empty used products with their general refuse. The second method, which is generally improper, is to flush the materials into a sewage or storm sewer system, burn materials or dispose of materials directly onto land. Instead of using these methods, many consumers store materials in their workshops, basements or garages. Environmentally appropriate disposal of household hazardous waste is not readily available to

individual consumers for all products used within the home. Guidance to the general public regarding the proper ways to dispose of potentially hazardous products can be difficult to find and often not specific.

It is difficult to assess the total quantities of hazardous materials which are generated in households. Possibly the most reliable data available on household hazardous waste disposal is from a study in which household waste that was set out for disposal was sorted and weighed in numerous census tracts in four different communities. The results showed that hazardous materials comprised from 0.35 to 0.40 percent of residential waste, and that this level of household hazardous waste was fairly consistent between the four communities' studies-Marion County, California; Tucson, Arizona; Phoenix, Arizona; and New Orleans, Louisiana. Additional studies in Los Angeles County, California and Portland, Oregon found that household hazardous materials comprised less than 0.2 percent of municipal waste, and a further study in Los Angeles found that household hazardous materials comprised as little as 0.0015 percent of municipal waste.

Composition studies have found that paint typically comprises the largest portion of the household hazardous waste stream. In the four-community study described above, paint and related household maintenance items comprised 37 percent by weight of the residential material set out for disposal. Household batteries comprised 19 percent by weight and oil and related automotive items comprised only 11 percent by weight.

The composition figures for the four-community study do not entirely agree with the results of programs organized to collect household hazardous wastes. Collection programs in Illinois over the last several years have received a larger share of latex and oil-based paint (70 percent). Of the materials collected at DeKalb's hazardous waste collection, 64% was paint. Likewise, in a collection program in Seattle, Washington, paint was found to comprise 45 percent by weight and oil was found to comprise 23 percent by weight of the total household hazardous waste collected. A permanent collection facility in San Francisco found the following distribution of container types over a one-year period during 1988: paint (60 %); oil, (10%); aerosols (6%); solvents (6%); pesticides (4%); and other (14%). The facility concluded that

paint comprised 29 percent by volume and oil comprised 24 percent by volume of the total household hazardous waste collected.

The composition findings of the collection programs may be less reliable than the results of the four-community study, due to methodological problems including "self-selection bias". In other words, the materials gathered in a collection program are possibly not representative of the materials generally disposed because the people who go to the effort to bring in the materials may not be representative of the wider population.

Presence of Hazardous Waste from Conditionally Exempt Small Quantity Generators (CESQG's) in the Waste Stream. The availability of specific data on CESQG's is very limited. The most recent USEPA study estimates the number of CESQG's in the U.S. to be between 450,000 and 500,000. These establishments represent 73 percent of all business establishments generating hazardous waste but less than 0.1 percent (approximately 210,000 tons per year) of the total hazardous waste generated by all business establishments. Table 4-2 shows the distribution of CESQG's by type of industry as estimated in the USEPA report National Small Quantity Generator Survey, 1985. Vehicle maintenance businesses comprised nearly half of CESQG's according to the survey. Industries with significant numbers of CESQG's in the "Other Non-Manufacturing" category include: laundries, printing/ceramics, pesticide-application services, photography, and analytical and clinical laboratories.

TABLE 4-2. DISTRIBUTION OF CESQG'S OF HAZARDOUS WASTE

Industry Group	Percent of CESQG's
Vehicle Maintenance	48%
Construction	13%
Other Non-Manufacturing	22%
Metal Manufacturing	8%
Other Manufacturing	9%
TOTAL	100%

The information presented for both Table 4-2 and Table 4-3 does not include "incidental generators", which generate hazardous waste on an irregular basis. Incidental generators are estimated to make up about 15 percent of all CESQG's. Thus, the distribution and characterization estimates shown in Table 4-2 and Table 4-3 should be viewed as approximations. Although agricultural waste is typically beyond the scope of solid waste management, it should be noted that the County has a large agricultural base and may potentially be generating significant quantities of toxic agricultural products such as pesticides, herbicides and garage-type products.

Specific data is not available on the ultimate disposition of CESQG waste, however, data from the USEPA report suggests that most CESQG waste is shipped off site. Of the CESQG's that ship waste off site, the majority of CESQG's sent their waste to a recycling facility (61%). A smaller number of CESQG's sent their waste to a solid waste landfill (17%) and the remainder sent their waste to a facility where the waste was managed in an unknown manner.

Perhaps one third of CESQG's manage their waste on site. Of these CESQG's, the largest portion disposed of their hazardous material in the sewer system (47%). Others recycled (23%) or treated the material (20%) and the remainder managed their waste in an unknown manner (10%).

Impacts of Hazardous Waste Generated by Households and CESQG's. The inappropriate use and disposal of hazardous products from households and CESQG's may pose serious threats to the public health and environment. While the waste generated by any one household or business may contain only minute quantities of hazardous products, the accumulation of these small quantities multiplied by thousands of people over time has raised legitimate concerns for their proper disposal. Three risks primarily associated with household hazardous products include health impacts, environmental impacts and sanitation worker safety.

TABLE 4-3. CHARACTERIZATION OF CESQG WASTE STREAM, 1985	
Type of Waste	Percentage of CESQG Waste
Used Lead-Acid Batteries	60.5%
Spent Solvents	18.1%
Dry Cleaning Filtration Residues	4.8%
Photographic Wastes	4.1%
Waste Formaldehyde	3.2%
Strong Acids or Alkalies	1.8%
Ignitable Paint Wastes	1.7%
Empty Pesticide Containers	1.2%
Pesticide Solutions	1.0%
Solutions/Sludge Containing Silver	0.9%
Other Ignitable Wastes	0.8%
TOTAL	98.1%

Health Impacts. The dangers to one's health from household hazardous products are generally the result of improper or overzealous use and inappropriate storage. Indoor air pollution may be the result of using more of a product than recommended without proper ventilation. Inappropriate storage has resulted in accidental poisonings to children and pets. Long term health problems such as cancer, birth defects, damage to organs or the nervous system and allergies have been attributed to chronic exposure of hazardous chemicals which may be found in the home or the workplace.

Environmental Impacts. Pollutants may be released into the groundwater when oil, solvents and other products are poured onto land surface, where run-off could carry the undiluted pollutants into groundwater resources. Similarly, hazardous wastes dumped into storm sewers or drainage ditches flow untreated into rivers, lakes and streams. Wastes are frequently poured into sewer systems and septic systems in an unsafe manner. Most wastewater treatment facilities are not designed to treat many of hazardous wastes which are received. As a result, there is often costly damage to plumbing and treatment equipment or the contaminants are discharged without proper treatment into the environment. Septic systems are even less equipped

to handle hazardous chemicals. Strong acids and bases, solvents and other chemicals can destroy septic systems and leach into groundwater. If a landfill doesn't have a well-designed liner and leachate collection system, household hazardous waste placed in the landfill could potentially contribute to groundwater pollution at the site. Fumes, fires and explosions are considerations whether items are placed in sewers, placed on land or burned. Clean-up of contaminated areas has been found to be very costly for communities faced with these environmental problems.

Sanitation Worker Safety. Household hazardous waste may have direct effects within the local waste disposal system through the exposure of toxic products to sanitation workers, the release of toxic fumes and fires and explosions in trucks, landfills, and incinerators from flammable and reactive products.

ALTERNATIVE PRODUCTS AND MANAGEMENT METHODS FOR HOUSEHOLD HAZARDOUS WASTES

Household hazardous wastes can be reduced and/or safely used and disposed in different ways depending on the type and quantity of the waste. The Illinois Environmental Protection Agency (IEPA), the Illinois Hazardous Waste Research and Information Center and other public or non-profit agencies advocate certain alternative products, precautionary uses and disposal techniques for the various types of household hazardous waste. These experts' recommendations for some of the more common forms of household hazardous waste are described below. These recommendations are presented here primarily as an overview to the issues involved and as an aid for determining what policies, if any, should be implemented to reduce the generation and improper management of these household products. It should be noted that the recommendations of the experts may not always be in agreement with each other and may not always be suitable for all communities. Figures 4-1 and 4-2, which were developed by the Illinois Hazardous Waste Research and Information Center, present further information on chemical hazards in the home, garage and home workshop.

Chemical Hazards in the Home

Product	Possible Hazards	Disposal Suggestions	Precautions and Substitutes
Aerosols	When sprayed, contents are broken into particles small enough to be inhaled. Cans may explode or burn.	Put only empty cans in trash. Do not burn. Do not place in trash compactor.	Store in cool place. Propellant may be flammable. Instead: use non-aerosol products.
Batteries: small-sized and button type	Swallowing one may be harmful if it leaks. *Toxicity 5**	Recycle if possible, or save for hazardous waste collection day.	No substitutes. If battery is swallowed or lodged in ear or nose, see doctor. For battery contents and recommended treatment call collect (202) 625-3333.
Bleach: chlorine	Fumes irritate eyes. Corrosive to eyes & skin. Poisonous if swallowed. *Toxicity 3**	Use up according to label instructions or give away.	NEVER mix with ammonia or strong acids like toilet bowl cleaner or rust remover! Instead: use Borax, non-chlorine bleach, sunlight, lemon juice.
Detergent cleaners	All are corrosive to some degree. Eye irritant. *Toxicity 2-4**	Use up according to label instructions or give away. May be diluted & washed down sink.	Liquid dishwashing detergent is mildest, laundry detergent is moderate, automatic dishwasher detergent is harshest. Instead: use the mildest product suitable for your needs.
Disinfectants	Eye & skin irritant. Fumes irritating. Poisonous if swallowed. *Toxicity 3-4**	Use up according to label instructions or dilute & pour down sink.	Some may contain bleach, others ammonia — DO NOT MIX! Instead: use detergent cleaners whenever possible.
Drain cleaners	Very corrosive. May be fatal if swallowed. Contact with eyes can cause blindness.	Use up according to label instructions or give away.	Prevention best: keep sink strainers in good condition. Instead: use plunger, plumber's snake, vinegar & baking soda followed by boiling water.
Flea powders, sprays & shampoos	Moderately to very poisonous. *Toxicity 2-4**	Use up or save for hazardous waste collection day.	DO NOT USE DOG PRODUCTS ON CATS. Vacuum-house regularly & thoroughly. Launder pet bedding frequently.
Insect and pest sprays	All are poisonous, some extremely so. May cause damage to kidneys, liver, or central nervous system. Toxicity varies from product to product.	Use up very carefully & according to label instructions. Save for hazardous waste collection day.	Instead: do not attract insects: keep all food securely covered, practice good sanitation in kitchen & bathrooms, remove trash every night.
Medicines: unneeded or expired	Frequently cause child poisonings.	Flush down sink or toilet.	Check content of medicine chest regularly. Old medications may lose their effectiveness, but not necessarily their toxicity. No substitutes.
Metal polishes	May be flammable. Mildly to very poisonous. *Toxicity 2-4**	Use up according to label instructions or give away.	Use only in well-ventilated area. Instead: substitute vinegar & salt or use baking soda on damp sponge.
Mothballs	Some are flammable. Eye & skin irritant, poisonous, may cause anemia in some individuals.	Use up according to label instructions or give away.	Do not use in living areas. Air out clothing and other items before use. Clean items before storage. Instead: use cedar shavings or aromatic herbs.
Oven cleaner	Corrosive. Very harmful if swallowed. Irritating vapors. Can damage eyes. *Toxicity 2-4**	Use up according to label instructions or give away. Save for hazardous waste collection day.	Do not use aerosols, which can explode and are difficult to control. Instead: use paste. Or heat oven to 200 degrees, turn off, leave small dish of ammonia in oven overnight and remove, then wipe oven with damp cloth and baking soda. Do not put baking soda on heating elements.
Toilet bowl cleaner	Corrosive. May be fatal if swallowed. *Toxicity 3-4**	Use up according to label instructions or wash down sink or toilet with lots of water.	Ventilate room. Instead: use ordinary cleanser or detergent and baking soda.
Window cleaner	Vapor may be irritating. Slightly poisonous. *Toxicity 2**	Use up according to label instructions or give away.	Ventilate room. Instead: spray on vinegar, then wipe dry with newsprint.
Wood cleaners, polishes, & waxes	Fumes irritating to eyes. Product harmful if swallowed. Eye & skin irritant. Petroleum types are flammable.	Use up according to label instructions or save for hazardous waste collection day.	Do not use aerosols. Use only in well-ventilated areas. Instead: use lemon oil or beeswax.

Format courtesy of Citizens for a Better Environment

***General Toxicity Rating**

	1	2	3	4	5	6
	Almost Non-Toxic	Slightly Toxic	Moderately Toxic	Very Toxic	Extremely Toxic	Super Toxic
Lethal Dose for 150 lb. Adult	More than 1 Quart	1 Pint to 1 Quart	1 Ounce to 1 Pint	1 Teaspoon to 1 Ounce	7 Drops to 1 Teaspoon	Less than 7 Drops

From Gosselin et al., 1984

For more information:
Hazardous Waste Research and Information Center 1-217-333-8940
Illinois Poison Control Center 1-800-252-2022
Illinois Animal Poison Information Center 1-217-333-3611

For more information about recycling motor oil in Champaign County:
Community Recycling Center 1-217-351-4495

Produced by the Illinois Hazardous Waste Research and Information Center (HWRIC)
#1 East Hazelwood Drive
Champaign, IL 61820
(217) 333-8940

ENR Illinois Department of Energy and Natural Resources

PATRICK ENGINEERING INC.

FIGURE 4-1

Chemical Hazards in the Garage and Home Workshop

Product	Possible Hazards	Disposal Suggestions	Precautions and Substitutes
Aerosols	When sprayed, contents are broken into particles small enough to be inhaled. Cans may explode or burn.	Put only empty cans in trash. Do not burn. Do not place in trash compactor.	Store in cool place. Propellant may be flammable. Instead: use non-aerosol products.
Asphalt roofing compound	Eye irritant. Fumes moderately toxic. *Toxicity 3**	Use up according to label instructions or give away.	Do not use indoors. No substitutes.
Auto: antifreeze	Very poisonous. Has sweet taste — attractive to small children & pets. *Toxicity 3-4**	Amounts of less than 1 gallon pour down sink with plenty of water. Do not do this if you have a septic tank.	Clean up any leaks or spills carefully. No substitutes.
Auto: batteries	Contain strong acid. Very corrosive. Danger to eyes & skin.	Recycle.	Trade in old batteries. No substitutes.
Auto: degreasers	Corrosive. Poisonous. Eye & skin irritant. *Toxicity 2-4**	Use up according to label instructions or give away.	Instead: choose strong detergent type over solvent type.
Auto: motor oil & transmission fluid	Poisonous. May be contaminated with lead and other toxic substances. Skin & eye irritant.	Recycle.	No substitutes.
Auto: waxes & polishes	Fumes irritating to eyes. Harmful if swallowed. Eye & skin irritant.	Use up according to label instructions or give away.	Use outside. No substitutes.
Lacquer & lacquer thinner	Extremely flammable. Very poisonous. *Toxicity 4**	Use up according to label instructions or save for hazardous waste collection day.	Ventilate area very well. Do not use in room with pilot light, open flame, electric motors, spark-generating equipment, etc. DO NOT SMOKE WHILE USING. No substitutes.
Paint strippers, thinners, & other solvents	Many are flammable. Eye & skin irritant. Moderately to very poisonous. *Toxicity 3-4**	Let settle, pour off cleaner for re-use. Pour sludge into container & seal, or wrap well in newspaper & throw in trash. Use up according to label instructions or save for hazardous waste collection day.	Avoid aerosols. Buy only as much as you need. Ventilate area well. Do not use near open flame. Instead of paint stripper: sand or use heat gun. Use water-based clean-up products as much as possible.
Paints (oil-based) & varnishes	Flammable. Eye & skin irritant. Use in small, closed area may cause unconsciousness.	Use up according to label instructions or save for hazardous waste collection day.	Ventilate area well. Do not use near open flame. May take weeks for fumes to go away. Instead: use water-based paints if possible.
Insecticides,* herbicides, fungicides, slugbait, rodent poison, wood preservatives	All are dangerous to some degree. Can cause central nervous system damage, kidney & liver damage, birth defects, internal bleeding, eye injury. Some are readily absorbed through the skin. *Toxicity 3-6**	Use up carefully, following label instructions. Save for hazardous waste collection day.	Do not buy more than you need. Instead: try hand-picking, mechanical cultivation, natural predators. Practice good sanitation. Choose hardy varieties. Use insect lures & traps. As a last resort, use least toxic suitable pesticides.

* The following pesticides were previously sold for use by homeowners and the general public but have since been banned or are no longer recommended for use by homeowners.
Calcium Arsenate, Copper Arsenate, Arsenate, Creosote, Pentachlorophenol (PCP), Chlordane, DDT, Silvex, 2-4-5 T, Sodium Arsenite, Heptachlor, Aldrin, Dieldrin.

These pesticides should be carefully stored and saved for a hazardous waste collection day. Here is one way to safely store them. Get a plastic container with a lid (a 5-gallon plastic bucket, for example). Fill halfway with kitty litter. Keep the substance IN ITS ORIGINAL BOTTLE OR BOX and put it in the plastic container. Fill to the top with kitty litter and replace the lid. Mark the container clearly and store it away from children, pets, etc. It is a good idea to store the container on a shelf rather than a concrete or soil floor to reduce corrosion.

Format courtesy of Citizens for a Better Environment

***General Toxicity Rating**

	1	2	3	4	5	6
	Almost Non-Toxic	Slightly Toxic	Moderately Toxic	Very Toxic	Extremely Toxic	Super Toxic
Lethal Dose for 150 lb. Adult	More than 1 Quart	1 Pint to 1 Quart	1 Ounce to 1 Pint	1 Teaspoon to 1 Ounce	7 Drops to 1 Teaspoon	Less than 7 Drops

From Gosselin et al., 1984

For more information:
Hazardous Waste Research and Information Center 1-217-333-8940
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(217) 333-8940

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ENR Illinois Department of Energy and Natural Resources

FIGURE 4-2

Painting and Decorating Products. Oil-based paint is flammable and toxic. If it contains aromatic hydrocarbon thinners, it can cause permanent damage to the liver and kidneys. Alternatives to oil-based paint are water-based or latex paint, and limestone-based whitewash, which are not flammable and are much less toxic. A necessary precaution during use of oil-based paint is good ventilation; it should be noted that fumes may remain for more than a week. Cans should be sealed tightly between uses and the paint should not be used near open flame. Leftover paint that is usable may be given to schools, theater groups, local park districts or charitable organizations. Otherwise, the paint should be used entirely or discarded with regular trash once solidified (by exposing to air outside). Oil-based paint may also be solidified by adding absorbent material to the leftover paint, such as sand, kitty litter, sawdust or vermiculite. If the paint cannot be donated and is not solidified, it should be saved for a household hazardous waste collection program.

Other decorating products and products related to paint include: cleaning solvents, turpentine, paint stripper, lacquer, lacquer thinner, wood stain and varnish. These products are typically flammable and toxic and depending on the specific chemicals, can cause liver, kidney, or nervous system damage. There are no substitutes for these items besides water-based paint and water-based clean-up products such as lye paint-stripper. Precautions for the use and disposal of these products are similar to those for oil-based paint, although cleaning solvents, turpentine, and paint strippers can be strained and reused. The other products can be safely disposed of when solidified. None of these items or oil-based paint should be disposed down sewers, into septic tanks or on the ground.

Policies regarding painting and decorating products should take into consideration four things. First, these products comprise the largest portion of household hazardous waste. Second, water-based paints and paint strippers provide a less toxic alternative than oil-based products. Third, leftover paint can sometimes be donated and can in some cases be bulked with other leftover paint to form a beige paint for priming, for park buildings or for other uses. Fourth, these products can often be safely disposed in the solid waste management system once they are solidified.

Automotive Products. Potentially hazardous automotive products include used motor oil, antifreeze, batteries, transmission fluid, old gasoline and other items. These products are typically toxic and corrosive. There are no non-toxic alternatives for these products other than using public transportation or bicycles. Batteries can be brought for recycling to any store that sells car batteries (as provided by Illinois Public Act 86-723) and used motor oil and transmission fluid can be recycled if there is a local gas station, automobile repair/supply shop nearby willing to accept the materials for recovery. Antifreeze can be poured into the sewer system in small quantities with plenty of water but not into a septic tank system. Old gasoline should be turned over to a hazardous waste collection program or reputable auto service facility as soon as possible. See Table 4-4 for contacts.

Policies regarding automotive products should take into consideration five things. First, automotive products, particularly motor oil, comprise a large portion of the household hazardous waste stream. Second, there are no suitable non-toxic alternatives. Third, much used motor oil in Illinois is suspected to be dumped on the ground. Fourth, there are often local outlets, such as gas stations or automotive repair/supply shops in counties where oil can be taken for recycling (re-refining) or energy recovery. Table 4-4 lists businesses that provide used oil drop-off sites in the County. Fifth, some automotive products such as old gasoline (and used oil, as of 1996) cannot be properly managed within the solid waste management system.

TABLE 4-4. USED OIL DISPOSAL IN DEKALB COUNTY			
Company	Hours	Notes	Hauler
DeKalb Auto Service & Repair 125 1/2 North Annie Glidden Rd. 756-7392	M-F: 7-5:00	They burn their own oil for heat	
The Pit Pros 308 N. 4th Street 815/756-9800	M-F: 8:30-5:30	They also take in used gas free	Solar Environmental
O X-Change 2615 Sycamore Rd.	M: 8-7:00 Sa: 8-4:30 Tue-F: 8-5:30		Southwest Waste Management
Joe's Muffler 424 1/2 E. Lincoln Hwy. 815/758-0775	M-F: 8-5:00 Sa: 8-12:00		Solar Environmental
Punk's Ltd. 121 N. Maple St. Sycamore Bruce: 815/895-4543	M-F: 7-5:30 Sa: 7-12:00		Safety Clean
Archer Alignment 424 1/2 Lincoln Hwy. 756-6246	M-F: 8-5:00 Sa: 8-12:00		Solar Environmental
Joe Daniels Chev/Geo/Olds/Cad 204 N. 4th St. 815/756-6351	Call for hours		Solar Environmental
Voss Motor Sales, Inc. 190 E. Lincoln Hwy. Hinckley 286-3206	Call for hours		Safety Clean
Car Hospital 1940 DeKalb Avenue Sycamore	Call for hours		Safety Clean
The Car Doctor 1422 E. Lincoln Hwy. 758-1442	M-F: 8-5:30 Sa: 8-12:00		Midwest Oil Co.
Tom Spark's Buick Inc. 216 S. 1st Street 756-9508	Call for hours	They burn their own oil	
Castenson Sales & Service 112 S. Maple St. Sycamore 895-4233	M-F: 7:30-5:30		Verona Carriers, Wisconsin Safety Clean
Note: These services are available to those who can verify that the oil does not contain any contaminating substances (antifreeze, etc.), and only have a small amount to dispose at any one time.			

Pesticidal and Herbicidal Products. These products include insecticides, herbicides, fungicides, slug bait and rodent poison. The products may be sprays, powders or solids. All of these products are inherently poisonous. Typically, they are carcinogenic and mutagenic, and can damage the nervous system, liver and kidneys. Substitutes include non-toxic pesticides such as soap and water for aphids, whiteflies and mites. Other alternatives are good sanitation and housekeeping, use of natural predators, careful selection of plants and mechanical cultivation. Pesticidal and herbicidal products should be used carefully and according to label instructions. Empty containers can be wrapped and disposed with other solid waste. Older pesticides and herbicides that have now been banned should be saved for a hazardous waste collection program. Overall, pesticidal and herbicidal products comprise a relatively small portion of the household hazardous waste stream. The local County or Cooperative Extension Service may be helpful in providing local information regarding the best use of these products.

Kitchen, Laundry and Bath Products. These products include drain openers, oven cleaners, oil furniture polish, rug/upholstery cleaners, toilet bowl cleaners, tub/tile cleaners, disinfectants such as pine oil, bleach, nail polish and remover, metal polishes, wood cleaners and polishes and waxes, spot removers and related items. These items are typically toxic and corrosive and sometimes flammable. There are various cleaners available which are less toxic, such as detergent cleaners, non-chlorine bleaches, baking soda and vinegar. Toxic cleaning products can typically be poured into the sewer system in small quantities with plenty of water. Only limited amounts should be poured into a septic system. Cleaners should not be mixed, since this could create dangerous fumes. Overall, cleaning products comprise a relatively small portion of the household hazardous waste stream.

Miscellaneous Products. This category includes batteries, treated wood, wood preservative, ammunition, old medicine and other miscellaneous items. Household batteries may comprise a relatively large portion of the household hazardous waste stream if the research in the four-community study described earlier is correct. Some types of batteries are especially harmful if they enter the municipal waste management system, including lead-acid batteries, mercuric oxide button batteries and silver-oxide button batteries. Lead-acid batteries are collected for recycling at any store that sells lead-acid batteries. The silver-oxide button

batteries found in watches are recycled by most watch stores because the silver has scrap value. Mercuric oxide batteries should ideally be saved for a hazardous waste collection program, but may be sold to a recycling company for their mercury content.

POLICIES TO ENCOURAGE TOXICITY REDUCTION AND RESPONSIBLE DISPOSAL

Although large scale toxicity reduction efforts are often state or national in scope, there are several effective policies that counties can implement to encourage toxicity reduction in their communities. Three primary methods in which counties can affect the toxicity of waste include consumer/CESQG education programming, separate collections of household hazardous waste and reduction and diversion efforts towards CESQG waste.

Consumer/CESQG Education. An education program is central to toxicity reduction. The education program should focus on explaining the potential health and environmental impacts of household hazardous wastes; the substitutes available for hazardous products and the proper and responsible disposal practices for toxic materials. Toxicity reduction information should be incorporated into the components of the broader source reduction education program. Education programs should be targeted towards residents, school children, consumers, businesses and the agricultural community. Since education programming is an integral function of solid waste management, Chapter 10 has been dedicated to review Solid Waste Education Systems. A variety of education program components which may be used to communicate important source reduction and reuse information including information clearinghouse/reference center, publicity campaign, public outreach/speaker's bureau, local directory, school curriculum, in-store shopper awareness, waste audit, model toxicity reduction programs, and waste exchange are discussed more thoroughly in Chapter 10.

Separate Collections for Household Hazardous Waste. In some cases, hazardous wastes generated by households can be more adequately managed through separate collection programs. To reduce the risks caused by household hazardous waste, communities across the country have conducted collection programs. During the last ten years, nearly 2000 such programs have been

administered in 45 states. Most of these collection programs have been single-event programs conducted for a short period of time at a temporary location. However, nearly 40 permanent collection facilities have also been established and a continuously operating mobile collection unit has been used in Seattle, Washington. Illinois has one permanent collection facility, located in the City of Naperville. This section will discuss three types collection alternatives: 1) single-event collection programs; 2) waste exchanges and collection for recycling; and 3) permanent collection stations.

Single-Event Collection Programs. The most common type of collection program in Illinois is a one-day collection program where members of the community drive to a temporary site on a designated day and drop off unused portions of hazardous materials from their homes. Approximately 54 single-event collection programs have been held by the IEPA in various locations throughout Illinois, including DeKalb County. Illinois communities may apply to co-sponsor the one-day collection events, in which they are responsible for providing an appropriate site and pre-event publicity. The IEPA provides 100% funding for a collection contractor to handle, identify, package, transport, manifest and provide final disposal for all waste delivered to the collections. The IEPA transfers as much of the liability onto the hazardous waste collection contractors as possible and the Agency assumes all long-term liability by accepting the responsibility of becoming the "generator" of all waste collected.

Data from fifteen collection programs conducted between May of 1990 and May of 1991 shows that the average cost was $113,179 per collection day or $185 per participating household. The average amount of household hazardous waste collected from each participating household has been approximately 0.4 drums. This is comparable to DeKalb's data, where the total cost for the event was $90,317, or $141.34 per household. The amount of hazardous waste collected from each DeKalb County household was 0.25 barrels. Costs for the collection and management of the wastes averaged $530 per drum. Participation at the one day events has been up to 4 percent of the households in the communities. Surveys conducted at the collections revealed that 85 percent of all participants traveled less than eight miles to the collection site.

Materials collected at the fifteen collection sites included latex paint (36.8%), oil based paint (32.8%), oil (7%), organic poisons (6.6%), flammable solvents (6.1%), aerosols (5.1%), corrosives (2.5%), oxidizers (0.6%) and others (2.5%). Disposal techniques for these materials has included fuel blending (81%), incineration (15%), treatment (3%) and landfilling (1%).

Waste Exchange and Recycling Collections. Several outlets may be coordinated to collect hazardous materials from the public for reuse or recycling opportunities. Waste exchanges, for example, may be coordinated so residents can exchange unused portions of materials. Certain materials such as paint and household cleaners that are suitable for reuse can be displayed in an area for people to choose and take what they want. Waste exchanges work most efficiently where a permanent collection facility has been set up, but some cities have also conducted waste exchanges in conjunction with single-day events or as an ongoing program apart from a general collection program. For example, civic organizations in Barrington, Illinois, have conducted a paint exchange program.

Private business can also be encouraged to collect certain types of household hazardous wastes that may have been bought as products from that store. Kane County has recently coordinated the collection of used latex paint with a paint retailer in each municipality located in the County. In this program, the retailer is responsible for collecting, mixing and storing the salvaged paint, while the County is responsible for supplying the 5-gallon paint containers to store the salvaged paints and assisting with the marketing of the salvaged paint to neighborhood restoration projects, volunteer organizations and schools/theater groups. Counties may also encourage service stations to accept used motor oil for recycling and jewelers and watch shops to accept silver-oxide button batteries for reclamation. Instituting a used oil reclamation system now will facilitate compliance with the materials disposal ban on liquid used oil in the future.

Permanent Collection Programs. Several states throughout the country have established permanent collection programs for household hazardous waste. In these programs, residents have a permanent outlet for their unused portions of hazardous products. Variations of permanent programs include a permanent station, "milk run" sites and mobile collections. Generally, a permanent station is a fixed facility at a central location. Milk run sites are often

several smaller spread-out sites which are serviced by one hazardous waste disposal contractor. Mobile collections usually pertain to collections offered by fully equipped vehicle which travels to designated sites. Permanent sites may either serve local residents or regional residents, depending on the type of permit obtained. Beginning January 1, 1994, collection centers will not be subject to local siting approval if the local government agrees to waive local siting approval procedures.

Naperville's Household Hazardous Waste collection facility is the only permanent collection site in Illinois. This joint venture between the IEPA and the City of Naperville accepts household hazardous wastes from Naperville residents on Saturdays and Sundays all year. The site, located in a fire station, accepts all pesticides and herbicides, automotive fluids, paints and related fluids, caustics, and containers of "mystery fluids" that must be identified for proper disposal. Non-hazardous waste, ammunition and unopened containers containing unused hazardous waste are not accepted, and no attempt is made to exchange paint or salvage paint for reuse. The IEPA contracts and finances the disposal of all collected materials, which is estimated to cost $70,000 per quarter. The actual cost for disposal to the IEPA for the period October 24, 1993 through June 30, 1993 was $152,140.89. The remaining costs of site development, community education, operating supplies, and personnel are financed by the City of Naperville. Since the site is located in a municipal fire station and is manned by fire fighters/paramedics trained in hazardous materials handling, the city was freed from the expenses of property acquisition and personnel training. The city spent $76,000 modifying the site to accommodate collection activities, and for the construction of a storage building designed for the storage of hazardous waste.

The program was first advertised to the community via a local cable television program, direct mailings, press releases, letters to homeowners' associations, and through education programs in local schools. A $10,000 annual budget is allotted for community education and further staff training. The cost of first year operating supplies was $17,000, although this represents the start-up cost and can be expected to decrease in subsequent years of operation. The estimated fiscal year 1994 cost is $1,400 or less. The personnel costs decreased also, from

the first six-month average of $2,100/pay period to $1,793/pay period for the second six months of operation.

The City of Rockford in Winnebago County is currently developing a permanent household hazardous waste collection site, which is to become operational in early summer of 1994. The site will only accept waste from Rockford residents, due to the siting and permitting difficulties involved with regional facilities. The IEPA has made a three year commitment to fund the hauling costs associated with disposal of the hazardous waste, and will assume the liability involved by acting as the generator of the waste. It is estimated that Rockford's cost of developing the site and beginning the program will reach $100,000.

Unfortunately, the start-up costs involved with developing and operating a permanent collection site have been prohibitive for many Illinois communities. With the exception of Naperville's site, all public collection programs within Illinois to date have been funded entirely by the State. State funding, even for permanent sites, is subject to re-evaluation. Once the IEPA three year commitment for funding and liability coverage has expired, there is no guarantee that the funding will be extended. The IEPA has suggested that at least one three-year extension will be made in the case of Naperville. The benefits of a permanent collection facility over a one day collection are lower overall costs due to less reliance on contractors, lower shipping costs and other factors. Public Act 87-0735, enacted in 1991, makes funds available to cover 67 percent of the capital costs involved in establishing a local or regional household hazardous waste collection center. This new legislation makes it more economically feasible for units of local government to develop a permanent collection facility. A permanent station can also serve and receive funding from several counties.

Besides cost, permanent collection programs offer other advantages in comparison to single-event collections. The staff of permanent programs can often reduce the amount of hazardous waste that needs disposal by setting up an ongoing waste exchange. The staff can also consult with participants about how certain materials can be reduced or rendered safe for disposal in the non-hazardous solid waste system. Permanent collection programs may send only 5 to 30 percent of the waste they receive to a disposal facility because the permanence of the

facility allows the staff to take advantage of whatever recycling and recovery alternatives are available in the region.

Permanent sites, however, must meet the siting, permitting and operational requirements of a hazardous waste storage facility. The operational requirements include limited 90-day storage of wastes; various building and fire code requirements; and separation and containerizing. Collection programs normally do not accept hazardous waste from businesses that are unregulated generators of hazardous waste because if such wastes are accepted, the collection site must meet more stringent Federal regulations. Facility costs for five stations in Minnesota ranged from $4,000 to $50,000 with an average cost of $15,200.

Policy alternatives for conducting a collection event or establishing a permanent collection program must take into consideration three things. First, participation in some existing programs has been low and it might be assumed that a relatively small proportion of household hazardous waste in the area has been collected. Second, costs are relatively high for local governments to carry alone and collection programs may be feasible only with State monetary assistance. Third, the collection programs can have an educational impact by making people more aware of household hazardous waste issues.

In light of these considerations, policy alternatives related to collection programs might include: 1) application to the State for funding of a local or regional permanent collection facility; and 2) communication with neighboring counties concerning the establishment of a regional collection program.

Reduction and Diversion of CESQG Waste. Several policy alternatives exist for the reduction and diversion of CESQG waste in the County. First, waste audit information and assistance can be provided to likely CESQG businesses. Second, incentives could be offered to known CESQG's to form "milk runs" or cooperative arrangements with other CESQG's or even SQG's for the combined transportation of their waste to a RCRA facility at a lower cost to all. Unfortunately, most haulers and disposal facilities cannot accept hazardous waste without a manifest; therefore, in order for a CESQG business to send its hazardous waste to the

appropriate facility, a CESQG business must obtain USEPA and IEPA generator numbers and must also fill out manifests for its hazardous waste. Third, the County could set up a permanent collection program for household hazardous waste that would also meet the necessary requirements to accept waste from businesses. This alternative would be dependent on State monetary assistance. Fourth, the County could investigate the feasibility of coordinating the collection of hazardous waste from households, CESQG's and the agricultural community.

TOXICITY REDUCTION AND THE MANAGEMENT OF HOUSEHOLD AND CESQG HAZARDOUS WASTE RECOMMENDATIONS

Described below are the recommended initiatives DeKalb County should pursue to encourage toxicity reduction and the responsible disposal of household hazardous waste. The recommendations include education programs; collection programs; and additional research.

Education Programs. In conjunction with source reduction educational activities described in Volume I, Chapter 3, the County should utilize existing information, develop local information and aggressively disseminate the information as it relates to hazardous waste generated by households and CESQG's. The education program should focus on explaining the potential health and environmental impacts of household hazardous wastes; the substitutes available for hazardous products and the proper and responsible disposal practices for toxic materials. More specific recommendations include:

- The County should gather the existing reference materials and information handouts concerning toxicity reduction developed by state agencies and other responsible sources. The materials should be made available to the public through a County information clearinghouse or reference center.
- The County should develop a publicity campaign concerning household hazardous waste and toxicity reduction through the use of local information hand-outs, newsletters and news releases.
- The County should provide and arrange speaking engagements to community groups, present displays at public events and hold special workshops concerning household hazardous waste and toxicity reduction.

- The County should develop a listing of local reuse/recycling opportunities for household hazardous products available to the residents of DeKalb County

- The County should encourage local school boards to incorporate toxicity reduction educational materials into school curriculum.

- The County should coordinate an in-store shopper awareness program to emphasize toxicity reduction.

- The County should inform local businesses of waste exchange opportunities, such as the Industrial Materials Exchange Service.

- The County should consider developing an aggressive waste auditing program for CESQG's, in attempt to reduce the toxicity of this waste stream.

Collection Programs. The County should attempt to provide or coordinate recycling/reuse/disposal opportunities for household hazardous products to residents. More specific recommendations include:

- The County should communicate with neighboring counties concerning the establishment of a regional collection program.

- The County should encourage and/or coordinate efforts of local paint retailers in the County to collect and recycle/reuse/dispose of used paint from customers.

- The County should establish a paint exchange, bulking or collection site where paint could be swapped, remixed for use in County projects, or picked up by a hauler for reprocessing.

- The County should encourage and/or coordinate efforts of local automotive businesses in the County to collect and recycle/reuse/dispose of used motor oil, antifreeze or other solvents from customers.

- The County should encourage and/or coordinate efforts of local jewelers and watch shops to collect and recycle/reuse/dispose of watch batteries from customers.

- The County should investigate the feasibility of developing a permanent collection program. If a permanent collection program is deemed feasible, the County should apply to the State for monetary assistance.

- The County should investigate the feasibility of offering incentives to CESQG's to send their waste to a approved RCRA facility.

- The County should investigate the feasibility of coordinating the collection of hazardous waste from households, CESQG's and the agricultural community.

Additional Research. The County should more thoroughly assess the level of hazardous waste that is generated by households and CESQG's. More specific recommendations include:

- The County should assess the quantity of household hazardous waste in the residential waste stream and evaluate the need for a permanent household hazardous waste collection program.

- The County should survey likely CESQG's in the County to determine the quantity of the CESQG waste stream in the County and evaluate the need for a CESQG hazardous waste collection program.

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CHAPTER 5
RECYCLING

Recycling is a series of activities by which materials, that would otherwise remain wastes, are collected, separated or processed and used in the form of raw materials. This chapter primarily deals with recycling methods which prevent materials from being discarded as waste for final disposal. This chapter discusses 1) the relevant background on recycling; 2) the existing recycling system in DeKalb County; 3) options to maximize residential recycling; 4) options to maximize commercial/institutional/industrial recycling; 5) options to maximize construction/demolition debris recycling; 6) options to maximize orphan waste recycling; 7) processing alternatives; 8) markets for recyclable materials; 9) additional alternatives to support recycling initiatives and 10) recommendations.

BACKGROUND

In order to provide some background information regarding recycling for the development of policy alternatives, this section reviews definitions and legislation/regulations pertaining to recycling.

Definitions. Definitions regarding recycling and landscape management are provided below to assist the reader. All the terms have been defined by the Illinois Compiled Statutes (ILCS) or reflect accepted industry terminology, unless otherwise indicated.

Clean Construction and Demolition Debris (415 ILCS 5/3.78). Clean construction and demolition debris means broken concrete without protruding metal bars, bricks, rock, stone, reclaimed asphalt pavement or uncontaminated dirt or sand generated from construction or demolition activities.

Closing the Loop. "Closing the loop" refers to the process of full cycle recycling as represented by the three chasing arrows in the recycling symbol. These arrows represent reclamation, remanufacturing and reuse. When consumers or businesses purchase products made

with recycled or secondary materials, the process of recycling is brought full circle. Purchasing products made from secondary materials creates demand for recyclables collected which helps ensure healthy end markets.

Commingled Recyclables. Commingled recyclables is a mixture of several materials into one container.

End Market/End Use. End market or end use refers to the use or uses of a diverted material or product which has been returned to the economic mainstream, whether or not this return is through the sale of the material or product.

Material Recovery Facility (MRFs). Material Recovery Facilities are centralized facilities that receive, separate, process and market recyclable materials. (See also: Recycling Center)

Municipal Waste Recycling Rate. As interpreted by the IEPA, the municipal waste recycling rate is the percentage derived by dividing the weight of the generated municipal waste that is being recycled (or planned for recycling) by the weight of the municipal waste generated, (or expected to be generated) within the area of concern during the same year. The weight of municipal waste being recycled is: the weighed amount of municipal waste received (or planned for receipt) for recycling, minus the weighed amount of material remaining after processing that is not recyclable.

Open Dumping (415 ILCS 5/3.24). Open dumping means the consolidation of refuse from one or more sources at a disposal site that does not fulfill the requirements of a sanitary landfill.

Orphan Wastes. Orphan wastes are miscellaneous wastes which require special handling, such as batteries, motor oil, tires and white goods.

Post-Consumer Materials. Post-consumer materials are those products or materials generated by a business or consumer that have served their intended end uses, and that have

been recovered from or otherwise diverted from the waste stream for the purpose of recycling. For example, recycled paper which is labeled to contain post-consumer materials would indicate that reclaimed paper previously used by consumers was used in producing the item.

Recyclables. Recyclables are materials that still have useful physical or chemical properties after serving their original purpose and that can, therefore be remanufactured into new products.

Recycling, Reclamation or Reuse (415 ILCS 15/3 et seq.). Recycling, reclamation or reuse means a method, technique or process designed to remove any contaminant from waste so as to render the waste reusable, or any process by which materials that would otherwise be disposed of or discarded are collected, separated or processed and returned to the economic mainstream in the form of raw materials or products.

The IEPA interprets the definition used by the Solid Waste Planning and Recycling Act as follows:

Recycling <u>does</u> include:

a. composting operations where the waste, once composted, is returned to the economic mainstream or replaces other raw materials for fertilizer, soil conditioner or mulch.

b. applying landscape or other municipal waste directly to agricultural land at agronomic rates.

c. landscape waste that is collected, separated or processed and returned to the economic mainstream in the form of raw materials or products.

d. shredding operations where the waste is returned to the economic mainstream or replaces other raw materials as soil conditioner, mulch or erosion control.

e. re-using construction or demolition debris for building construction purposes or re-use as road surface materials.

f. using waste for commercial feed for such things as mink farms, swine operations or fish production.

g. processing waste at a rendering facility for return to the economic mainstream.

h. processing municipal waste, particularly metal appliances, for metal recovery.

Recycling Center (415 ILCS 15/3 et seq.). Recycling center means a facility that accepts only segregated, nonhazardous, non-special, homogeneous, non-putrescible materials, such as dry paper, glass, cans or plastics, for subsequent use in the secondary materials market.

Secondary Material. Secondary materials are materials that are used in place of primary or virgin materials in the manufacturing of a product.

Source Separation. Source separation refers to the segregation of recyclable materials from waste products at the point of generation. For example, residences source-separate recyclables from their refuse as part of a curbside recycling program.

White Goods (415 ILCS 5/22.28). As currently defined, white goods include all discarded refrigerators, ranges, water heaters, freezers, air conditioners, humidifiers and other similar domestic and commercial large appliances.

Legislation. Illinois legislation has fundamentally influenced recycling programs in the State. This section reviews significant legislation passed in the 84th, 85th, 86th, 87th and 88th General Assemblies.

Solid Waste Planning and Recycling Act (415 ILCS 15/1 et seq.). This Act requires each county to design a program to recycle 15 percent of its municipal waste by the third year of program implementation and 25 percent of its municipal waste by the fifth year of program implementation, subject to the existence of a viable market for the recycled material. The recycling program must also provide for:

- County-wide implementation according to a planned schedule.
- The designation of a Solid Waste Coordinator.

- The separate collection and composting of leaves.

- A public education program.

- Provisions for compliance, including incentives and penalties. The plan may additionally provide for mandatory separation requirements.

- Provisions for recycling the collected materials, identifying markets for at least three recyclable materials and promoting the use of recycled materials among businesses, newspapers and local governments in the County.

- The plan may additionally provide for the construction and operation of one or more recycling centers and may make special provision for commercial and institutional establishments to implement recycling programs at their facilities.

Management of Used Tires (415 ILCS 5/53 et seq.). Title XIV of the Environmental Protection Act addresses the management of used tires. The statute created a permanent means of combatting the spread of the Asian Tiger mosquito, which nests in discarded tires and has been identified as a potential carrier of encephalitis. The key provisions of the Act are as follows:

- Beginning July 1, 1990, persons providing storage for 50 or more used or waste tires must notify IEPA.

- The Illinois Pollution Control Board must issue regulations which prescribe standards for the transport, storage, processing and disposal of used and waste tires.

- Beginning July 1, 1994, whole tires may not be landfilled. Shredded or split tires may be disposed in landfills if the landfill meets certain criteria.

This Act also establishes a grant program, administered by ENR, to encourage the recycling of used tires. The grants are available to both the public and private sectors. Financial assistance is also being provided by IEPA to assist local governments in cleaning up used tire accumulations.

Management of Lead-acid Batteries (415 ILCS 5/22.23). Beginning September 1, 1990, lead-acid batteries cannot be disposed of in landfills or incinerators. The law also requires

retailers of lead-acid batteries to accept used batteries for recycling in exchange for new batteries purchased. ENR is charged with the responsibility of developing alternative processing and recycling options for lead-acid batteries.

Management of Liquid Used Oil (415 ILCS 5/21.6). Under provisions of the materials disposal ban, beginning July 1, 1996, no person may knowingly mix liquid used oil with any municipal waste that is intended for collection and disposal at a landfill. Beginning July 1, 1996, no owner or operator of a sanitary landfill shall accept liquid used oil for final disposal that is discernable in the course of prudent business operation. Liquid used oil shall not include used oil filters, rags, absorbent materials used to collect spilled oil or other materials incidentally contaminated with used oil, or empty containers which previously contained virgin oil, refined oil or used oil. The IEPA will be responsible for investigating the manner in which liquid used oil is currently being utilized and potential prospects for future use.

Management of White Goods (415 ILCS 5/22.28). Beginning July 1, 1994, white goods may not be offered for collection unless the white good components have been removed. Beginning July 1, 1994, no landfill owner or operator may accept white goods unless the landfill participates in the Illinois Industrial Material Exchange Service (IMES) program and the components have been removed. The IEPA is authorized to provide financial assistance to local units of government to plan for and implement a management program for white goods. The Governor's Task Force on White Goods has submitted a final report which will most likely be considered by the General Assembly this Spring. Potential changes resulting from the Task Force report will be discussed in greater detail in the section pertaining to "orphan wastes."

Procurement (415 ILCS 20/3). The provisions of this statute target recycled paper products (including cellulose insulation), retreaded tires and re-refined oil. State agencies are to procure products with recyclable material "whenever economically and practically feasible".

STATUS OF EXISTING RECYCLING PROGRAMS IN DEKALB COUNTY

As documented in the DeKalb County Waste Management Needs Assessment and based upon recently updated information, the County is estimated to have recycled approximately 38,238 tons of municipal waste in 1993. In addition, another 8,576 tons of landscape waste was composted. Using the IEPA interpretation of recycling, the data indicates that DeKalb County recycled approximately 44 percent of its municipal waste during 1993. The current recycling infrastructure in DeKalb County includes drop-off centers, single-family curbside collection service, multi-family collection service, commercial/institutional and industrial recycling programs and construction/demolition recycling.

The Solid Waste Planning and Recycling Act states that the recycling program for each county "shall be designed to recycle, by the end of the third and fifth years of the program, respectively 15% and 25% of the municipal waste generated in the county." Since DeKalb County has already exceeded these goals, the County may wish to consider setting its own goals to:

1. Insure continued success in achieving the State's goals;
2. Further extend the life expectancy of the County landfill, or;
3. Anticipate that the State will be increasing it's mandated goals sometime in the future.

To better evaluate options to maximize recycling opportunities, below is a summary of the recycling activities in each of the relevant sectors:

Drop-Off Recycling Centers. Drop-off recycling opportunities currently available within DeKalb County include the DeKalb County Disposal (WMX/DCD) facilities at the landfill in Cortland and in the City of DeKalb, the NIU Student Association Recycling Center and DeKalb Iron and Metal, both also in the City of DeKalb and R & T Recycling in Somonauk. It is estimated that 1,960 tons of DeKalb County's municipal waste was recycled at drop-off centers in 1993.

Curbside Recycling. In DeKalb County, residents of all 13 municipalities now have access to operating curbside recycling programs. It is estimated that 4,734 tons of DeKalb County's municipal waste was recycled from curbside recycling programs in 1993.

Commercial/Institutional and Industrial Recycling Programs. Several commercial, institutional and industrial establishments have incorporated recycling programs within their operations. It is estimated that 12,952 tons of DeKalb County's municipal waste were recycled in 1993.

Construction/Demolition Recycling. The Sears Quarry in DeKalb County has been recycling concrete (and asphalt which per IEPA interpretations cannot be counted as part of MW recycling) for several years. It is estimated that approximately 20,000 tons of concrete were processed and recycled in 1993.

Material Recovery Facilities (MRFs). MRFs able to serve the needs of DeKalb County recycling programs include the WMX/DCD processing center in the City of DeKalb.

OPTIONS TO MAXIMIZE RESIDENTIAL RECYCLING

In designing a residential recycling program either to maintain the current level of waste reduction or to advance toward goals the County may wish to establish, DeKalb County has a wide range of options to consider. Given the advanced state of recycling in the County, this section will briefly review the following options: drop-off collection, curbside bin collection, curbside bag collection and multi-unit (high-density residential) recycling.

Drop-off Centers. Drop-off recycling centers have historically been the most common method utilized to collect recyclables from residents and businesses. Drop-off centers are generally designed to serve the needs of single family residents, multi-family residents and businesses without other available recycling alternatives and to supplement existing curbside

collection programs. This section will examine drop-off recycling opportunities available to DeKalb County residents and considerations for potential program expansion.

Drop-off recycling opportunities, including drop-off centers, buy-back centers, MRFs, and salvage yards currently operating within DeKalb County and the surrounding region are listed in Table 5-1.

TABLE 5-1. RECYCLING CENTERS IN THE DEKALB COUNTY AREA

Recycling Center	Hours	Type	Materials Collected
DeKalb County Landfill Somonauk Road Cortland, IL 758-6906	AT: M-F 7-3:30 2nd Sa/Mo 7-11 UN: Su-Sa 24hrs	DB	ONP, GL, AL, S/B, 1P, 2P
DeKalb Iron & Metal Co. 900 Oak Street DeKalb, IL 758-2458	AT: M-F 8-11:30 12:30-4 Sa 8-11:30	BB, PR	GL, AL, S/B, SM
NIU Student Association Recycling Center Northern Illinois University DeKalb, IL 753-9920	UN: Su - Sa 24hrs	FSRC	GL (clear), AL, S/B, NFM, FM, AB, WG
R & T Recycling P. O. Box 603 S. Goge Street Somonauk, IL 498-3749	AT: M-F 10-5 Sa 9-3	BB	AB, SM
WMX/DCD Processing Center 115 Simmonds Avenue DeKalb, IL 758-5209	AT: 8-5 UN: Su - Sa 24hrs	DB PR	ONP, CR, CP, HG, MP, MG, GL, AL, S/B, 1P, 2P, 6P, #4RG, MJC

Key: *Type of Collection:* **DB**: drop-box **FSRC**: full service recycling center **BB**: buy-back center **PR**: processor

Materials: **ONP**: Newspaper **CR**: Corrugated cardboard **MG**: Magazines **HG**: High Grade Paper **MP**: Mixed paper **CP**: Chipboard **SB**:Steel/Bi-Metal **AL**: Aluminum **GL**: Glass **1P**: PETE Plastic **2P**: HDPE Plastic **#4RG**: plastic rings **6L**: Polystyrene Plastic **MJC**: Milk and juice cartons **SM**: Scrap Metal **AB**: Automobile Batteries & Radiators **WG**: White Goods

Source: Recycling Center Surveys, 1993.

Full Service Drop-Off. A full-service facility is considered to be an attended, more permanent structure or site which accepts recyclable materials from the public. The distinction of a full-service drop-off from a limited service one is that a full service center processes and/or markets materials to some degree at the site. At a full service center, staff may be able to assist participants with handling their materials; educate participants about the mechanics of recycling; and insure that the drop-off is not used as a place to dispose of refuse.

Limited Service Drop-Off. A limited service drop-off center is considered to be a primarily unattended site in which participants deposit materials into clearly-marked containers.

Buy-back Centers/Salvage Yards. Buy-back centers and salvage yards, which are mostly for-profit establishments, typically pay for the materials they receive (mostly ferrous and non-ferrous metals), although some of these establishments also collect additional materials without offering any payment.

MRFs and End Markets. MRFs and end markets, which primarily are in the business to process, market and/or remanufacture recyclable materials, often provide drop-off collections for the public at their facilities.

Location. Since drop-off recycling centers require residents to transport their materials to a site to be recycled, the location of facilities often determines the participation encountered at drop-off centers. A study by the Illinois Department of Energy and Natural Resources (ENR) estimates that residents will utilize a drop-off facility if it is located less than five miles from their homes. Frequently a trip will be made to the drop-off center as part of another errand. This suggests that the optimal location for a drop-off facility is near the center of the intended service area and near a facility such as a store that residents visit on a regular basis.

Operation. Most full-service drop-off centers are operated by municipal employees, volunteers and/or non-profit organizations. Municipal staff and haulers may be responsible for limited service centers. Longer hours of operation will generally make a drop-off more convenient to residents, although the number of attended hours at a facility may be dependant

upon cost considerations. With proper signage and security/safety measures, unattended centers may potentially be open 24 hours a day.

Materials. One of the primary benefits of a drop-off facility is that a wide variety of materials can be collected. Some drop-off programs collect only the "traditional" materials of newspaper, aluminum cans and glass. Other, more aggressive programs have targeted materials such as plastic (1P PETE, 2P HDPE and 6P PS), corrugated cardboard, mixed paper, white goods, used motor oil, tires and batteries. Collecting additional materials may increase the space requirements, the liabilities and, therefore, the cost of the drop-off facility. However, a drop-off is often the most viable means of collecting these materials. Furthermore, drop-off programs frequently serve as testing grounds for new, innovative collections and are often the first to expand material collections.

Participation and Recovery. Participation and diversion rates are difficult to measure with a drop-off facility because the service area of a drop-off is not well defined. It is perhaps more instructive to consider the yearly tonnages of materials that can be recovered by drop-off facilities. A survey of drop-off facilities in Illinois by ENR found that "full-service" drop-offs recovered an average of 260 tons of material per year per 10,000 people served, with a range of 128 to 457 tons per year. "Limited-service" drop-offs recovered an average of 69 tons per year per 10,000 people served, with a range of 56 to 87 tons per year. The material tonnages recovered by the drop-offs were expressed in terms of tons per 10,000 people served in order to facilitate extrapolation of the quantities to communities of different size.

Considerations. Decisions regarding the use of drop-off sites in DeKalb County should take into consideration five things. First, drop-off sites may provide a less costly recycling alternative for both low-population density and high-density residential areas of the County. Second, drop-off facilities may work well for certain types of materials such as "white goods" (major appliances), tires or motor oil that are difficult if not impossible to collect through curbside programs. Fourth, collection of orphan wastes through drop-off centers may create unwanted liabilities. And fifth, regional material recovery facilities may be utilized to handle the processing and marketing of recyclable materials collected at drop-off recycling centers.

To build on the existing drop-off/buy-back center system it may be beneficial for DeKalb County to work with drop-off/buy-back center operators, units of government, haulers and/or other interested parties to increase the impact of collecting recyclables from the public through drop-off/buy-back recycling centers. The County may offer technical assistance and capital/operational assistance, as resources and funding are available, which may include the following:

- Encourage operators to collect additional materials to increase recycling levels.
- Encourage operators to expand the hours of operation to increase convenience and participation.
- Work with operators to secure the most efficient and economical markets to reduce expenses and maximize revenue.
- Work with community groups to arrange additional volunteer assistance to reduce staffing expenses.
- Provide equipment, containers and/or signage to reduce operational expenses.
- Provide information, education and promotion of the facilities to increase awareness and understanding.
- Assist in development of State grant applications to supplement funding sources.
- Provide technical assistance to facilitate the development of new drop-off facilities.
- Encourage townships to explore cooperative arrangements with haulers to set up drop-off centers to serve unincorporated areas.

Curbside Recycling Bin-Based Collection. Curbside collection of recyclables in bin containers has grown rapidly in Illinois and throughout the United States. It is estimated that over 5,000 communities in the United States have implemented some form of curbside collection program. Within the past several years, the number of curbside programs in Illinois has grown to over 330, with over 1,000,000 households receiving service. Although curbside programs in Illinois were initially concentrated in the suburban areas of Chicago, more programs are being started in rural areas. Currently, all 13 municipalities in DeKalb County have access to

operating curbside recycling programs. Table 5-2 lists program statistics for curbside programs which have been implemented in DeKalb County.

TABLE 5-2. DEKALB COUNTY CURBSIDE RECYCLING PROGRAM OVERVIEW

Community	SF HHLDs[1]	HHLDs w/ Curbside[2]	% HHLDs Part.	Materials Collected
Cortland	338	415	75%	ONP, OCC, CB, HG, MP, OMG, GL, AL, S/B, 1P, 2P, 6P, 4P, DB
DeKalb	6,493	5,900	95%	ONP, OCC, CB, HG, MP, OMG, GL, AL, S/B, 1P, 2P, 6P, 4P, DB
Genoa	1,018	1,080	90%	ONP, OCC, CB, OMG, GL, AL, S/B, 1P, 2P
Hinckley	599	650	90%	ONP, GL, AL, S/B, 1P, 2P
Kirkland	331	250	90%	ONP, GL, AL, S/B, 1P, 2P
Kingston	181	168	90%	ONP, GL, AL, S/B, 1P, 2P
Lee	46	100	%	
Malta	300	325	75%	ONP, OCC, CB, HG, MP, OMG, GL, AL, S/B, 1P, 2P, 6P, 4P, DB
Sandwich	1863	35	NA	NA
Shabbona	308	400	90%	ONP, GL, AL, S/B, 1P, 2P
Somonauk	378	to come		N\A
Sycamore	3,176	3,400	95%	ONP, OCC, CB, HG, MP, OMG, GL, AL, S/B, 1P, 2P, 6P, 4P, DB
Waterman	358	450	90%	ONP, GL, AL, S/B, 1P, 2P
Incorp. Subtotal	15,391	13,173		varies
Unincorp. Subtotal	4,954	50		varies
Total	20,343	13,223		

Notes: 1. Haulers estimate of homes with curbside service available (homes with a recycling bin). The figure in parenthesis is the number of single family homes (1 - 4 units attached) in each municipality.
2. Haulers estimate of households which set out recyclables at least once a month

Key: *Materials:* **ONP**: Newspaper **OCC**: Corrugated Cardboard **OMG**: Magazines **HG**: High Grade Paper **MP**: Mixed paper **CB**: Chipboard **S/B**: Steel/Bi-Metal **AL**: Aluminum **GL**: Glass **1P**: PETE Plastic **2P**: HDPE Plastic **4P**: Plastic Carrier Rings **6P**: PS Plastic **DB**: Drink Box

Source: Hauler Surveys, 1993. Municipal Surveys, 1993.

Bin-based or "blue box" recycling programs vary widely in their characteristics. The following issues should be evaluated in planning a program: public or private collection; scheduling; containers; materials; materials preparation and separation; participation and recovery; and other considerations. The existing programs have typically been instituted at a municipal rather than a township or county-wide level. Most programs collect at least newspaper, aluminum and steel/bi-metal cans, glass bottles and jars, and 1P PETE and 2P HDPE plastic containers, with more aggressive programs targeting chipboard, corrugated cardboard, drink boxes, 4P LDPE beverage carrier rings, 6P PS plastic and high grade and mixed paper. Participation rates in DeKalb County range from 75 - 90 percent on a monthly basis.

Public or Private Collection. Most rural curbside programs in Illinois utilize a private hauler for collection, although several communities have opted to utilize municipal crews or not-for-profit organizations. There are a number of advantages to contracting with a private hauler for curbside collection. In particular, the community does not have to make an investment in collection personnel or in collection vehicles, which can run from $45,000 to $125,000 for dedicated recycling vehicles. Perhaps more importantly, however, the community may not have the recycling experience that many haulers have developed.

Scheduling. Most of the curbside recycling programs in Illinois provide collection once per week on the same day as normal refuse pick-up. Less frequent collection may result in lower collection costs, however, it requires residents to store materials for a longer period of time. Studies have shown that participation and material recovery may be greater with weekly collections on the same day as pick-ups.

Containers. Studies have shown that residents that have been provided with a durable container to store recyclable materials have higher participation rates than residents without containers. Capacity of curbside recycling containers typically ranges from 14 to 20 gallons. As programs have continued to expand the collection of additional materials, especially plastics which are more bulky, the need for larger bins or even two bins has become more evident.

Materials. Typically the more materials that are collected the higher the monthly fee charged to households, with the largest incremental increase coming if plastics are collected. There is an incentive to increase the number of materials collected in order to leverage the investment in collection vehicles and processing facilities and maximize waste diversion, but this must be weighed against higher collection and processing costs.

The major consideration in deciding whether to include a material in a curbside or any other type of recycling program is the availability of markets for the material. As noted in the market analysis section, markets for most recyclable materials have been in a slump lately. The Solid Waste Planning and Recycling Act requires that county waste management plans have a recycling program which targets at least three materials. Thus, curbside recycling programs implemented in DeKalb County must target three materials at a minimum.

Materials Preparation and Separation. One of the most important planning steps of a program is to determine the extent that residents, haulers and processors will need to process and sort materials. There are two primary methods of material preparation and separation.

In the first method, residents are responsible for source separating their recyclables from their refuse. Residents may also be required to separate each type of recyclable material collected in the program. This reduces the amount of sorting that must take place at the curb during collection. In any case, residents deposit their semi-sorted materials at the curb and the collection crew "curb sorts" or deposits each recyclable material into the proper storage chamber in the segmented collection vehicle. Once the recyclables have been collected, the collection vehicle may either deliver the recyclables to a processor or its yard to be further processed or transport the recyclables directly to a market.

In the second method, residents are also responsible for source separating their recyclables from their refuse. Residents may be required to perform some minimal separation, such as paper separated from non-paper. In effect, the recyclables are largely "commingled" together when deposited at the curb. As the collection crew loads the recyclables into the vehicles, the crews may either commingle all of the materials together or may separate

categories of commingled materials, such as paper from non-paper. The collection vehicle may deliver the recyclables to a materials recovery facility where the items may sorted, processed and shipped to market.

The issue of whether recyclables should be sorted at the curb into segmented collection vehicles or collected commingled for later separation at a processing facility is a heated one. Collecting the materials commingled results in less time sorting materials at the curb and thus, presumably, more efficient collection. Collecting materials commingled also facilitates adding new materials to a curbside program, since additional segmented compartments do not have to be added to the collection vehicle. However, commingled recyclables may have higher processing costs since the materials may have to be separated at a processing facility. Furthermore, it has been asserted that collecting materials commingled may result in greater levels of residual materials that need to be disposed after processing.

Participation and Recovery. Typically a curbside recycling program can be expected to recycle 10 to 25 percent of the waste generated by the households served by the program. However, every household in a community does not always choose to participate in the curbside recycling program. In addition, every residential household is not necessarily served by the curbside recycling program, particularly multi-family households. After accounting for the actual amount of residential recycling occurring, and factoring the level of residential recycling into municipal waste recycling (which includes residential, commercial/institutional waste and construction/demolition waste), municipal recycling rates may be significantly lower than the 10 to 25 residential recycling rates. Nevertheless, because curbside recycling programs recover greater quantities of materials than drop-off facilities, they are an important component of an overall residential recycling program. Recovery rates are significantly higher if the program is implemented in conjunction with volume-based rates.

Considerations. Decisions regarding curbside recycling programs in DeKalb County should take into consideration four things. First, collection costs for curbside recycling services will be higher in areas of lower housing density. Second, volume-based rates in conjunction with a curbside program often lead to much higher participation. Third, mandatory recycling

requirements can also increase participation. Fourth, regional MRFs may be utilized to handle the processing and marketing of recyclable materials collected from curbside recycling programs.

In an effort to build on the existing curbside recycling system, it may be beneficial for DeKalb County to work with units of government, haulers and/or other interested parties to increase the impact of collecting recyclables from the public through curbside bin programs. The County may offer technical assistance, as resources are available, which may include the following:

- Provide technical assistance to facilitate the expansion of curbside bin programs to all County residents.
- Encourage haulers to initiate or expand curbside services to additional households where collection is economically feasible.
- Encourage haulers to collect the maximum range of materials to increase recycling levels based on the availability of processors/markets, cost-effectiveness of collection and the reduction in volume, weight or toxicity of the waste stream due to the recycling efforts.
- Assist haulers to secure relationships with processors/markets of recyclable/materials.
- Work with haulers to overcome operational difficulties.
- Work with haulers to provide or make available additional containers, lid/wheel units, larger containers to maximize the convenience of residents.
- Provide information, education and promotion of curbside recycling services to increase awareness and understanding.

Curbside Bag Recycling. Curbside bag-based recycling or "blue bag" recycling is a relatively new concept that is emerging as an alternative to the bin-based curbside recycling programs. In a bag-based program, residents utilize clear or semi-transparent bags to store their source-separated recyclables. In curbside bag-based recycling, either all recyclables may be commingled into one bag or types of recyclables may be placed in separate bags, such as newspaper in one bag and non-paper recyclables such as bottles and cans in another bag.

Currently, there are no bag-based recycling programs located in DeKalb County. Table 5-3 presents an overview of bag-based recycling programs in Illinois.

TABLE 5-3. BLUE (& CLEAR) BAG-BASED RECYCLING PROGRAMS IN ILLINOIS (as of July 1993)

Community[1]	Bag Color[2]	Bag Contents[3]	Veh. Coll.[4]	P. U. Freq.[5]	Bag Distr.[6]	Price of bags[7]	Part. Rate[8]
Kinsman Grundy County	blue	PR (1B) NPR (1B)	SFR	SDAR	MR	$1.79/ 8 box	25% - 72%
Frentress Lake Jo Daviess County	clear	NPR	CC	SDAR	MR	?	N/A
Montgomery Kane County	blue	PR (1B) NPR (1B)	SFR	SDAR	MR	$1.79/ 8 box	25% - 75%
Oswego Kendall County	blue	PR (1B) NPR (1B)	SFR	SDAR	MR	$1.79/ 8 box	25% - 72%
Jacksonville Morgan County **	clear	NPR (1B) PR(1B)	SFR	SDAR DDTR	HDO HO VO	NCTR	58% 1x/wk
Whiteside County All Unincorporated Areas	blue	PR (1B) NPR (1B)	CC	SDAR	MR	?	N/A
Plainfield Will County	blue	PR (1B) NPR (1B)	SFR	SDAR	MR	$1.79/ 8 box	25% - 72%
Plainfield Township* Will County	blue	PR (1B) NPR (1B)	SFR	SDAR	MR	?	40% 1x/wk
Wilmington Will County	blue	PR (1B) NPR (1B)	SFR	SDAR	MR	$1.79/ 8 box	25% - 72%

Notes:
1. "Community" indicates on-line, community-wide blue/clear bag recycling programs unless otherwise noted. * denotes programs which are voluntary, not community-wide
   ** denotes pilot programs
2. "Bag Color" indicates if the bags are either clear or tinted blue.
3. "Bag Contents" indicates which type of recyclables are placed in the plastic bags.
   NPR: non-paper recyclables **PR**: paper recyclables
4. "Vehicle Collection" indicates if the recyclables are co-collected in vehicles with refuse.
   SFR: separate from refuse **CC**: co-collected
5. "Pick-Up Frequency" indicates whether the recyclables are collected on the same day as refuse.
   SDAR: same day as refuse **DDTR**: different day than refuse **EOW**: every other week
6. "Distribution of Bag" indicates where residents receive or buy the plastic bags.
   MR: merchant **HDO**: hauler drops off **HO**: hauler's office **VO**: village office
7. "Price of Bags" indicates the price of the plastic bags, either per bag or per box.
   NCTR: no (direct) charge to resident
8. "Participation Rate" indicates how often residents participate in the program at least once a month unless otherwise noted.

Typically, bags of recyclables are set out at the curb for collection on the same day as refuse. Three forms of curbside bag recycling programs have been developed to collect the recyclables once the bags are placed at the curb. In the first two program types, the bags of recyclables are collected in a separate collection vehicle than the bags of refuse. In some instances, the vehicle used is a standard curbside recycling vehicle. In other programs, a vehicle with compaction capabilities is used. In these programs, the compaction ratio is usually one-half of the compaction ratio used when collecting refuse. In the third type of program, bags of recyclables are co-collected with the bags of refuse in the same packer truck. The bags containing recyclables are later separated from the bags containing refuse at a transfer station or processing facility. In either type of collection program, after the bags have been collected, they must be opened. Typically this has been performed manually with a utility knife by laborers wearing heavy gloves, although automated de-baggers have been developed to open the bags.

Bag recycling programs have sparked considerable controversy. Proponents of the programs point to the following advantages:

- The bags may eliminate the need for purchase of specialized curbside recycling vehicles.
- The bags are relatively easy to handle and store in the kitchen where most recyclables are generated. Also, many residents are already familiar with using bags as containers.
- The bags enable one-way carrying of the recycling container.
- The bags offer sanitary storage of recyclables and protect recyclables set at the curb from snow, rain, wind and insects.
- If the bags are translucent and tinted, as opposed to clear bags, residents may have a sense of privacy when discarding their materials.
- The bags may be used by both single-unit and multi-unit households, whereas a bin program is typically offered only to households in structures of four units or less.
- The bags may offer more capacity than rigid bins of a fixed capacity.

Criticism by opponents of the bag-based system includes:

- Contamination levels may be greater due to the combination of compaction, bag breakage and commingling materials.
- The anticipation of contamination and lower marketability of certain materials may preclude these materials from being collected in recycling programs.
- Since bags are used both for recyclables and refuse, residents do not distinguish between throwing away refuse in a plastic bag and "throwing away" recyclables in a plastic bag.
- In most cases, residents have to purchase bags. In a voluntary recycling program, residents may not always chose to purchase bags in order to participate in the program.
- Centralized waste processing facilities are needed to utilize bag-based systems. Without an existing processing facility available, the cost of implementing such a program may be prohibitive.

Considerations. Decisions regarding curbside bag collection programs in DeKalb County should take into consideration two things. First, in order to utilize a bag-based recycling program, a MRF or transfer station with capabilities to accommodate bagged materials is needed. Second, since bag collection programs are relatively new, the effectiveness of bag collection programs has not been tested extensively. Few bag programs have been studied in rural areas.

If a bag-based recycling program is pursued, it may be beneficial for DeKalb County to work with the units of government, haulers and/or other interested parties to develop effective bag-based programs to increase the impact on collecting recyclables from the public. The County may offer technical assistance, similar to the measures described under the previous section, "Curbside Recycling Bin-Based Collection"

Multi-Family Collection Programs. In addition to addressing the recycling needs of single-family residences, a comprehensive recycling plan will have to provide for the recycling needs of multi-family households. It is estimated that approximately 21 percent of the households in DeKalb County are located in structures of 5 attached units or more. Recycling

in multi-unit structures is still in a development stage, since most recycling efforts are focused upon single family curbside collection, for households with four units or less. Residents of the multi-family households generally need to utilize a drop-off or a buy-back center in order to recycle their materials.

Providing more convenient multi-family recycling has been a difficult task due to the physical layout of multi-unit structures and the habits of multi-family households. The following factors contribute to the difficulty of implementing a comprehensive multi-family recycling program:

- There is generally little room available for storage of recycling containers, both within the individual apartments and within the common areas of the building.
- The physical layout of different buildings varies widely, making it difficult to develop a standardized collection system. Indeed, in order to be successful a program will have to be designed for each building taking into account the unique characteristics of that building.
- It is difficult to balance convenience to the resident with convenience to the hauler that collects the materials. It is more convenient, for instance, for residents in high-rise buildings to be able to place recyclables in common areas on their floor than to carry the materials to a collection container accessible to the hauler. However, the hauler normally will only collect materials from centralized, vehicle-accessible location(s). Therefore, a program convenient to the residents may necessitate the involvement of building maintenance staff to remove containers from different floors of the building. Thus, while a program that is more convenient to the residents will probably result in higher participation, it may also result in greater collection or maintenance costs.
- Building owners and managers may be reluctant to bother with the "hassle" of providing a recycling program.
- Residents of multi-family households are typically young and mobile and may be less likely to participate in recycling. Furthermore, the transient nature of multi-family households makes on-going education necessary to inform new tenants of the specifics of a program.

Despite these problems, several systems have been developed to extend recycling to multi-family residences. In one such system, toters (60-90 gallon wheeled carts) are used to collect recyclables. The toters are generally placed near the central collection dumpster or in

parking areas for convenience. They are clearly marked to indicate the appropriate material to deposit in them, usually separated into paper and non-paper categories. These containers are then emptied on a scheduled basis as part of a commercial or residential recycling route.

In another system, a segmented dumpster of two to three cubic yards in capacity is placed adjacent to the normal refuse dumpster. Residents are responsible for bringing recyclable materials to the segmented dumpster. The hauler uses a segmented collection vehicle which is designed to match-up with the recycling dumpsters. Frequently, the segmented collection vehicles are used in curbside recycling programs as well. The ability to service both single and multi-family households with the same collection vehicle results in greater collection efficiency.

The segmented container system is utilized in over 100 complexes in Okaloosa, Florida and 12 complexes in Clearwater, Florida. It is estimated that participation in the Okaloosa program ranges from 20 to 30 percent and that diversion in the Clearwater program is approximately 8 pounds per unit per week. A similar program is utilized in Tukilwa, Washington, except that a non-segmented container is provided and the recyclable materials (including newspaper, mixed paper, corrugated, glass, aluminum, tin and plastic bottles) are commingled in the container. The commingling of materials was chosen because it was felt to be more convenient for residents and because the hauler had access to a materials recovery facility.

Considerations. Five issues should be considered in regard to developing a multi-family recycling program. First, approximately 21 percent of DeKalb County households are considered to be multi-family structures. Most of these structures are located within the City of DeKalb, serving the needs of NIU students - a highly transient population. Second, two factors shown to affect the success of on-site multi-family recycling programs include: 1) gaining the cooperation of building owners, residents and haulers; and 2) designing a program that best fits the physical layout of the building and is convenient to both residents and haulers. Third, there are already some examples of multi-family recycling programs in the County upon which to build a program. Fourth, conveniently located drop-off centers are often utilized to serve the recycling needs of multi-family residents. Fifth, a bag-based multi-family unit recycling

program may be an option if regional MRFs are able to accommodate bag-based recycling programs.

OPTIONS TO MAXIMIZE COMMERCIAL/INSTITUTIONAL/INDUSTRIAL RECYCLING

According to the DeKalb County Waste Management Needs Assessment, commercial/institutional waste accounts for 30 percent of the municipal waste generated within the county and it is estimated that 11,544 tons or 46 percent of the commercial/institutional waste stream was recycled in 1993. The County's waste reduction efforts have benefitted from the strength of the recycling program in the commercial/institutional sector. Additional benefit can be gained by focusing additional attention on these programs.

Commercial/institutional recycling programs have generally focused on increasing collection of three types of materials: 1) corrugated; 2) high grade office paper; and 3) aluminum, steel/bi-metal cans and glass containers. Grocery and retail stores as well as warehouses are typically targeted for corrugated collection. Offices, schools, governments and other service-oriented establishments are typically targeted for office paper collection. Restaurants and other food/beverage service establishments are typically targeted for aluminum, steel/bi-metal and glass container collection. Table 5-4 provides an overview of some of the collection services offered by haulers to DeKalb County businesses.

TABLE 5-4. DEKALB COUNTY COMMERCIAL RECYCLING SERVICES

	Materials Potentially Collected[1]
BFI- Rockford	OCC
WMX/DCD	HG, OCC, ONP, GL, AL, S/B, 1PL, 2P

Notes: 1. Material collections may vary depending on the nature of the business.

Key: **ONP**: Newspaper **OCC**: Corrugated Cardboard **HG**: Office Paper **S/B**: Steel/Bi-Metal **AL**: Aluminum **GL**: Glass **1P**: PETE Plastic **2P**: HDPE Plastic

Source: Hauler Surveys, 1993.

According to estimates by Franklin Associates, corrugated comprises about 12 percent of the municipal waste stream, although for commercial establishments the percentage could be 50% or higher. Corrugated has traditionally been recycled by large generators of the material such as grocery stores and warehouses, primarily as a means of reducing waste disposal costs. Transfer station operators also regularly segregate corrugated from mixed waste loads with high cardboard content to reduce waste transportation and landfilling costs.

Office paper recycling programs have been one of the fastest growing types of recycling programs. The increase in such programs has in many regions led to the flooding of high grade paper markets, just as the rapid increase in curbside recycling programs contributed to the glut in the newspaper market. It is important when designing an office paper recycling program that a market be identified and material specifications be obtained.

A recent study for the Northeast Recycling Council estimates that waste generation among office workers ranges from 1.4 to 2.3 pounds per employee per day, with office paper consisting of 55 to 75 percent of the total waste generated. Increased office recycling may be one way for the County to increase the level of commercial recycling. Existing office recycling programs have shown that the key elements of a successful program are: 1) strong support for the program from management; 2) education of employees; 3) developing a collection system that is convenient for employees and maintenance staff; and 4) monitoring the results of the program.

Interest in recycling the corrugated, glass and metal cans from restaurants and bars is also beginning to increase. The California Glass Recycling Corporation estimates that 25 percent of restaurant waste is corrugated, 10 to 20 percent is glass and 15 percent is cans. Over 3,700 bars, restaurants and hotels in the State of California have developed recycling programs. In Portland, Oregon about 900 restaurants have started programs. Overall, however, it is estimated that only 5 percent of the nation's bars, restaurants, hotels and other food service establishments recycle. Recycling in restaurants is generally difficult because of inadequate space, high turnover among employees, the time necessary to color sort glass or flatten cans and in certain cases the small return from recycling.

Considerations. One of the biggest impediments to increasing commercial sector recycling is the small size of many commercial establishments. There are three potential ways of dealing with this impediment. First, if a comprehensive residential recycling program is offered, small businesses may be able to access those programs using similar containers or employees may opt to bring materials from work to recycle at home. Second, small establishments that are located near each other may act to develop a joint recycling program. Thus, although one small office may not generate enough material to warrant a pick-up from a private recycler, several offices together may generate sufficient quantities. Third, commercial/institutional and industrial establishments may have the option of pursuing bag-based recycling programs if regional MRFs are able to accommodate bag-based recycling programs.

It must be stressed that the most important element in increasing the recycling rate in the commercial sector is economics. If landfill tipping fees continue to escalate at their current rate and if recycling can be proven to be a smart business decision, then recycling will become more common in the workplace. Many haulers in both rural and urban areas of the State are beginning to offer increased recycling opportunities because some commercial customers are demanding it. DeKalb County may try to increase the development of commercial sector recycling through the following initiatives:

- Encourage haulers to expand commercial/institutional services to more establishments.
- Encourage haulers to provide "milk run" collection services for smaller business establishments, which acting alone may not produce enough materials to make collections economical.
- Encourage haulers to collect the maximum range of materials to increase recycling levels based on the availability of processors/markets, cost-effectiveness of collection and the reduction in volume, weight or toxicity of the waste stream due to the recycling efforts.
- Assist haulers to secure relationships with processors/markets of recyclable/materials.
- Work with haulers to overcome operational difficulties.
- Provide information, education and promotion of commercial/institutional recycling services to increase awareness and understanding.

- Promote commercial recycling by featuring local success stories through award/recognition programs.

- Encourage commercial landlords to coordinate recycling programs for multi-tenant buildings.

A waste audit program can be used to demonstrate the economics of commercial waste reduction programs. The components of the a waste audit program sponsored by the County may include:

- Assist or conduct waste stream audits for interested businesses to characterize: how their waste is generated, how much and what type of waste is generated and how certain components of the generated waste could be separated and marketed (i.e. recycled) or how to avoid generating waste in the first place (i.e. source reduction).

- Develop a manual which instructs businesses on how to perform self-audits of their waste streams and provide helpful information on setting up a recycling program and local recycling opportunities.

OPTIONS TO MAXIMIZE CONSTRUCTION/DEMOLITION DEBRIS RECYCLING

Construction/demolition waste is a significant fraction of municipal waste and thus recycling of this waste is viewed as a crucial means of meeting increasingly aggressive state and local recycling goals. On a national level, Franklin Associates estimates that construction/demolition (C & D) waste comprises about 23 percent of the municipal waste stream. Local and regional variations in the generation of construction/demolition waste exist, however, as the result of differences in growth patterns. Construction/demolition waste is estimated to comprise 33,972 tons or 32 percent of DeKalb County's municipal waste. In 1993, it is estimated that 20,000 tons of concrete generated in DeKalb County were processed and recycled at the Sears Quarry.

Construction/demolition waste is generally comprised of about 50 percent rubble-based materials including concrete, bricks and asphalt; 25 percent wood-based materials including

pallets, lumber and tree parts; and 25 percent other wastes including metals, plastics, sheet rock and paper products, according to estimates made by Cosulich Associates. Frequently, C & D waste component fractions are generated separately to a large extent. For example, when building a residential home, waste generated during the construction of the frame would consist of wood primarily. As the interior was being installed, waste might consist largely of sheet rock. On a commercial demolition project, the early stages may consist largely of bricks while later stages may consist primarily of steel and other metals.

Of construction/demolition wastes, the most frequently recycled material is asphalt rubble or "millings". When a road or highway is repaved, the top layer of asphalt is taken off the road and the millings produced can be reused in the roadbase, on road shoulders, or less frequently, in the "hot mix" asphalt put on the surface of the road. Typically, mobile crushing units are used at a road construction site to crush the asphalt for reuse. If material is not crushed and reused on-site, it may be sold to municipalities or counties or transported to a storage or processing site. Crawford County in southeastern Illinois acquired about 400 tons of asphalt millings from a State highway project at an estimated savings to the County of more than $20,000 compared to the cost of virgin asphalt. Usually very little asphalt rubble reaches landfills because it is a valuable and readily usable waste material. Concrete rubble can generally be reused in the same way as asphalt. Crushed concrete makes a good roadbase material. Concrete is usually not processed and reused on-site like asphalt, however. Much of the wood waste generated by construction/demolition activities can be processed for use as landscaping mulch, boiler fuel, animal bedding or a bulking agent for sludge composting, in descending order of price and demand. Other materials such as shingles and gypsum have relatively limited recycling potential, although some construction/demolition waste processing facilities do handle these wastes. A firm named Cornerstone, located in McHenry County, recycles construction/demolition debris including wood, cardboard, metal, carpet padding, "bisqueen" polyethylene covering, and other reusable items. Cornerstone takes advantage of the natural order in which wastes are generated during construction projects and concentrates its collection efforts on specific materials generated at different project phases.

The City of Los Angeles developed a construction and demolition waste recycling guide to inform area contractors of the recycling opportunities available to them. To supplement this guide, the City of Los Angeles also published a resource guide to recycled construction products, to bolster the demand for these secondary products. The Toronto Home Builders Association (THBA) has published several reports "Making a Molehill out of Mountain" in a proactive effort to confront their landfill crisis. One guide explains general solid waste issues and alternatives contractors have to sending construction and demolition wastes to a landfill. THBA published another report which explored topics including reducing C/D waste at the source, reusing C/D wastes and recycling C/D materials for which there is no immediate use.

A construction/demolition waste processing facility can cost $1 to $4 million and processing equipment can cost another $1 million. Although capital and processing costs are high, the construction/demolition waste recycling facilities can sometimes operate with favorable economics. This is because the facilities often charge a lower tipping fee than landfills (especially in the northeastern U.S. where landfill tipping fees are the highest) and because the processed wood chips and concrete aggregate are sold for a lower price than similar materials available from traditional sources such as quarries. Furthermore, the facilities allow users to make effective use of backhaul, bringing wood or concrete waste to the facility and transporting back processed wood chips or concrete aggregate.

Considerations. Very few construction/demolition programs or MRFs are known to be operating in Illinois. Little, if any, information on the availability of markets for construction and demolition materials has been assembled. To counter this lack of information, several counties have planned to undertake extensive studies on the generation and management of construction and demolition waste. Once more information is obtained, counties will be more able to pursue the planning and implementation of aggressive construction and demolition recycling programs.

Options DeKalb County may want to pursue in terms of construction/demolition recycling may include the following:

- Conduct a study to assess the characteristics of construction/demolition waste generated within DeKalb County.
- Meet with C/D contractors to exchange information.
- Identify local markets or potential markets for recycled C/D materials.
- As information becomes available, develop information guides for construction/demolition operators concerning source reduction, reuse and Recycling.

OPTIONS TO MAXIMIZE ORPHAN WASTE RECYCLING

Several materials in the municipal waste stream require special collection methods for recycling. These wastes are known collectively as "orphan wastes." As described below, orphan wastes may include batteries, white goods, motor oil and tires. Orphan waste recycling is still a relatively new effort throughout Illinois. There is little available information on the exact quantities of batteries, motor oil, tires or white goods that are being generated within DeKalb County.

Lead-Acid Batteries. In Illinois, lead-acid batteries have been banned from incineration or landfill disposal since September 1, 1990 (415 ILCS 22.23), due to concerns over the health effects of lead. State-wide lead-acid batteries are already recovered at a high rate, estimated at between 80 and 90 percent. State law requires all retailers of lead-acid batteries in Illinois to accept old batteries when new batteries are purchased.

It is estimated that about 80 million lead-acid batteries are consumed annually in the United States for vehicle use. A survey of 1,000 households by the Battery Council International found that almost 20 percent were storing one lead-acid battery and many were storing two or more.

Given that retailers are reclaiming used vehicle batteries with new purchases, it is probably not necessary that the DeKalb County recycling plan provide for the collection of lead-acid batteries. However, since many residents may be storing old batteries, there is still a need

to convey information to the public on battery recovery programs. DeKalb County should stay abreast of new recycling opportunities for lead-acid batteries and for other types of batteries as well.

Refuse haulers serving DeKalb County were surveyed to determine their procedures for dealing with lead-acid batteries left out for collection. With one exception, all of them indicated that if a battery was observed then policy dictated that it be left behind. One hauler, Marengo Disposal, indicated that it has collected lead-acid batteries separately for recycling for many years and continues to do so. If contacted regarding battery pick-up, the haulers indicated that the typical procedure is to refer the customer to a battery retailer. Invariably the haulers indicated that it was an unusual occasion to find a battery set out for collection. In most instances, a battery is generated as waste as a result of replacing it with a new battery. Battery retailers would normally take the old battery as a matter of business.

Motor Oil. Illinois law, 415 ILCS 5/21.6 (Materials Disposal Ban), provides that beginning July 1, 1996, no person may knowingly mix liquid used oil with any municipal waste that is intended for collection and disposal at a landfill. Additionally, no owner or operator of a sanitary landfill shall accept liquid used oil for final disposal that is discernable in the course of prudent business operation.

Refuse haulers serving the DeKalb County area were surveyed regarding their procedures for dealing with used motor oil left out for collection. All of them indicated that if motor oil was left out for collection it was their policy to leave it behind. If contacted by a customer regarding the collection of motor oil, most indicated that they would refer inquiries to local service stations. One hauler said that, if given the opportunity, he discouraged do-it-yourself oil changers by informing them of the environmental problems associated with improper disposal and the relative economy of using specialized oil changing services.

In an effort to improve toxicity reduction and responsible disposal, the County could encourage local automotive service stations and motor oil retailers to accept and recycle motor oil from the public (pending regulatory requirements). Residents, especially do-it-yourself oil

changers, should be informed of the environmental consequences of improper disposal as well as motor oil recycling opportunities available within the DeKalb County region. In addition, government procurement policies can be used to stimulate the market for re-refined lube oil and motor oil that is composed of used motor oil. (Used motor oil from small quantity generators is discussed in detail in Chapter 4).

Tires. Illinois law, 415 ILCS 5/53, Title XIV of the Environmental Protection Act, provides that beginning July 1, 1994, whole tires may not be landfilled. Shredded or split tires may be disposed in landfills if the facility meets certain criteria. ENR estimates that about 11 million used tires are discarded in Illinois on an annual basis. Interest in recycling used tires stems primarily from the potential negative impacts of tire accumulations, such as fire and mosquito infestation and because tires tend to "float" to the top of landfills.

To help alleviate these problems, Title XIV also requires that all persons or businesses in Illinois with tire accumulations of greater than 50 tires notify the IEPA. A recent amendment set up a fee of one dollar per tire sold. This fee is used to build a fund to finance tire management programs. The law also requires tire retailers to accept old tires when new tires are purchased and requires the IEPA to step up collection programs for large stockpiles of old tires.

Refuse haulers serving the DeKalb County area were surveyed to determine their procedures for dealing with used tires that have been set out for collection. All of them indicated that they are currently accepting a limited number of tires (usually 1 or 2) set out for collection. Typically, there is a small extra charge for accepting them due to extra charges imposed at the landfill.

Recovery of used tires occurs principally by two methods: retreading and burning. The market for retread tires has declined and is projected to continue to do so (although new legislation has now been enacted to increase government procurement of retreads). It is estimated that the number of retread tires declined from 31 million in 1978 to 15 million in 1986, with projections calling for only 6 million retread tires to be produced in 2005. Tires are

also a high BTU content fuel and are burned either whole or shredded. The tires may be used as a primary fuel but more commonly are used as a supplemental fuel.

Since retailers are required to collect used tires when new tires are purchased, it may not be necessary for the DeKalb County plan to provide for the collection of tires. However, since many residents may have accumulated and stored old tires, it may be necessary to provide collection for tires which will not be exchanged for new tires.

One method counties and municipalities may pursue to collect old tires is to hold a one-day tire collection event in conjunction with the IEPA. In this program, the sponsoring unit of government is responsible for providing a collection site, press coverage and some staffing. The IEPA is responsible for handling the collection, marketing and funding for the event through its grant program. To date, the IEPA has held over 100 tire collection days throughout Illinois. Grant funding for tire collection programs is collected through State fees including the $1.00 per tire user fee and the 50 cents title transfer fee. Tires which are collected are generally distributed to companies that mix the rubber with coal for fuel. Local governments are able to apply for the event periodically. In addition to the one-day collections, DeKalb County may want to start a dialogue with local tire retailers and haulers to alleviate any difficulties with the disposal of tires.

White Goods. Currently, Federal Law prohibits the disposal of appliances unless all refrigerant gases have been removed. Illinois law, 415 ILCS 5/22.28, provides that beginning July 1, 1994, white goods may not be offered for collection unless the white good components have been removed. Under the current definition, "white goods" consist of refrigerators, ranges, water heaters, freezers, air conditioners, humidifiers, and other similar domestic and commercial large appliances. "White good components" include fluorocarbon refrigerant gases, electrical switches containing mercury, and other electrical components which may contain PCB's.

According to national-level estimates by Franklin Associates, white goods comprise just under two percent of municipal waste. Recycling of white goods traditionally has been performed by scrap dealers. The appliances are shredded in automobile shredding machines and

the ferrous and non-ferrous metal recovered and sold. Illinois law (415 ILCS 5/22.28) currently prohibits a landfill operator from disposing of white goods beginning July 1, 1994, unless the operator meets certain criteria (i.e., participates in Illinois Materials Exchange Service, removes electrical switches and CFC gases).

The Governor's Task Force on White Goods has submitted it's final report which recommends a number of changes to the existing law. The IEPA has drafted legislation based on these recommendations which will probably be submitted for consideration by the General Assembly this Spring. If these recommendations become law, both the recycling and disposal of white goods will become more difficult. The recommendations of the task force are summarized below:

- Change the definition of "white goods" to "major appliances" and clarifies and extends its meaning.
- Change the effective date for the landfill disposal ban to March 1, 1995.
- Require major appliance processors to register with the IEPA.
- Eliminate shredding of major appliances with hazardous (white good) components.
- Implement a grant program to assist businesses and local governments in the proper management of major appliances.
- Institute a surcharge on the sale of new appliances for 2 years to fund the grant program.

There is some concern with the shredding of appliances, however, due to the presence of PCBs in capacitors used in appliances manufactured prior to 1979. When such appliances are shredded, the non-metallic fluff that is recovered may be contaminated with PCBs. In 1988 the U.S. Environmental Protection Agency issued a policy statement that contaminated shredder fluff was subject to the rules of the Toxic Substance Control Act, which regulates waste contaminated with PCBs. The result of the ruling was that many scrap dealers refused to accept white goods for processing, even after the EPA stated that there were probably few white goods in the waste stream that were manufactured prior to 1979.

Refuse haulers serving the DeKalb County area were surveyed regarding their current procedures and future plans for dealing with major appliances set out for collection. On this matter, the haulers are taking their lead from the landfill operators. All of the haulers continue to accept major appliances, most of them for an extra charge. Typically, the collection customer will contact the hauler to arrange for pick-up. The hauler will provide the names of qualified appliance services that will remove the refrigerant gases. A service call costs approximately $25 - $35. The appliance service will provide a receipt and sticker to be placed on the appliance indicating the regulated components have been removed and it can be collected for disposal. Two haulers charge the customer a similar fee that includes removal of the components. The appliances are picked up and delivered to scrap dealers who accept the delivery, but charge for removal of the regulated components.

In order to be able to comply with the white goods legislation taking effect in 1994, DeKalb County should review the recommendations of the White Goods Task Force and IEPA grant rules for the development of waste management programs addressing major appliances. DeKalb County should work closely with haulers, appliance services, and white good recyclers and the County landfill operator to alleviate any difficulties with the disposal of white goods once the legislation goes into effect.

PROCESSING ALTERNATIVES

Collection of recyclables is only one aspect of recycling. Once the recyclables are collected they must also be processed and prepared for sale to end-user markets. Many communities and waste haulers are developing processing facilities to handle increasing quantities and multiple types of residential and commercial recyclables. These facilities are typically known as Material Recovery Facilities (MRFs). MRFs sort and process materials into marketable commodities for remanufacturing. Most MRFs specialize in processing residential recyclables, although MRFs may also accept materials from drop-off centers, buy-back centers and commercial recycling collections. A listing of several MRFs located within the Northern Illinois region is presented in Table 5-5.

TABLE 5-5. OVERVIEW OF MRFs LOCATED IN NORTHERN ILLINOIS					
Facility & Location	Capacity (TPD)	Materials Accepted[1]	Owned/ Operated[2]	Access[3]	Tipping Fee/ Revenue[4]
Crown/Groot Cook County	225 Res. 205 Com.	AL, CB, GL, MP, OCC, OMG, ONP, 1P, 2P, S/B	PV/PV	OTP	N/A
DeKalb County Disposal DeKalb County	N/A	MP, OCC, ONP	PV/PV	DeKalb Co. only (public by authority)	NTF
DuPage Co. IPF DuPage County	250 Res.	AL, GL, MP, OCC, OMG, ONP, 1P, 2P, S/B	PB/PV	OTP	NTF
Evanston Cook County	40 Total	AL, CB, GL, HG, OCC, OMG, ONP, 1P, 2P, S/B	PB/PB	City of Evanston only	NTF
Illinois Valley Recycling LaSalle County	50+ Total	AL, GL, HG, MP, OCC, ONP, 1P, 2P, S/B	PV/PV	OTP	TF
Laidlaw Cook County	100 Total	AL, CB, GL, MP, OCC, OMG, ONP, 1PL, 2P, 3P, 4P, S/B	PV/PV	OTP	RDOM
Resource Mgmt. Will County	250 Res. 50 Com.	AL, CB, GL, HG, OCC, OMG, ONP, 1P, 2P, 6P, S/B	PV/PV	OTP	RDOM
Rockford Recycling Winnebago Co.	175 Total	AL, GL, HG, OCC, OMG, ONP, 1P, 2P, S/B	PV/PV	OTP	N/A
Sinow/Wienman Lee County	N/A	AL, CB, GL, HG, MP, OCC, OMG, ONP, 1P, 2P, S/B	PV/PV	OTP	NTF
Speedway Kane County	80 Total	AL, CB, GL, HG, OCC, OMG, ONP, 1P, 2P, S/B	PV/PV	OTP	RDOM
WMI-Elgin Cook County	N/A	AL, GL, OCC, OMG, ONP, 1P, 2P, S/B	PV/PV	WMI Only	N/A

Key:
1. Materials Accepted: **AL**: Aluminum **CB**: Chipboard **GL**: Glass **HG**: High Grade Paper **MP**: Mixed Paper **OCC**: corrugated **OMG**: magazines **ONP**: Newspaper **1P**: PETE Plastic **2P**: HDPE Plastic **4P**: LDPE Plastic **6P**: PS Plastic
2. Owned/Operated: **PV**: Private **PB**: Public
3. Access - **OTP**: Open To Public
4. Tipping Fee/Revenue: **TF**: Tipping Fee **NTF**: No Tipping Fee to deliver materials **RDOM**: Revenue Potential Depending on the Material

It is important to note that the term "MRF" generally refers to a facility which processes recyclable materials only and mixed refuse is not accepted at these facilities. The term "mixed waste processing facility", such as the XL Disposal facility in Crestwood, Illinois generally refers to facilities which separate recyclables out of mixed waste (see Chapter 6 for a discussion

on mixed waste processing). The distinction between the two types of facilities is made here only because a MRF as defined above does not require siting or permitting approval in Illinois. Since mixed waste processing facilities handle refuse, they must be sited and permitted as transfer station operations.

Typically, materials accepted at MRFs are processed in paper and non-paper streams. The paper stream generally includes newspaper; corrugated cardboard; magazines; and mixed waste paper. The non-paper stream generally includes aluminum cans; steel/bi-metal cans; glass food and beverage containers; and 1P PETE and 2P HDPE plastic containers.

The average cost to process recyclables at a MRF, before revenues from the sale of recyclables are considered is $50.30 per ton. Paper processing costs average $33.55 per ton and commingled container processing costs average $83.36 per ton. MRF cost components include labor (33.4%), building rental/amortization (16.7%), equipment amortization (13.5%), general administration (13.0%), residue hauling/disposal (7.7%), maintenance/repairs (6.1%) and insurance/taxes/miscellaneous (9.7%). Given current markets, sales of most recycled materials to end users do not cover MRF costs.

MRF's are an important component of a comprehensive recycling program for the following reasons:

- Many MRFs are designed to handle commingled materials.
- The processing capacity enables MRFs to accumulate large amounts of recyclables, which can increase leverage in the marketplace.
- MRFs improve the marketability of materials by processing them into a form more acceptable to markets.
- Processing of the materials, such as baling of paper and crushing of cans and glass, allows more efficient transportation of materials to end user markets.
- Many MRF's provide for the indoor storage of materials. This prevents contamination of the materials from moisture, dirt, etc.

- Processing capacity enables new items to be added to a recycling program more easily.

- To successfully compete for limited market capacity, a recycling program will have to be able to process its materials to a high degree of quality.

Considerations. First, every recycling program does not need to have its own processing center. Materials may be marketed to brokers, processors and in some cases, end users. Second, if additional processing capability is necessary, DeKalb County may want to build on existing recycling infrastructure by working with local recycling centers, buy-backs or MRFs to expand their capabilities. Third, if DeKalb County determines that additional processing capacity is needed, but cannot be satisfied through private companies, a regional cooperative marketing arrangement may be an alternative to investigate.

MARKETS FOR RECYCLABLE MATERIALS

This section will review market situations for: 1) paper; 2) glass containers; 3) aluminum cans; 4) steel and bi-metal cans; and 5) plastic containers. Market trends have been derived from the markets section of the Illinois Recycling Association Newsletter (now called Material Matters) and the Recycling Times newspaper. Market price information has been derived from the 1993 and 1994 editions of the Recycling Times. The information is provided to demonstrate the marketability of various materials collected in recycling programs. However, Actual prices paid for commodities can vary greatly from published averages. Suppliers with established relationships, long-term contracts and large, stable volumes of materials often benefit from better pricing. Since buyers have individual preferences, negotiations over freight, specifications and price need to be conducted on an individual basis with each buyer.

Paper. Paper grades which are collected for recycling and marketed typically include newspaper (ONP), corrugated cardboard (OCC), magazines (OMG), computer paper (CPO) and other grades of office paper such as white ledger (high grade/HG) and mixed paper (MP). This section describes market trends, regional and local markets/processors and material specifications.

Market Trends. Prices for paper have been low for the past few years. Low prices have been blamed in part on the sluggish export demand for waste paper due primarily to a general recession in the world economy. The United States has an enormous supply of waste paper and, in the past, the level of waste paper exports increased steadily, thereby causing the recycling infrastructure to rely on foreign demand. Unfortunately, the demand from buyers in Asia, Europe and Mexico has slackened, competition from foreign sources has increased and the continued flat demand for U.S. production have all combined to limit paper consumption. Table 5-6 shows bi-monthly published market prices for various paper grades paid by end users and dealers in the East Central United States from February 1993 - February 1994.

TABLE 5-6. PAPER MARKET PRICE RANGES BY DEALERS AND END USERS IN EAST CENTRAL U.S., BI-MONTHLY 2/93 - 2/94 ($/TON)

	2/93	4/93	6/93	8/93	10/93	12/93	2/94
Prices Paid by End Users							
Newsprint	0-30	0-30	0-30	0-30	0-25	0-25	0-25
Corrugated	10-35	10-35	10-35	10-35	10-35	15-35	5-35
Mixed Office	5-15	5-15	5-15	5-15	5-15	5-15	5-15
Computer Printout	140-280	140-280	140-280	140-280	110-200	120-200	120-200
White Ledger	140-210	140-210	140-210	140-210	100-115	115-140	115-140
Color Ledger	50-70	50-70	50-70	50-70	50-70	50-70	50-70
Magazines	0-20	0-20	0-20	0-20	0-20	0-20	0-20
Prices Paid by Dealers							
Newsprint	-15-0*, 5	-15-0*, 5-30	-15-0*, 5-30	-15-0*, 5-30	-10-0* 5-15	-30-0* 5-15	-20-0* 5-20
Corrugated	-10-10*, 10-22	-10-10*, 10-22	-10-10*, 10-22	-10-10*, 10-22	-10-10* 0-25	-10-15* 0-25	-10-15* 0-25
Mixed Office	-20-0*, 20	-20-0*, 20	-20-0*, 20	-20-0*, 20	-20-0* 10-20	-20-0* 10-20	-20-0* 10-20
Computer Printout	65-140	65-140	65-100	65-100	60-100	60-100	65-100
White Ledger	30-60	30-60	30-60	20-60	20-30	20-30	20-30
Color Ledger	20-25	20-25	20-25	20-25	20-25, 40	20-25, 40	20-40
Magazines	0	0	0	0	0	0	0

Notes: 1. Prices are in dollars per tons and are for delivered materials.
2. Prices were determined from the Recycling Times for the East Central Region.
* Loose material, not baled.

Regional and Local Markets/Processors. One very large buyer located in northern Illinois is FSC Paper Corporation in Alsip, Illinois. This manufacturer currently uses 13,000 tons per month of old newspaper for the manufacture of newsprint and 5,000 tons per month of old magazine and high-grade paper for tissue production. Another northern Illinois manufacturer is Container Corporation of America in Carol Stream, which purchases paper for its own 18 mills and sells additional paper to other mills. Table 5-7 lists large buyers of waste paper located in or accessible to recyclers in the Northern Illinois region.

TABLE 5-7. REGIONAL BUYERS OF PAPER

Buyer	Location	Newspaper	Corrugated	High Grades	Mixed	Magazines
American Cellulose	Minonk	X				
Beloit Boxboard	South Beloit		X			
Chicago Paperboard	Chicago	X	X			
Container Corp.	Carol Stream	X	X	X	X	X
Davey Company	Aurora			X		
Fort Howard Corp.	Green Bay, WI			X	X	X
FSC Paper	Alsip	X				X
Globe Industries	Chicago	X	X			
Insul-Mor	Oregon	X	X			
Ivex	Joliet		X			
Laidlaw	Canada	X				X
Sonoco Products	Rockton	X	X			X

Regional paper stock dealers include Durbin Paper Stock in Rock Island, Midland Paper & Products in Rock Island, Sonoco in Rockton, Insul-Moore Manufacturing in Oregon, and Vock Distributing/Rock Valley Recycling in Sterling.

Waste paper is usually recycled into paper, paperboard or tissue, but it can also be recycled as insulation material. For example, Insul-Mor Manufacturing in Oregon, Illinois and American Cellulose Manufacturing in Minonk, Illinois are two Illinois companies that recycle waste paper into cellulose insulation. These plants are currently taking donated paper only, but

when the market supply has been tighter, these plants subsidized transportation or have paid a small amount for the paper they receive. Prices paid by paper mills are generally higher.

Waste paper can also be used for animal bedding. In the advent of dried up markets for newspaper or other low paper grades, recycling programs have pursued farm bedding markets for their unmarketable paper products. Newspaper bedding has been in use for several years as the advantages over the more conventional straw bedding or other types of bedding have become more evident. First, the cost of using newspaper may often be less than the price of straw. For example, straw will generally run from $40 to $70 per ton, but REP systems in Lee County sells 1,500 pound bales of shredded newspaper to a local feed cattle farmer for only $22.50 each. Shredded newspaper can be sold for less because the cost of collection is born by the recycler (collection customer). Since the raw material can be obtained at minimal expense (a processor may even be able to charge a tipping fee), it can be shredded, baled and offered for sale at a price competitive with straw. Second, tests have shown that newspaper will absorb nearly twice as much moisture per pound and will last longer than straw if shredded and spread correctly. Third, newspaper contains no weed seeds or dust; consists of fewer germs; and does not support fly breeding. Dairy barns where paper is used are significantly cleaner than barns where straw is used. Fourth, newspaper is more easily handled in conventional manure handling systems and decomposes more readily on fields. Finally, there is a constant and large supply of newspaper available, whereas bad weather can severely affect the quantity of straw available.

Some of the disadvantages of newspaper bedding include potential blowing and matting. These problems can be avoided through proper shredding and spreading procedures. Studies in which livestock have been fed substantial quantities of paper have shown that toxicity is not a problem. Paper bedding has been successfully used by dairy, beef, pork and poultry producers as well as by horse farms and small animal veterinarians. Paper bedding is not useful for animals farmed in confinement, however.

Material Specifications. Paper is used for so many different purposes that there are more than 50 grades of waste paper that are commonly marketed. Most markets require paper to be sorted into various grades. Sorting paper into these grades requires a large storage area and

intensive labor. Some buyers such as Fort Howard Corp. will buy mixed office paper and will sort the paper themselves. Paper is often baled for delivery to markets.

Glass Containers. Glass containers which are collected for recycling and marketed typically include clear (flint), brown (amber) and green (emerald) glass food and beverage containers. This section describes market trends, regional and local markets/processors and material specifications.

Market Trends. Glass prices remained low in 1993 since many glass manufacturers in 1992 turned to benefaction plants or third party processors to provide furnace ready cullet (ie. color separated crushed glass). For this reason, many glass manufacturers stopped buying unprocessed cullet and the price of unprocessed cullet dropped across the country. Some dealers stopped accepting green glass or began charging to accept it because the markets were flooded with this commodity. Glass prices became depressed and many processors no longer welcomed the material due to oversupply.

An oversupply of green cullet, however, has prompted manufacturers to use green cullet at a level as high as 80 percent of the feedstock batches in some furnaces (especially in the larger companies). But despite the greater use of green cullet in container production, manufacturers have large stockpiles of green cullet and the demand for green cullet has greatly slackened in the last year. The reason is that although green glass containers comprise only 13 percent of domestic container production, green containers comprise 23 percent of the recovered glass waste stream. This imbalance is due to the import of beverages that are in green containers. When recovery rates were lower, manufacturers could make up the imbalance without much difficulty, but with today's higher recovery rate this is no longer true. As a result, manufacturers are exploring new methods of production to make use of the oversupply of green cullet (and mixed-use cullet, which can only be used in small amounts per batch), while recyclers and processors are looking for alternative markets for the green and mixed-color cullet.

Another factor that introduces uncertainty into the glass container market is the manufacturers' trend away from processing cullet. Owens-Brockway, the largest processor of

cullet in the U.S., is evaluating proposals from national processors to take over this function. Other companies and manufacturing plants are moving in the same direction, seeking to purchase only furnace-ready cullet from a single, reliable regional processor. In the future, processors will become a more distinct tier in the glass recycling infrastructure. As processors settle in and carve out their own profit margin, the market for glass cullet can be expected to undergo changes. Table 5-8 summarizes the glass market price ranges of dealers and end users in the East Central United States from March 1993 - February 1994.

TABLE 5-8. GLASS MARKET PRICE RANGES PAID BY DEALERS AND END USERS IN EAST CENTRAL U.S., 3/93 - 2/94 ($/TON)

	Flint		Amber		Green	
Month	Dealer	End User	Dealer	End User	Dealer	End User
3/93	0-10	50	0-10	25-40	0-10	5-15
4/93	0-10	50	0-10	25-40	0-10	5-15
5/93	0-10	50	0-10	25-40	0-10	5-15
6/93	0-10	50	0-10	25-40	0-10	0-15
7/93	0-10	50	0-10	25-40	0-10	0-15
8/93	0-10	50	0-10	25-40	0-10	0-15
9/93	0-10	50	0-10	15-40	0-30	0-25
10/93	0-10	50	0-10	15-40	0-10	0-15
11/93	0-10	50	0-10	15-40	0-10	0-15
12/93	0-10	50	0-10	15-40	0-10	0-15
1/94	0-10	50	0-10	15-40	0-10	0-15
2/94	0-10	50	0-10	15-40	0-10	0-15

Note: The prices are for furnace-ready material and do not include freight costs.

Regional and Local Markets/Processors. Large end-use buyers in Illinois include Owens-Brockway Inc. in Streator, Anchor-Glass in Streator, Container Recycling Alliance in Chicago, Kerr in Plainfield and Ball-Incon in Dolton. Owens-Brockway Inc. is one of the largest buyers of recycled glass in the region. Anchor-Glass in Streator is considering closing its plant and may no longer provide a market.

Container production is not the only market for glass cullet. Cullet also has applications in the production of fiberglass insulation, sandblasting material and glasphalt. Since the color of cullet does not matter for these alternative uses, these applications provide a good outlet for mixed color and green cullet. Insulation manufacturing could potentially consume as much as 400,000 tons of cullet per year, but insulation applications currently demand only a small percentage of the total available cullet. Sand blasting consumption of cullet is also limited and glasphalt applications are not a cost-effective alternative at five dollars per ton of processed and delivered cullet.

Material Specifications and Preparation. Buyers need glass to be color separated with caps removed. Furnace-ready material cannot have any contamination from metal, ceramics and other substances that are harmful to the furnace or that decrease the quality of the manufactured glass. All glass must be container glass such as bottles and jars. Some buyers, such as Owens-Brockway, prefer glass cullet to be in boxed containers since the cullet is more accessible this way and less likely to be contaminated by materials from the truck. Glass is often crushed or granulated for delivery to markets. Very few, if any, regional end-use manufacturers accept mixed glass, although some processors of glass such as Advance Cullet in Chicago will accept it for sale to distant markets.

Aluminum Cans. Aluminum which is collected for recycling and marketed primarily includes aluminum beverage cans, although aluminum foil and aluminum scrap may also be marketed. This section describes national market trends, regional and local markets/processors and material specifications.

Market Trends. Markets for aluminum used beverage cans (UBC's) have been weak during 1993. Weak prices for aluminum cans may be attributed to two factors. First, the recession has had a dampening effect on housing starts and auto production which are two primary uses of aluminum. Second, cash-starved eastern European nations, primarily Russia, have been overproducing virgin aluminum and flooding the market. Aluminum inventory is at a high level world-wide, which has been driving the prices downward. Compounding the oversupply problem is a lack of an agreement among major producers to cut back production.

Table 5-9 summarizes the aluminum UBC market price ranges of dealers and end users in the East Central United States from March 1993 - February 1994.

TABLE 5-9. ALUMINUM UBC MARKET PRICE RANGES PAID BY DEALERS AND END USERS IN EAST CENTRAL U.S., 3/93 - 2/94 ($/TON)

Month	Dealer Price	End User Price
3/93	400-680	500-840
4/93	400-600	500-790
5/93	400-620	500-800
6/93	400-600	500-800
7/93	400-600	500-780
8/93	440-640	560-840
9/93	400-560	500-680
10/93	400-540	500-680
11/93	400-540	500-740
12/93	400-540	520-750
1/94	400-540	520-750
2/94	440-540	750-880

Note: Freight costs are not included in these prices.

Regional and Local Markets. Large end-use buyers of aluminum cans in Illinois include ALCOA Recycling in Rock Island, ALCOA Recycling in Chicago, American National Can Company in Chicago, AMG Resources in Gary and U.S. Steel in Gary. Most buyers pay a slightly higher price for baled or densified aluminum, but bales must meet specifications for density and size that are suitable to the particular buyer's manufacturing line.

Material Preparation. Once aluminum cans are separated from other metals, such as steel and bi-metal cans, aluminum may be flattened or baled for shipment to markets.

Steel/Bi-Metal Cans. Steel/bi-metal which is collected for recycling and marketed primarily consists of tin-plated steel and bi-metal food or beverage cans. This section describes market trends, regional and local markets/processors and material specifications.

Market Trends. Prices for steel cans have been falling in the past few years. Strong export demand and smaller scrap steel inventories should prevent any severe market downswings throughout the end of 1993. Steel cans are bought by de-tinning companies, steel mills and iron and steel foundries. Steel mills such as LTV Steel in East Chicago, Indiana, pay higher prices than de-tinners such as AMG Resources. Table 5-10 summarizes the steel can market price ranges of dealers and end users in the East Central United States from March 1993 - February 1994.

TABLE 5-10. STEEL CAN MARKET PRICE RANGES PAID BY DEALERS AND END USERS IN EAST CENTRAL U.S., 3/93 - 2/94 ($/GROSS TON)

Month	Processor Price	End-use Manufacturer Price
3/93	0-22.4	55-87
4/93	0-22.4	55-87
5/93	0-22.4	59.50-87
6/93	0-22.4	59.50-87
7/93	0-22.4	59.50-87
8/93	0-22.4	59.50-95
9/93	0-22.4	59.50-95
10/93	0-22.4	59.50-95
11/93	0-22.4	59.50-95
12/93	0-22.4	59.50-95
1/94	0-22.4	59.50-100
2/94	0-22.4	59.50-100

Note: A gross ton is equivalent to 2,240 pounds. Prices do not include freight.

Regional and Local Markets/Processors. End-use manufacturers located in the Illinois region that buy steel/bi-metal cans include LTV Steel in East Chicago, American National Can in Chicago, AMG Resources in Gary, Midwest Industrial in Chicago and U.S. Steel in Gary. Some buyers, such as LTV Steel, have said that they are paying a price that is higher than the true value of the material. This higher price is apparently being subsidized by can manufacturers as an incentive to build a recycling infrastructure. This is similar to what aluminum can manufacturers have done to build a recycling infrastructure for aluminum cans.

Material Specifications. Once steel/bi-metal cans are separated from other metals, such as aluminum cans, steel/bi-metal may be flattened or baled for shipment to markets. Steel mills also have tighter specifications for cleanliness and bale density, because the mills place the bales directly into the steel melt without processing. Buyers expressed no preferences about labels, although food contamination must be kept to a minimum.

Plastic Containers. Plastic which is collected for recycling and marketed primarily consists of clear or colored PETE and clear or colored HDPE food and beverage containers, although LDPE, polystyrene, and other plastic containers may also be recycled. This section describes market trends, regional and local markets/processors and material specifications.

Market Trends. Prices remain very low as the recyclable materials attempt to compete with virgin materials. Price drops in virgin plastic resin made it difficult if not impossible for plastic re-processors to find strong markets. Few incentives exist to encourage end users to buy recycled plastics when they can get virgin resin for less money.

The markets for HDPE and PETE have been the strongest of the recycled plastic resin markets, although some recycling programs across the nation also collect and market vinyl (PVC), film (LDPE) and polystyrene. PETE markets remain strong as product manufacturers find favorable market acceptance for carpet and other non-food container products. HDPE markets are still sluggish. PVC is such a small portion of the residential waste stream that it is generally not cost-effective to collect. Although film is also a small part of the residential waste stream, plastic film is mostly collected for recycling from the commercial/institutional and

industrial waste stream. Processing polystyrene for recycling may be cost-effective when the recycled material is clean industrial scrap, but the processing technology has probably not yet made the recycling of post-consumer scrap cost-effective. Manufacturers have also been experimenting with technologies to recycle aseptic packaging, disposable diapers and other items made wholly or partially from plastic.

Five important factors that will influence the future market for recycled plastics are, 1) the current aggressive investment of plastic manufacturers in the collection and processing of plastics for recycling; 2) the continual development of new processing and production technologies for recycled plastic; 3) a movement among manufacturers toward developing their own processing facilities or toward a joint venture with a single regional processing facility; 4) the potential government acceptance of recycled plastic packaging for food uses; and, 5) oil prices and the general state of the economy. Table 5-11 summarizes the plastic market price ranges of dealers and end users in the East Central United States from March 1993 - February 1994.

TABLE 5-11. PLASTIC MARKET PRICE RANGES PAID BY END USERS IN EAST CENTRAL U.S., 3/93 - 2/94 ($/TON)

Month	Clear PETE	Mixed PETE	Clear HDPE	Mixed HDPE
3/93	40-200	40-160	40-260	60-100
4/93	40-200	40-160	40-240	60-100
5/93	40-200	40-160	40-240	60-120
6/93	40-200	40-160	40-240	60-120
7/93	40-200	40-160	40-240	60-120
8/93	40-200	40-160	40-240	60-120
9/93	40-200	40-160	40-240	60-120
10/93	40-200	40-160	40-240	60-120
11/93	40-200	40-160	40-240	50-120
12/93	40-200	40-160	40-240	50-120
1/94	40-200	40-160	40-240	50-120
2/94	40-200	40-160	40-240	50-120

Note: Prices are for loose materials in large quantities (40,000 lbs) and freight costs are not included.

Regional and Local Markets/Processors. End-use buyers of HDPE and PETE located in the Illinois region include Midwest Plastics in Edgerton, Wisconsin, Eaglebrook Plastics in Chicago, Hammer's Plastic in Iowa Falls, Iowa, Nucon Corp. in Northbrook, Landfill Alternatives in Elburn and Plastic Recycling Alliance in Chicago. Plastic Recycling Alliance (PRA) is the largest buyer of post-consumer plastic in the Chicago area and has a processing capacity of 20,000 tons of HDPE and PETE per year. Eaglebrook Plastics is another large buyer of HDPE and PETE and has recently begun recycling polystyrene, as well. In a joint venture with National Polystyrene Recycling Corporation, Eaglebrook operates a polystyrene recycling facility with 7,500 tons per year of capacity.

Other companies are also increasing their plastic manufacturing capacity in the Midwest. Partek's new plant in Anderson, Indiana, has a manufacturing capacity of 10,000 tons of recycled HDPE per year. In several months Midwest Plastic will be tripling its capacity to 1,500 tons per year. A new Johnson Controls facility in Novi, Michigan, will bring added PETE processing capacity to the Midwest.

Material Specifications and Preparation. Because of the nature of plastic manufacturing, contamination is a key concern for manufacturers. Plastic must be sorted correctly and foreign materials must be kept to a minimum, especially for re-grind plastic. Buyers of HDPE want extrusion grade HDPE only. Injection grade HDPE such as margarine tubs is regarded as a contaminant. Most buyers prefer baled or loose material and many buyers refuse to take re-grind (especially PETE re-grind) because they do not trust its purity unless it was processed at their plant or by an established processing facility that has materials of proven quality.

ADDITIONAL ALTERNATIVES TO SUPPORT RECYCLING INITIATIVES

There are several alternatives which can be undertaken to support recycling initiatives, including educational programming, recycling policies, administrative activities, reporting system, and local government recycling and procurement programs.

Education Programming. Education is a crucial component of a successful recycling program. There are many purposes for a strong education campaign. Residents and businesses need to be educated on what recycling opportunities are available to them. They also need to be informed on how to participate in recycling programs, what materials are recyclable and how those materials should be prepared. This is important not only for increasing participation and the quantity of material that is recycled, but increasing the quality of recyclable materials (reducing the amount of non-recyclable materials ending up in recycling collections). Since education programming is an integral function of overall municipal waste management program, Chapter 10 has been dedicated to review Public Involvement and Education. Chapter 10 will discuss a variety of education program components which may be used to communicate important recycling information.

Recycling Policies. There are a number of policies which may be implemented to facilitate or support recycling including mandatory recycling ordinances, volume-based disposal fees, anti-scavenging, haulers licensing, business licensing and zoning/building codes.

Mandatory Recycling. Mandatory recycling has been implemented in some communities in the United States to compel participation in recycling programs. Most notably, a mandatory recycling ordinance was passed by McHenry County in November, 1992. Under this ordinance, McHenry County residents are required to separate their newsprint, glass containers, aluminum and steel cans from their refuse. Residents may either have a licensed hauler collect their separated recyclable materials through a curbside recycling program or may take their recyclable materials to a licensed recycling facility. Residents which do not comply may risk warnings, citations or not having their refuse collected.

The ordinance prohibits haulers from knowingly collecting refuse from residents which contains newsprint, glass containers, aluminum and steel cans. Haulers are required by the ordinance to obtain an annual license from McHenry County to collect refuse, landscape waste or recyclables. In order to obtain a license and vehicle registration, haulers must pay a $50 fee for the license and an additional $25 fee for each vehicle operated by the hauler for the collection of refuse, landscape waste or recyclables. In addition, haulers are required to submit

a materials separation plan; an annual report indicating the quantities of refuse and recyclable collected; and certification of information reported. Haulers who do not comply may be subject to civil penalties and fines, and the suspension or revocation of their license. McHenry County policy also strongly favors implementation of volume-based waste collection programs, but does not mandate them.

Several other communities in northwestern Illinois which have instituted mandatory recycling programs as well, including Oregon and Rochelle in Ogle County.

Mandatory recycling is subject to some controversy within the recycling community. Proponents argue that it is necessary for maximizing participation and is justified since disposal costs are frequently one of the fastest growing expenses in a municipal budget. Opponents argue that voluntary programs, in conjunction with a strong education campaign, can result in high participation rates and that enforcement of mandatory recycling is difficult and requires expenditure of resources.

Many Illinois communities have instituted a quasi-mandatory program in which all residents are billed for recycling service, although they are not fined if they do not participate. Such a system tends to encourage residents to participate since they pay for the service whether they participate or not. A quasi-mandatory recycling program, in which all residents are billed for recycling service must consider the impact such a program would have on fixed-income residents and which billing system would be utilized to collect such a fee.

Volume-Based Disposal Fees. Instituting volume-based disposal fees can give residents a financial incentive to recycle because under a volume-based rate structure (such as a pay-per-bag system), residents are charged in proportion to the amount of waste they set out for disposal. A comprehensive recycling program such as a curbside bin program or drop-off network program complements and, indeed, is a necessary component of volume-based disposal systems because it provides residents with an alternative to disposing of all their waste in a metered bag. Aggressive education is required, however, to insure that only marketable materials are recovered by the recycling program. (Volume-based rates are discussed in detail in Chapter 3.)

Anti-Scavenging Ordinance. Anti-scavenging ordinances may have to be passed to prohibit scavengers from collecting aluminum and other high value materials from recycling containers.

Hauler Licensing. As a condition of obtaining a license required for providing refuse services, haulers may be required to provide recycling services to single-family, multi-family and commercial/institutional establishments. Elk Grove Village in Cook County, Illinois has passed an ordinance which requires the hauler to submit a recycling program for its commercial clients to the Village prior to receiving a license. The Village wrote specific language into the ordinance concerning the content of the programs.

Business Licensing. As a condition of a business license or liquor license, the County or unit of local government may require businesses to perform a waste audit or may require businesses (for firms over a certain size) to submit a recycling plan and an annual progress report. The City of Chicago and the Village of Schaumburg have each adopted this type of policy in an effort to advance commercial waste reduction programs.

Zoning/Building Codes and Permits. Counties have amended building codes to require the provision of space for the collection, storage and loading of recyclable materials in all new construction and major renovation projects for multi-family structures and commercial/institutional/industrial establishments. Counties may also amend zoning ordinances to provide for the siting of recycling centers and material recycling facilities (MRFs). Special provisions may also be required to obtain building or demolition permits. For example, in order to be issued a building or demolition permit (for projects of a specified size), the contractor must submit a plan which identities how construction/demolition wastes will be handled, specifically which reduction, reuse or recycling measures will be utilized to prevent the landfilling of the C/D debris as a result of the project. The Village of Hoffman Estates Planning Commission has adopted a policy requiring developers to demonstrate that some thought has been given to waste management with an eye toward recycling at proposed construction sites. Village staff has been directed to confirm that proposals brought before the Planning Commission contain such provisions. Potential developers know that prior to Planning Commission approval, they will

confront questions regarding their plans for potentially recyclable construction and demolition waste.

Administrative Activities. One of the recommendations of this chapter is that the County designate a Solid Waste Coordinator. More specifically, will an existing staff member be designated to handle recycling duties or will an employee be hired specifically to fulfill recycling and other solid waste duties. The responsibilities for a recycling/solid waste coordinator position vary among counties and solid waste planning agencies. Job descriptions for county recycling coordinators have included the following:

- Contact local governments, public agencies and major businesses to determine the status of current and planned recycling programs.
- Provide technical assistance to municipalities and townships in the planning and implementation of their recycling programs.
- Research recycling opportunities in the County and regional area. This includes identifying haulers, end users, possible markets for recyclables and producers and suppliers of products made of recycled materials.
- Maintain and expand the information clearinghouse and make the information available to the public.
- Respond to questions and inquiries about recycling from the general public.
- Develop presentations and speak throughout the area on recycling.
- Develop and produce promotional and educational materials.
- Develop and implement special recycling events or workshops.
- Administer the County's refuse and recycling data collection program.
- Prepare and produce an annual report on recycling activities and recycling rate achieved by the County.
- Develop and implement a commercial waste audit program.
- Develop and implement a white goods recycling program.
- Work with the County to implement their in-house recycling program.

- Assist in the development of procurement policy for County to purchase materials with recycled content.

- Research and seek grant opportunities for recycling initiatives.

Reporting System. Currently, DeKalb County have not yet established a formal central reporting system to record the amounts of waste landfilled, incinerated, recycled and composted/land-applied. Reporting will be necessary to document the level of recycling in DeKalb County relative to the State's recycling goals.

Reporting has been a growing issue among counties which are attempting to implement waste management plans. There are several benefits to the development of a simplified reporting system which is sensitive to the proprietary nature of waste management information. Data collected can be used to monitor the progress of waste management goals, evaluate the effectiveness of programs and plan future waste management programs. In addition, certain waste data is needed to apply or receive grants and funding.

Local Government Procurement Program. Government procurement policies stimulate recycling by requiring governments to give greater consideration in their purchasing decisions of products that are recyclable or are made from recycled materials. Ordinances or laws which institute a procurement policy usually include a provision which grants an exemption from purchasing recycled content products if they cost 10 to 15 percent more than comparable products made from virgin materials.

The motivation behind government procurement ordinances is that since it is often a unit of government that proposes or mandates recycling, the unit of government should therefore set an example by purchasing products with a recycled content. Furthermore, since governmental bodies are large purchasers of goods, procurement can help to stimulate markets for recycled materials, particularly paper markets. The State of Illinois has implemented procurement procedures which favor products made from recycled materials. In fiscal year 1991, 39 percent of the paper purchased by state agencies contained recycled fiber.

Government may further set an example and stimulate recycling by implementing recycling programs in government facilities. The Illinois Department of Central Management Services has implemented an office recycling program which recovered approximately 4 million pounds of wastepaper in 1990. The Governor recently issued a directive for the Department of Central Management Services to expand recycling in state agencies.

In order to encourage the procurement of secondary materials in public and private establishments throughout DeKalb County, the County may want to implement an in-house procurement program and gather or prepare model procurement policy and ordinances to be used by local government units and business establishments.

RECYCLING RECOMMENDATIONS

Described below are the preliminary recommendations to be considered by DeKalb County to encourage recycling. The discussion points include options for residential recycling, commercial, institutional and industrial recycling, management of construction/demolition debris, management of orphan wastes, processing alternatives, education programs, recycling policies, administrative activities, monitoring/reporting system and local government in-house recycling and procurement programs.

Residential Recycling

- The County should set a residential recycling goal of 35% in the fifth year and 40% in the tenth year of plan implementation. Even though the current recycling rate is 31%, over one-third of this diversion is attributed to landscape waste. This is important, because if the County is successful at source reducing landscape waste through on-site management practices, then the total recycling percentage will shrink.

- The County should consider whether it is necessary to develop a drop-box recycling network to serve residents located in the unincorporated areas of the County. If deemed necessary, the County should consider entering into discussions with township officials and haulers to implement this drop-box network.

- The County should consider whether it is necessary to extend curbside recycling services to residents in unincorporated areas, especially in rural subdivisions and adjacent to incorporated towns.

Commercial/Institutional and Industrial Recycling

- The County should consider encouraging commercial, industrial and institutional (CII) haulers to collect a maximum range of recyclables. Priorities for determining which materials to collect should include availability of markets, cost effectiveness of collection and the potential volume, weight of toxicity reduction incurred due to recycling the material.

- The County should consider offering assistance to interested CII establishments in conducting waste audits to develop or expand recycling programs and the County should consider developing and providing a self-audit manual for businesses.

- The County should consider identifying or helping to develop model recycling programs in CII establishments and promote their success in the media.

Municipal Waste Recycling Goal

- The County should set a municipal waste recycling goal of 47% in the fifth year and 51% in the tenth year of plan implementation. The current municipal waste recycling rate is 44%. By setting a ten year goal of 51%, the County hopes to eventually recycle a majority of the waste it generates.

Management of Construction/Demolition (C/D) Debris

- The County should quantify the rate of C/D recycling and include the recycled material in the County's municipal recycling rate per IEPA guidelines (June 1, 1994).

- The County should consider beginning a dialogue with local C/D contractors to consider undertaking a study to more closely examine the generation and management of C/D debris, with a special emphasis on the management of asphalt and concrete generated within the County. An effort should be made to identify local C/D markets and/or potential market opportunities.

- After obtaining adequate information, the County should consider setting quantitative C/D recycling goals comparable to the goals established by the Solid

Waste Planning and Recycling Act of 15% and 25% in the third and fifth years, respectively, of plan implementation.

- The County should consider developing and providing information guides concerning the preferred management of C/D debris.

- The County should consider adopting a policy mandating that new construction, demolition or renovation projects submit waste management plans outlining methods to be used to minimize waste. The County should consider encouraging municipalities to adopt similar policies.

Management of Orphan Wastes

- The County should consider preparing or making available information on local lead-acid battery recycling and should track the development of recycling opportunities for all types of batteries.

- The County should consider making available information on motor oil recycling, should encourage local automotive service stations and motor oil retailers to collect motor oil from the public and should aggressively publicize motor oil collections. The County should also consider methods of discouraging do-it-yourself oil changing through public education programs.

- The County should consider aggressively publicizing tire collection days, such as the one sponsored by Farm Bureau through the IEPA, and should start a dialogue with local tire retailers and haulers to alleviate any difficulties with the disposal of tires once the tire legislation becomes effective in 1994.

- The County should consider working closely with haulers, appliance services, the County landfill operator and white good recyclers to alleviate any difficulties with the recycling and disposal of white goods once the legislation becomes effective in 1994. The County should monitor the progress of the White Goods Task Force recommendations as, if implemented, it will become more difficult to dispose of or recycle major appliances.

- The County should evaluate grant opportunities for managing orphan wastes.

Processing Alternatives

- Given the regional processing capabilities available and the economics of developing a MRF, the County should not consider the development of a County-owned and/or operated centralized processing facility at this time.

Education Programs

- Educational efforts should be a strong emphasis of the recycling program. Specific educational components will be outlined in Chapter 10 of Volume I.

Recycling Policies

- The County should review and amend as necessary its existing solid waste ordinances and anti-dumping provisions.

Administrative Activities

- The County should consider developing a job description for the Recycling/Solid Waste Coordinator position.
- The County should consider designating a Recycling/Solid Waste Coordinator.

Monitoring/Reporting System

- The County should consider developing a reporting form and data collection system to track the quantities of municipal waste landfilled, incinerated, recycled and composted in DeKalb County in order to measure progress toward the County's and State's municipal waste recycling goals.
- The County should consider developing an annual report documenting, to the best of its abilities, the level of municipal waste recycling occurring within the County.

Local Government Recycling and Procurement Programs

- The County should consider whether it is necessary to expand or upgrade its in-house recycling program, focusing on office paper and aluminum cans at a minimum and strongly encourage other units of local government to implement similar programs.
- The County should consider developing a procurement policy patterned after the State's policy which gives preference to recycled-content materials wherever economically and practically feasible and strongly encourage other units of local

government to develop similar policies. Attempts should be made to purchase post-consumer recycled paper (office paper, stationary, forms, tissue paper, etc.), post-consumer recycled plastic products (e.g. lawn edging, garbage cans, park benches), re-refined motor oil and remanufactured/retread tires for government vehicles, and compost for landscaping in parks, wherever such use is practical and economical.

- The County should explore the feasibility of developing a procurement policy for recycled C/D material.

- The County should gather and/or develop model procurement ordinances to be used in public and private sector organizations within DeKalb County.

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CHAPTER 6
INTERMEDIATE FACILITIES

Facilities designed to handle or process waste prior to final disposal are called intermediate facilities. Transfer stations, mixed waste processing facilities and refuse derived fuel (RDF) facilities are classified as intermediate facilities.

BACKGROUND

Section 3.83 of the Illinois Environmental Protection Act defines a transfer station as "a site or facility that accepts waste for temporary storage or consolidation and further transfer to a waste disposal, treatment or storage facility." A transfer station is a facility designed to make the transportation of waste more efficient. The traditional method of waste transportation has relied on packer trucks collecting the waste at the source of generation and delivering the waste to a local disposal facility, predominately landfills. The current trend towards fewer landfills results in larger, regional disposal facilities. This generally results in longer haul distances and increased transportation costs. Packer trucks are efficient collection vehicles. However, their use as a transportation vehicle over long distances is cost prohibitive.

At a transfer station, waste from collection vehicles (mostly packer trucks) is transferred into larger vehicles better suited for long haul. The types of vehicles used for the transportation of waste from the transfer station can include tractor trailers, railcars or barges.

A mixed waste processing facility is a transfer station where recyclables are separated from mixed waste. By recovering recyclables from waste entering the transfer station, the quantity of waste shipped from the transfer station is reduced, thus reducing the costs of hauling and final disposal. In addition, the sale of recyclables generates a revenue stream which helps offset operating costs. A mixed waste processing facility may also incorporate a design to separate compostable material from non-compostable materials. Composting operations are discussed in Chapter 7.

RDF facilities are a hybrid of the mixed waste processing facilities. RDF facilities produce a burnable material from waste. RDF facilities attempt to separate non-burnable materials, such as ferrous metals, glass, and grit in order to produce a fuel that has better combustion characteristics than mixed waste.

This chapter will focus on technology, siting and permitting, transportation, facility layout, economic, and implementation considerations of intermediate facilities.

TRANSFER STATION TECHNOLOGY

Low Technology Transfer Stations. The simplest form of transfer station uses the direct dump method. This method utilizes a platform from which the collection vehicles dump their waste into a transfer trailer that is placed directly below the platform. The advantages and disadvantages to the direct dump method are listed below:

Advantages:

- Lowest capital cost of all transfer methods.
- Lack of machinery eliminates the possibility of equipment down-time.
- Limited amount of personnel required to operate the transfer station.

Disadvantages:

- Little compaction of waste in the transfer container does not significantly minimize transportation cost.

- Leachate may collect in the transfer container if the facility is an open air facility.

- Greater tendency for litter problems.

The two types of transfer containers typically used at direct dump facilities are roll-off containers and tandem-axle trailers. Both of these containers are loaded from the top. Once loaded, the container is covered and hauled to the disposal facility and an empty container is placed in position for loading. A cover on the container is required to prevent waste from blowing out of the container during transport. After unloading at the disposal facility the empty containers are returned to the transfer station.

High Technology Transfer Systems. The transfer process can be made more efficient by increasing the amount of equipment involved in the process. By increasing the level of technology, the transfer station will be able to operate at a higher capacity. Waste processing equipment increases efficiency by increasing the density of the waste and/or making the waste easier to handle. The most common types of equipment include compactors, balers and shredders.

Compactors. Compactors are used to densify waste and push it into transfer trailers. Waste densities of 900 pounds per cubic yard can be achieved with this equipment. The advantages and disadvantages of compacting waste into transfer trailers are listed below.

Advantages:

- The higher density of waste increases the amount of waste loaded on each trailer and hauled each trip. This lowers the transportation cost considerably.

- Completely enclosed transfer trailers prevent blowing of waste and the generation of leachate.

- Fewer trailers are required. Fewer trailers reduce the loading area required and reduce the investment cost for trailers.

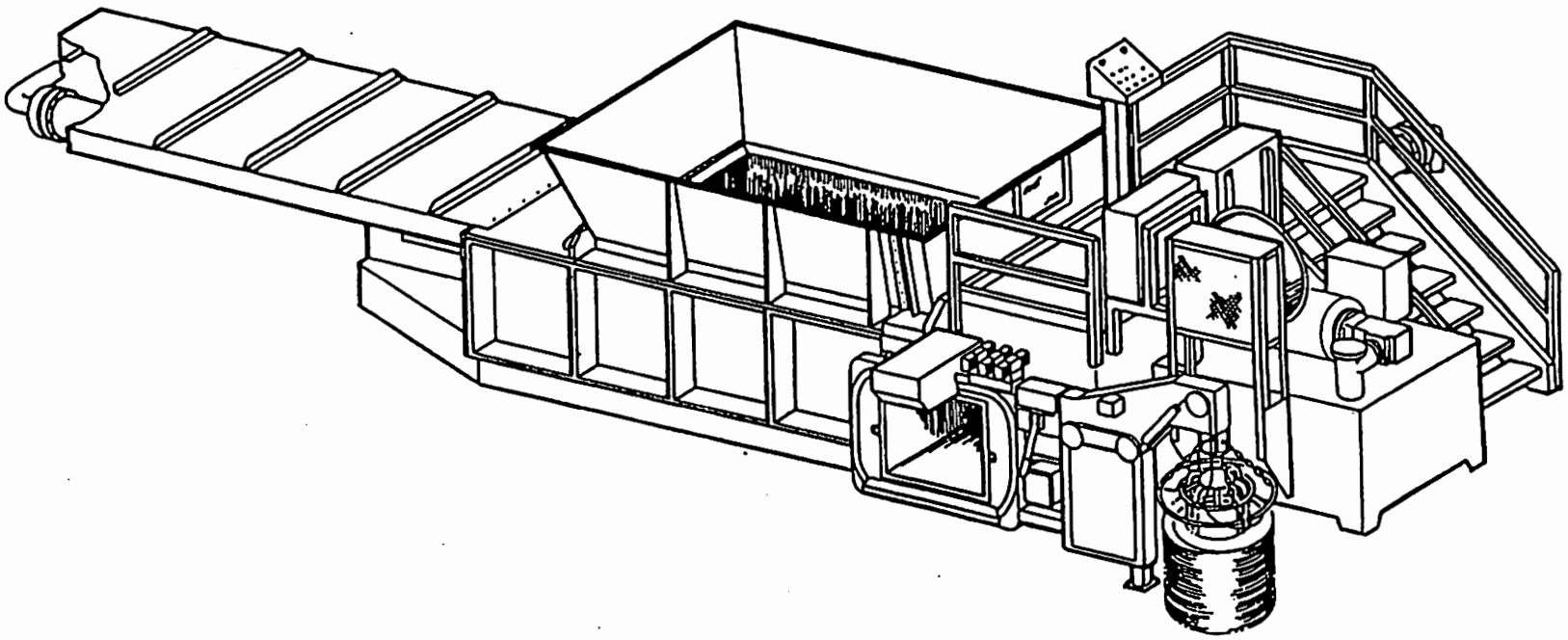
Disadvantages:

- The capital cost for compactors is high.

- Heavier, reinforced transfer containers are required in order to withstand the compaction pressure. This will increase capital costs.

- Compactor down time may stall the waste flow through the transfer station if redundant design is not implemented.

Balers. Baling equipment is similar to compaction equipment in that its primary function is to increase the density of the waste. (Figure 6-1 shows a typical baler.) However, the end product of the processing is different. Balers compact the waste and then tie the bale with wire to prevent the bale from rebounding back to its original density. Balers can create densities of 1,350 pounds per cubic yard. This is significant because highway weight limits can be reached at these densities. This will maximize the amount of waste taken to the disposal facility in a single trip. The amount of waste that a baler can process depends on the size of the baler. Modern balers can process up to 74 tons per hour. Typically a transfer station will have more than one baler to provide for additional capacity in the event of mechanical failures and maintenance downtime. The advantages and disadvantages of balers are as follows:



TYPICAL BALER

PATRICK
ENGINEERING INC.

FIGURE 6-1

Advantages:

- Low-profile, flat-bed trailers may be used as opposed to fully enclosed, standard height, reinforced trailers used with other processing equipment.

- High waste densities and low trailer weight (as opposed to standard height trailers) allow the largest amount of waste to be taken to the disposal facility in a single trip. For example, a full height, open top aluminum pusher trailer with a 90 cubic yard capacity weighs 18,400 pounds. A low profile trailer that can haul bales weighs 14,200 pounds. The selection of the baling system and lower weight trailer allows 4,200 additional pounds of refuse to be hauled per trip, improving the effectiveness of the transfer operation.

- The compact bale size allows for easy handling with proper equipment.

Disadvantages:

- High capital cost.

- Baler down time can reduce or stall the throughput of waste if bypass routes or equipment redundancies are not provided.

Shredders. Shredders are not typically used at transfer stations. However, they do produce a more homogeneous mixture of waste that is easy to handle. This may be advantageous in some situations such as automated loading of hoppers for rail hauling. Shredders are more commonly used for the preparation of RDF. The advantages and disadvantages of shredders are as follows:

Advantages:

- Homogeneous mixture of waste is easy to handle and compact.
- Easily integrated into automated processing lines.

Disadvantages:

- Air pollution control equipment is required to control particulate emissions.
- Particulate matter may be considered a special waste.
- Potential for explosions.

MIXED WASTE PROCESSING FACILITIES

Mixed waste processing facilities can be viewed as an alternative or supplement to source separation programs. The difference between a material recovery facility (MRF) and a mixed waste processing facility is that the material input for a MRF are source separated recyclables, while the input to a mixed waste processing facility is waste. A mixed waste processing facility separates recyclables from the incoming mixed waste. The recovered material is then sold to end markets. The garbage remaining is then transferred to a disposal facility.

The arguments supporting mixed waste processing facilities include:

- Mixed waste processing facilities, especially those that accept select loads from commercial establishments, can result in large quantities of material being diverted from the landfill.

- Mixed waste processing facilities reduce the need for source separation programs. Furthermore, mixed waste processing programs result in an involuntary 100 percent participation, since the waste from all of the residents and businesses served by a facility passes through the separation system. Source separation programs rarely achieve a 100 percent participation rate.

- Mixed waste processing facilities are compatible with source separation programs. Some facilities have two sorting lines -- one for mixed waste and one for source separated recyclables. The mixed waste line acts as a backup to source separation programs and thus maximizes the amount of material recycled.

The arguments against mixed waste processing facilities include:

- The materials recovered through mixed waste processing are inferior to those recovered by source separation programs. Glass breakage and paper contamination are high due to the manner in which those materials are handled.

- Capital and operating costs are high for mixed waste processing facilities because the systems are equipment intensive. Capital costs for existing facilities range from $1 million to $80 million, and operating costs can be as high as $50 per ton.

- Mixed waste processing facilities do not require citizen participation, therefore the education and awareness aspects of recycling are not promoted.

Table 6-1 shows statistics for selected mixed waste processing facilities. Table 6-2 provides additional information on the operation of the XL Recycling facility in Crestwood, Illinois, now owned by USA Waste. Table 6-2 shows recovery rates of specific waste components. The table shows that 1,559.1 tons of "conventional" recyclables were recovered during the first six months of 1993. Conventional recyclables include aluminum, ferrous metal, corrugated, newsprint, plastics and glass. These materials were recovered at a rate of 6.9

TABLE 6-1. SELECTED MIXED WASTE PROCESSING FACILITIES

Program	System Design	Facility Description	Capital Cost ($M)[1]	Throughput (tons/day)[2]	Processing Fee ($/ton)	Recovery (percent)[3]	Labor (FTE)
XL Recycling/USA Waste Crestwood, IL	NRT	T,W	~4	400	40	7	NA
Mid-American Waste Systems Canal Winchester, OH	NRT	R,T,W	14.1	400 (16 hours)	40	15	28-32
Norton Environmental Medina, OH	Lindemann	T,W	6.7	400 (16 hours)	38	15	35-40
Prison Industry Authority Folsom, CA	Stone & Webster	C,T,W	4.2	100 (8 hours)	31	20-30	80-100
Resource Authority in Sumner County Gallatin, TN	Lundell	W	4.1	200 (8 hours)[4]	40-44	7-10	32
Solar International Babylon, NY	Wehren/RRT	C,D,R,T,W	15.0	840 (16 hours)	32	40	110-120
CR Transfer, Inc. Stanton, CA	NA	NA	+10	1,400 (14 hours)	38-54	25	75

$M = Million dollars.
FTE = Full-time equivalents.
NRT = National Recovery Technologies.
C = Composting module.
D = Construction and demolition waste processing.
R = Source-separated recyclables processing.
T = Transfer station.
W = Mixed waste processing system.
NA = Information not available.

Notes:
1. In general, capital costs for mixed waste processing equipment systems alone run $1 million to $5 million, depending on capacity and technological sophistication.
2. The listed throughput levels are for the mixed waste processing module of the facility.
3. Only material recovery levels are reported; diversion due to mixed waste compost or other products has not been determined.
4. Two Lundell processing systems are used, each processing about 13 tons per hour.

Source: Resource Recycling, September 1993, p. 51.

percent of the incoming mixed waste. Process fines, including dirt and grit were recovered at 13.3 percent. Yard waste was processed, although collected separately, at a rate of 13.8 percent.

Table 6-2 shows that a mixed waste processing facility may not necessarily provide a high recovery rate of conventional recyclables (6.9%) without the integration of yard waste (13.8%). It is questionable whether process fines (13.3%) can be marketed. One potential use for process fines is landfill cover, although its use will require a special clause in a landfill's permit. If yard waste is not collected at the facility and process fines are not marketed, the resulting recovery rate will be approximately seven percent.

TABLE 6-2. XL RECYCLING FACILITY RECOVERY RATES FROM JANUARY 1, 1993 THROUGH JUNE 30, 1993

Material	Tons	Percent of Incoming Waste	Hand Sorted (tons)	Mechanically Sorted (tons)
Aluminum	86.9	0.4	0	86.9
Ferrous	1,061.3	4.7	453.4	607.9
Corrugated	63.5	0.3	63.5	0
Newsprint	260.4	1.2	260.4	0
Plastics	72.0	0.3	72.0	0
Glass	15.0	0.1	15.0	0
Subtotal	1,559.1	6.9	864.3	694.8
Yardwaste	3,114.8	13.8	3,114.8	0
Process Fines	3,001.5	13.3	0	3,001.5
Total Separated	7,675.4	34.0	3,979.1	3,696.3
Landfilled	14,905.6	66.0		
Total Accepted	22,581.0	100.0		

Source: Obtained from the Illinois Department of Energy and Natural Resources.

The operational history of mixed waste processing facilities is very short. Most facilities opened after 1990. Additionally, vendors and/or facility operators are typically not required to provide accurate data concerning their operation, thus making it difficult to accurately assess the viability of a mixed waste processing facility. Table 6-1 shows that processing fees are necessary to operate a mixed waste processing facility. One reason for this is that the revenue generated from the sale of recyclables will not cover the capital and operating costs.

One potential problem associated with mixed waste processing is worker safety. Currently, technology has not advanced to the point where manual sorting can be eliminated. Sorting through refuse for recyclables exposes workers to health risks (molds, dust, punctures and lacerations). There are currently no Occupational Safety and Health Administration (OSHA) rules specifically regarding the operation of mixed waste facilities, although general worker safety standards apply.

The recovery rates shown in Tables 6-1 and 6-2 indicate that many materials in mixed waste are not marketable or are difficult to separate. The mixing and compacting of waste will tend to cross-contaminate materials, such as soaking paper with food waste or other liquid in the waste. Since paper markets require a very high grade of paper, contaminated paper will not be accepted, greatly reducing the potential for recovering a significant fraction of the waste. By incorporating a wet/dry collection strategy, cross-contamination of paper may be reduced. Wet/dry collection systems are discussed in Chapter 7. Also, identification and separation technology and methods must be improved in order to capture a larger fraction of items in the waste.

Some vendors have recently guaranteed minimum recovery rates. NRT of Nashville, Tennessee has entered into a contract to design and operate a mixed waste facility in Riverside, California. NRT will guarantee a 20 percent recovery rate. NRT has developed equipment which increases recovery, such as bag openers, aluminum sorters, plastic sorters, etc.

Low technology mixed waste processing facilities. The simplest type of mixed waste processing facility, referred to as the "dump and pick" operation, requires no special equipment.

Materials are manually pulled from the garbage after it is dumped on the transfer station floor. Other low technology options may include a grapple claw device which can lift and separate heavy objects, such as refrigerators, piles of aluminum siding, etc. As more technology is added to the operation, the operation approaches the high technology classification.

A conveyor system with manual picking stations can be considered low technology, although it does include aspects of higher technology options. In a typical conveyor operation, waste is conveyed past laborers standing on an elevated platform. The laborers pull materials from the waste as it passes by. The conveyor operation increases the amount of waste each laborer sees and thus increases the recovery rate. Some facilities limit the types of wastes they receive in order to recover larger fractions of the incoming waste. For instance, over 60 percent of the waste from certain commercial establishments is highly recoverable paper. Therefore, by receiving waste from only certain commercial establishments with a large fraction of recyclable paper, a larger portion of the incoming waste can be recovered.

The advantages of low technology facilities include little or no additional equipment, thus minimizing capital, fuel and maintenance expense. Equipment down time is therefore not a factor in the rate of garbage flow through the facility.

The disadvantages of low technology facilities include worker safety issues (bending injuries, danger from moving vehicles, sharp and protruding objects, etc.). Also, the amount of recovered material is highly dependent upon the number of laborers picking through the garbage and on the amount of room and time allotted for picking.

High Technology Mixed Waste Processing Facilities. Modern mixed waste processing facilities are more elaborate than the traditional "dump and pick" operations. Since the technology for sorting waste has not evolved to the point that sorting is fully automated, all waste processing facilities utilize at least some manual labor.

In a high technology waste processing operation, automated debaggers, trommel screens, air classifiers, magnetic separators, eddy current separators and ballistic separators are utilized

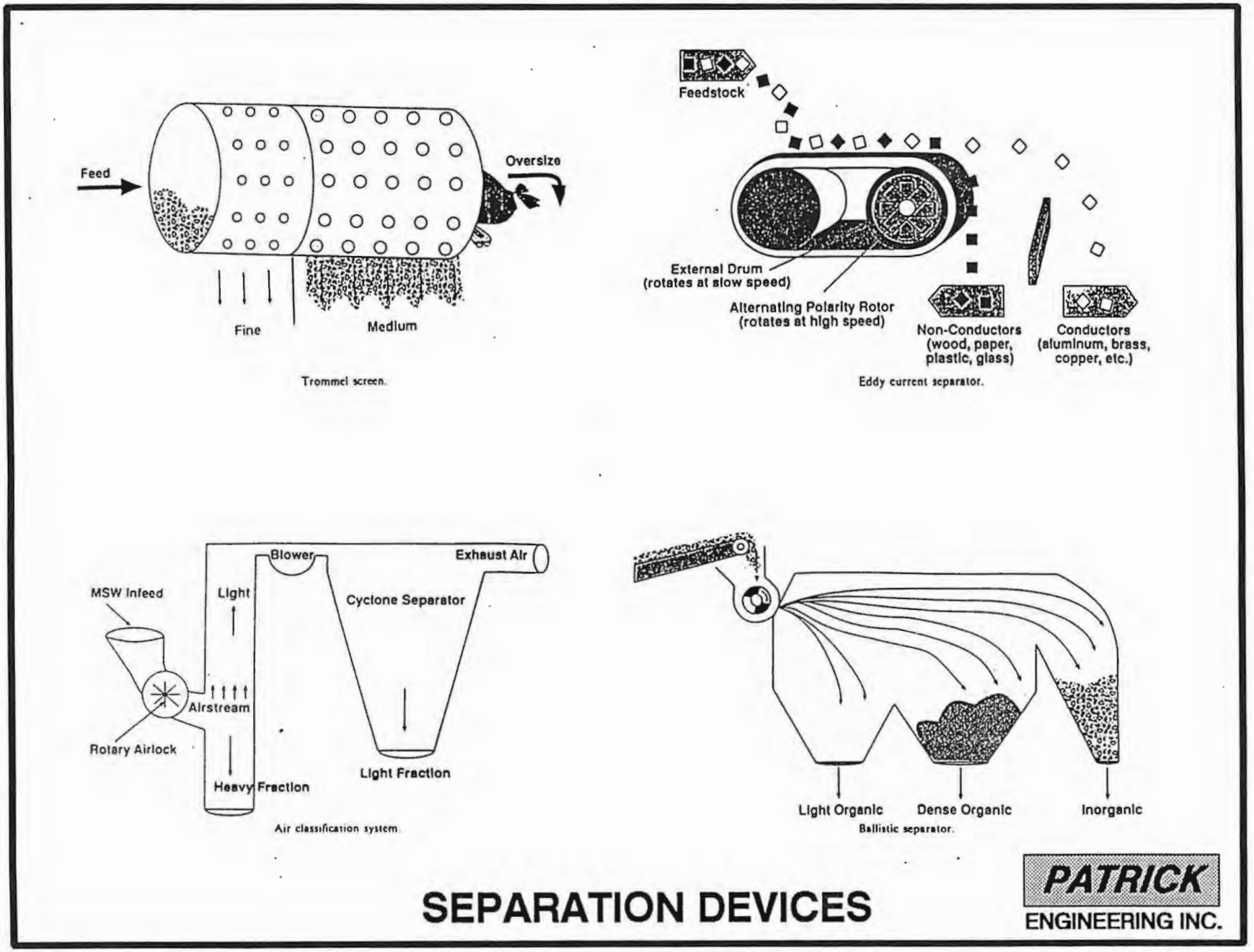
to separate recyclable materials from waste. The trommels and air classifiers are used to remove grit and other fines. Air classifiers also separate the incoming garbage into light and heavy fractions. The magnetic separators remove ferrous materials. The eddy current separators pull out non-ferrous metals (aluminum cans and foil). Plastic, glass, and newspaper typically must be manually separated although new technology exists that can separate glass by color and plastic by resin type. The actual equipment and equipment configuration utilized is often a proprietary system. Table 6-3 provides a list of separation technologies and the materials targeted. Figure 6-2 provides drawings of some of the technologies used.

TABLE 6-3. WASTE SEPARATION TECHNOLOGIES

Technology	Materials Targeted
Screening	Large: film plastics, large paper, cardboard, misc. Fines: organics, metal fragments, misc.
Handpicking	Recyclables, inerts and chemical contaminants
Magnetic separation	Ferrous
Eddy current separation	Non-ferrous metals
Air Classification	Lights: paper, plastic Heavies: metals, glass, organics
Wet Separation	Floats: organics, misc. Sinks: metals, glass, gravel, misc.
Ballistic separation	Light: plastic, undecomposed paper Medium: organics Heavy: metals, glass, gravel, misc.

Source: T.L. Richard.

The advantages of high technology facilities include higher recovery rates of recyclables. Generally, high technology facilities enable larger throughputs of garbage per employee, thus reducing the labor cost per ton of material recovered.



SEPARATION DEVICES

Source: T.L. Richard

FIGURE 6-2

The disadvantages of high technology facilities include equipment capital and maintenance costs, the potential down time and the resulting throughput problems, and the fact that manual labor is still required to perform certain separation functions.

Mixed waste processing facilities may be further distinguished by the end use of the paper and other organics that are processed at the facility. While some facilities market the paper to paper fiber markets, some convert the paper into a fuel product, refuse derived fuel (RDF). Others separate the organic fibers and compost them in solid waste composting facilities. The RDF facilities are discussed in the next section. Composting facilities are discussed in Chapter 7.

REFUSE DERIVED FUEL (RDF) TECHNOLOGY

Refuse Derived Fuel (RDF) processing systems are generally energy and labor intensive due to the front end processing that is required. RDF processing includes the removal of large, non-processible objects, separation of non-combustible materials, size reduction, size separation, and/or compaction. Processing steps typically include screening, shredding, magnetic separation and air classifying. The end result is a uniformly sized product with a higher energy content than unprocessed waste. RDF is typically fired with less maintenance than other solid waste combustion methods. Also, RDF is fired in more conventional boiler systems, such as coal burning facilities. Although producing RDF may reduce the amount of material that needs to be disposed in landfills, it will not replace the need for a landfill. Non-recyclable materials separated and removed prior to processing, as well as residuals removed during the process, still need to be disposed.

Waste Handling and Processing. The use of shredders to process waste is generally a primary step in producing RDF. Single shredders reduce waste to a 2 to 6-inch particle size. Further reduction of particle size requires the use of multiple shredders.

Screening devices are used for the size separation of waste. Screens can be installed in a number of locations: as an initial component in the waste processing stream, after shredding, after air classification of the light and heavy fraction, and in any combination of locations. The screening device allows waste to flow in a lift and drop fashion while removing many of the small sized non-combustible materials through the screen openings. There are three basic types of screening devices: 1) the reciprocating vibrating screen, 2) the disc screen, and 3) the rotating screen, normally referred to as a trommel screen (shown in Figure 6-2). Trommels are popular in the waste processing industry due to their size distribution effectiveness and efficiency. A trommel is a perforated cylinder, typically 9 to 12 feet in diameter. The perforations can vary in size from one-half inch to several inches in diameter. The cylinder is slanted at an angle and rotates between 5 and 40 revolutions per minute. As the material is fed in from the top end of the trommel, the rotational speed of the screen and its length will dictate the residence time, which has an impact on the efficiency of the separation.

An electromagnetic separator device is used to remove the ferrous material from the combustible fraction. It is typically installed above the conveyor line following the screening and shredding devices.

An air classification device is used for separating lightweight materials from their heavier counterparts by imposing an air flow generated drag on falling wastestream components. Depending on the size and density, an object will either be carried away with the air flow or overcome the air flow force and settle out. This allows for the separation of the lightweight fraction combustibles such as paper, plastic and wood from the non-combustibles such as glass and metals. Another device that separates materials by their differing densities is the ballistic separator. Both devices are shown in Figure 6-2.

Refuse Derived Fuel (RDF). RDF can be burned in a loose, uncompacted state, called fluff RDF or in a densified state called densified RDF (d-RDF). The lighter fraction of material obtained from the air classifier is called fluff RDF. The fluff RDF product typically must be burned within a few days. Because of the material's composition it will generally set-up as a solid in a very short time, and retrieval for later use becomes quite difficult. Fluff RDF is more practical to produce if the combustion facility is on-site because difficulties in handling and transporting this material are minimized or eliminated.

Densified RDF (d-RDF) is produced by compressing fluff RDF into pellets or briquettes. This usually requires fluff RDF be reduced to a smaller particle size than typical fluff RDF. Densified RDF can be co-fired with coal which is one common reason for producing this type of RDF. Long-term storage and transportation advantages are important features of d-RDF. Densifying RDF allows for a more economic transport of the final product for longer distances and also provides longer product life. The shape of the d-RDF also allows the material to be handled by normal coal handling equipment. A number of studies have found that d-RDF can be burned without supplemental fuel in existing boilers or can be used as supplemental fuel in conjunction with coal. The typical heat content of d-RDF averages about 5,000 Btu's per pound, about one-half that of coal.

The d-RDF process adds flexibility and cost to the RDF system. Additional costs associated with this type of process are primarily due to the capital and operating costs of the densifying equipment. Some densifying equipment has been found to have high wear rates and high electricity usage. Due to concern over pelletizer wear, generally more material processing is utilized to minimize noncombustibles (glass, metal and grit) from being pelletized. The heating value of the d-RDF is therefore generally greater than fluff RDF.

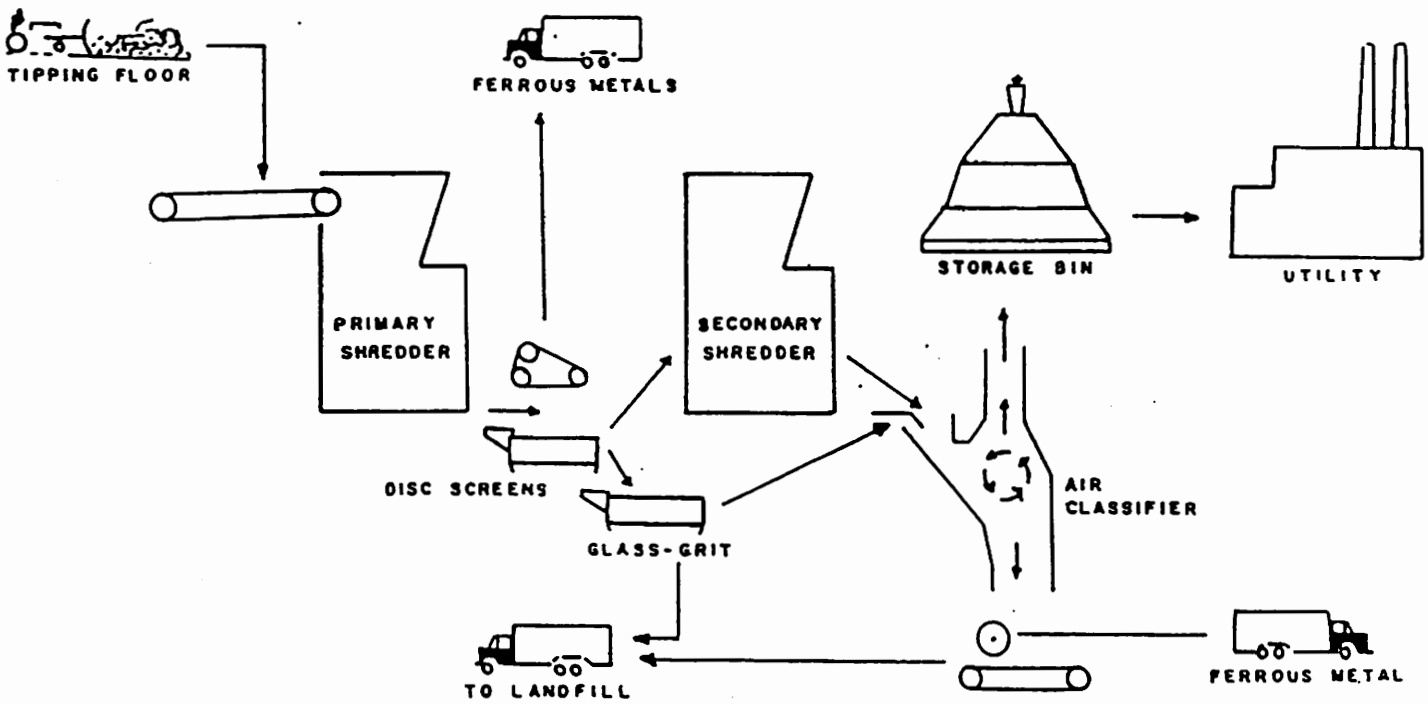
Binder enhanced d-RDF improves a number of physical and combustion properties of RDF. By adding binders such as calcium hydroxide to the d-RDF, the density and shelf life is increased, and emissions of acid gases are reduced. For instance, the storage life of d-RDF without binders is 4 to 5 days while the binder-enhanced d-RDF life is up to 6 months.

RDF Process Description. Two examples of existing RDF operations are presented in this section: the Arnold O. Chatland Resource Recovery Center in Ames, Iowa and the Eden Prairie Facility. These two facilities cover most of the processes typically employed at RDF facilities, including material recovery. The Ames Facility represents an example of a RDF facility producing fluff RDF, with minimal front-end material recovery, while the Eden Prairie Facility represents a facility producing d-RDF, employing extensive front-end material recovery.

The Arnold O. Chatland Resource Recovery Center is owned and operated by the city of Ames, Iowa. At the Ames facility, approximately 20 tons of waste is received on the tipping floor area per hour for a period of 10 to 12 hours per day. Using a front end loader, the waste is moved onto inclined infeed conveyors (see Figure 6-3). The conveyors feed into a primary shredder (hammermill) where the waste is milled into smaller particle sizes. As the shredded material leaves the primary shredder it passes under a revolving belted electromagnet that removes ferrous material.

The remaining shredded material is transported to a disc screen separator where larger pieces of refuse (6-inches) are carried over the top of discs and the smaller pieces of refuse drop through the disc spacings. The 6-inch pieces which are bounced over the top pass down the conveyor line to a secondary shredder. The smaller pieces that fall through the disc screen separator (90 percent of which are under 1½ inches) then are sent to a secondary disc screen separator that separates the grit and dust from the 1½-inch pieces. The grit is conveyed to a reject bin for the landfill and the 1½-inch combustible fraction is conveyed to an air classification system.

The secondary shredder is identical to the first in size and operation, but the hammers are a bit smaller and the resulting pieces are reduced to about 2 inches. The shredded refuse is conveyed to an air classification system, where the heavier weight pieces fall through a chute to a residue conveyor. The heavies are landfilled. The lighter weight combustible fraction of refuse becomes the fluff RDF, and is carried upwards through a pneumatic tube into a large storage bin. The RDF bin is located between the RDF facility and the municipal power plant. The RDF is pneumatically conveyed from the bin into one of the pulverized coal utility boilers,



FLOW DIAGRAM OF THE RESOURCE RECOVERY CENTER IN AMES, IOWA

Source: The Ames Experience, 1989.

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FIGURE 6-3

The Ames Facility receives material from regions that have no curbside recycling. However, Iowa's deposit law essentially removed most of the aluminum beverage cans from the wastestream which prompted the decommissioning of the eddy current aluminum separator. Also, the Ames Facility pays a $20 per ton avoidance fee to area recyclers for glass they recycle at their facility. These programs help reduce the glass and aluminum components that reach the facility.

About 12% of the incoming waste is separated at the tipping floor and consists of oversized items such as white goods and mattresses, some of which are landfilled and a portion recycled. The remaining 88% is sent through the process. About 4% of the incoming waste is recycled (mostly ferrous metal) and the remaining 19% is grit and non-processibles which is landfilled. Approximately 65% of the incoming waste ultimately becomes fluff RDF.

The Eden Prairie Facility is located in Hopkins, Minnesota. The Eden Prairie Facility uses a primary and secondary shredding system, magnetic separation for ferrous material, and rotating disc screens for size separation of the materials. The Eden Prairie Facility also recovers aluminum, plastic, cardboard and the fluff RDF is further processed into d-RDF pellets. The Eden Prairie Facility accepts waste materials from areas serviced by curbside recycling programs. Prior to implementation of the curbside programs, the facility recycled between five and fifteen percent of the incoming waste. Now, after the curbside programs have been implemented, two to five percent of the wastestream is recovered at the facility. Between 45 and 50% of the incoming waste material becomes d-RDF. The balance is the tipping floor and process residue, amounting to approximately 50% of the incoming waste. A schematic layout of this facility is shown in Figure 6-4.

Issues Confronting RDF Facilities. The concept of a RDF facility provides appeal when considering increasing waste utilization beyond 25%. RDF facilities can provide a backup to an existing recycling program by recovering additional metals, plastic, glass and paper. However, the primary reason most RDF facilities are designed is to produce a homogeneous fuel. The conversion of waste to RDF can provide 30 to 50% recovery of the waste. However, currently RDF production and combustion cannot be counted toward recycling in Illinois.

d-RDF SYSTEM WITH MATERIAL RECOVERY: EDEN PRAIRIE FACILITY

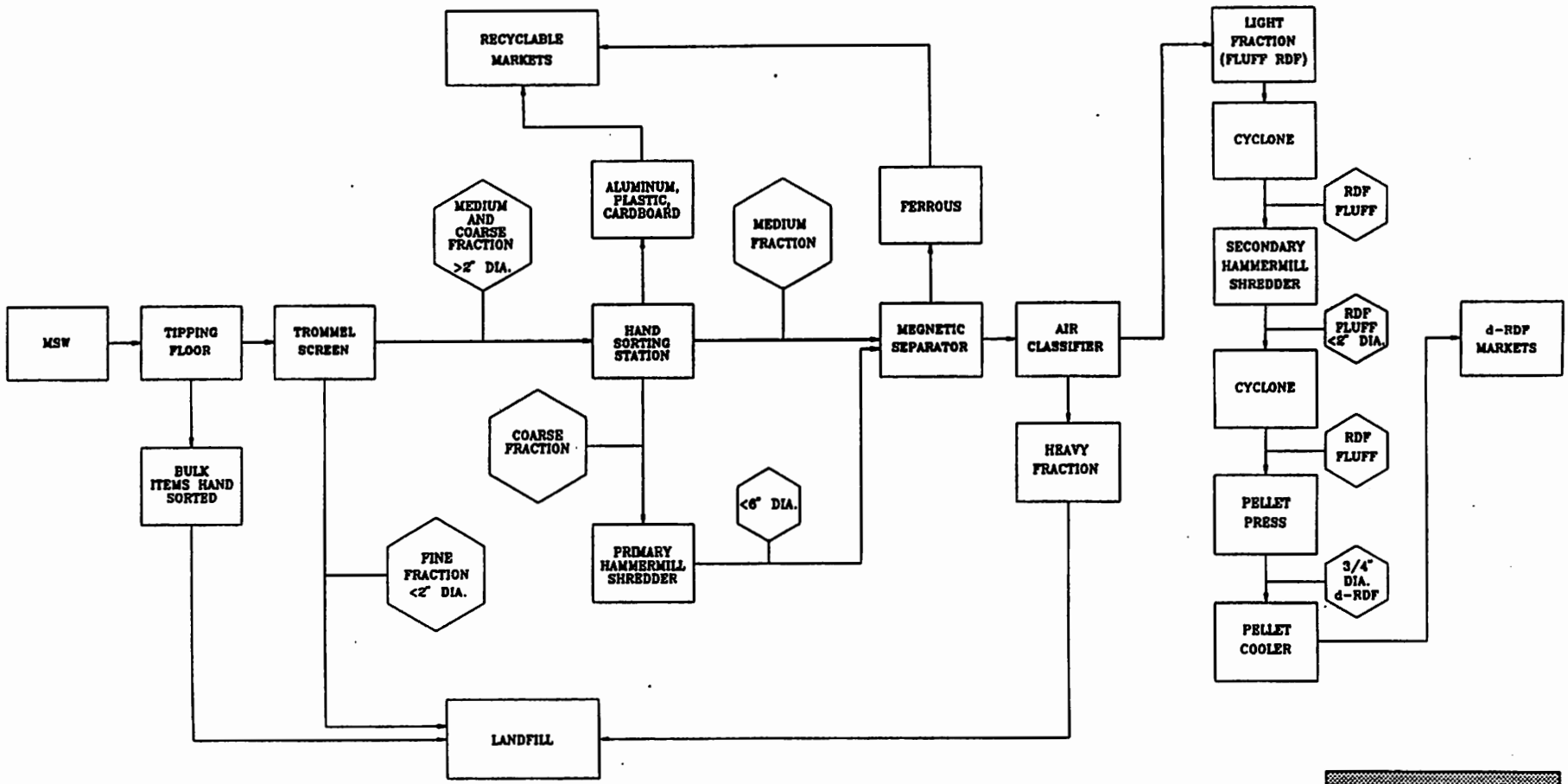

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FIGURE 6-4

When evaluating the possibility of implementing a RDF facility, a number of issues must be considered:

- The wastestream must be evaluated to determine equipment and building needs. Oversized or improperly designed facilities result in higher capital and operating costs.

- The capital and operating costs for RDF facilities are higher than traditional waste disposal options.

- RDF facilities still produce a residue which must be landfilled.

- Explosions resulting from shredding operations have been a common problem in RDF facilities.

- Equipment downtime will result in lost processing capabilities and lower revenues. Equipment bypass or redundancy is needed to ensure steady operation.

- Current RDF equipment has separation efficiency limits which may be surpassed with newer designs.

- Revenues will vary with ups and downs in the economy. Market demand for recyclables and RDF will vary, creating market price fluctuations and revenue variations.

- If a stable, long-term fuel market is not available, RDF cannot be an option.

- RDF has approximately half the heating value of coal. Since co-firing RDF in an existing coal-burning facility is more cost effective than building a dedicated combustion facility, an understanding of coal prices, coal handling, coal combustion technology and facility management willingness to burn supplemental fuel is required.

- RDF may increase the operational cost at a coal-burning facility due to slagging increases, plugging of boiler grates, additional ash, etc.

- The worker environment must be designed to minimize health and safety risk factors.

- When an existing coal burning facility considers burning RDF, it will be under increased environmental scrutiny. Since RDF is derived from waste, burning of the RDF is considered "municipal waste incineration" and must meet air pollution standards of incinerators.

SITING CONSIDERATIONS

Locating a suitable site for an intermediate facility involves searching for available property and evaluating the sites according to various criteria. These criteria include setbacks specified by the Illinois Environmental Protection Act, SB 172 siting requirements, centralization within the wasteshed and the proximity to utilities and services.

Setback Requirements - Section 22.14 of The Act. Section 22.14 of the Illinois Environmental Protection Act pertains to transfer stations and can be interpreted to apply to other intermediate facilities. Section 22.14 defines the setback requirements for transfer stations with respect to property that is zoned for residential use. A transfer station may not be located within 1,000 feet of any property zoned primarily for residential use or within 1,000 feet of any dwelling.

Site Approval Per SB 172. The first step in gaining regulatory approval of a regional intermediate facility is to apply for local siting approval from the local governmental body that has jurisdiction over the proposed site. The siting process in Illinois is sometimes called "SB 172 siting" after the senate bill that the legislation was introduced under. This legislation amended the Environmental Protection Act by adding Section 39.2 to the Act.

The siting process begins with written notice of the request for siting being sent by registered mail to adjacent property owners within 250 feet of the proposed site and to members of the General Assembly from the legislative district in which the facility is proposed. This notice must be served no later than 14 days prior to a request for siting approval. The application is then filed with the county board or the governing body of the municipality. At least one public hearing shall be held no sooner than 90 days but no later than 120 days from the date that the application was filed. The county board or governing body shall consider written public comment received or postmarked no later than 30 days after the date of the last hearing. The county board or governing body shall produce a written decision no later than 180 days after the date the application was filed. If a decision is not reached within 180 days the application shall be considered approved. In making its decision, the county board or governing

body shall evaluate the application in accordance with Section 39.2 of the Act. Local siting approval shall be granted if the proposed facility meets the following nine criteria:

1. The facility is necessary to accommodate the waste needs of the area it is intended to serve.

2. The facility is so designed, located and proposed to be operated that the public health, safety and welfare will be protected.

3. The facility is located so as to minimize incompatibility with the character of the surrounding area and to minimize the effect on the value of the surrounding property.

4. The facility is located outside the boundary of the 100 year floodplain or the site is flood-proofed.

5. The plan of operations for the facility is designed to minimize the danger to the surrounding area from fire, spills, or other operational accidents.

6. The traffic patterns to or from the facility are so designed as to minimize the impact on existing traffic flows;

7. If the facility will be treating, storing or disposing of hazardous waste, an emergency response plan exists for the facility which includes notification, containment and evacuation procedures to be used in case of an accidental release.

8. If the facility is to be located in a county where the county board has adopted a solid waste management plan consistent with the planning requirements of the Local Solid Waste Disposal Act or the Solid Waste Planning and Recycling Act, the facility is consistent with that plan.

9. If the facility will be located within a regulated recharge area, any applicable requirements specified by the board for such areas have been met.

Other Location Criteria. The placement of the intermediate facility near the center of the wasteshed is important. In order to minimize costs, the time that packer trucks spend traveling between their collection routes and the facility should be minimized.

Another set of location criteria include the proximity to utilities and services. Transportation facilities play the largest role in determining an adequate site. Sufficient roads, rail access or waterway access will dictate what types of transportation are available to the site. Other utilities that need to be considered include electrical service, water, storm sewer and sanitary sewer.

PERMITTING AND ENVIRONMENTAL IMPACTS

Regulatory Overview/Permitting. Transfer stations and other intermediate facilities are permitted by the Illinois Environmental Protection Agency, Bureau of Land. Four forms along with supplemental information are required for a permit application for a transfer station. The forms are: General Application for Permit (LPC-PA1), Application for Permit - Non-Special Municipal Waste Storage/Transfer Facility (LPC-PA5), Certification of Siting Approval (LPC-PA8), if appropriate, and Closure Plans and Post-Closure Care Plans (LPC-PA11).

Basic requirements for transfer stations have been published in an IEPA guidance document commonly called the "Green Sheets." These guidelines are listed below.

General:

- Siting according to Section 39.2 of the Act if the facility will be regional (i.e. serve more than one unit of local government).

- A totally enclosed building or a 6-foot high chain link fence.

Safety:

- A contingency plan to address any accident or equipment failure.

Operation:

- Notice of the hours of operation are to be posted at the entrance to the transfer station.

- Compacted waste may only be stored overnight if it is contained in a transfer trailer.

- All buildings, containers and other equipment shall be cleaned at the end of the day.

- Litter at the site shall be collected at least daily.

- A vector control specialist shall inspect the site at least once a month and perform control measures if necessary.

- No municipal waste transfer station shall accept, receive, store or transfer special waste.

Closure:

- The owner shall notify the Agency of closure of the facility.

- If the Agency finds that all waste has been removed, the Agency shall certify, in writing, to the owner and operator that the completion and closure requirements have been met.

Post-closure:

- After closure, the owner of the property shall maintain the site for one year. All waste, litter, vector and odor problems shall be remedied by the owner/operator.

These criteria for transfer stations are only guidelines, but it is recommended that at a minimum these issues should be addressed in the permit application and supporting documentation. Since other intermediate facilities are derivatives of transfer stations, these guidelines are considered minimum for intermediate facilities.

The IEPA may also demand additional requirements in the permit. In previous permits issued by the IEPA a number of conditions have been stipulated. The primary conditions have included specifying the hours of operation and outlining the specific closure/post-closure care procedure.

Closure and post-closure care requirements for intermediate facilities are relatively easy compared to final disposal facilities. The closure plan should also contain an estimate of the cost to remove all waste, recyclables and RDF from the facility and decontaminate all equipment and the tipping floor. Once this has been approved by the IEPA, a letter certifying the closure will be sent to the owner. Typically no post-closure care is required since there will be no final disposal or storage of waste on the site.

Environmental Impacts. An intermediate facility can potentially impact the surrounding air, water and land quality. In particular, dust and particulate matter are created from the various waste processing activities. Such activities include waste tipping, shredding, screening, air classifying, and transferring operations. The air emissions due to dust and particulate matter

can be controlled by air handling and filtering equipment. By establishing a negative air pressure inside the facility building with a dust collection system, airborne dust and particulate matter are prevented from passively escaping the building. Airborne particulates or dust particulates can be collected by the ventilation system and filtered out. Dust collection ducts with filter or baghouse installations can be installed over the tipping floor, processing conveyors, shredders and screens to collect airborne particulate matter.

Degradation of the water quality may be a potential problem occurring from washdown procedures of the facility floors and equipment. The washdown water may be treated onsite or held in a detention pond onsite before being released into the municipal sewer system. Special street sweepers and steam cleaners can be used to minimize the generation of washdown water.

Noise, litter and odors can also be potential problems of the intermediate facility. Noise and litter can be controlled or minimized by fully enclosing the receiving and processing areas. Odors can be controlled by utilizing a negative air pressure system inside the building, and treating all air using activated carbon filters prior to being exhausted into the atmosphere.

To further minimize impacts, the facility should be sited in a remote or industrial zoned area. Sensitive areas such as residentially zoned areas should be avoided.

The environmental impacts and mitigation measures associated with burning RDF are addressed in the Incineration Chapter.

TRANSPORTATION ALTERNATIVES

Waste is transported to the intermediate facilities by the collection vehicle fleet. These are typically packer trucks with a net waste capacity from 7 to 13 tons. Packer trucks are extremely costly to use for long distance transportation. A main component of this cost is the relative small size of the payload. If a two-person crew is used, the costs increase dramatically.

The intermediate facility's function is to relieve the packer truck from the responsibility of hauling waste over long distances to a disposal facility.

The outgoing waste transportation system is an integral part of the intermediate facility. Tractor-trailers are the most commonly used form of waste transport from the transfer station to the disposal facility. Rail transportation and barges are also used. The intermediate facility should be equipped with equipment that caters to the mode of transportation chosen for the outgoing waste. The choice of transportation is based largely on geographic and transportation infrastructure considerations. Table 6-4 shows a comparison of waste transfer alternatives and approximate associated costs. These are only guidelines and cannot be used for site specific comparisons.

TABLE 6-4. WASTE TRANSFER ALTERNATIVES AND ASSOCIATED COSTS

Type	Manpower	Fixed Cost/Hour To Operate	Variable Cost/Mile @ 40 mph	Net Cargo Capacity (tons)	Cost/Ton/Mile 73,200 lb. Maximum	Cost/Ton/Mile 80,000 lb. Maximum
Packer Truck	Driver & Helper	$55.14	$2.19	10	$0.352	N/A
Transfer Trailer	Driver	$44.00	$0.82	18/21*	$0.107	$0.091
Baled Transfer	Driver	$44.00	$0.82	21.5/24.5*	$0.089	$0.078
Railcar	N/A	N/A	N/A	90	$0.040	N/A

* Capacity for 80,000 lb. weight limit.

Truck Transportation. As stated previously, truck transportation is the most common mode for outgoing waste. In order to maximize the amount of waste carried with each trip, truck tractors with semitrailers are normally used. The type of semitrailer that is used will depend on the intermediate facility. Semitrailer types and the corresponding transfer stations (or other intermediate facilities) are listed below.

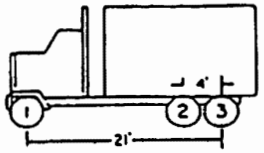
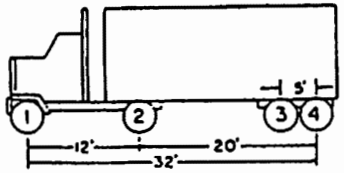
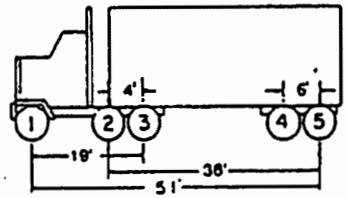
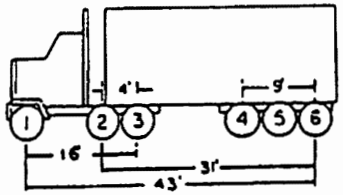
1. Direct dump facilities use open-topped trailers. Waste may be compacted into these trailers from above but the amount of compaction is relatively low. These trailers are equipped with covers to prevent waste from blowing out of the trailer during transport to the disposal facility.

2. Trailers used in conjunction with compactors are heavily reinforced to handle the pressure exerted by the compactor. They are constructed of steel or aluminum with the latter being preferred due to its lightweight. There is no need for extra covers since the trailer is fully enclosed.

3. Flat-bed trailers are typically used for baled waste. The reduced weight of a flat-bed is attractive since the weight savings from the trailer increases the amount of waste that can be hauled. It is necessary to cover the bales on the flat-bed to prevent stray debris from blowing away from the bale, to prevent rain from soaking the bales, and is recommended to prevent waste from being seen by the public.

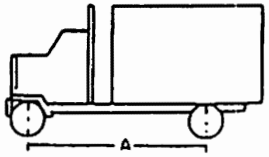
Weight Limit Laws. One issue that relates to all of the trailers mentioned above are the weight limit laws in Illinois. Figure 6-5 shows typical loadings for various configurations. These laws are complex and will not be fully covered in this report but an attempt has been made to highlight main portions of the laws. The weight limits are based on two main criteria, the Designated State Highway Truck Route System and the Federal Bridge Formula. Information concerning these two criteria is available from the Illinois Department of Transportation (IDOT) and the Illinois State Police. The Designated State Highway Truck Route System is a network of highways throughout the state. These highways are divided into Class I, II and III highways. When traveling on one of these three classes of highway, the legal gross weights are based on the bridge formula. The maximum allowable gross weight is 80,000 pounds with a maximum single axle load of 20,000 pounds and maximum tandem load of 34,000 pounds. This maximum is based on the number of axles and the length of the vehicle. Some vehicles may have a maximum gross weight limit of less than 80,000 pounds. This depends on the configuration of the vehicle and the vehicle length.

TYPICAL LOADINGS

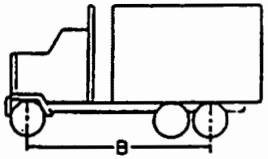
VEHICLE or COMBINATIONS	MAXIMUM WEIGHT, POUNDS (designated highways)	
	Axle 1	20,000
	Axles 2,3	34,000
	Axles 1,2,3	51,500*
	Axle 1	20,000
	Axle 2	20,000
	Axles 3,4	34,000
	Axles 1,2	40,000*
	Axles 2,3,4	51,000*
	Axles 1 thru 4	63,500*
	Axle 1	20,000
	Axles 2,3	34,000
	Axles 4,5	34,000
	Axles 1,2,3	48,000*
	Axles 2 thru 5	68,000*
	Axles 1 thru 5	80,000*
	Axle 1	20,000
	Axles 2,3	34,000
	Axles 4,5,6,	42,500*
	Axles 1,2,3	48,000*
	Axles 2 thru 6	67,500*
	Axles 1 thru 6	80,000*

*From Table

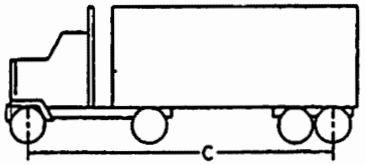
For non-designated highways (other state highways and local roads and streets) the following table indicates maximum weight limits.



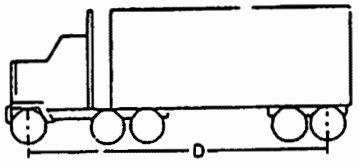
Gr. Wt. [1] 36,000



B	Gr. Wt.	B	Gr. Wt.
10'-	41,000	16'-	46,000
11'-	42,000	17'-	47,000
12'-	43,000	18'-	47,500
13'-	44,000	19'-	48,000
14'-	44,500	20'-	49,000
15'-	45,000	21'- or more	50,000



C	Gr. Wt.	C	Gr. Wt.
15'-	50,000	26'-	57,500
16'-	50,500	27'-	58,000
17'-	51,500	28'-	58,500
18'-	52,000	29'-	59,500
19'-	52,500	30'-	60,000
20'-	53,500	31'-	60,500
21'-	54,000	32'-	61,500
22'-	54,500	33'-	62,000
23'-	55,500	34'-	62,500
24'-	56,000	35'-	63,500
25'-	56,500	36'- or more	64,000



D		Gr. Wt.
42'	or less	72,000
43'		73,000
44'	or more	73,280

Source: Illinois State Police, Understanding The Illinois Weight Laws, June 1989.

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FIGURE 6-5

When not traveling on the designated system, vehicles with 5 or more axles and greater than or equal to 44 feet in length have a gross weight limit of 73,280 pounds with a maximum single axle weight of 18,000 pounds and a maximum tandem weight of 32,000 pounds. An exception to this weight limit is allowed for vehicles that use the designated system. These vehicles are allowed to travel 5 miles off of the designated system to make deliveries and perform other duties.

It is important to note that these maximum weight limits are attainable by transfer vehicles. Weight limits must be taken into consideration when designing the transfer system, selecting equipment and operating the transfer station.

Rail Haul. The hauling of waste by rail lines has increased over the past few years. Currently, it is estimated that railhaul accounts for the transport of one percent of all of the waste disposed nationwide. Major railroads hope that this share will increase to 15 to 20 percent in the future. Railroad companies are primarily focused on hauling cargo. They pick up loaded cars on a spur and deliver them to another spur somewhere else. Arrangements for loading and unloading the waste is taken care of by someone else.

The cost to railhaul is influenced by many factors. First and foremost is the quantity of the waste. Hauling one railcar of waste will cost just about as much as hauling ten railcars. This economy of scale limits the amount of waste hauled by rail to a minimum volume per year. This minimum volume varies with conditions and with railroads.

A second major factor is the location and distance to the disposal facility. Unlike over-the-road hauling, the distance to the disposal facility is not a controlling factor. There have been actual applications of railhauling where the haul distance has been less than 30 miles. These short haul distances are feasible when large volumes are hauled to a disposal facility on a regular basis. Regardless, railhauling looks more and more attractive as the haul distance increases. Table 6-4 shows an approximate cost of railhauling as compared to other types of transportation. This cost assumes that a minimum required amount of waste is available and that

facilities are available for both the transfer of the waste into railcars and to empty the cars at the disposal facility.

The railhauling companies have minimum requirements for hauling contracts. A contract will typically specify a minimum number of cars that must be transported in a year and establish a penalty if this minimum is not reached. One railroad company that has hauled waste in Illinois quoted a minimum range from 1000 to 1300 railcars per year. A typical boxcar can hold 90 tons of baled waste. Therefore, a minimum waste disposal rate would be approximately 90,000 tons per year.

Another cost that is factored into the overall haul cost is the leasing of the railcars. Railcars dedicated to waste hauling are usually leased on a monthly basis. Back hauling of other commodities is usually unacceptable due to the need for cleaning and/or sterilizing the car. An alternative to leasing is to buy railcars. This alternative may be feasible for relatively short haul distances where the cars have a short turnaround time. Fewer cars are required for shorter haul distances.

Another factor is the actual distance from the point of origin to the point of disposal. The hauling route may necessitate using more than one railroad's lines. The more railroads that are involved with either hauling or owning of the lines will increase the cost of the hauling. For this reason, shopping for the lowest final disposal tipping fee may not result in the lowest ultimate cost to dispose of municipal solid waste.

The type of railcar will be dependent on the transfer station configuration, loading equipment available and the availability of railcars. Railcars that are commonly used for hauling waste include boxcars, flatbeds and open-top cars. Boxcars are used when the waste is baled and can be handled by forklifts. Bales are loaded individually into the boxcars with as many bales loaded as possible to keep the cost per ton to a minimum. Partially filled cars cost just as much to transport as full cars do. Waste can be compacted into trailers or intermodal containers that are designed to fit on both flatbed railcars and rolloff trucks. Many of these intermodal containers have walking floors to facilitate unloading at the disposal site. Cranes or

similar equipment are required for loading and unloading the flatbed railcars. Open-top cars are used in conjunction with direct dump transfer stations. These railcars can be easily loaded from above. Unloading open-top cars requires heavy equipment capable of lifting the entire car off the tracks and dumping the waste in an appropriate area.

A common misconception concerning railhaul is that it allows flexibility for waste to be hauled to the cheapest landfill available at any given time. This is not true. Railroads will require a hauling contract that specifically states the volume of waste to be hauled, the final destination of the waste and a set time period (typically 24 to 48 hours) for delivery of the waste to the designated site. The contract allows railroads to avoid having to change schedules on a weekly or monthly basis just to find the cheapest tipping fee available. Railhauling is most economical when large volumes of waste is hauled over the same route and on a regular basis.

DeKalb County landfilled approximately 72,600 tons of waste in 1993. It is unlikely that an economical contract for railhauling could be obtained from a railroad for that amount of waste. The only disposal facility in Illinois that is currently accepting waste by rail is Five Oaks Recycling and Disposal Facility near Taylorville (1,600 tons per day).

Barge Transport. Another form of transportation that can be used to haul waste is by barge. Since DeKalb County is much nearer to numerous landfills than to a navigable river, barge transport is not feasible. In order to utilize a nearby river, waste from DeKalb County must be transferred from packer trucks to the barge with a specialized loading system. Such a system might include a process to bale waste and load the bales onto barges or a process to fill intermodal trailers with waste and load the trailers onto barges. A barge unloading facility would also be required. Finally, the disposal site must have the capability to handle waste packaged in this manner.

FACILITY SIZING

The sizing of a transfer station and other intermediate facilities depends on many different variables. These variables include waste generation rates, source separation recycling rates, processing equipment, material recovery goals, recyclables storage requirements, the rate of collection vehicle unloading, the rate of transfer trailer loading and transfer trailer capacity. The sizing of the facility is not clearly defined by a single equation but rather, it is determined by applying logical assumptions about the variables listed to general guidelines.

The starting point for sizing a facility is to determine the "throughput" of the facility. This is a general figure that is expressed in tons of waste processed in a day. The throughput is determined by first calculating the waste generation rate for the service area of the facility. The waste generation rate is then adjusted to account for source reduction and recycling to obtain the refuse throughput of the intermediate facility. The final design throughput rate may be adjusted by multiplying the generation rate by a peak factor. A peak factor will allow for seasonal changes in waste generation and for special events that cause an increase in the amount of waste handled by the intermediate facility.

The throughput is an important factor when considering the type and size of equipment. Compactors, balers, shredders, conveyors, screens, magnets, pelletizers, transfer trailers and other equipment are capable of handling a specific quantity of waste in a given time period. The engineers and designers working on developing an intermediate facility assess the capacity of the equipment and choose a combination of equipment that will sufficiently process the throughput. A level of redundancy is built into the system to prevent stalling when mechanical breakdowns or scheduled maintenance occur.

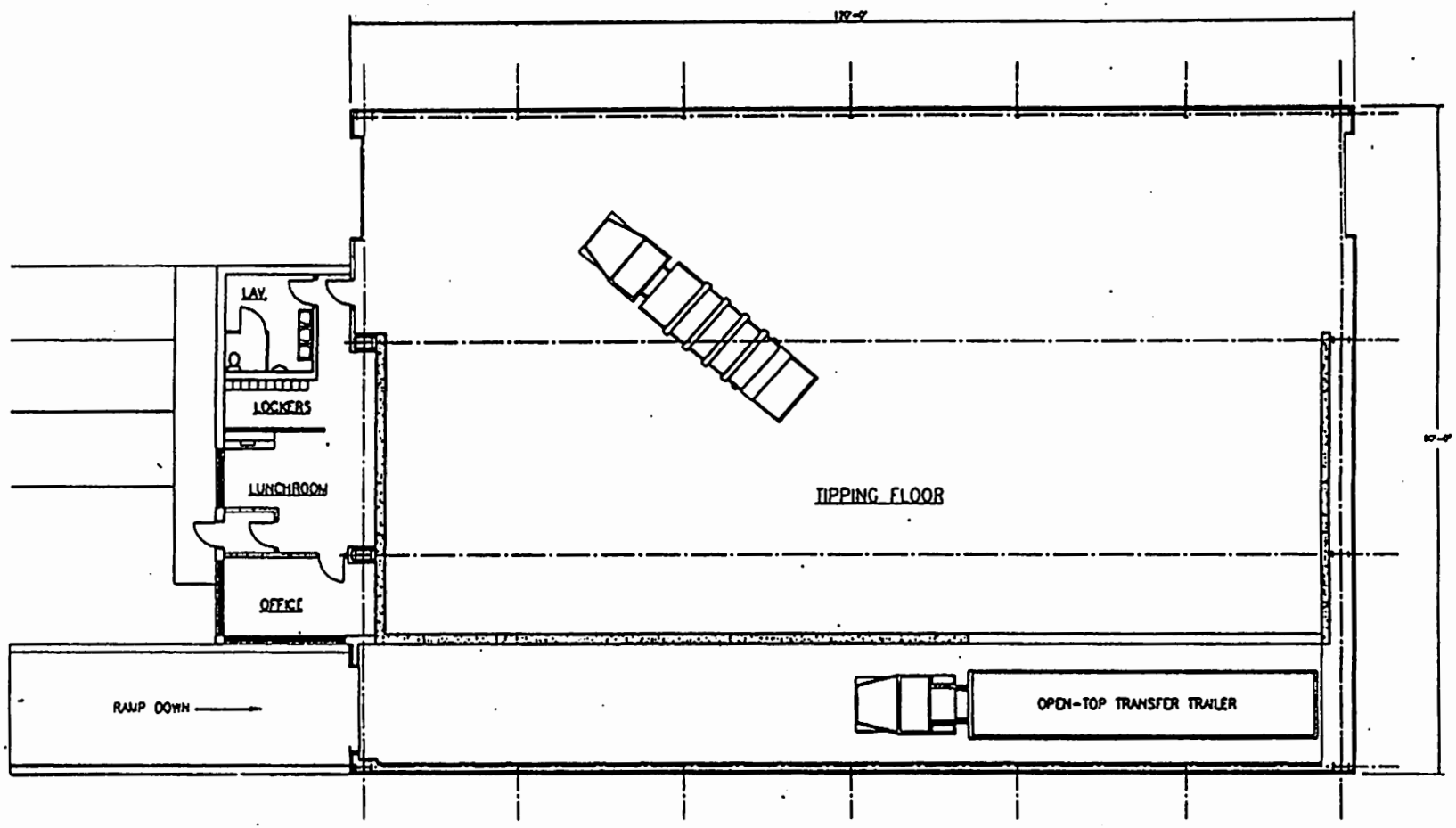
The distance to each disposal facility and the respective tipping fees will dictate where the waste will be taken. The number of transfer vehicles will depend on the throughput of the facility and the time required to make a round trip to the disposal facility. The transfer fleet should be sized so that it will be able to transport waste to a number of different disposal

facilities. This is advantageous with the current trend of rising tipping fees and fewer landfills. Other considerations are mechanical breakdowns and scheduled maintenance.

The site plan may be dependent upon several requirements, not only for operating procedures but also related to local zoning and state siting requirements. The layout should provide for smooth traffic flow through the transfer station, adequate stormwater detention, queuing capacity for collection vehicles, adequate parking for transfer trailers and proper fencing and signage. Zoning requirements usually include a minimum amount of parking spaces for employees and visitors and a maximum lot to floor ratio. State siting requirements include local siting approval and compliance with setbacks from residential property.

Figure 6-6 shows a possible transfer station facility layout. Once all of the equipment is determined, largely based on the throughput and material recovery goals, the building itself can be designed and laid out. A designer will be able to lay out the intermediate facility to provide the proper space requirements for the equipment and the tipping operation. Other areas that need to be included in the layout include office space, employee facilities, equipment and recovered material storage, a maintenance area, if required, and trailer loading areas.

Figure 6-7 shows a building layout for a mixed waste processing facility and transfer station. Facilities of this nature can be designed to handle various components of the waste (residential, commercial and construction/demolition debris) separately or together. Although more space is required to handle the materials separately, better separation can be obtained.



TRANSFER STATION LAYOUT

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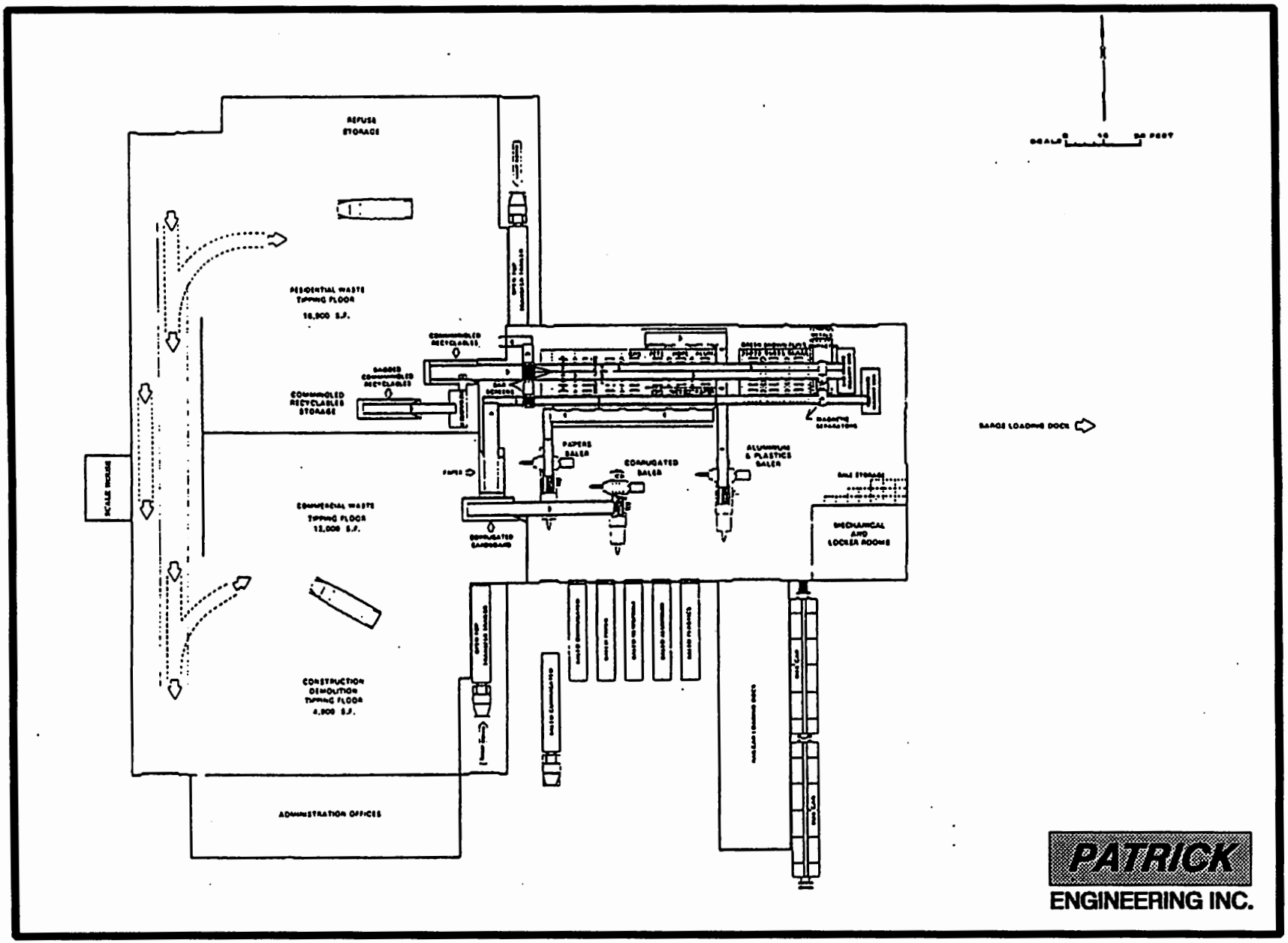
FIGURE 6-6



MIXED WASTE PROCESSING FACILITY LAYOUT

FIGURE 6-7

ECONOMIC ANALYSES

Capital and Operating Costs. Capital costs for an intermediate facility include the costs associated with the design, construction and start-up phases of the project. Capital costs include:

- Design
- Land Acquisition
- Siting and Permitting
- Site Development
- Building Construction
- Waste Handling and Loading Equipment
- Start-up and Initial Operation Tests

Additional capital costs are also incurred to obtain necessary project permits and to pay for legal and other consultant fees.

The annual operating and maintenance (O&M) costs include:

- Labor
- Maintenance, Repair, and Supplies for Waste Receiving/Handling Equipment
- Building Maintenance and Supplies
- Waste Disposal Costs
- Insurance
- Administrative Costs
- Legal and Engineering Fees for Environmental Compliance Requirements
- Debt Retirement Costs

The costs associated with intermediate facilities are outlined in the following sections.

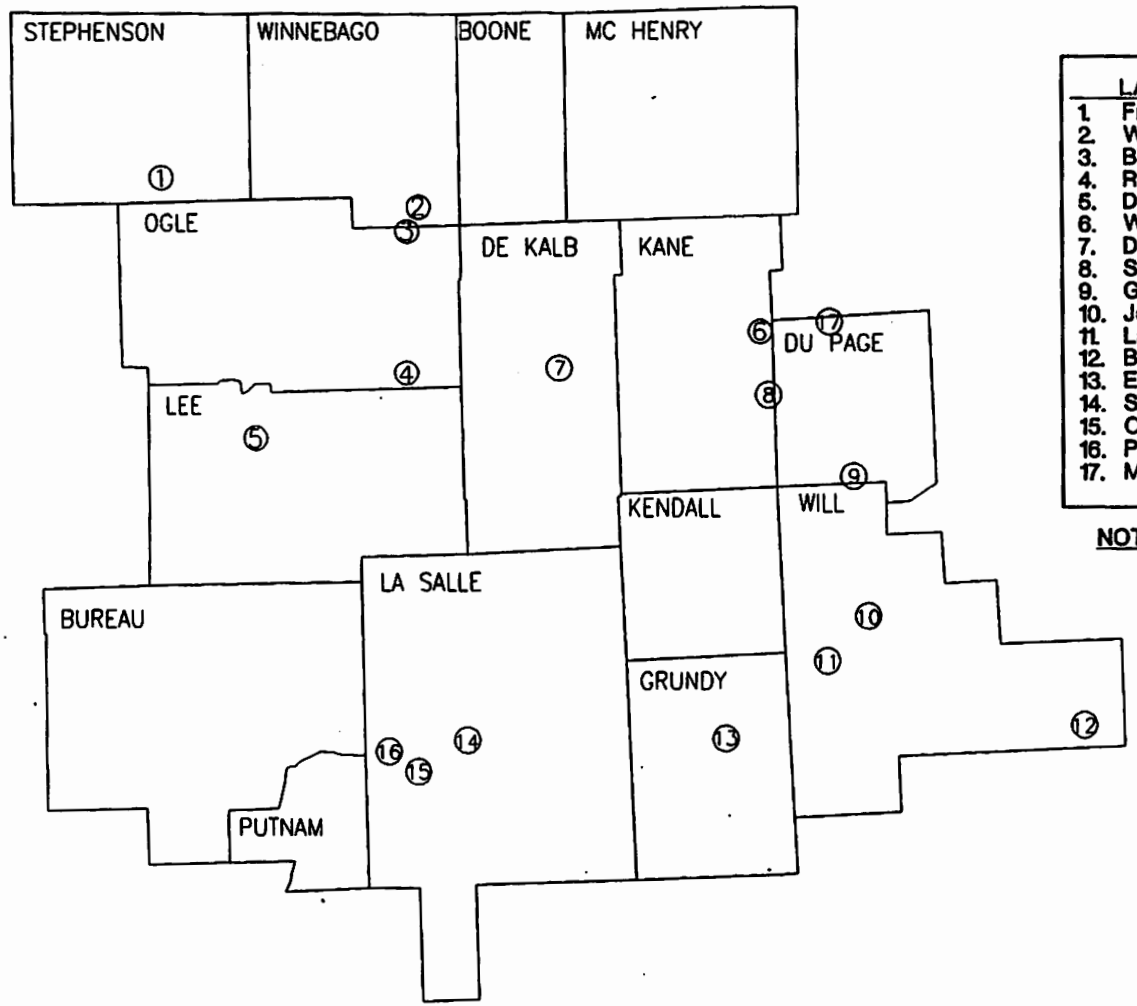
Waste Transfer. The economic feasibility of constructing and operating a transfer station can be determined by performing a break-even analysis of direct haul costs versus transfer haul costs. This analysis takes into account the cost of building a transfer station and hauling waste to a distant disposal facility in transfer trailer trucks. The cost per ton of hauling waste is plotted against the distance to the disposal facility for both direct haul and for transfer haul. At the break-even point, the cost to direct haul waste is roughly equal to the cost of building a transfer station and of hauling waste with transfer trailers. At greater distances than the break-even distance, utilizing the transfer station is more economical than direct hauling waste in packer trucks.

This type of analysis needs to be completed for each transfer station configuration that is considered. Break-even points will be different for different transfer stations depending on the facility sophistication and quantity of waste flowthrough. Figure 6-8 shows landfills located in Illinois that may be used by a transfer station in DeKalb County. An economic analysis was performed to investigate the feasibility of a transfer station to serve DeKalb County. The analysis was based on a transfer-only facility with limited processing capabilities in order to keep capital costs down and a facility sized only to handle waste from the County, or 77,237 tons per year (276 tons per day).

The results of the economic analysis are shown in Table 6-5, Table 6-6, Table 6-7 and Figure 6-9. The cost summary in Table 6-5 shows both fixed costs and variable operating costs for direct haul with packer trucks. Overhead is estimated to be 15 percent of direct operating expenses. Since the hauling in the region is performed by private companies, a profit of 10 percent of all expenses was added to the cost summary.

Transfer haul costs are separated into two separate components, the Transfer Haul Cost Summary (Table 6-6) and the Transfer Station Cost Summary (Table 6-7). The Transfer Station Cost Summary shows the costs associated with building and operating the transfer station. A cost per ton of waste transferred is calculated from the summary of the transfer station costs. This value is the cost to take one ton of waste and transfer it from a packer truck to a transfer trailer at the transfer station facility.

LANDFILLS AVAILABLE TO DEKALB COUNTY



	LANDFILL	EXPECTED CLOSURE DATE
1.	Freeport Municipal Landfill #4	2008
2.	Winnebago Reclamation	2041
3.	BFI/Davis Junction Landfill	1994
4.	Rochelle Municipal Landfill	2003
5.	Dixon Municipal Landfill	2029
6.	Woodland #1 & #2 Landfill	1999
7.	Dekalb County Landfill	2014
8.	Settler's Hill Landfill	2002
9.	Greene Valley Landfill	1997
10.	Joliet/CDT Landfill	1998
11.	Laraway/ESL Landfill	1994
12.	Beecher Landfill	1997
13.	Environtech Landfill	1994
14.	States Land Improvement Landfill	2000
15.	Oglesby Municipal Landfill	1997
16.	Peru Municipal Landfill	1995
17.	Mallard Lake Landfill	1997

NOTE: Expected closure date based on current permitted capacity and does not take into account future potential expansions.

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FIGURE 6-8

TABLE 6-5. PACKER TRUCK COST SUMMARY		
	Fixed Costs ($/year)	($/year)
1.	Capital Cost $100,000 amortized over 7 years at 8 percent	$19,207
2.	Insurance, at $1.25 per $100 of replacement cost	$ 1,250
3.	Labor, one person crew at $15.00/hour Benefits, at 35 percent of labor Total Labor and Benefits	$31,200 $10,920 $42,120
	Total fixed operating expenses	$62,577
4.	Overhead, at 15 percent of operating expenses	$ 9,387
5.	Profit, at 10 percent of all expenses	$ 7,196
	Total Fixed Cost	$79,160
	Variable Costs ($/mile)	
1.	Fuel (1.9 mpg)	$0.57
2.	Maintenance	$0.95
3.	Tire	$0.21
	Total Variable Operating Expenses	$1.73
4.	Overhead, at 15 percent of operating expenses	$0.26
5.	Profit, at 10 percent of all expenses	$0.20
	Total Variable Cost	$2.19
Fixed cost to operate ($/hour) one person crew (2,080 hrs./year)		$38.06
Variable cost to operate packer ($/mile)		$2.19
Capacity of packer truck (tons)		10
Assumed average speed of packer truck (mph)		40
	Cost per ton to transport waste	
One-way distance to disposal facility:		
	10 miles	$ 6.28
	20 miles	$12.57
	30 miles	$18.85
	40 miles	$25.13
	50 miles	$31.42
	60 miles	$37.70

TABLE 6-6. TRANSFER HAUL COST SUMMARY		
	Fixed Costs ($/year)	($/year)
1.	Capital Cost $110,000 amortized over 7 years at 8 percent	$21,128
2.	Insurance, at $1.25 per $100 of replacement cost	$1,375
3.	Labor, one person crew at $18.00/hour Benefits, at 35 percent of labor Total	$37,440 $13,104 $50,544
	Total fixed operating expenses	$73,047
4.	Overhead, at 15 percent of operating expenses	$10,957
5.	Profit, at 10 percent of all expenses	$8,400
	Total Fixed Cost	$92,404
	Variable Costs ($/mile)	
1.	Fuel (4.4 MPG)	$0.26
2.	Maintenance	$0.26
3.	Tire	$0.13
	Total Variable Operating Expenses	$0.65
4.	Overhead, at 15 percent of operating expenses	$0.10
5.	Profit, at 10 percent of all expenses	$0.07
	Total Variable Cost	$0.82
Fixed cost to operate transfer truck ($/hour) (2,080 hrs./year)		$44.43
Variable cost to operate transfer truck ($/hour)		$0.82
Capacity of transfer trailer truck (tons)		22
Assumed average speed of transfer truck (mph)		40
	Cost per ton to transport waste	
One-way distance to disposal facility:		
	10 miles	$1.76
	20 miles	$3.51
	30 miles	$5.27
	40 miles	$7.02
	50 miles	$8.78
	60 miles	$10.53

TABLE 6-7. TRANSFER STATION COST SUMMARY		
1.	Transfer Station Building Costs:	
	Land Acquisition	$ 35,000
	Building Costs 13,500 sq. ft. @ $45.00 per sq. ft.	$607,500
	Site Work (roads, excavation, utilities, etc.)	$100,000
	Contractor Overhead/Profit	$ 75,000
	Engineering/Architect	$ 60,000
	Siting and Permitting	$ 60,000
	Subtotal of Transfer Station Building Costs	$937,000
	Annualized over 20 years at 8%	$ 95,500
2.	Equipment Costs	
	Utility Tractor and Accessories - $90,000 Annualized for 10 years at 9%	$ 14,000
	Annual Operation and Maintenance	$ 30,900
	Subtotal of Equipment Costs	$ 44,900
3.	Labor (Including Benefits)	
	Heavy Equipment Operator/Director of Operations - 1 @ $50,000	$ 50,000
	Laborers - 2 @ $30,000	$ 60,000
	Weigh Station Attendant/Clerical - 1 @ $30,000	$ 30,000
	Subtotal of Annual Labor Cost	$140,000
4.	Annual Utilities Cost	$ 10,000
	Total Annual Costs (Items 1, 2, 3, and 4)	$290,400
	Operating Overhead @ 15% of Annual Costs	$ 43,600
	Profit @ 10% of Annual Costs	$ 33,400
	Total Annual Costs (Including Overhead and Profit)	$367,400
	Total Annual Tonnage - 276 Tons Per Day, 280 Days Per Year	77,237
	Total Cost Per Ton of Waste	$ 4.76

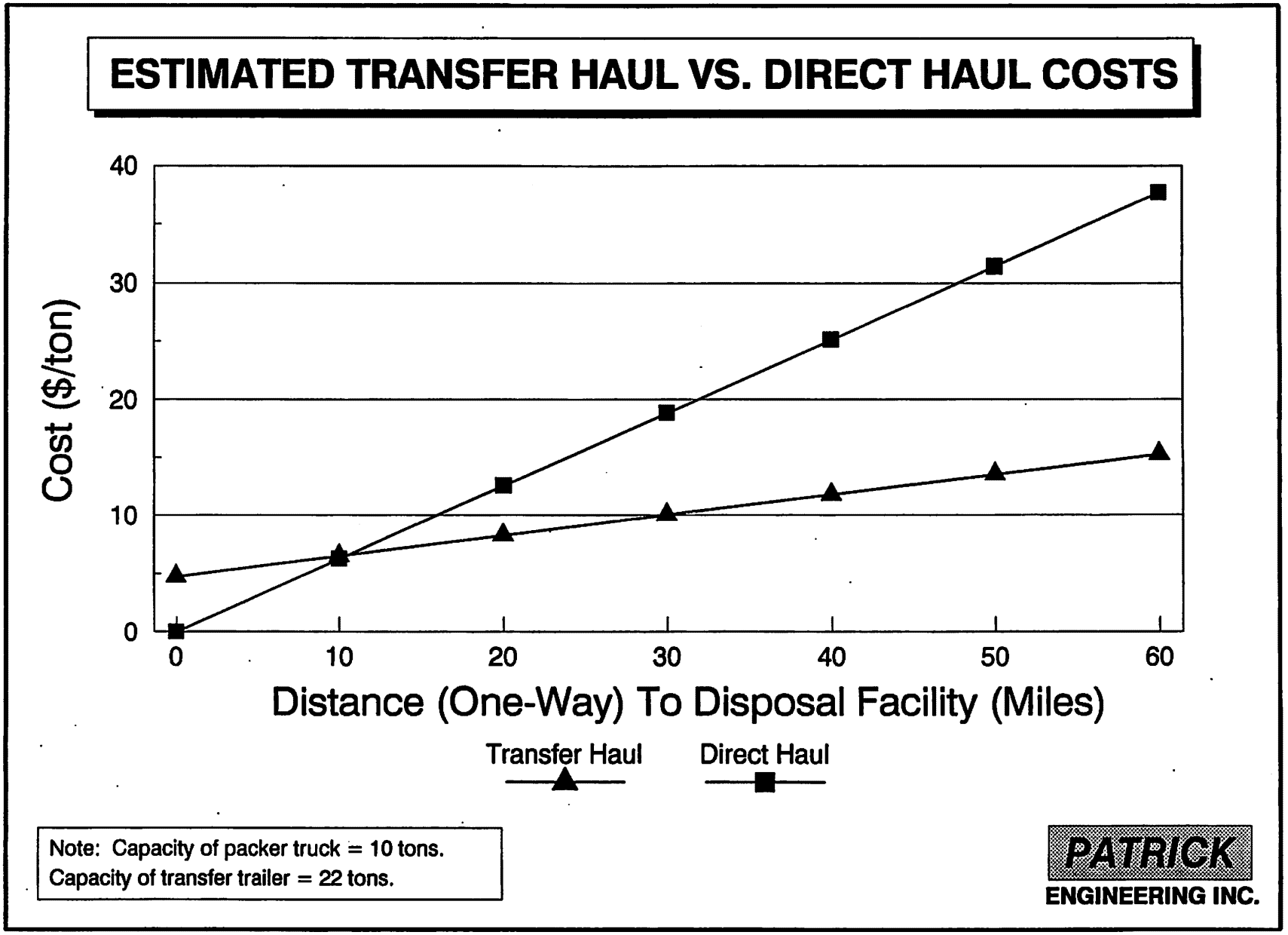

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FIGURE 6-9

The cost to transport the transfer trailer to a disposal facility is shown in the Transfer Haul Cost Summary. This summary is similar to the one for direct haul and results in a cost per ton to transport waste in trailers to a disposal facility. When the cost per ton of the transfer station is added to the cost per ton to transport waste in transfer trailers, the result can be plotted on the same graph as the direct haul data and a break-even point can be identified by the intersection of the two lines. This intersection is shown on Figure 6-9.

Based on the graph in Figure 6-9, the break-even point is approximately 10.5 miles. Direct haul is more economical when the distance to the disposal facility is less than the break-even point. Conversely, transfer haul is more economical when the distance is greater than the break-even point. Table 6-8 shows a summary of existing landfills in the region and their respective tipping fees. Since roughly 98 percent of DeKalb County waste is deposited in the DeKalb County Landfill and the landfill is located approximately three miles from the population centroid (the City of DeKalb), the distance to the landfill is therefore less than the 10.5 mile break-even distance. It is therefore not feasible, based on waste transportation costs, to develop a transfer station. However, if the DeKalb County Landfill closes, and no new landfill is built in the region, the nearest landfill is at least 15 miles from DeKalb. In that case, it would be economically feasible to develop a transfer station in DeKalb County.

Economy of Scale. An economy of scale exists for transfer stations. Larger transfer stations cost less per ton of throughput than smaller transfer stations. For example, a DeKalb County transfer station would handle approximately 276 tons per day. The break-even cost for a 276 ton per day facility is approximately $4.76 per ton and the break-even distance is about 10.5 miles. The break-even cost for a 150 ton per day facility is $6.70 per ton and the break-even distance is 15 miles. Smaller transfer stations are at a disadvantage because there is a minimum amount of land and building space and up front design and permitting expenses required regardless of how much waste is taken at the facility.

TABLE 6-8. PER TON COSTS FOR LANDFILLS IN THE REGION[1]			
Landfill	Location	Tipping Fee ($/ton)	Tipping Fee ($/cubic yard)
BFI/Davis Junction	Davis Junction (Ogle Co.)	$39.00	
DeKalb County	Cortland (DeKalb Co.)	$21.38[2]	$8.55
Environtech Inc.	Morris (Grundy Co.)	$21.13[2]	$8.45
Greene Valley	Naperville (DuPage Co.)	$23.48[2]	$9.39
Mallard Lake	Hanover Park (DuPage Co.)	$22.88[2]	$9.15
Morris Community	Morris (Grundy Co.)	$20.00[2]	$8.00
Rochelle Municipal	Rochelle (Ogle Co.)	$23.57	
Settler's Hill	Batavia (Kane Co.)	$24.38[2]	$9.75
States Land Improvement	Ottawa (LaSalle Co.)	$18.75[2]	$7.50
Winnebago Reclamation	Rockford (Winnebago Co.)	$53.00	
Woodland	South Elgin (Kane Co.)	$28.38[2]	$11.35

Notes:

1. Prices obtained from the Solid Waste Price Index, December, 1993.
2. Cubic yard price was converted to $/ton using 800 pounds/cubic yard packer truck density.

Waste Transfer With Mixed Waste Processing. When a transfer station recovers recyclables such as steel, aluminum, glass, paper, wood, etc. from mixed waste, the result is less waste requires disposal at a landfill or incinerator. Therefore, the cost of final disposal is reduced. The costs to equip and operate the facility must be added to the total cost of waste handling. Operating experience of mixed waste processing facilities is limited and available cost data is rare. Economic analyses of these facilities are therefore based upon limited data and assumptions, limiting the accuracy of the analyses.

Low technology facilities, or dump and pick operations, require little or no extra equipment. Laborers are used to manually pick out recoverable materials on the floor of the transfer station. Typically cardboard, aluminum siding, usable pallets, and other large items with resale value are separated. The number of pickers must be kept to a minimum because

heavy equipment poses a danger to persons on the transfer station floor, and typically only a small area is available for sorting.

The avoided disposal cost for the transfer station operator is the reduced cost of landfilling and hauling. Dump and pick operations generally recover only a small percentage of the incoming waste, so this analysis assumes that other recycling programs will be implemented to recover 25% of the waste. Assuming that a dump and pick operation recovers 6 tons per day from a 276 ton per day facility, the disposal cost savings is 6 tons x $21.38/ton = $128.28 per day, or $0.46 per ton of incoming waste (assuming the refuse is disposed at DeKalb County Landfill). It is estimated that one laborer (picker) could sort 1.5 tons per day. At a labor rate of $10.00 per hour ($7.41/hr. + 35% fringe), the labor cost is $1.16 per ton of incoming waste. If the net value of recovered material averages $15 per ton, then the revenue is $0.33 per ton of incoming waste. The effect of dump and pick operation would be a net loss of $0.37 per ton of incoming waste.

If a mixed waste processing facility is incorporated at a transfer station and is required to provide municipal waste recycling for the County, then the basic transfer station facility must be significantly upgraded. Since the County is already achieving a 31% recycling rate, the following analysis is provided only as a demonstration. The following analysis assumes that a recovery rate of at least 20 percent is achieved with a mixed waste facility - Table 6-1 shows that without composting or processing source separated material, high recovery rates may be difficult to obtain.

This analysis also incorporates Scenario One of the Waste Management Needs Assessment, which shows a total waste landfill rate of 77,237 tons per year and a municipal waste generation of 90,952 tons per year by the year 2015. To maintain the anticipated municipal waste recycling rate, and assuming composting rates reach 8,936 tons per year, the required recycling quantity, excluding composting, is 19,653 tons per year or 70 tons per day. If the total waste landfilled plus the existing municipal materials recycled are processed through the transfer station, then 96,890 tons of material would be handled, or 346 tons per day. The required recovery rate is therefore 20%.

If a sorting conveyor belt is installed, each sorter can more safely separate material than sorted at a dump and pick operation. Also, more sorters can be used because of improved layout and safety. The cost of a heavy duty conveyor system with sorting stations, magnets, additional building space, trommel screen, six trailers and a baler will add significant upfront costs to the operation (approximately $1,291,900). The total added annual cost is approximately $1.74 million. The added cost is therefore $17.94 per ton of incoming waste. Since there is no existing transfer station, the total cost per ton of waste received is $22.70/ton, excluding landfill tip fees.

A break-even tipping fee for the mixed waste processing facility is $39.74 per ton of refuse received. The total cost for recycling at the facility is $88 per ton of material recovered.

This analysis assumes that the average net revenue for recoverables is $0 per ton (net after transportation costs of recyclables).

This analysis demonstrates that the cost of disposal for a typical waste generator in DeKalb County may be affected by the inclusion of a mixed waste processing facility when added to an existing transfer station. Figure 6-9 shows that if the average haul distance is over 11 miles, the use of a transfer station will be advantageous. However, since the primary landfill facility is approximately 3 miles from DeKalb, a transfer station is not necessary. Mixed waste processing will cost $22.70 more per incoming ton of waste. Again, this analysis is only approximate. Very limited operational experience exists with mixed waste facilities and many assumptions must be made.

Waste Transfer With Refuse Derived Fuel Production. A review of numerous RDF operations shown on Table 6-9 indicates that facility capital costs have ranged from between $31,000 and $77,000 per daily ton of throughput, compared to the estimated transfer station cost of $3,400 per daily ton (calculated from Table 6-7). The debt retirement costs would result in a range from an estimated $11 to $31 per ton of throughput (assuming a 20-year debt retirement at 8% interest). When the debt retirement costs are added to the operating costs listed in Table

6-9, the resulting total costs per ton are shown to be high; generally much higher than landfill tipping fees.

Two important factors affect the capital and operating costs of RDF facilities. One factor, the wastestream type, will determine the types and redundancy of equipment. If the waste type is uniform, such as many commercial wastestreams, less equipment is needed. Also, the advent of effective recycling programs will affect equipment needs and sizing.

The availability of markets must be addressed prior to implementing a RDF facility. Market acceptance of RDF has been very limited in the U.S., and without locked-in markets, investing in a facility poses a very high risk.

Markets. Coal-burning electric power plants are a potential market for RDF. RDF is often burned as a substitute for up to 10% of the coal. Industrial facilities may also be a potential market for RDF. The RDF may be burned in combination with coal or wood. Another option is a dedicated RDF boiler, which only burns RDF.

The quality of the RDF directly affects its market potential. The quality of the RDF is characterized by the quantity of impurities, specifically the amount of grit, glass, metals, and other non-combustible materials. Because RDF is not as homogeneous as coal, boiler alterations may need to be undertaken. A high quality RDF product often can be burned without operational problems. A low quality RDF product on the other hand, will cause serious slagging and jamming problems potentially causing major shut-down and repair of equipment.

To market RDF one must demonstrate that RDF can be an economically viable option as a substitute for other types of fuel. Economic considerations of the potential RDF buyer are current fuel costs, RDF cost, RDF heating value, transportation costs, reliable quality and quantity and combustion system retrofit costs.

TABLE 6-9. SELECTED RDF OPERATIONS

	Delaware Reclamation	Future Fuel	Reuter	Ames, Iowa	S.P.S.A, Virginia
Types of Waste[1]	R - 90% C - 10% sludge	R, C	R	R, C	R, C
Throughput[2] (tons/day)	1,000 (R, C) 260 (sludge)	45	400	170	1,600
Recycled Materials[3]	F, NF, G/M	OCC, F, NF, P	OCC, F, NF, P	F, NF	F, NF
Products	Compost, RDF pellets	Compost, RDF pellets	RDF pellets	RDF fluff	RDF fluff
Site Area (acres)	25	12	11	NA	23
Building Size (square feet)	120,000	36,000	75,000	91,000	218,000
Capital Cost (millions)	$76.9	$1.5	$20.0	$6.6	$50
Operating Cost[4] ($/ton)	$51.21	$35-$45	NA	$40	NA
Tipping Fee at Facility[5] ($/ton)	$45.17	$45	$92	$10/ton	NA
Landfill Tip Fee[6] ($/ton)	$45.17	$12, 60 miles	$95	NA	NA
Labor (FTE)[7]	130	19	92	14	62
Operating Schedule (days per year/8-hour shifts)	250/2	250/1	312/2	NA	286/3
Downtime (% of operating time)	10%	10%	NA	NA	NA
Source Separation	None	None	Curbside	Drop-off	Curbside, Drop-off

Source: Resource Recycling, September, 1990 and personal communication with operators.

NA = Not available.

Notes:

1. R = mixed residential solid waste, C = mixed commercial solid waste.
2. Design capacities are shown for facilities operating less than a year.
3. OCC = old corrugated containers, MP = mixed waste paper, F = ferrous, NF = non-ferrous, G/M = mixed color glass containers, P = container plastics (e.g., HDPE, PET).
4. Operating cost does not include debt service.
5. Tipping fees at some locations vary because of the level of recyclables or the origin of the waste delivered to the facility.
6. Landfill costs represent the cost of residue disposal. Shipping distance or transportation cost is indicated if out of the community.
7. Full-time equivalent.
8. Recycling services provided in service area.

The revenue from the sale of RDF can help offset the debt retirement and operating costs. The value of a high grade RDF, on a heating value basis, is approximately equivalent to two thirds of that of coal. For instance, if the cost is $30 per ton for a 12,000 Btu per pound coal, then the equivalent value for a high grade 8,000 Btu per pounds RDF would be $20 per ton. The heat content of most RDF is 5,000 - 6,000 Btu per pound, or about half of coal. Other factors mentioned (combustion system compatibility, proven quality, reliable supply, etc.) will reduce the value of RDF to below its equivalent market value. Reported values for RDF pellets range from $0 (RDF must be given away) to $27 per ton.

If a high quality RDF is produced, and if it can be marketed, then the revenue can be used to help offset the higher operating costs of the RDF facility. The economic analysis of a RDF facility can be shown by examining a hypothetical facility. Assume the average operating cost for RDF facilities listed in Table 6-9 of $44 per ton is typical. Also assume that a RDF market and recycling markets are less than 40 miles from the facility, so the transportation cost is approximately $7 per ton (Table 6-6). Assuming that 15% of the incoming waste is recycled at an average revenue of $30 per ton, 40% of the incoming waste becomes RDF and sells for $10/ton, and 45% of the incoming waste is landfilled at a combined cost of $25 per ton (hauling and landfilling), the break-even tipping fee for the facility is:

$$\begin{aligned}\text{Tip fee} &= \text{operating cost} + \text{debt costs} + \text{transportation cost} + \text{disposal cost} - \text{revenues}\\ &= \$44/\text{ton} + \$11/\text{ton} + [\$7/\text{ton} \times 0.40 + \$7/\text{ton} \times 0.15] + [\$25/\text{ton} \times 0.45]\\ &\quad - [0.15 \times \$30/\text{ton} + \$10 \times 0.4] =\\ &\$44/\text{ton} + \$11/\text{ton} + \$3.85/\text{ton} + \$11.25/\text{ton} - \$8.50/\text{ton} = \$61.60\end{aligned}$$

The resulting tip fee of $61.60 is required to offset the assumed costs. The equation used to calculate the break-even fee shows how the numerous variables affect the analysis.

IMPLEMENTATION

This section examines the implementation issues associated with developing an intermediate facility. It must be determined who will own and operate the facility; what type of procurement approach will be utilized; how the project risks will be allocated; how the project will be financed; and how flow control will be instituted. Resolving these issues is essential to the successful implementation. These issues are examined in the following subsections.

Ownership and Operation Options. The first decision that must be made once a disposal technology has been chosen is who will own and operate the facility. This decision will impact the other implementation issues (i.e. procurement, risk management and financing). There are basically four different ownership and operation arrangements:

1. Public ownership and operation - Under this arrangement a public entity owns the facility and hires its own personnel to operate the facility. With public ownership and operation, the public entity assumes all the risk associated with the project.

2. Public ownership, private operation - Under this arrangement the public entity would own the facility, but enter into a contract with a private operator to handle the day-to-day operation of the facility. This approach is becoming more predominant because the 1986 tax reforms have reduced the tax and depreciation benefits associated with private ownership. This has resulted in a shift toward more public ownership with the private sector maintaining control of the operation. Under this scenario there is a sharing of the risk associated with the project.

3. Private ownership, public operation - This approach is common for other municipal services, but is not very common for solid waste disposal facilities. Under this arrangement the private sector is responsible for financing and owning the facility and the public sector would operate the facility under a lease agreement. This arrangement allows the public sector to operate a facility

without having to obligate public funds or bonding authority. As with the previous arrangement there is a sharing of risk.

4. Private ownership and operation - Under this arrangement a private entity is responsible for the financing, construction, ownership and operation of the facility. This type of "full service" approach is still a common arrangement for incineration in spite of the 1986 tax reforms. A majority of the risk is shifted to the private entity with the main role of the public entity being a commitment of its wastestream.

Once the ownership and operation issue has been resolved, the next step in the implementation process is to decide on the appropriate procurement approach.

Procurement. Procurement refers to the buying, renting, leasing or otherwise acquiring supplies, services, or construction. During this phase, the planning entity must determine the approach and method to be used to develop an intermediate facility. The decision should be made after the planning entity has analyzed the following factors: 1) facility ownership and operation, 2) financing approach and 3) allocation of risk. All of these factors are interdependent and the planning entity must look at the "big picture" when determining the appropriate procurement approach.

The following is a brief explanation of the three approaches which can be utilized by a public entity to procure a solid waste disposal facility.

1. Architect/Engineering (A/E) - This is the traditional approach utilized by the public sector to procure public works projects. The procurement process is broken down into two phases: architectural/engineering services and facility construction. The chosen A/E firm will design the facility and prepare the specifications bid document. The A/E approach is used primarily when the public sector has chosen to own the facility. The public sector bears most of the risk under an A/E approach.

2. Turnkey - Under the turnkey approach a single contractor has responsibility for the design, construction and start-up of the facility. The contractor is chosen through a Request for Proposal (RFP) arrangement. The RFP must include a general description of the type of facility that the public entity wants. The RFP does not specify the design, materials and equipment. Once the contractor has designed and constructed the facility, it is then turned over to the public entity. The public entity then becomes responsible for the operation of the facility and may use its own employees or contract the operation to the private sector. The turnkey approach allows for a sharing of the risk between the contractor and the public entity.

3. Full Service - Under the full service approach, a private firm is given responsibility for the design, construction, operation and possibly the ownership of the facility. The full service approach has the potential to allow the public entity to transfer a majority of the project risk to the private sector.

   Because of the Tax Reform Act of 1986, the private sector does not receive tax benefits previously received under private ownership. As a result, the full service approach has been modified by having the public entity retain ownership of the facility. The full service contractor may either enter into a lease agreement with the public entity or a contract to operate. Under a lease agreement, the full service contractor would assume more responsibility for repayment of the bonds and may be entitled to all or a portion of the profits. Under the contract agreement, the public entity is clearly the owner of the facility and the rate of return for the private operator would be expressed in the contract.

Financial Responsibility. The issues of ownership and operation, procurement approach and risk allocation are mutually dependent. A decision concerning ownership will impact the procurement approach selected (and financing options), which in turn, will dictate how the project risks are allocated.

Constructing an intermediate facility is a large capital project that a public entity can become involved with. Public entities must fully understand the many levels of risk and who bears the responsibility if there is a problem. Currently, the trend has been for the public sector to shift more of the risk to the private contractor. In return, the private contractor will expect to receive a larger portion of the profits. If a public entity chooses to assume the ownership of a facility, it becomes responsible for substantial risks.

Financing Issues. It is essential during the preliminary planning stages that the public entity understands the various options available concerning ownership and operation, procurement, risk allocation and financing.

It is important that a project team be assembled. The team should include a bond counsel and a financial advisor early in the planning stages. During the preliminary project planning stages, the unit of local government will have to confront and make critical decisions (e.g. technology, ownership, financing). Therefore, it is essential that the unit of local government have expert counsel so that it maintains control over the process. Only then can the unit of local government achieve the lowest cost for solid waste disposal at an acceptable financial risk.

There are three common elements to implementing a successful project: 1) control of the waste supply and revenues, 2) assurance of technology and economic feasibility, and 3) responsible parties assuming risk.

An adequate wastestream must be assured over the economic life of the project. Contracts must be entered into between the units of local government and the owner of the facility. These contracts are commonly referred to as "Put or Pay" contracts. These contracts have two general provisions:

- The entity supplying the waste commits to deliver (put) a minimum quantity of waste for a specific time period at a set tipping fee. If it is unable to deliver the agreed upon amount of waste to the facility, it is still obligated to pay the tipping fee for the amount of waste stipulated in the contract.

- The supplier of the waste must designate the facility as the primary waste disposal option and not participate in other projects that would conflict with the obligations stated in the contract.

Assurances must be made to the prospective bond investors and credit rating agencies that the project is economically sound. This requires that a qualified engineering consultant be hired to prepare a technology feasibility study on the proposed facility. Economic assurances must be made that adequate revenues will be generated by the tipping fees and material revenues to insure payment of principle and interest on the bonds.

Finally, the track record of the parties assuming risk in the project will be scrutinized. If the private sector is going to be involved with the construction and/or operation of the facility, the guarantees made by the private sector will be closely scrutinized to insure that the private sector entity can financially support the risk it assumes.

Flow Control. The assurance of an adequate waste flow to the facility is essential to the financial feasibility of the project. This assurance of waste is commonly referred to as flow control. Units of local government achieve flow control through local ordinances, contracts or licenses. Flow control measures require haulers to collect the waste from a unit of local government and deliver it to a designated facility. Several Illinois statutes include flow control language.

Flow control is currently a hotly debated topic. Recent court cases have called into question the legal viability of flow control ordinances. The U.S. Congress is currently assessing flow control and may eventually address this issue with federal legislation.

INTERMEDIATE FACILITY RECOMMENDATIONS

Listed below are the preliminary recommendations for intermediate facilities to be considered by DeKalb County.

Mixed Waste Processing.

- Mixed waste processing is not a recommended component of the DeKalb County plan at this time, based on the effective existing recycling programs in DeKalb County, and based on the relatively high capital and operating costs and the lack of extensive information and experience on the reliability of mixed waste processing systems. However, if a transfer station is established in the region, then mixed waste processing becomes more economically attractive and should be given further consideration.

Refuse Derived Fuel.

- A refuse derived fuel (RDF) facility is not a recommended component of the DeKalb County plan at this time, based on the relatively high capital and operating costs, the lack of established markets for the RDF in the region, and the lack of extensive information and experience on the reliability of RDF systems.

Transfer Station.

- Based on preliminary analyses, it appears that a transfer station sized to handle the County's waste is not economically feasible at this time. If the DeKalb County Landfill closes, then the County should give serious consideration to developing a transfer station in the County near the City of DeKalb.

Plan Update.

- Each of these options should be reevaluated as a component of the five year plan update.

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CHAPTER 7
COMPOST PROCESSES AND COLLECTION SYSTEMS

Organic waste comprises a significant portion of the municipal wastestream. Alternative management strategies for organic waste may reduce DeKalb County's reliance on landfills and produce a beneficial end-product. This chapter discusses 1) relevant background to landscape waste (LSW) management and mixed municipal waste (MW) composting; 2) composting processes and technologies; 3) a description of landscape waste, green waste, and mixed municipal waste composting; 4) collection systems; 5) siting considerations; 6) environmental permits and issues; 7) economics of composting; and 8) recommendations.

BACKGROUND

In order to provide some background information regarding landscape waste management for the development of policy alternatives, this section reviews definitions, legislation and regulations pertaining to recycling, landscape waste management and composting.

Definitions. Definitions regarding landscape management are provided below to assist the reader. All the terms have been defined by Patrick Engineering Inc., the Illinois Environmental Protection Agency or the Illinois Compiled Statutes unless otherwise indicated.

Aeration. Aeration is the process of exposing bulk material, such as compost, to air.

Aerobic. Aerobic refers to the biochemical process or condition occurring in the presence of oxygen.

Anaerobic. Anaerobic refers to a biochemical process or condition occurring in the absence of oxygen.

Backyard Burning. Backyard burning refers to the practice of managing LSW through burning.

Compost. As defined by P.A. 85-1429, compost is a the humus-like product of composting waste, which may be used as a soil conditioner.

Composting. As defined by P.A. 87-0650, composting is the biological process by which microorganisms decompose the organic fraction of waste, producing a compost.

Green Waste Composting. A method of composting source separated "green" waste comprised of food waste and landscape waste. This type of composting generally produces a cleaner end product than mixed MW composting.

In-Vessel Composting. In-vessel composting is a composting method in which the compost is continuously and mechanically mixed and aerated in a large, contained structure or vessel.

Landscape Waste (LSW). As defined by the Illinois Environmental Protection Act, landscape waste is all accumulations of grass or shrubbery cuttings, leaves, tree limbs and other materials accumulated as the result of the care of lawns, shrubbery, vines and trees.

Mixed Municipal Waste Composting. A method of composting the organic fraction of the entire municipal wastestream without source separation.

Wet/Dry Collection Systems. A method to collect the "wet" or compostable fraction from the "dry" or recyclable fraction of the municipal wastestream without commingling them. This source separated collection method is believed to produce a higher quality compost than mixed MW composting.

Windrow. A windrow is a large, elongated pile of composting material.

Legislation. Illinois legislation has fundamentally influenced landscape waste management and composting in the State. This section reviews significant legislative acts passed by the Illinois General Assembly and subsequently signed into law by the Governor.

An Act Concerning the Management of Landscape Waste (Public Act 85-1430). This Act banned the landfilling of landscape waste after July 1, 1990. The Act has had a significant impact since landscape waste comprises a substantial portion of the municipal wastestream. According to DeKalb County's Waste Management Needs Assessment, an estimated 8,576 tons of landscape waste is collected for composting. Homeowners are managing a portion of the landscape wastestream on their own through such means as composting, mulching or burning.

The statutory language as found in 415 ILCS 5/22.22 of the Illinois Compiled Statutes and in the Illinois Environmental Protection Act, Section 22.22, states:

> (a) Beginning July 1, 1990, no person may knowingly mix landscape waste that is intended for collection or for disposal at a landfill with any other municipal waste.
>
> (b) Beginning July 1, 1990, no person may knowingly put landscape waste into a container intended for collection or disposal at a landfill, unless such container is biodegradable.
>
> (c) Beginning July 1, 1990, no owner or operator of a sanitary landfill shall accept landscape waste for final disposal, except that landscape waste separated from municipal waste may be accepted by a sanitary landfill if (1) the landfill provides and maintains for that purpose separate landscape waste composting facilities and composts all landscape waste and (2) the composted waste is utilized, part of the final vegetative cover for the landfill or for such other uses as soil conditioning material.
>
> (d) The requirements of this Section shall not apply (i) to landscape waste collected as part of a municipal street sweeping operation where the intent is to provide street sweeping service rather than leaf collection, nor (ii) to landscape waste collected by bar screens or grates in a sewage treatment system.

Compost Quality Standards (P.A. 87-1227). This act calls for the creation of a compost quality standards advisory committee to recommend draft compost quality standards and site operation regulations to the Illinois Pollution Control Board by January 1, 1994. These proposed recommendations will govern the design and operation of composting facilities as well as end-product quality standards. Only draft LSW composting regulations have been submitted to the Illinois Pollution Control Board for formal rulemaking thus far.

Performance standards for LSW compost facilities shall at a minimum include: management of odors; management of surface waters; contingency planning for handling end-product compost material that does not meet requirements of the adopted standards; plans for intended purposes of end-use product; and a financial assurance plan necessary to restore the site as specified in the IEPA permit.

In addition to these regulations, green waste and mixed municipal waste composting facilities will need to meet the following performance standards: the management of potential exposures to human disease vectors and litter; management of leachate; and provisions restricting the processing of potential contaminants and problem materials such as heavy metals.

STATUS OF EXISTING LSW MANAGEMENT AND MW COMPOSTING IN DEKALB COUNTY

Since the ban of landscape waste from landfills was enacted in July 1990, residents are required to separate landscape waste from refuse if they wish to have it collected for disposal. According to DeKalb County's Solid Waste Needs Assessment, 8,576 tons of LSW is collected. This material is sent to the DeKalb County Landscape Waste Facility. In some cases, mostly in rural areas of the County, landscape waste is managed within the resident's property through burning, composting, mulching or shredding.

Currently, there are no operating green waste composting, wet/dry collection programs or permitted municipal waste composting sites located in or near the County.

COMPOSTING PROCESSES AND TECHNOLOGY

Processing Basics. Composting is the controlled biological decomposition of organic materials. Composting is accomplished in the presence of air and produces carbon dioxide, water, minerals, and stabilized organic matter. Controlling the environmental conditions in the composting process plays a significant role in determining the rate of decomposition and quality

of compost produced. Compost is the finished product resulting from the composting process. Compost is generally dark in color and resembles rich top soil. Because of its high organic content, compost makes a valuable soil amendment.

Composting is not a new process. For centuries composting has been used as a method of stabilizing agricultural and human waste. In more recent years, composting has been successfully used for the stabilization of sewage sludges, industrial waste, LSW and municipal waste.

After waste reaches a compost facility, the following processing activities may be performed depending on the technology utilized: removal of bulky items, particle size reduction, magnetic removal of ferrous material, moisture addition and mixing, rapid rate composting, curing, and final (or post) processing.

It is necessary to remove all bulky, non-compostable items, such as furniture, white goods, rugs or carpets, steel pipe, and so on, before beginning the composting process. These non-compostable items are typically disposed of by recycling or landfilling.

Particle size reduction is also an important factor in composting. Reducing the waste particle size increases the surface area of the waste which increases the ability of microbes to break down the waste. Also, waste handling characteristics are improved because the waste particle sizes are more uniform.

Rotating drums or shredding equipment are typically used in green waste and mixed MW composting to reduce the size of the material. Size reduction in a rotating drum is accomplished by the tumbling action of the waste against a series of knives, chains, or spikes, which protrude from the drum's inner wall. Hammermills are commonly used as one type of shredding equipment because of their ability to handle larger quantities of waste per hour than other types of shredding equipment. Slow speed shear shredders are also used to reduce the bulkiness of solid waste. Landscape waste is typically not subject to size reduction in rural areas of the state, due to the high costs of operation.

Electromagnetic devices (such as magnets and/or eddy currents) are often used in MW compost operations in the pre-processing phase to remove the ferrous and non-ferrous metals from the compostable portion of the waste.

Moisture addition and mixing of the compost material is important to ensure that the composting process proceeds at a rapid rate. Water is the most commonly used moisture source, although sewage sludges may also be used. Several methods are used to mix liquids with waste. Mixers equipped with a series of rotating pedals or augers placed in a fixed bin are common for mixing shredded waste. Shredded waste can also be mixed on a flat surface, such as a concrete floor using machines such as front-end loaders or equipment fitted with rotating augers. Landscape waste is often placed on bare ground and mixed with either a front-end loader, a windrow turner or not turned at all.

For proper composting, which results in low odor generation, pathogen destruction and rapid rate volume reduction, the following conditions should be maintained:

- Moisture Control - A moisture level of between 45 and 60% by weight is necessary to maintain optimal microbial activity. If moisture levels exceed 60%, then the material becomes overly saturated, the microbial activity ceases or slows, and anaerobic conditions occur. If moisture levels go below 45%, then there is not enough moisture to support rapid microbial activity and decomposition slows.

- Odor Control - Keep the compost pile temperatures below 160°F to minimize the generation of ammonia. Maintain oxygen levels between 12% and 17%. Maintain adequate structure to minimize clumping and to maximize oxygen diffusion.

- Pathogen Destruction - Maintain compost pile temperatures above 130°F for at least three days to assure pathogen destruction.

- Volume Reduction - For maximum volume reduction, keep pile temperatures between 115°F and 130°F. Also, maintain a carbon/nitrogen (C/N) ratio between 25 and 40. A mixture below 25 C/N, which indicates a high nitrogen content, may liberate nitrogen in the form of ammonia, causing odor. A C/N ratio above 40 has too little nitrogen to ensure vigorous composting. Organic material is potentially reduced by 30 to 50% of its original volume.

Compost piles must be aerated. Microbes performing the composting process require oxygen. They also operate within certain temperature ranges that can be controlled by providing the proper amounts of air. Mechanical agitation and/or turning the material helps aerate the piles as well as help mix and break down material.

The optimum composting process requires that a number of conditions be met simultaneously. A composting operation should be designed to maintain all of the conditions previously mentioned to maximize volume reduction, pathogen destruction and minimize nuisances, such as odors and litter. Such a process design includes minimizing chemical and physical contaminants with up-front processes, monitoring temperature, oxygen, moisture, carbon to nitrogen ratio, and protecting the process from environmental extremes (extreme cold, wind, rain, etc.). For instance, placing the initial composting process indoors will reduce odor, litter and vector problems.

After waste goes through the rapid rate compost process, post-processing occurs. Typically, post-processing strategies include one or two screening steps, curing the compost, and additional grinding to prepare the compost for markets. Screens are used to separate the compost from the non-compostable fraction. The non-compostable fraction is sent to a landfill while the compostable portion is retained and is returned to the composting process. Curing the compost material allows the compost to achieve a biologically stable condition. Microbial activity continues during curing at a slower rate than during the actual composting process. Curing is achieved utilizing a windrow system. Curing may take from a few days to several weeks or months, depending on the level of maintenance applied. The cured compost is then prepared for market. Depending on the market needs, the compost may need to pass through

a shredder and an additional screening process. A conceptual composting system is shown on Figure 7-1.

There are several types and levels of technologies available for composting. These technologies vary in the method of air supply, temperature control, mixing/turning of the compost material, and the time required to produce a finished product. Capital, operating and maintenance costs will vary with each of these technologies. Composting technologies can be classified into four general categories: land application of landscape waste, windrow, aerated static pile, and in-vessel composting methods for landscape, green and mixed municipal waste. These are discussed in the next sections.

Land Application of Landscape Waste. The lowest level of composting technology and generally the least expensive method is direct land application of landscape waste. Direct land application of landscape waste may be an alternative to higher level composting operations in certain circumstances. Specifically, direct application is most suitable for areas characterized by relatively small communities with an abundance of open space or farmland available nearby, such as areas in this region.

In Illinois, landscape waste can be applied to the land at agronomic rates (i.e., no more than 20 tons per acre). Land application of landscape waste at agronomic rates requires knowledge of soil characteristics and potential environmental impacts. Land applied material decomposes differently than material that is processed using windrow or in-vessel techniques which will be discussed later. Land-applied landscape waste is first degraded near the soil surface by organisms such as earthworms and soil insects. Once these larger organisms reduce the size and consume a portion of the material, smaller organisms begin decomposing the material at low temperatures and at relatively slow rates.

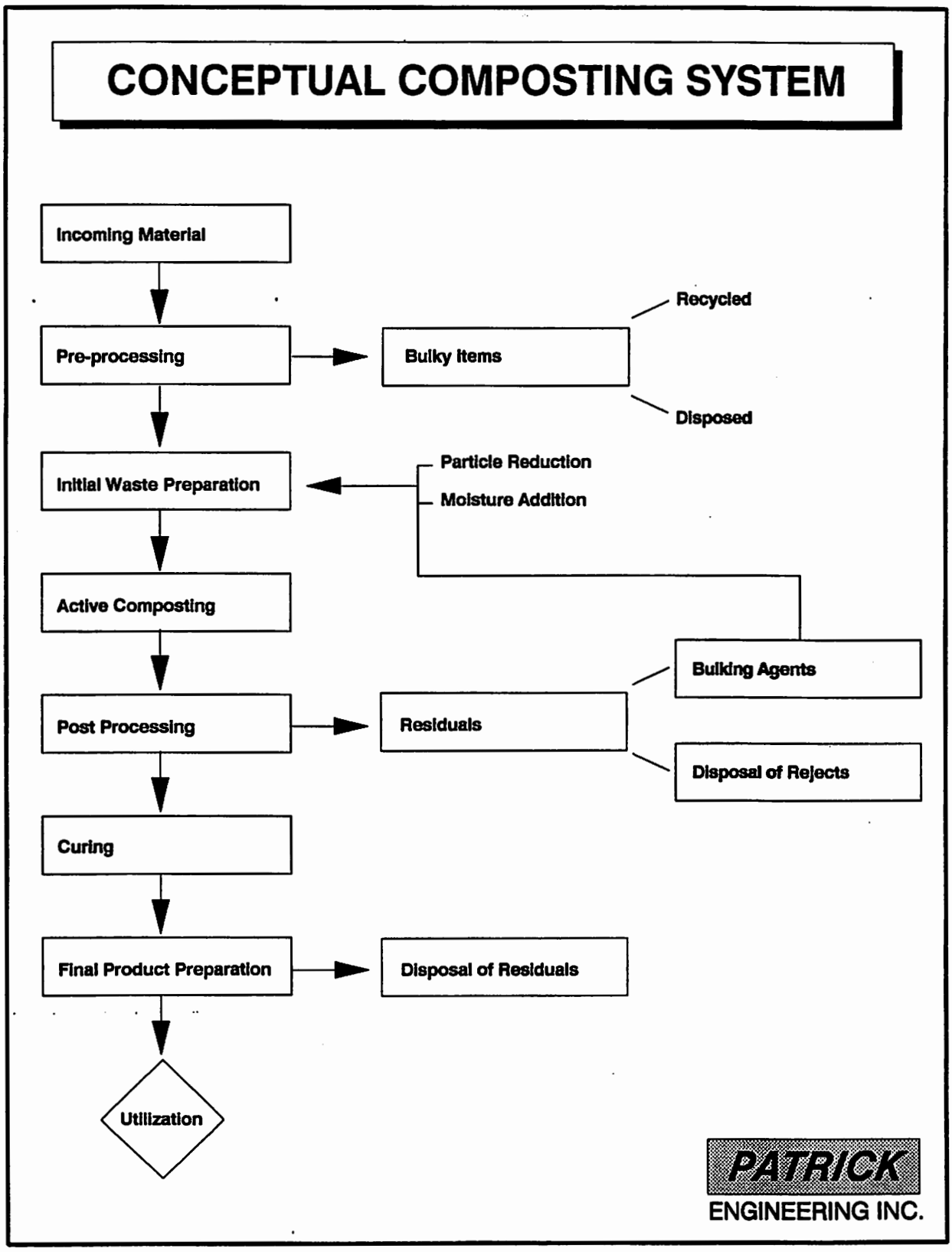

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FIGURE 7-1

Land application of landscape waste may be attractive to farmers because the incoming material is generally supplied at no cost to them and because decomposed material has soil conditioning benefits. However, the cooperating farmer will most likely want the raw landscape material free of brush, debris, glass and any other contaminants. Also, the farmer may want the material tested for potential chemical contaminants (pesticides, herbicides, trace metals, etc.).

A manure spreader can be used to land apply the landscape waste material and a chisel plow can be used to mix the material into the soil. Raw leaves may be difficult to handle in this manner because of their greater bulk and tendency to clump together when wet. Shredding the leaves before land applying, however, will facilitate mixing the material into the soil.

Windrow Composting. Windrow composting is a low to medium level composting technology for managing landscape waste, green waste and mixed municipal waste. The windrow process involves forming piles, triangular in cross-section, that are typically 7 feet high and 14 to 16 feet wide at the base. The height and width of the pile at the base are determined by the type of equipment available for turning the pile. The windrows can be formed outdoors or in an enclosed building. Windrows placed outdoors may create odors, surface runoff and leachate, or (in the case of mixed municipal waste) attract vectors and birds, thereby reducing public acceptance. To help avoid these problems, the windrows can be placed in an enclosed building. The initial capital costs for an indoor operation will obviously be greater than an outdoor operation.

Turning the windrows as needed (daily to once or twice per week) will ensure proper temperature, moisture conditions, and air supply. Windrows should be placed on a paved surface to allow for easier access and ease in turning the material. The time required for windrow composting can generally range from two to six months depending on the level of maintenance applied.

Aerated Static Pile. The aerated static pile method represents a medium level of composting technology. The aerated static pile method requires that the composting mixture be placed in piles that are mechanically aerated with forced air. These piles are placed over a

network of pipes which are connected to a blower for supplying air to the material. The aerated static pile method is less labor intensive than the windrow method because the piles are not turned until the composting process is nearly completed.

Aerated static pile composting can be performed outside or in an enclosed building. Composting outdoors with the static pile method has the same disadvantages as composting outdoors using the windrow method. However, the odors are generally less than those encountered using the windrow method. Usually odors are a problem when the static piles are turned and the materials within the piles are exposed to the surrounding air.

The aerated static pile method is generally less capital intensive than the in-vessel technology system and can be less capital intensive than the windrow composting system. However, continual electrical cost to supply air to the composting piles must be considered in the operating cost. The time required for aerated static pile composting can generally range from six weeks to six months.

In-Vessel Composting. The in-vessel composting method represents a higher level of composting technology. It is different from the two previously described methods in that the composting takes place in an enclosed vessel. Common in-vessel systems include drums, silos, digester bins, and tunnels. The vessels may be single or multi-compartment units. In some cases, the vessel rotates; in others, the vessel is stationary and a mixing/agitating device moves within the vessel to mix the material. Most in-vessel systems are continuous feed systems. All in-vessel systems require post-processing after the material has been discharged from the vessel. Typically this will include using a windrow system for curing followed by final screening.

In-vessel systems offer the advantage of short retention times ranging from three days to as much as four weeks during the initial composting phase. This reduces land area requirements, as compared to the windrow and aerated static pile methods described. The in-vessel system, if properly operated, produces minimal odors, little or no leachate and minimizes scavenging. In a recent study conducted in Connecticut, a stable, mature compost was achieved with four weeks of in-vessel composting and six to eight weeks of windrow composting.

Table 7-1 provides a partial summary of a number of MW compost facilities that have operated in the U.S. It should be noted that some facilities are undergoing extensive modification to control odor or have shut down due to odor.

What follows in the next three sections is a discussion of management options for LSW, green waste and mixed municipal waste composting.

LANDSCAPE WASTE MANAGEMENT

Landscape Waste Collection. Currently, a significant quantity of landscape waste is collected from households for processing in the County. The majority of the landscape waste which is collected is composted. Some is burned by Public Works Departments that collect landscape waste. Options the County may want to pursue in terms of landscape waste management may include the following:

- Encourage residents to handle landscape waste in their own backyards; and,
- Development of special collection programs or services for landscape waste which is difficult for residents to manage, such as large diameter landscape waste, storm damage and Christmas trees.

Backyard Burning. Very few households within the region reportedly gather landscape waste and burn it on their property. While this approach may seem to be a quick and inexpensive disposal method to homeowners, there is evidence that the air pollution generated by this practice may pose health and safety hazards. Several municipalities within Illinois, especially in areas of higher population density, have restricted or prohibited the burning of landscape waste. Table 7-2 summarizes the municipal requirements of burning landscape waste within municipalities located in DeKalb County. Restrictions throughout the State range from an outright ban on the burning of landscape waste at any time to the restriction of burning to

TABLE 7-1. EXISTING MIXED MUNICIPAL WASTE COMPOSTING OPERATIONS[1]

Community	Design Capacity (TPD)	Composting Vendor	Technology	Began Operation
Lakeside, AZ	15	Bedminster	Vessel	7/1/91
Baltimore, MD	700	FERST	Vessel	3/1/93
Mackinac Island, MI	1.6	Architect/Engineering Procurement	Aerated Static Pile	5/1/92
Columbia County, WI	80	Architect/Engineering Procurement	Vessel	11/1/91
Escambia County, FL	250	Architect/Engineering Procurement	Windrow	11/1/91
Buena Vista County, IA	70	Architect/Engineering Procurement	Windrow	12/1/90
Sumter County, FL	120	AMERECYCLE	Shred/Windrow	1/1/88
Montgomery County, KS	300	Res. Recovery	Windrow	3/1/89
Mora, MN[2]	250	DANECO	Aerated Static Pile	8/15/91
St. Cloud, MN[2]	60	RECOMP	Vessel/Aerate	3/1/85
Wright County, MN	165	Buhler	Shred/Aerate	4/10/92
Martin/Faribault County, MN	100	OTV/RYAN	Shred/Aerate	8/15/91
Pennington County, MN	80	LUNDELL	Shred/Aerate	11/1/85
Filmore County, MN	11	Architect/Engineering Procurement	Shred/Aerate	9/1/87
Swift County, MN	40	CAL. RECOV.	Shred/Aerate	5/1/90
Lake of the Woods, MN	10	Architect/Engineering Procurement	Shred/Aerate	3/1/89
Big Sandy, TX	25	Eweson	Vessel	1972
Ferndale, WA	125	RECOMP	Vessel/Aerate	12/1/91
Portage, WI	40	Architect/Engineering Procurement	Vessel	9/1/86
Sevier County, TN	225	Bedminster Bioconversion	Vessel	10/1/92

Notes: 1. As of December 2, 1993.
2. Undergoing or has undergone modifications to control odors.

certain times of the day, certain seasons during the year, certain types of materials and/or certain locations where the material can be burned. Counties may also prohibit or restrict the burning of landscape waste in unincorporated areas of the county. For example, DuPage County enacted an ordinance which prohibits the burning of landscape waste in the unincorporated areas of DuPage County. Individuals who violate the ordinance may be fined from $50 to $500. The ordinance also prohibits unauthorized dumping of landscape waste to counter any dumping caused by the burning ban and landfill disposal ban.

TABLE 7-2. SELECTED LIMITATIONS ON LANDSCAPE WASTE BURNING IN THE REGION

Municipality	Estimated Percent Burned	Burn Ban/Conditions
Cortland	NA	• Landscape waste may be burned.
DeKalb	2	• No ordinance
Genoa	1	• No ordinance
Kingston	0	• An ordinance exists. • It is not enforced.
Kirkland	0-80	• An ordinance exists. • Burning is allowed from Sept. 15 to Jan. 1. • Public works burns at sewer plant.
Lee	10	• An ordinance exists. • It is not enforced.
Malta	NA	• No ordinance. • The Village burns tree limbs.
Sandwich	NA	• The ordinance allows burning from 9:00 a.m. to 6:00 p.m.
Somonauk	NA	• An ordinance exists.
Sycamore	5	• No ordinance.
Waterman	NA	• Ordinance allows burning of leaves and twigs.

Source: Surveys of municipalities in DeKalb County, 1993.

GREEN WASTE COMPOSTING

Food waste and landscape waste are sometimes referred to together as "green waste". Food waste and landscape waste often comprise a significant portion of the solid wastestream (anywhere from 20 - 60%), making it necessary to consider methods to recycle this component of the wastestream (primarily through composting). In DeKalb County, food waste and landscape waste comprise 25 percent of municipal waste.

An issue that has prompted increased interest in green waste composting is compost quality. A number of studies have shown that compost quality is dependent upon the type of waste composted. The "cleaner" the waste input into the composting operation, the better the end product. When food waste and landscape waste are collected separate from mixed waste and composted, the resulting compost contains far lower heavy metal concentrations than compost made from mixed municipal waste. The Illinois Department of Energy and Natural Resources has adopted the policy to promote composting of source separated organics instead of mixed solid waste due to concern over compost quality. The impact of keeping organic waste separate is shown in Table 7-3.

The compost quality resulting from mixed MW composting can be improved by implementing up-front processing (as discussed in the Mixed Waste Processing Facilities section of Chapter 6 on Intermediate Facilities). Up-front processes can help remove potentially harmful items, such as batteries, that contribute to higher levels of contaminants. If sewage sludges are added as a moisture additive, heavy metal concentrations may also increase. However, it appears that even with extensive up-front processing, compost derived from mixed MW exhibits higher concentrations of contaminants than compost made from green waste.

TABLE 7-3. HEAVY METAL CONTENT IN COMPOSTS				
Metal	Compost From Mixed Waste, No Separation (ppm)[1]	Compost From Mixed Waste, Central Separation (ppm)	Compost From Source Separated Organics (ppm)[2]	Agricultural and Prunings (ppm)
Cadmium	11, 1.8 - 14	5.5	0.5, 1, 0.8	<1
Chromium	179, 11 - 220	71	55, 36, 29	16
Copper	715, 80 - 240	274	47, 33, 43	22
Lead	1,460, 290 - 2,850	513	62, 133, 76	27
Mercury	7, 1.2 - 8	2.4	0.5, <1, 0.2	N.D.
Nickel	90, 20 - 73	45	14, 29, 7	21
Zinc	2,200, 565 - 1,255	1,570	198, 408, 235	80

ppm = Parts per million
N.D. = no data.

Notes: 1. Data from two separate studies.
2. Data from three separate studies.

Source: Resource Recycling, July 1992.

Numerous business and institutional establishments generate a significant quantity of green waste. Schools and universities, hospitals, prisons, restaurants, grocery stores, food manufacturers, and businesses with cafeterias generally generate a large fraction of food and other waste stream components that can feasibly be kept separate from other refuse. Once separate, the green waste can be transported to a processing facility in dedicated vehicles or in the same vehicle used for refuse. Once at a composting facility, the green waste should undergo minor up-front processing to identify obvious contaminants. The composting process is the same as for LSW and mixed municipal waste; it requires moisture, aeration and temperature control. Green waste composting operations are subject to the same siting and permitting constraints as MW composting sites discussed later in this chapter.

Green waste from institutions may also be composted on-site. Since the composting takes place on the property the waste is generated, no State permit is required. On-site composting may be less costly because transportation costs are reduced.

MIXED MUNICIPAL WASTE COMPOSTING

Compostable organic material makes up approximately 60% of the typical solid wastestream. The compostable fraction includes landscape waste, food waste and paper. This fact suggests the importance of considering composting as a waste management option. Recent surveys indicate that in 1993 at least 20 operating composting facilities nationwide derived at least a part of their input from mixed municipal waste (up from nine facilities in 1990). Although composting can be utilized to significantly reduce the reliance on landfills, it does not replace the need for a landfill. Materials that are not currently recyclable or compostable, in addition to residuals from composting, must still be disposed.

Municipal waste composting has potential to convert large amounts of solid waste into a marketable product. A number of cities and counties in the U.S. have selected composting as a disposal option. When evaluating composting as an alternative technology, a number of advantages and disadvantages should be considered:

Advantages

- Solid waste composting provides an outlet for waste typically not recycled, such as food waste which is 13 percent of DeKalb County's municipal wastestream.

- Composting can provide an outlet for materials potentially recyclable but not currently recycled, such as contaminated portions of high and low grade paper, cardboard, newspaper and paper towels.

- One green waste or MW compost facility can utilize landscape waste as a feedstock, potentially eliminating the need for a separate LSW composting facility.

- Composting facilities may have a better public image and acceptance than a landfill or incinerator.

- Higher recycling goals can be attained with the addition of composting. The utilization of finished compost is considered recycling. The recycling rate can be increased substantially because a large proportion of the waste (after recycling) is compostable. The recycling rate can be increased depending upon system components (source separation effectiveness, processing techniques, markets).

- The use of a composting facility, and the consequent marketing of the compost locally, could warrant and encourage increased source separation and public awareness of recycling.

- Composting facilities often pre-process the material, resulting in additional non-compostable recovery (steel, plastic, white goods, etc.), increasing the overall recycling rate.

- Typically, less land is required for composting than for landfilling.

- The use of a composting facility will prolong the life of an existing landfill or reduce the size requirements of a new landfill.

- A composting facility can be an integral component of a total solid waste recycling, composting, transfer and disposal system. Many functions can be housed in one facility, increasing the efficiency of the total system. For example, one truck, with three distinct compartments, could haul all organic waste, recyclables and refuse to the same facility, reducing the need for dedicated trucks and reducing travel time and costs.

Disadvantages

- Odors can be a problem for public acceptance as well as for local siting and state permitting if the site is not operated correctly.

- Securing steady markets for the finished compost material may be difficult.

- High quality compost requires intensive pre-processing and/or intensive source separation, and finished product screening, which increases capital and operating costs.

- The addition of another solid waste management component to the solid waste management system may increase system costs.

- A potential for air pollution exists during the composting operation as a result of dust during pretreatment of refuse (shredding) and odors resulting from processing of compostables (windrow turning and static pile aeration).

- Tipping fees at compost facilities are typically higher than at landfills, depending on the type of technology utilized.

- Operational histories for medium to large facilities are very limited. Most problems encountered to date include:

  - Immature compost leading to mold.

  - High levels of visible and chemical contaminants in the compost.

  - Actual throughputs below the design rate.

  - Inadequate source separation and corresponding reduced equipment effectiveness.

  - Odors.

  - Markets for the compost.

COLLECTION SYSTEMS

There are two methods of collecting landscape waste, green waste and mixed municipal waste for composting, namely wet/dry collection (i.e. source separated collection) with dedicated vehicles or compartments and commingled collection whereby all waste is collected in the same compartment of the refuse truck without prior separation of waste.

Wet/Dry Collection Systems. Wet/dry collection systems are a natural extension of solid waste composting operations. A wet/dry collection system collects dry recyclable material (metals, plastic, glass and unsoiled papers) in a separate container than wet organic materials (LSW, food waste, soiled paper). Dry recyclables are collected in one container, similar to existing curbside container programs, and the compostable wet organic fraction is placed in another container. The remaining refuse may be placed in a third container. By managing the wet and dry recyclable materials separately, less cross contamination will occur leading to higher market values for those materials. This method, though, depends entirely on the conscientious participation of the waste generator, because extra effort is required to separate waste into the wet and dry portions. Without wide participation, the purpose of source separation is defeated.

With the development of multi-compartment collection vehicles (garbage trucks with separate compaction units for refuse, recyclables and compostables) and multi-purpose transfer/processing facilities, the separate transportation of different wastestreams can be eliminated. For instance, a hauler can collect recyclables, refuse and compostables on the same route if the vehicle is equipped with compartments for each material. The separate compartments eliminate the possibility of cross-contamination. Table 7-4 provides a partial list of programs that have tested and used multi-compartment refuse trucks. It is not necessary to have a multi-compartment truck to operate a wet/dry collection system.

TABLE 7-4. CO-COLLECTION ACTIVITY WITH MULTI-COMPARTMENT TRUCKS

Location	# of Households Served	Status	Truck Capacity		Recyclables Collected[1]	Crew Size	# of HHs/Day
			Refuse (cu.yd.)	Recyclables (cu.yd.)			
Freeport, IL	3,172	Operating	17	13	A,OCC,T,G,ONP	2	800
Loveland, CO	2,000	Pilot	20	11	T,A,G,ONP,OCC,P	N/A	N/A
Sunnyvalle, CA	2,000	Pilot	N/A	N/A	ONP,OCC,G,PET,A, OIL	1	400
Toronto, Canada	Commercial	Operating	N/A	N/A	OCC,A,MP	N/A	N/A
Southeast, PA	500	Operating	13	9	ONP,G,A,T,P	N/A	200
Shaker Hts, OH[2]	9,000	Operating B.Y.T.R.[3]	16	11	ONP,G,A,P	3	500

Sources: Biocycle, January, 1992 and Personal Contacts.

Notes:

1. HH = Households, A = Aluminum, G = Glass, MP = Mixed Paper, OCC = Corrugated, ONP = Old Newsprint, P = PET and HDPE, T = Tin Cans.

2. This program is different in that the crew collects waste from the back yard of participating households.

3. BYTR - Back Yard Trash and Recyclables Collection.

A typical packer truck can be used to collect the materials, provided that each material type is placed in a separate bag. The bags can be placed in the single compaction unit and hauled to a processing facility where the bags are then separated by type. Unfortunately, cross contamination and bag breakage sometimes occur, reducing the effectiveness of this collection process.

An alternative to using a single collection vehicle for all materials is to use separate vehicles for waste and recoverables, which is the case in many existing curbside programs. Separate collection of distinct types of materials (wet and dry) will increase the costs of collection because additional vehicles and labor are required. However, separate collection vehicles can be designed to handle one type of waste and are not affected if the processing facility and final disposal facility are at different locations. Also, separate collection enables each processing facility type (recycling, composting and transfer) to be designed to handle a more narrow, "clean" material stream, simplifying the process and ensuring compost quality.

If one facility is capable of processing recyclables, composting organic waste and transferring (or landfilling) the refuse, then the economic feasibility of co-collecting all materials in a single vehicle is improved. Other factors that affect the feasibility are crew size, vehicle capacity, population density and participation rates.

In a recent wet bag composting demonstration project conducted in Greenwich and Fairfield, Connecticut (spring and summer, 1992), households sorted their food, landscape waste and soiled paper waste at home in special compost bags. The compost ("wet") bags were weighed and composted at the Fairfield Compost Facility. Recyclables and waste were also kept separate and weighed.

The results of the study, as indicated in Table 7-5, show that of the participating households, 40 percent of the household waste was recycled, 30 percent was composted, and 30 percent was landfilled. Out of an average 47 pounds of waste generated per week per household, 19 pounds were recycled, 14 pounds were composted, and 14 pounds were disposed.

Since collection occurred during March, no landscape waste was collected. From spring through the fall months, the amount of waste collected for composting will likely increase.

TABLE 7-5. RESULTS OF THE CONNECTICUT WET BAG PILOT PROJECT

	Fairfield	Greenwich	Combined Total or Average
Volunteer Households	386	181	567
Recyclables (lbs/hh/wk)	18	22	19
Compostables (lbs/hh/wk)	15	12	14
Waste (lbs/hh/wk)	19	8	14
Total	52	42	47

lbs/hh/wk = Pounds per household per week.

Note: No landscape was available because the collection period was in March, 1992.

Source: Wet Bag Composting Demonstration Project, 1993.

Recently, the Crawford Solid Waste Disposal Agency and Patrick Engineering conducted a food waste study in Robinson, Illinois. Residential and commercial participants were solicited to participate in this source separation study to determine how much food waste could be separated by the participants. Results of this study are summarized below.

Residential participants were given a food waste container and instructions on how to prepare food waste for collection. Over the four week study period, residents source separated an average of 7.6 pounds of food waste (or 21 percent of all refuse, by weight) per week for collection. Surveys were administered to participants and random Robinson residents to estimate what levels of participation could be expected if a separate food waste collection service were offered. Results indicate that 42 percent of all participants and 44 percent of random Robinson residents would use a separate food waste collection service if it were available at no additional charge. If an additional charge was applied, only 6 percent of the participants and 17 percent of Robinson residents would participate. If they were given a backyard composting bin for food waste, 21 percent of participants and 34 percent of random residents would use them. If they

were asked to supplement the cost of the bin, 17 percent of participants and 12 percent of random residents would pay a fee.

Commercial and institutional food service participants were also given a food waste container and instructions on what food to separate. Over the course of the one-week study, these establishments source separated an average of 20 percent of all waste generated on a weekly basis. Surveys were administered to participants and other food service establishments in Robinson to determine what levels of participation could be expected if a separate food waste collection service was available at no extra charge. If no additional charge was applied, 67 percent of all participants and 83 percent of the remaining food service establishments indicated they would use the service. If an additional fee was charged, only 33 percent of all participants and 17 percent of the remaining food service establishments would pay for it.

Various food waste processing alternatives were also evaluated to determine what the total costs would be on a per ton basis. Backyard composting was determined to be the least expensive alternative ($48 per ton to manage food waste) and a local food waste composting facility was determined to be the most expensive ($189 per ton). In addition to these two alternatives, a regional composting facility, on-site commercial composting, land application of food waste, and food waste ensiling were also evaluated.

Separate food waste diversion programs have the potential to divert a large portion of the municipal waste stream. Residential and food service sector participants source separated about 20 percent of all refuse generated over the course of this study. Cost effective management alternatives exist to divert this portion of the municipal waste stream from landfills.

Wet/dry collection systems that have been tested generally support the following findings:

- When a two-stream system is used (one container for dry waste, one for wet waste), a process must be in place to separate unwanted refuse from one or both streams. The refuse, including paint cans, razor blades, hypodermic needles, and

other non-recyclables must be separated by the process. These items pose handling and safety problems.

- When a three-stream system is used (one container for organics, one for dry recyclables, and one for refuse) then a portion of the recoverable fraction may be "lost" to the refuse container. This will lower the recovery rate. However, the three-stream system will provide cleaner material streams because contamination with refuse is minimized. Also, safety concerns are reduced since the potentially dangerous items are disposed in the refuse stream and not commingled in either the wet or dry recyclable streams.

- Collecting the organic waste in bags is typically preferred to collecting the organics in unlined bins. However, in Guelph, Ontario, bins were found to be more acceptable to the participants. The use of bags minimizes food residue left on the bins and the resulting problems with odors, pests, and cleanliness. Cellophane-lined paper bags are preferred over plastic because they readily decompose. Large, 64-gallon wheeled bins are now available that are equipped with special ventilation features to allow air flow and keep odors to a minimum.

- Freezing of wet organics to the bags and bins may be a problem in cold weather. If a plastic bag is frozen to the food waste, then it is impractical to try to separate the bag from the food waste until it has thawed. The result is that plastic will be carried through the system and must be screened out at the end of the process. If the bag is easily compostable, such as a paper bag, then freezing is not an issue because the bag will compost along with the organic waste.

- Food and other organics contain high moisture levels and free liquid may be liberated when handling. The liquid can be contained in plastic or cellophane-lined paper bags, or bins. Liquid typically squeezed from organics in a packing unit may be collected with specially designed liquid containers which are emptied at the compost or disposal site.

- Special commercial generators of food waste, especially grocery stores, are ideally suited for wet/dry collection. Grocery stores generate a significant amount of food waste and it has been demonstrated that source separation can be accomplished with minimal modification to existing waste handling methods. For instance, it was found that nearly 60% of the waste from stores is collected for composting in a food waste collection program in Grand Rapids, Michigan.

Commingled Waste Collection Systems. Source separation of waste into wet and dry fractions requires much more effort on the part of waste generators. Collecting commingled waste (i.e. no source separation of organics from refuse) is another available system. Commingling is much more efficient than source separation, in that all that is needed is a packer truck used to collect waste. For this reason, commingled collection is less costly at the front-end, because no additional labor, equipment purchases or modifications are needed. Collection of commingled waste requires no extra effort to prepare the waste for collection; it is simply picked up as it would be normally.

However, commingled collection can increase total costs, since additional processing is required at the back-end of the system to prepare the waste for composting. This additional preparation step not only increases the system costs, but potential for contamination of the waste exists and the materials which may be separated for recycling are exposed to liquids or food waste possibly decreasing their market value or requiring them to be disposed altogether. This additional residual increases the total amount of waste requiring alternative disposal. The efficiency of commingled collection, the back end costs associated with processing and the potentially lower quality final product must be compared with the additional labor, equipment purchases or modifications and higher quality end product for wet/dry separation before deciding on which collection system to employ.

SITING CONSIDERATIONS

Landscape Waste Compost Facility Siting. Regardless of whether or not LSW compost sites accept waste from outside the local jurisdiction, they are not required to get local siting approval. Nevertheless, all homeowners within 250 feet of the proposed landscape waste compost facility boundaries must be notified and notice must appear in a general circulation newspaper for three consecutive weeks prior to site development. In addition, some counties across Illinois require that special use zoning approval be obtained.

Green Waste or Mixed Municipal Waste Composting Facility Siting. If a green waste or mixed municipal waste composting facility is designed to handle waste from outside the local jurisdiction, then the facility is considered a regional pollution control facility and must obtain siting approval through the siting process outlined in the Illinois Environmental Protection Act, Section 39.2 (discussed in chapter 6). There are no specific regulatory siting criteria for solid waste composting facilities other than those listed in the Act. If the compost facility is located within the boundary of a local general purpose unit of government and intended to serve only that entity, then the facility is not a regional pollution control facility and does not require siting as specified in the Act.

Appropriate Location Criteria. Site location is a key factor in minimizing off-site odor impacts of LSW, green waste and mixed municipal waste compost facilities. The following are some suggested criteria for location and design:

- Proximity to Populated Areas. The facility should be sited in a sparsely populated area. If there are residential enclaves or individual residences surrounding the site, a sufficient setback from the facility to the nearest dwelling should be provided. The statutory setback requirement of one 1/8 mile from the active composting area for a LSW compost facility may not provide a sufficient buffer from odors. It is recommended that at least a 1/4 mile setback be provided from the nearest dwelling and a 1/2 mile setback be provided from the nearest residential enclave.

- Site Buffers. Natural or man-made buffers (trees, berms, fences, etc.) provided around the site can serve to reduce the amount of potential odors from reaching nearby populated areas by diverting off-site airflow.

- Prevailing Wind Directions. Being aware of the prevailing wind directions and the location(s) of sensitive receptors can help minimize off-site odor impacts. The windrows can also be orientated in such a way to provide greater air mixing. Finished material can be located on the downwind side of the site, while the raw material be located furthest from the downwind side.

- Topography. Topography is another factor to be considered. Specifically, does the topography change significantly around the proposed site and if so how does it affect the air quality. For example, if the site is located at a higher elevation with respect to the surrounding area, better air mixing will occur thereby reducing the concentrations of odors.

Non-regulatory siting considerations for LSW, green waste and mixed municipal waste composting facilities include being centrally located within the wasteshed near utilities and services. Since waste is being processed on-site for a longer period of time (compared to a transfer station), there is a higher risk of environmental nuisance, such as odor, litter and vectors.

Location standards for composting operations should reflect the proposed type of compost operation. Facilities that conduct all or the majority of composting activity inside a building are more able to minimize scavenging, litter, odor and runoff problems, and therefore could be placed nearer occupied areas than a facility that relies solely on windrow composting.

ENVIRONMENTAL PERMITS AND CONCERNS

Permitting Landscape Waste Compost Sites. Public Act 85-1429 requires that permits for LSW composting facilities be obtained from the Illinois Environmental Protection Agency (IEPA). The statutory language, as found in the Illinois Environmental Protection Act, Sections 21 and 39, states:

> Section 21(r). No person shall conduct a landscape waste composting operation without an Agency permit, provided, however, that no permit shall be required for any person (1) conducting a landscape waste composting operation for landscape wastes generated by such person's own activities which are stored, treated or disposed of within the site where such wastes are generated, (2) applying landscape waste or composted landscape waste at agronomic rates or (3) operating a landscape waste composting facility on a farm (if the facility meets certain criteria).
>
> Section 39(m). The Agency may issue permits to persons owning or operating a facility for composting landscape waste. In granting such permits, the Agency may impose such conditions as may be necessary to accomplish the purposes of this Act and as are not inconsistent with applicable regulations promulgated by the Board. Except as otherwise provided in this Act, a bond or other security shall not be required as a condition for the issuance of a permit. If the Agency denies any permit pursuant to this subsection, the Agency shall transmit to the applicant within the time limitations of this subsection specific, detailed statements as to the reasons the permit application was denied.

Requirements for obtaining an IEPA permit, as specified in Section 39 (m), include:

1. A legal description of the site.

2. A topographic map of the site with a scale of 200 feet to the inch or larger.

3. A description of the operation, including the area served.

4. An estimate of the volume of materials to be processed.

5. Documentation that the location of the facility includes a setback of at least 200 feet from any potable water supply well.

6. Documentation that the location of the facility is outside the boundary of the 10 year floodplain or the site will be flood-proofed.

7. Documentation that the location of the facility will minimize the incompatibility with the character of the surrounding area, including at least one eighth of a mile setback from any residence.

8. Documentation that the design of the facility will prevent any compost from being placed within 5 feet of the water table; adequately control runoff from the site; and collect and manage any leachate that is generated on the site.

9. Documentation that the operation of the facility will include appropriate dust and odor control measures; appropriate noise control measures for shredding, chipping and similar equipment; management procedures for composting containment and disposal of non-compostable wastes; and limitations on operating hours.

10. A description of procedures to be used for terminating operations at the site and record keeping sufficient to document the amount of materials received, composted and otherwise disposed. The operator must submit a written annual statement to the Agency on or before April 1 of each year that includes an estimate of the amount of materials, in tons, received for composting.

Permitting Green Waste and Mixed Municipal Waste Composting Facilities. The Illinois Environmental Protection Agency is also responsible for permitting all green waste or mixed MW composting facilities. The environmental permits required for a green waste and mixed municipal waste compost facility in Illinois include:

- LPC-PA1 General Application for Permit.

- LPC-PA4 Application for Operating Permit.

- LPC-PA6 Application for a Permit to Develop a Solid Waste Composting Facility.

- LPC-PA8 Certification of Siting Approval.

- LPC-PA11 Closure Plans and Post Closure Plans.

- LPC-PA16 Notice of Application for Permit to Manage Waste.

Environmental Concerns at Composting Facilities. A composting facility can potentially impact air, water and land quality. Odor, noise, dust and particulate matter are created from the various processing activities associated with a composting operation. Such activities include waste tipping, shredding, screening, and transferring operations. Depending on the process design and particular steps taken to control the quality of the product, composting has a number of sources of potential exposure to pathogens, toxic substances and other hazards. Although these problems can be serious, proper design control and operation can minimize these issues.

Particularly for mixed municipal waste compost sites, the air emissions resulting from dust and particulate matter can be controlled by conducting the operations in an enclosed building. To ensure that these emissions are maintained inside the building an air handling and filtering system should be installed. Establishing a negative air pressure inside the facility building will prevent airborne dust and particulate matter from escaping the building through uncontrolled openings, such as doors and windows. Dust collection ducts with filter or baghouse installations can be installed over the processing conveyors, shredders and screens to collect any airborne particulate matter as it is generated, minimizing airborne matter. Proper fresh air quantities should be supplied to worker areas to minimize health risks to workers.

Noise, litter, and odor can also be potential problems of a composting facility. Noise and litter can be controlled or minimized by fully enclosing the receiving and processing areas. Noise can be further minimized by proper selection of building components and equipment types. Properly aerating the compostables during the compost process will result in minimal odor generation. Air should be exhausted through an odor abatement device. Biofilters are currently being used at a number of composting operations.

Pests, such as birds and rodents, can be effectively minimized by conducting the primary high-rate degradation in an enclosed structure. During the final phase of stabilization, or curing, pests and odors are generally not a problem, so curing can be conducted outside on a constructed pad with water and leachate collection.

Degradation of the surface water quality may be a potential problem occurring from washdown procedures of the facility floors and equipment. The washdown water may be treated on-site or held in a detention pond on-site before being released into the municipal sewer system. Groundwater can be protected by controlling, collecting and treating leachate. Leachate generation in enclosed environments is minimized because moisture addition is controlled. In open environments, precipitation is a primary factor in the production of leachate.

To further minimize environmental impacts, the facility should be sited in a remote or industrial zoned area. Sensitive areas such as residentially zoned areas should be avoided.

Compost facility workers are exposed to a number of potential hazards. Occupational exposure to volatile organic compounds may be of concern if ventilation is inadequately designed and maintained. Other hazards include primary human pathogens (from diapers), secondary pathogens (spores), metals and other inorganics (such as asbestos), allergens and explosive and caustic materials (like needles). All of these should be considered when designing a compost education, collection and processing system.

ECONOMICS OF COMPOSTING

Economics of LSW Compost Sites. The costs of a LSW compost facility are based on the developmental costs related to siting and permitting the facility, constructing the site, equipment purchases, and operating and maintenance costs in addition to those costs associated with marketing the final product. LSW composting can be a cost-effective management technique as long as tip fee revenues cover costs, product quality is good, and supply is consistent. The tip fee at the DeKalb County landscape waste composting site is $9.00/cubic yard.

Economics of Solid Waste Composting. The costs for a mixed municipal waste composting facility are based on the development costs related to permitting and siting of the facility, the construction costs of the facility, equipment purchases, costs associated with marketing the final product, and the on-going operation and maintenance costs. These costs vary depending on the type of technology selected: windrow, aerated static pile, or in-vessel. The operating and capital costs are also dependent upon the effectiveness of source separation programs. Cost estimates are presented in this section for each of the following composting technologies: 1) windrow composting; 2) aerated static pile composting; and 3) in-vessel composting. The cost estimates for these three technologies are based on data from existing mixed MW composting facilities.

Economics of Windrow Composting. The Fillmore County composting facility located in Preston, Minnesota employs the windrow method of composting. The Fillmore County facility began its operation in August, 1987. The facility was designed to handle 11 tons of mixed municipal waste per day. Currently, the facility is processing approximately 8 tons of waste per day. The County employs 18 operating personnel at the facility including eight disabled workers.

The County has mandatory curbside recycling in cities and private haulers are expected to enforce it. The recycling program requires a three bag system; one bag contains recyclables; one bag contains compostables; and one bag contains garbage. The processing building has two

processing lines. Recyclables are sorted on one line and compostables are handled on the other. Recyclable materials such as old corrugated containers, glass bottles, newspaper, metal cans, plastic bottles, white paper and clothing are sorted by hand. The remaining compostable material is processed by a shredder to reduce the particle size to four inches or less. Water is then mixed with the shredded material to achieve a 55% moisture content. The mixture is then transported and formed into windrows using a front-end loader.

During the windrow composting process the material is turned once or twice a week. In the summer it takes about 10 weeks for the digestion process and in the winter it takes about 14 to 16 weeks. After the composting is completed the material is put through a ½-inch trommel screen. The over-sized material is sent to a landfill, and the remaining portion is stockpiled and made available for landfill cover, farmers, nursery owners, and the public at no charge. The compost is considered Class I which means it can be used in any soil application for Minnesota.

The capital cost for this facility totals $1,400,000. The annual operating costs in 1988 and 1989 were $251,669 and $278,795, respectively. As of May, 1993, the tipping fees were $40 per ton for compostables and $70 per ton for garbage. If the material is brought to the facility mixed, i.e., recyclables and yard waste mixed with refuse, then the tip fee is $125 per ton. Roughly 43% of the incoming material is landfilled, 17% recycled, and 40% is composted.

Economics of Aerated Static Pile Composting. The Swift County composting facility, located in Benson, Minnesota, uses a modified version of the aerated static pile method of composting. Swift County also has a mandatory three bag curbside collection system. Swift County residents separate their wastes into three components: recyclables, compostables and refuse (non-processibles). Swift County began operating its facility in May, 1990. The facility employs four full time and two part time operators. The facility handles about 13 tons per day of compostable and non-compostable material, and four tons per day of recyclable materials. Pickers on the compostable line remove and send any bulk items to a landfill. A hammermill is used to shred the picked waste and a 1-inch trommel screen is used for screening. The screened oversized material is sent to a landfill, while the undersized material is formed into

windrows using a front-end loader. The windrows sit on top of grates that allow forced air to come up through the bottom of the windrow piles. The windrows are turned once or twice a week. Any leachate formed from the windrows is collected and reapplied on the compost material. The composting process takes about six months time.

After composting, the material is screened to a 1-inch particle size. The finished product was recently used as a landfill cover, because a high level of inerts made the compost a Class II compost. The capital cost of this facility was approximately $1,615,900 in 1990. The composting equipment was slightly more than 25% of the capital cost. The annual operating cost was approximately $255,536 for the first year of operation. As of December, 1993 the tipping fee was $80 per ton. The residue percentage was 20%, recycled percent was 35% and composted fraction was 45%.

Recent renovations at the facility includes a windrow turner, mixer, screens, and a destoner designed to remove inert material from the compost. The improvements cost $327,000. It is hoped that the new equipment will allow the facility to produce a Class I compost, which has stricter standards for inerts and heavy metals than Class II.

Economics of In-Vessel Composting. The Recomp composting facility located in St. Cloud, Minnesota uses the in-vessel method of composting. The Recomp facility receives waste from a tri-county area. Curbside separation of recyclables such as corrugated paper, newspaper, glass, steel, aluminum, PETE, and HDPE plastics is mandatory in the tri-county area. Recomp receives nearly 170 tons of waste per day from city and private haulers, and charges a tipping fee of $89.67 per ton. The Recomp facility employs 20 operating personnel. The facility operates six days a week. The facility has recently undergone modifications, adding a building with a Royer agitated bed system and an odor control biofilter system during the 1991-1992 winter. Recomp has received a 5-year permit to compost 60 tons per day of refuse and 15 tons per day of a nitrogen source (from sewage sludge).

After waste is received at the facility, sorting/picking is used to remove any oversized material. Waste is then moved into a trommel screen having a 6-inch screen size. The

oversized portion is sent to the Elk River Resource Recovery RDF Facility for eventual incineration. The undersized material is conveyed into one of the two Eweson digester vessels. Moisture is added at the front of the digester. Only one digester is used due to the permit limit of 60 tons per day. The composting material slowly passes through the vessel over a three day period. When the material leaves the digester, it is transported by a conveyor outside the building to a 1½ inch screen. The undersized material passing through the screen is transferred to another building and placed in one of eight Royer troughs for a period of approximately 30 days. The remaining oversized portion is sent to a landfill. After 21 to 30 days in the trough system, the compost material is sent to an exterior concrete pad for final curing another 30 days. The total residue material is roughly one third of total incoming waste.

The estimated capital cost of the Recomp facility is approximately seven million dollars to date. Recomp continues to modify the system. Prior to the installation of the new building and biofilter, the annual operating cost for this facility was approximately one million dollars. The annual costs, for 1993, are estimated at five million dollars.

A summary of this facility, as well as a number of other operating facilities in the U.S., are presented in Table 7-6. The tipping fees range from $0 to $90 a ton. It should be noted that facilities that do not charge a tipping fee are located in regions where the soil is generally nutrient deficient. Most facilities pre-process the waste to improve compost quality by recycling materials and rejecting inert material. The amount of reject material averages 30% of incoming waste. The amount of material recycled averages 15% and amount composted averages 55% using values submitted by 12 compost facilities. By reducing the amount of material put through the compost operation, the size of the composting operation can be reduced, reducing the capital costs. The average capital cost for the 20 facilities listed in Table 7-6 is $130,000 per design ton per day.

TABLE 7-6. SUMMARY OF SOLID WASTE COMPOSTING FACILITIES IN U.S.

Facility Location	Design Capacity (TPD)	Waste Separation	Type of Composting	Capital Cost ($)	Tip Fee ($/Ton)
Lakeside, AZ	15	Manual & Mechanical	In-Vessel	775,000	0.00
Baltimore, MD	700	Manual & Mechanical	In-Vessel	42,000,000	N/A
Mackinac Island, MI	1.6	Manual	Aerated Static Pile	2,300,000	Variable
Columbia County, WI	80	Manual & Mechanical	In-Vessel	3,550,000	33.00
Escambia County, FL	400	Manual	Windrow	536,000	30.00
Buena Vista County, IA	70	Manual & Mechanical	Windrow	1,910,000	35.00
Sumter County, FL	200	Manual	Windrow	5,000,000	35.00
Montgomery County, KS	300	Manual	Windrow	N/A	16.40
Mora, MN	500	Manual & Mechanical	Aerated Static Pile	12,900,000	87.00
St. Cloud, MN	75	Manual	In-Vessel	7,000,000	89.00
Wright County, MN	165	Manual	Aerated Windrow	13,800,000	89.00
Martin/Faribault Counties, MN	100	Manual & Mechanical	In-Vessel	8,600,000	50.00
Pennington County, MN	80	Manual & Mechanical	Windrows	1,700,000	45.00
Filmore County, MN	11	Manual	Aerated Windrow	1,828,499	40.00
Swift County, MN	40	Manual	Aerated Windrow	1,700,000	80.00
Lake in the Woods, MN	10	Manual	Static Pile	600,000	40.00
Big Sandy, TX	25	Manual	In-Vessel	N/A	3.00
Ferndale, WA	125	Manual & Mechanical	In-Vessel	8,000,000	90.00
Sevier County, TN	225	Manual & Mechanical	In-Vessel	6,500,000	30.00
Portage, WI	40	Manual	In-Vessel	1,100,000	35.00

Sources:

1. Phone Survey with individual facilities, December 2, 1993
2. U.S. Solid Waste Composting Facility Profile, by U.S. Conference of Mayors, March, 1993.

Table 7-7 suggests that approximately 66 percent of the municipal waste in DeKalb County is compostable (from Table 5-4, DeKalb County Waste Managment Needs Assessment). This table also indicates the potential size and cost of a facility to manage the County's waste. However, this table includes paper and corrugated materials that can be recycled instead of composted. If only food waste and landscape waste are composted, then approximately 25 percent of DeKalb County's municipal waste can be composted.

TABLE 7-7. TOTAL COMPOSTABLE WASTE IN DEKALB COUNTY (TONS PER YEAR)

	Municipal Waste
Paper	35,208
Landscape Waste	10,305
Food Waste	11,164
Total Compostable	56,677
FW & LSW Only[1]	21,469
Facility Size (TPD)[2]	77
Approximate Capital Cost[3]	$6,160,000

Source: DeKalb County Waste Management Needs Assessment.

Notes:
1. FW & LSW refers to Food Waste and Landscape Waste.
2. TPD refers to Tons Per Day. Figured on a 280 day operation processing only green waste.
3. Assumes a capital cost of $80,000 per design ton. Not intended to be a detailed cost analysis. Assumes processing green waste only.

A composting facility sized for the County to handle food and landscape waste alone would require the capacity to handle 77 tons per day at an estimated capital cost of between $5.2 and $6.2 million. The debt service costs are estimated to be between $26 and $31 per ton. The operating and labor costs are estimated to be approximately $30 per ton. Therefore, the resulting tipping fees required to offset the cost of operation and debt retirement of a green waste composting facility are estimated to be $56 to $61 per ton, much higher than existing local and regional landfills.

Most mixed MW compost operations around the country charge tipping fees between $35 and $90 per ton. In a study conducted for the Kane County Development Department, the operating costs for a Kane County solid waste composting facility designed to handle all municipal waste was estimated to cost $74.82 per ton in 1991 dollars, which is over $84 per ton in 1994 dollars. MW compost facilities require extensive front-end processing and back-end screening to produce an acceptable compost, and therefore the operating costs and equipment requirements are increased.

Markets for Finished Compost. Markets for the finished product should be considered in the earliest phases of consideration, since market considerations should dictate the technology utilized. A chemical analysis of the compost should be made to determine the potential markets for this material. The more contaminated the compost material is, the more its sale will be restricted. Potential markets of compost material may include:

- Public agencies for road construction, parks and schools;
- Land reclamation or mine reclamation;
- Landfill cover;
- Private non-agricultural uses that would include landscaping, tree farms, sod farms, and golf courses;
- Soil dealers for bulk soils, or bagging operations; and
- Agricultural uses.

To secure compost markets, a high quality product and continuous (or regular) supply must be ensured. The higher the quality, however, the higher the capital and operating costs will be. Some other factors affecting marketability of compost include:

- Contaminant levels including glass, plastics, metals, and toxic chemicals;
- The benefits of the composting material including nutrient levels and water retention capabilities;
- Published standards and performance data for good compost; and
- Cost and availability of the product.

COMPOST PROCESSES AND COLLECTION SYSTEMS RECOMMENDATIONS

Listed below are the preliminary recommendations for composting of landscape waste, green waste and municipal waste and wet/dry collection systems.

Landscape Waste Collection and Management. The following activities should be pursued by the County to encourage the preferred management of landscape waste:

- Since the landscape waste composted in DeKalb County makes up 10 percent of the municipal wastestream, the County should encourage its continued success.
- The County should encourage residents to leave grass clippings on the lawn or compost landscape waste in their own backyards.
- The County should encourage residents to utilize the DeKalb County Landscape Waste Facility instead of burning landscape waste in their yards.

- The processing and marketing of landscape waste should remain the responsibility of the private sector.

- The County should encourage the use of composted materials.

- The County should investigate the implementation of special collection and management programs for landscape waste which is difficult for residents to manage in their own back yards, such as large diameter landscape waste, storm damage and Christmas trees.

Green Waste Composting. Should landfill availability decrease and tipping fees in the region increase, the relative economics of green waste composting may become more attractive. Green waste accounts for approximately 25 percent of the municipal waste. It is recommended, therefore, that:

- The County should review the green waste composting option in the five year update to the Plan.

- Any proposals by the private sector regarding green waste composting should still be encouraged and considered, but issues such as odors, markets for compost and cost impacts to residents, should be convincingly addressed by would-be developers.

- The County should not pursue a County-owned green waste processing due to the already successful recycling programs in the County.

Wet/Dry Collection Systems. Wet/dry collection systems are not recommended components of the County's plan at this time. A wet/dry system relies on the existence of a green waste composting facility. Until such a compost facility is implemented in or near the County, a wet/dry collection system is not feasible.

Municipal Waste Composting. Municipal waste composting is not a recommended component of the County's plan at this time, based on the relatively high capital and operating costs associated with municipal waste composting, the lack of established markets for the compost in the region, the lack of support for mixed waste composting from the State, and the lack of extensive information and experience on the reliability of mixed municipal waste compost systems.

If landfill availability decreases and tipping fees in the region increase, the relative economics of municipal waste composting and wet/dry collection may become more attractive. It is recommended, therefore, that these options be reviewed as new information becomes available or in the five year updates to the plan. Any proposals by the private sector regarding mixed municipal waste composting should still be considered, but solutions to problems such as markets for compost should be convincingly demonstrated by would-be developers.

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CHAPTER 8
INCINERATION FOR ENERGY RECOVERY AND VOLUME REDUCTION

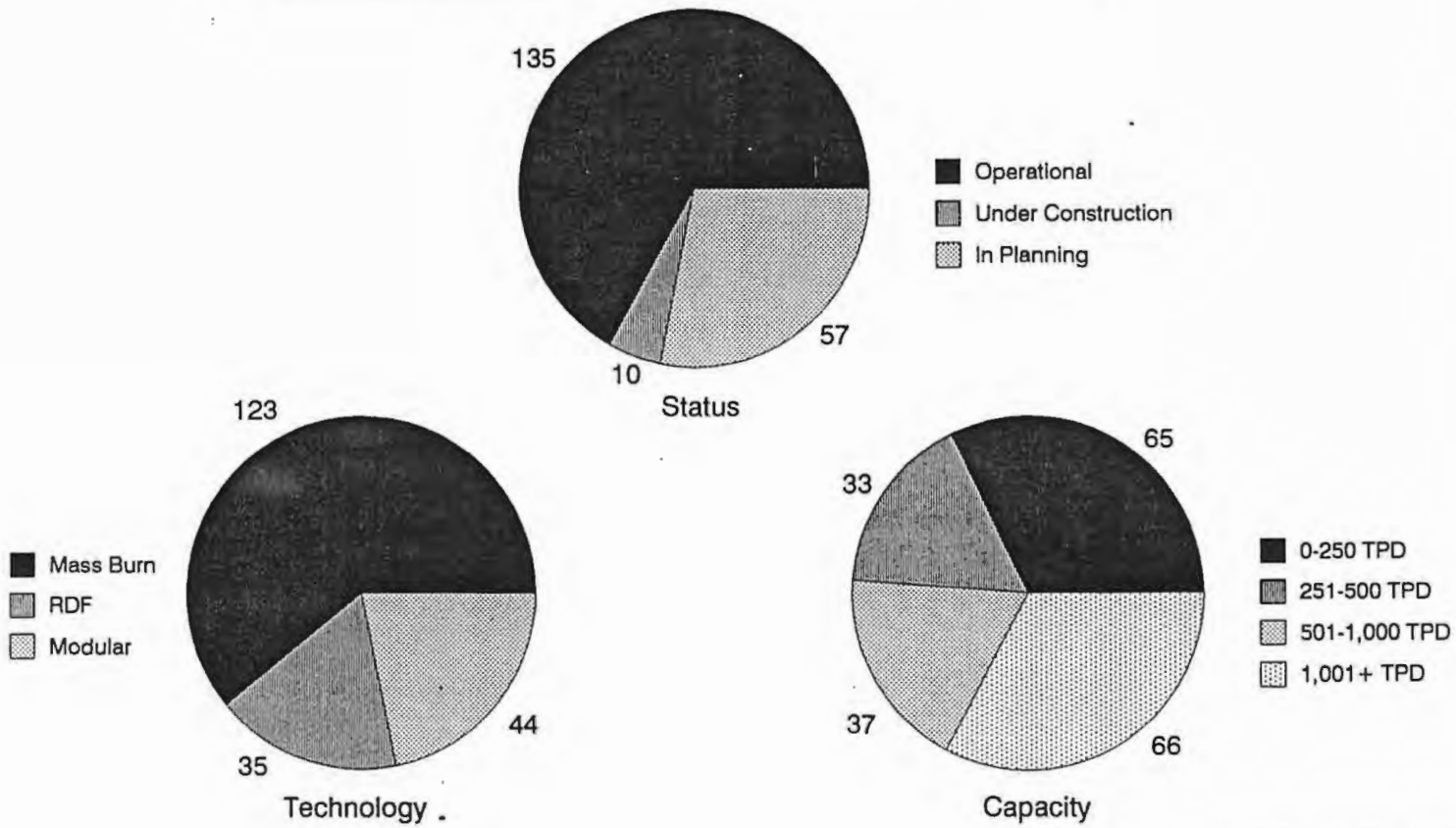
This chapter discusses the technical aspects and issues surrounding the implementation of incineration for energy recovery and volume reduction. While volume reduction is an important aspect of incineration, energy recovery is important for both environmental and economic concerns. This chapter will focus on waste-to-energy as the primary function of incineration because incineration for volume reduction is typically not feasible under current regulations and economic conditions. In the United States and Canada 128 waste-to-energy facilities and 34 waste incinerators (for volume reduction) were operational in June, 1993. Figure 8-1 shows the distribution of these facilities according to technology.

TRENDS IN WASTE-TO-ENERGY DEVELOPMENT IN ILLINOIS

The 1986 Illinois Solid Waste Management Act (P.A. 84-1319) created a hierarchy of solid waste management techniques. These include: 1) volume reduction at the source, 2) recycling and reuse, 3) combustion with energy recovery, 4) combustion for volume reduction, and 5) disposal in landfill facilities. Ideally the waste stream would be managed by implementing each step of the hierarchy in sequence. In reality this methodology is beyond the capabilities of some communities due to the capital requirements of the combustion options.

Illinois currently has one operating municipal waste-to-energy facility, the Chicago Northwest Waste-to-Energy Facility. The Illinois Environmental Protection Agency has recently permitted one other facility, the Robbins Resource Recovery Facility. Two other waste-to-energy projects have received siting approval from the central Illinois towns of Beardstown and Havana.

WASTE-TO-ENERGY FACILITIES IN THE U.S. AND CANADA (1991)



Source: 1991-1992 Waste-From-Energy Report, Solid Waste & Power

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FIGURE 8-1

The Chicago Northwest Waste-to-Energy Facility is owned and operated by the City of Chicago. It began operation on September 1, 1970 and is one of the oldest waste-to-energy facilities in the nation. When operating at peak capacity, the facility burns 1,600 tons of municipal waste in one day. This facility generates electricity and also supplies steam to the Brach Candy Company.

The Robbins Resource Recovery Facility is in the developmental stage. Local siting has been approved and the IEPA permits have been issued. The developers of the $300 million facility are negotiating with numerous communities to agree to a 20 year contract to provide waste to the facility at a specified price. At least 10 communities must sign contracts before financial backers will provide funding. Once the facility is constructed, it will be capable of burning 1,600 tons of solid waste per day and will generate 50 megawatts of electricity.

The Havana City Council approved siting of a 1,800 ton per day facility in December, 1993. The approval is being appealed to the Illinois Pollution Control Board. The Beardstown City Council approved the siting of a 1,800 ton per day facility in February, 1994. The Beardstown siting approval is also being appealed. Both projects are based on receiving and burning processed refuse from the Chicago area to generate electricity for sale to a local utility.

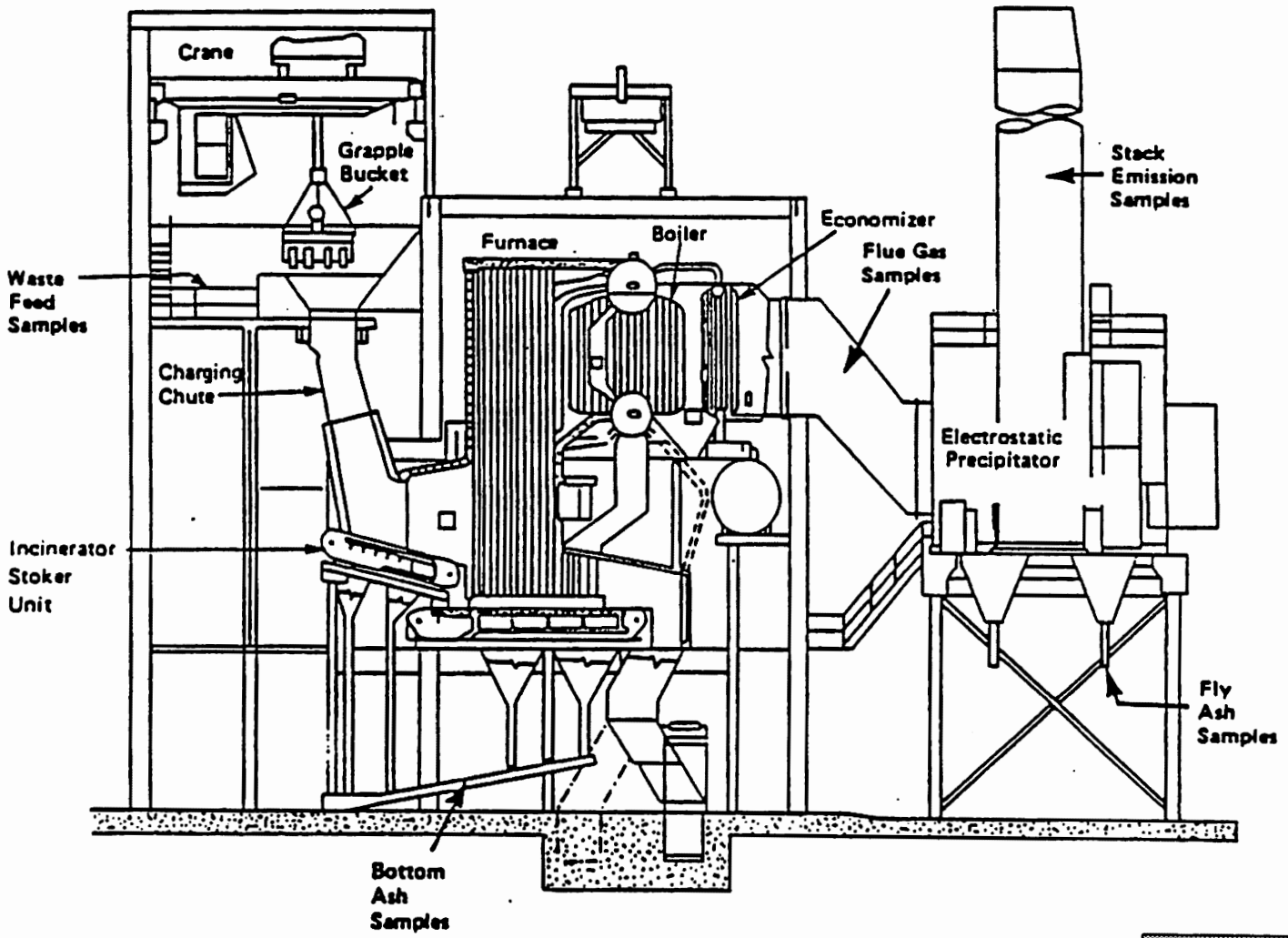
Northern Illinois University (NIU) retained Advanced Energy Systems Co., Inc. (AES) during the fall of 1993 to analyze the feasibility of incinerating the University's wastestream. The analysis evaluated a 24 ton per day facility, operating 5 days per week, year round. The study indicates that the University's waste generation rate varies from between 150 and 400 tons per month and the incinerator would burn between 7 and 19 tons per day, including waste currently landfilled and material currently being recycled. The 24 ton per day facility would be capable of burning all of the waste generated, and suggests that burning recyclable paper for its energy content should be considered. The cost estimate for the 24 ton per day facility is approximately three million dollars. The final report was submitted to NIU in April of 1994 and is currently under review.

TECHNOLOGY AND CONFIGURATION

All waste-to-energy facilities have the same basic components. A combustion chamber equipped with components to move the waste through the chamber is located on the front end of the unit. A boiler is used next to convert the heat generated in the combustion chamber into steam. The boiler also lowers the temperature of the flue gases before they enter the air pollution control equipment. An economizer can be used to further reduce the temperature of the flue gases. This is important to reduce the amount of organic gases that are formed in certain temperature ranges. Hot water generated in the economizer can be used as an energy product. The air pollution control equipment will vary depending on the combustion technology used and the site-specific air permits. The following sections describe the different waste-to-energy technologies and configurations in more detail.

Mass Burn. Mass burn waste-to-energy facilities are the most common type of facility constructed. The term mass burn comes from the facility combusting the entire mass of the waste stream. Lately, the term has been used to signify a large field-erected facility. These facilities are capable of combusting over 250 tons of municipal waste per day. Figure 8-2 shows a mass burn facility.

All mass burn facilities have the same basic components: a combustion chamber, a boiler, and air pollution control equipment. The combustion chamber is charged with waste to be combusted. Some facilities are continuous charged and others are batch charged. Continuous feed facilities are more common and usually more efficient due to the relative stability of the furnace temperature. The combustion chamber is equipped with a mechanism that moves the waste through the combustion chamber. The. three most common mechanisms include reciprocating grates, push-rams and a rotary chamber.



MASS BURN, FIELD ERECTED WTE FACILITY

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FIGURE 8-2

A reciprocating grate system uses a set of grates that alternatively lift (or push) the waste and move it forward. Once one set of grates has moved the waste forward, it sets the waste down and returns by dropping below the other grates and moves back to its original position. The grates are inclined slightly along the length of the combustion chamber to allow gravity to assist in the process.

Push-rams are arranged in a step like fashion along the length of the combustion chamber. The waste is pushed from one step to the next lower step by a plate attached to the ram. The rams alternate to prevent the buildup of waste and ash behind the ram.

A rotary chamber is a long perforated cylinder that rotates along its longitudinal axis. The cylinder is inclined to move the waste through the chamber with the assistance of gravity. Perforations in the cylinder allow combustion air to enter the chamber.

Fluidized-bed combustors use different combustion technology to burn the waste. In this type of combustor, underfire air is forced through a bed of loose sand and limestone. This mixture creates turbulence within the combustion chamber resulting in higher combustion efficiencies at lower temperatures. The limestone in the bed mixture reduces the acid gases produced. Particulates are reduced by lower air velocities within the combustion chamber. The proposed Robbins facility will use two fluidized bed combustors to burn 1600 tons per day.

There are primarily two types of energy recovery systems used for mass burn combustion: waterwall and refractory-lined. In a waterwall system, the furnace wall is made up of water-filled tubes which absorb the heat during the combustion of the waste, creating steam. A refractory-lined system consists of a combustion chamber lined with a thick (six to eight inches) heat resistant coating. The main difference between a refractory-lined unit and a waterwall unit is that with a waterwall unit, the boiler is part of the combustion chamber, whereas in a refractory lined unit, the boiler is located downstream of the combustion chamber.

The purpose of the combustors is to properly mix the refuse to enhance combustion efficiency and to feed the material through the combustor. The operating conditions that can be

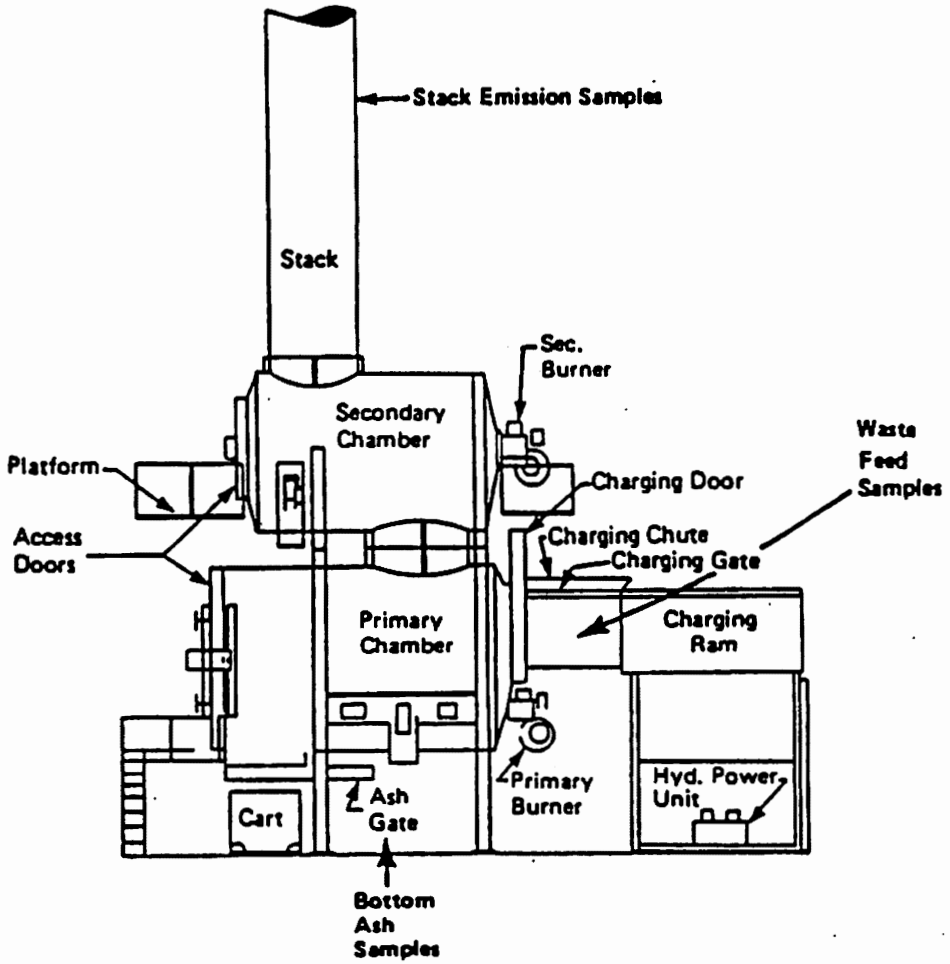
controlled in mass burn systems are the waste feed rate, the oxygen concentration in the combustion chamber, the temperature within the combustor, the auxiliary fuel firing rate and the residence time. Monitoring and adjusting these variables is essential to the proper combustion of municipal waste, because waste is not a homogeneous fuel. These variables are typically computer controlled using temperature sensors and other devices.

Once the gases are emitted from the combustion chamber, they may pass through a secondary combustion chamber, additional heat exchangers and finally through air pollution control devices. The bottom ash is removed from the combustion chamber and the fly ash is removed from the air pollution control systems.

Waterwall systems are becoming more common than refractory lined systems because the boiler or heat recovery capabilities of the waterwall systems are 3 to 10 percent more efficient. In addition, refractory lined systems require a larger volume of air for both the combustion process and for cooling the furnace wall and grate system. This results in increased costs for refractory systems because the cost of the furnace draft system and air pollution control equipment is dependent on the volume of air passing through the systems.

The majority of mass burn facilities are field erected. Field erected facilities are constructed at the site. While some parts and equipment are fabricated in an off-site shop, the majority of the construction takes place at the site. By contrast, some smaller combustors are modular and constructed off site in modular form.

Modular. Modular units provide the advantage of shorter start-up times but their capacity is much smaller than can be achieved with a field-erected facility. If larger capacities are required, more than one modular unit is installed at a facility. These units are constructed off-site in modules which are then pieced together at the facility site. Technically, most modular incinerators are mass burn combustors due to the combustion of unprocessed waste. Figure 8-3 shows a starved-air modular facility.



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MODULAR WTE FACILITY

FIGURE 8-3

The majority of modular units use starved air combustion technology. Starved air combustion involves two combustion chambers. The primary chamber operates at approximately 40 percent of the theoretical air required for total combustion of the waste. This primary chamber uses incomplete combustion to convert the waste into charred residue and combustible gases. The gases are vented to a secondary chamber, mixed with additional air and combusted. Even though the process is called starved air, the actual air usage by all of the chambers amounts to approximately 140-160 percent of the theoretical air requirement.

The primary advantages of starved air modular facilities are as follows:

- They are quicker and easier to build because many of the components are factory assembled.
- They result in less production of particulate matter than mass burn facilities.
- They are more appropriate for smaller waste streams.
- Traditionally the capital costs have been less than those for field-erected mass burn systems.

Disadvantage include:

- Thermal efficiency is less than mass burn systems.
- Not suitable for large waste streams.

Refuse-Derived-Fuel (RDF). RDF technology is used to process municipal waste prior to combustion. Processing is accomplished utilizing shredders, hammer mills, trommels, magnetic separators, screens, air classifiers and typically a significant number of laborers. The purpose is to recover non-combustible material such as glass and metals prior to combustion. Combing through the waste looking for explosives such as propane tanks has proven to be a

necessity at virtually all RDF plants. Currently, 19 of the municipal waste combustors in the U.S. and Canada use RDF technology. The Robbins incinerator project will include a $30 million material recovery facility which will recover recyclable materials and reduce the amount of inert material that will be burned.

RDF is a two stage process. The first stage is the preparation of the RDF utilizing separation technologies. Once the RDF is prepared it can be further processed into a densified RDF (e.g. pellets). The second stage of the process is the actual combustion of the RDF. This can be accomplished through co-combustion with coal in coal fired power plants or through a RDF dedicated furnace/boiler. The furnace/boiler system may utilize a spreader stoker with a moving grate or a fluidized bed furnace.

The advantages of RDF include:

- RDF is a more homogeneous fuel with a higher heat content than unprocessed waste.

- RDF is a fuel that may be burned as a supplemental fuel in an existing coal fired boiler (which eliminates the need to construct a new combustion facility) and thus is more marketable as a fuel than unprocessed waste.

- An RDF waste processing system offers the potential for increased material recovery in areas where recycling opportunities are minimal.

- Removal of inert, non-combustibles results in fewer operational problems in the combustor (explosions, grate jams, slagging, etc.).

- The potential for reduced air emissions and ash generation exists.

The disadvantages of RDF include:

- Processing equipment is energy intensive and requires frequent maintenance.

- Materials recovered during RDF processing are more contaminated, and therefore more difficult to market, than materials separated at the source of generation (i.e. curbside recycling).

- In order to avoid constructing a boiler dedicated to burning only RDF, a suitable and long-term market for RDF must be found. Markets for RDF have been difficult to find.

- High speed hammermill shredders, which are often used to shred waste, have been prone to explosions and must be designed to withstand explosions.

Source separation recycling programs are beneficial in removing inert materials such as steel, glass and aluminum from the waste stream. This results in a higher quality RDF product and reduces the equipment required for processing the waste stream.

WASTESTREAM COMPOSITION AND QUANTIFICATION

An important consideration when designing an energy producing system is the quality and quantity of the fuel or combination of fuels. In the case of a municipal waste combustor, the fuel quality will be a function of the wastestream composition. The quantity of waste will play a role in sizing the facility and determining if auxiliary fuels are required. Sizing of the bypass and ash disposal facilities will also depend on the waste quantity.

Current Disposal Rate and Facility Sizing. According to the DeKalb County Waste Management Needs Assessment, approximately 73,000 tons of total solid waste are currently landfilled from the region each year. If the County constructs an incinerator to dispose of the

waste currently landfilled, the daily capacity of the incinerator would need to be approximately 200 tons per day. To determine design capacity, assume that the incinerator operates 365 days per year at an availability of 83 percent and the maximum seasonal variation in waste generation is 38 percent, as shown in the Needs Assessment. The resulting required design capacity is 280 tons per day. A large modular combustor system or small site built system capable of burning 300 tons per day is appropriate, incorporating three 100 ton per day combustion trains. The extra 100 ton per day unit is needed to allow for the seasonal variation in waste quantities, growth in waste generation over the next 20 years, and scheduled maintenance on each unit while providing uninterrupted disposal for the area's total disposal rate. The waste quantities landfilled average at or below 200 tons per day for six months during the year. During the other six months, the quantity is over 200 tons per day.

Alternative sizing techniques can be used which minimize the size of the facility and rely on bypass capacity at landfills. For example, four 50 ton per day units (200 tons per day total) would be capable of burning all of the County's waste six months out of the year, if equipment down time is minimal. During the other six months, some waste must bypass the facility and go directly to a landfill. During equipment down time, additional waste must bypass the facility. Although more waste must be landfilled, this sizing method will reduce the cost of the facility significantly (approximately 10.9 million dollars).

Heating Value. The County's Waste Management Needs Assessment also characterized the municipal wastestream by dividing the wastestream into several constituents. The relative amounts of these constituents will impact the heating value of the waste. The amount of heat that a given amount of waste will generate when combusted is called the heating value. In general, heating values of municipal waste range from 3,800 to 6,000 Btu/lb with an average of approximately 4,500 Btu/lb. The heating value of waste can be approximated by looking at the heating values of the constituents of the waste. Waste constituents include paper, landscape waste, food, plastic, glass, metals, and others. Table 8-1 gives the probable composition of DeKalb County's waste and also gives the approximate heating values for the individual constituents. The average heating value of all waste is estimated to be between 4,990 and 5,740 Btus per pound of waste.

TABLE 8-1. DEKALB COUNTY'S WASTE COMPOSITION AND HEATING VALUE			
Waste Constituent	Total Tons Per Year[1]	Percent of Total Waste	Approximate As-Received Value (Btu/pound)[2]
Paper	35,208	47	7,000
Glass	4,294	6	0
Metals	5,152	7	0
Plastic	7,729	10	9,500 - 17,000
Food	11,164	15	2,500
Other[3]	12,022	15	2,500
Total	75,569	100	4,990 - 5,740

Notes:
1. Values taken from the Waste Management Needs Assessment report. Landscape waste is excluded.
2. The values are estimates of material heating values as received which are normally lower than published, dry heating values. As-received waste contain between 20% and 30% moisture.
3. Other includes textiles, rubber, wood, grit and miscellaneous materials.

Recycling Effect. A common misconception regarding municipal waste combustors is that these facilities are not compatible with recycling. While recycling will reduce the amount of waste entering a combustor, the heating value of the wastestream may actually increase. Table 8-2 shows the effect of recycling on the heating value and the ash content of the wastestream. The most beneficial part of recycling is the removal of metals and glass from the wastestream. The removal of metals and glass reduces the amount of ash and increases the fraction of combustible material in the wastestream. This results in a higher heating value for the remaining wastestream. Removal of metals will also assist in the removal of household and automobile batteries which can reduce the wastestream's lead, cadmium and mercury content. Lead acid batteries (automotive batteries) contributed 64% of the lead in the wastestream in 1988. Illinois law prohibits lead acid batteries from being disposed in landfills or incinerators. Household batteries contributed 52% of the cadmium in waste in 1988 and 88% of the mercury discarded in 1989. The removal of aluminum from the wastestream is also beneficial. Aluminum will melt within the combustor and clog grates and air inlets causing expensive downtime and repairs.

TABLE 8-2. EFFECT OF RECYCLING ON FUEL QUALITY				
Materials Recycled	Recycling Rate (%)	Moisture Content (%)	Remaining Ash (%)	Heating Value (BTU/lb)
None	0	25.2	29.9	6497
Combustibles Only	4.9	25.2	31.1	6389
Inerts Only	6.7	26.8	23.4	7105
Yard Waste Only	9.0	22.7	30.7	6444
Inerts & Yard Waste	15.7	24.4	23.7	7099
Combustibles, Inerts & Yard Waste	20.6	24.3	24.7	7003
Maximum Combustibles, Inerts & Yard Waste	36.6	24.4	24.3	6955

1. All percentages are on a weight basis.
2. Remaining Ash and Heating Value are on a dry basis.

Source: Herrman, Robert H., Berry, John R., "The Impact of Recycling and Pre-Combustion Processing of Municipal Solid Waste on Fuel Properties and Steam Generation", Proceedings: SWANA's Seventh Annual Waste-to-Energy Symposium, January 28-30, 1992.

AIR POLLUTION CONTROL REGULATIONS

Clean Air Act Amendments of 1990. The Clean Air Act Amendments (CAAA) of 1990 have made the permitting process for municipal waste combustors extremely complex. These amendments revised the New Source Performance Standards (NSPS) for new combustors and created Emission Guidelines for existing combustors. The following is a description of various applicable regulatory tools that currently exist and apply to new municipal waste combustors.

National Primary and Secondary Ambient Air Quality Standards (NAAQS). NAAQS are currently in effect for the criteria pollutants set by the USEPA. These criteria pollutants are sulfur dioxide, nitrogen dioxide, carbon monoxide, particulate matter, ozone and lead. The standards for these pollutants specify the maximum concentration of air contaminants allowed in the surrounding air. Areas which meet the NAAQS are considered attainment areas. Those that do not meet the NAAQS are considered non-attainment areas. Facilities locating in attainment areas may be subject to the Prevention of Significant Deterioration (PSD)

requirements. Facilities locating in non-attainment areas are subject to more stringent regulations.

Prevention of Significant Deterioration of Air Quality (PSD). Any major stationary source of air pollution must undergo PSD review before a permit can be issued for construction of a facility. A major source is any facility that has the potential to emit 10 tons per year or more of any hazardous air pollutant or 25 tons per year or more of any combination of hazardous air pollutants specified by the federal regulations (Section 112, 42 USC 7412). A major source is also any stationary source that has the potential to emit 100 tons per year or more of any air pollutant (42 USC 7602).

New Source Performance Standards (NSPS) and Emission Guidelines (EG). NSPS apply to new facilities that were placed under construction after December 20, 1990. A companion to the NSPS are Emission Guidelines which apply to existing facilities burning over 1,100 tons/day. NSPS establish the maximum allowed rate at which a pollutant may be emitted into the atmosphere. For instance, new units must install acid gas scrubbers that reduce metals emissions and organic compounds by 99%, and acid gases by 90% to 95%. These new rules were issued on February 11, 1991 and apply only to incinerators that charge more than 250 TPD. Until rules are established for smaller incinerators, it is up to the IEPA to set maximum emission limits for small incinerators.

Best Available Control Technology (BACT). BACT is a tool used by regulatory agencies to determine air emission limits for municipal waste combustors. A BACT determination will specify a technology that gives the best demonstrated performance based on environmental, economic, and energy impacts. BACT has been used by the IEPA in determining emission limits for facilities in Illinois. The CAAA of 1990 will require a new permitting program to meet the new NSPS and EG limits.

Maximum Achievable Control Technology (MACT). MACT is defined by the CAAA as the control technology being achieved by the best 12% of municipal waste combustors in the U.S. MACT applies to existing municipal waste combustors, all of which are now expected to

achieve the same level of air pollution control as that reached by the best 12% of existing facilities.

PERMITTING PROCESS

The permitting of municipal waste combustors in Illinois is the responsibility of the Illinois Environmental Protection Agency. The authority to issue permits was obtained from the USEPA through a Delegation of Authority agreement pursuant to the Clean Air Act. Two bureaus within the agency issue permits for these facilities. The Bureau of Land issues a construction permit that allows the development and construction of the facility. The Bureau of Air is responsible for issuing a construction permit as well and is also responsible for approving the Start-up Plan of the facility.

The permitting of municipal waste combustors is a complex and time consuming process. Land and water regulations must be met in addition to air regulations. A new state plan for implementing the CAAA of 1990 is still pending approval from the USEPA. IEPA's air regulations must meet or exceed the limits set by the NSPS and EG. The following is a step-by-step explanation of the current permitting process in Illinois. This process is likely to change before any new facilities apply for permits in Illinois. The Robbins Facility had emission limits set by this permitting process. These limits are given in Table 8-3.

1. If a municipal waste combustor is a regional pollution control facility, the applicant must submit proof to the IEPA that the facility has been granted siting approval pursuant to Section 39.2 of the Act before the IEPA will begin reviewing the application.

2. The IEPA utilizes a joint permit review process for the issuance of the development permit (Bureau of Land) and the construction permit (Bureau of Air). The IEPA must act upon the permit applications within 180 days of the filing date. Once issued, the applicant may begin constructing the facility.

Before a facility commences operation, the proper operating permits must be obtained from the air and land bureaus. A National Pollutant Discharge Elimination System (NPDES) permit must be obtained from the Bureau of Water if wastewater will be discharged.

3. Section 9.4 of the Illinois Environmental Protection Act states that municipal waste incinerators burning 25 tons per day or more of refuse shall be subject to the emission limits and operating standards based upon the application of Best Available Control Technology (BACT). BACT emission limits and operating standards are made on a case-by-case basis taking into consideration energy, environmental and economic impacts. The IEPA must apply BACT to determine emission limits for the following pollutants:

   - particulate matter, sulfur dioxide, nitrogen oxide.
   - acid gases including hydrogen chloride.
   - heavy metals including arsenic, cadmium, mercury, chromium, nickel and lead.
   - organic materials including polychlorinated dibenzo-p-dioxins, polychlorinated dibenzofurans and polynuclear aromatic hydrocarbons.

   BACT determinations and the resulting emission limits written into permits issued by the Bureau of Air have the same regulatory effect as New Source Performance Standards (NSPS). In effect, BACT determinations have replaced NSPS as the active regulatory mechanism at the state level.

4. After a determination has been made concerning the need for a BACT evaluation, the next consideration is whether the municipal waste incinerator is a major stationary source and if a PSD review is required.

5. If an applicant is proposing a municipal waste incinerator in a non-attainment area, it must go through an even more stringent permitting process. According to Illinois regulations (35 Ill. Adm. Code 203.301 and 203.302) an incinerator proposed in a non-attainment area must design for the Lowest Achievable Emissions Rate (LAER) and meet emission offset requirements. LAER is defined as:

- The lowest emission limitation which is contained in the implementation plan of any state, unless it can be demonstrated the limitation is not achievable.

- The most stringent emission limitation which is achievable.

- The applicable new source performance standard.

The primary difference between BACT and LAER is that BACT allows for the consideration of energy, environmental and economic factors while LAER determinations are based solely on current technological capabilities.

TABLE 8-3. EMISSION LIMITS ESTABLISHED IN THE PROPOSED ROBBINS FACILITY PERMIT

Particulate matter	0.010 grains per dry standard cubic foot when corrected to 7% oxygen.
Hydrogen chloride	25 ppm corrected to 7% oxygen or 5% of the uncontrolled rate.
Organic materials	10 ppm, as total hydrocarbons, on a 24 hour basis, corrected to 7% oxygen.
Carbon monoxide (CO)	100 ppm on a four hour block average, corrected to 7% oxygen.
Visible air contaminants (opacity)	10% opacity.
Sulfur dioxide (SO2)	30 ppm corrected to 7% oxygen on a 24 hour block average or 15% of the uncontrolled rate.
Nitrogen oxide (NO)	130 ppm corrected to 7% oxygen on a 24 hour block average.
Combustion efficiency	(CO2/CO2+CO x 100); shall not be less than 99.9% on a 4 hour block average.
Dioxins/Furans	Shall comply with NSPS when finalized.

Source: IEPA, Robbins Permit, June 11, 1990.

AIR POLLUTION CONTROL TECHNOLOGY

As previously discussed, there is a broad range of air pollutants subject to regulation. The control of these pollutants can be accomplished through design changes to the combustor, modifying the operation of the combustor, and downstream air pollution control devices. However, the application of a control technology for one specific pollutant may have an adverse affect on the control of another pollutant. The challenge is to have each of the elements of air pollution control working together to optimize the removal of all the regulated pollutants. The following is a discussion of the available control technologies for particulate matter, acid gases, nitrogen oxides, organic emissions and heavy metals.

Particulate Control. Particulate material control occurs downstream of the waste combustor. Particulate matter is composed of fly ash from the combustion process, reaction products from the control of acid gases and unreacted dry lime from the scrubber(s). The following discussion describes the two proven technologies for removing particulate matter - electrostatic precipitators (ESPs) and fabric filters (baghouses).

In an ESP, the incoming flue gas is distributed evenly between rows of discharge electrodes and grounded collecting plates. The particulate matter is electrically charged which causes the particulates to migrate to the collecting plates. The particulate matter is then removed from the collection plates by mechanical rapping which generates a vibration causing the particulates to fall off of the collection plates into a hopper beneath the ESP. The resulting residue is frequently called fly ash. ESPs have the longest operational track record on municipal waste incinerators and they have demonstrated a high level of particulate removal efficiency.

ESP efficiency varies from about 93% for fine respirable particles of less than two microns to 99.8% for larger particles. ESPs have not consistently been able to meet the 0.01 grains/dry standard cubic foot level (gr/dscf) required by the IEPA's Bureau of Air in the permit it issued in 1987 for an incineration project in Crestwood, Illinois. Future designs may be capable of meeting the more stringent standards.

The fabric filter, or baghouse, operates much like a vacuum cleaner. The flue gas is pulled through a finely woven fabric which captures the particulate matter. The fabric is typically cleaned on a regular basis to reduce the amount of "filter cake" build-up on the fabric.

Although most existing municipal waste incinerators use ESPs for particulate control, new proposed incinerators are being designed with baghouses. Baghouses have the following advantages over ESPs:

- They have a higher collection efficiency with a proven ability to meet the 0.01 gr/dscf and have even shown the ability to reduce levels as low as 0.001 to 0.005 gr/dscf.

- They have the ability, when used in conjunction with an acid gas scrubber, to increase the removal of acid gases, sulfur dioxide and heavy metals.

- They are more effective at removing finer particulates (under two microns).

In summary, the baghouse technology appears to be gaining favor in the regulatory community.

Acid Gas Control. The acid gas emissions of primary concern are sulfur dioxide (SO2), hydrogen chloride (HCl) and hydrogen fluoride (HF). Flue gas scrubbers are most often used to remove SO2, HCl and HF. These devices are typically located immediately after the boiler exit and before the baghouse or ESP. There are primarily three types of scrubbers utilized to capture acid gases: wet scrubbers, spray-dry and dry injection.

Wet scrubbers capture acid gases by causing the gaseous pollutants to react with an alkaline liquid scrubbing medium which is injected into the flue gas. As the gas is emitted from the wet scrubber, it is typically saturated with water vapor (i.e. wet). Wet scrubbers have the highest removal efficiency of the various technologies. The disadvantages of wet scrubbers are

they require more maintenance and have higher operating costs than the dry scrubbing options (i.e. spray-dry and dry injection).

A spray-dryer scrubber is similar to a wet scrubber in that a fine spray of absorbent solution is introduced into the combustion gas stream. The gaseous contaminants react chemically with the solution droplets and neutralize the acidic gases. The water in the absorbent solution is evaporated as the reactions occur and thereby cools the gas stream. Large amounts of particulate matter are introduced into the gas stream by the spray-dryer, but before the gases are emitted, they pass through either a baghouse or ESP. No liquid remains in the spray-dryer scrubber which is why it is designated as a dry scrubber.

Dry injection is also considered a dry scrubber technology. A dry alkaline solution is injected into the combustion gas downstream of the combustion chamber. The sorbent reacts with the sulfur dioxide and acid gases before the particulate matter is removed by the baghouse or ESP. Capital costs for dry scrubbers are less than those for wet scrubbers and spray-dryer scrubbers but they are not as effective in removing the HCl, HF and SO2. Operational costs associated with a dry scrubber will increase as more sorbent is used to increase efficiency to the levels of a wet scrubber or spray-dryer.

Nitrogen Oxides Control. Emissions of oxides of nitrogen (NOx) are believed to be precursors to ozone and acid rain. As a result, efforts have been made to develop methods to reduce NOx. NOx can be reduced in three ways:

1. Reduce the nitrogen content of refuse. For example, removing landscape waste (especially grass) from the wastestream will lower the nitrogen content of refuse.

2. Minimize the quantity of NOx generated during combustion (combustion modification).

3. Reduce the quantity of NOx in the flue gas stream (flue gas controls).

Three major combustion design modifications to reduce NOx are: 1) low excess air operation, 2) staging of combustion and 3) flue gas recirculation. All three techniques have been used individually or together to achieve reductions in NOx and also CO (carbon monoxide), hydrocarbons and organics.

Flue gas controls are needed to bring about further reductions in NOx. Three relatively new technologies are: selective catalytic reduction, wet flue gas denitrification and selective non-catalytic reduction. The most advanced of these is the Thermal DeNOx Process (non-catalytic reduction) included in the Commerce, California waste incinerator. This process involves the injection of ammonia into the combustion chamber. The ammonia reacts with the NOx to produce diatomic nitrogen (N_2) and water. Control of NOx is growing in importance as more states include limits for NOx. The IEPA-issued Robbins permit has a NOx emission limit of 130 ppm.

Organic Emissions Control. Emissions of organic matter are generated as products of incomplete combustion. These emissions include dioxins, furans, carbon monoxide, hydrocarbons and poly-cyclic aromatic hydrocarbons. Hydrocarbons and carbon monoxide are emitted as gases; toxic organics (i.e. dioxins, furans) may exit the stack either in the vapor phase or condensed onto fine particulate matter.

There are two general methods for controlling organic emissions from incinerators. One method involves optimizing the combustion process while the other method is based on use of post-combustion pollution control equipment. The combustion and post-combustion methods should be utilized together to achieve the most effective control of organic emissions.

Efficient combustion can be achieved through appropriate time in the combustion chamber and monitoring of the temperature level. Thermal destruction of organics requires a minimum temperature of 1,600°F with a residence time of at least one second under well mixed conditions. The USEPA has developed a set of "good combustion practices" for mass burn, RDF and modular incinerators which are intended to minimize organic emissions. Good

combustion practices generally include adequate air to supply oxygen and mixing of combustibles, and a long residence time at a high temperature (1,800°F).

In addition to combustion control, organic emissions can be controlled through post-combustion air pollution control devices. The formation of organic compounds resulting from incineration of waste is not fully understood. It has been found that once the organic compounds form they adhere to particulate matter in the flue gas. Therefore, control of organic emissions can be achieved by utilizing pollution control equipment (ESPs and baghouses) designed to control particulates enriched with organic compounds.

Control of Heavy Metals. Emissions of heavy metals result from the combustion of waste that contains metals. Metals can be released in both a solid particulate form or as a vapor. Vaporized metals will condense on the surface of very fine particulates in the flue gas. This condensation process occurs after the flue gas has been through the heat recovery unit (boiler) and the temperature of the flue gas drops below 455°F. By utilizing a baghouse or ESP, the heavy metals can be controlled by capturing the particulate matter. Removal percentages of heavy metals can be extremely high with the exception of mercury which has a lower condensation point than other metals of concern (cadmium, lead, zinc, chromium). Mercury is therefore more difficult to extract.

With the new NSPS and EG emission limits, mercury control may be required. There are two methods of controlling mercury emissions after combustion, both of which involve injection of a substance into flue gases. Activated carbon can be injected before the air pollution control devices. The carbon provides a surface for the mercury to condense onto at high temperatures. The carbon is then removed by the ESP or baghouse. Another method involves the injection of sodium sulfide into the flue gas. The mercury and sodium sulfide react to form salts that are removed by the ESP or baghouse.

The best method of reducing mercury emissions is reducing the amount in the wastestream. Household batteries have previously been blamed for the majority of the mercury in the wastestream. In 1989, household batteries contributed to 88% of the mercury in the

wastestream. However, the reduction of mercury in alkaline batteries over the past few years has caused a significant reduction in the amount of mercury that is disposed. From 1984 to 1989, the mercury in batteries has been reduced by 81%. Another source of mercury in the wastestream is fluorescent light bulbs. It is estimated that electric lighting will account for nearly 11% of the total mercury in the wastestream in 1993.

One of the most straightforward ways to minimize heavy metals would be to remove metals from the wastestream prior to combustion. This would reduce the amount of heavy metals in the flue gas. Intuitively, this would lead to a reduction of heavy metals in the fly ash and decrease the potential environmental impacts of ash.

Summary. In order to gain regulatory approval and public acceptance, municipal waste combustors must be: 1) constructed with state-of-the-art air pollution control equipment, and 2) properly operated. Based on a review of the IEPA's Crestwood and Robbins permits (which underwent a BACT review by IEPA) and of the available air pollution control devices and procedures, the following is a list of options available to help control and minimize the release of air pollutants:

- Removal of landscape waste from the wastestream to help reduce NOx emissions.

- Removal of non-combustibles from the wastestream to increase the operating efficiency of the combustor. In particular, metals should be removed prior to combustion to help minimize heavy metal emissions.

- Removal of car batteries and household batteries to help reduce emissions of heavy metals (P.A. 86-723, effective September 1, 1990, bans lead-acid batteries from disposal in landfills or incinerators).

- Utilization of good combustion practices to help insure that organics are destroyed. Good combustion practices will also help reduce the levels for carbon monoxide and hydrocarbons.

- Proper training of all waste incinerator personnel to insure that the combustor is properly monitored and operated.

- State-of-the-art air pollution control equipment including a scrubber (wet or dry) and a fabric filter (baghouse) for particulate control. Consideration should also be given to utilizing the Thermal DeNOx Process or other appropriate technology to help control NOx emissions (if the proposed NSPS are promulgated, NOx control will be required).

ASH MANAGEMENT

Combustion of municipal waste results in two types of solid waste residue - bottom ash and fly ash. Bottom ash is the ash remaining in the combustion chamber after the refuse is burned. Fly ash is small particulate matter which remains in suspension with the flue gas that leaves the combustor and is later captured by the air pollution control equipment. Most incinerators combine the two ashes prior to disposal. Municipal waste incinerators reduce the weight of refuse by between 65-80%. The volume can be reduced by as much as 90%. Typically, bottom ash is 85-90% by weight of the total ash residue. Currently, the most frequent disposal method for combustion ash is co-disposal in a Subtitle D landfill. This practice is beginning to change because of environmental concerns about the heavy metals and toxic organic compounds in ash.

Ash Composition. The physical and chemical composition of ash is dependent upon the composition of the waste, the type of combustion unit and the combustion efficiency of the unit. The predominant physical components of ash are glass, ferrous metal and mineral matter (ceramic, stone, sand, slag). Table 8-4 contains information on the range of concentrations for selected constituents in ash including inorganics, dioxins, furans and PCBs. Based on the information in Table 8-4, it is clear that fly ash exhibits higher levels of heavy metals than bottom ash.

TABLE 8-4. RANGES OF CONCENTRATIONS FOR SELECTED CONSTITUENTS IN MSW ASH			
Constituent	Fly Ash	Bottom Ash	Combined Fly and Bottom Ash
Arsenic (ppm)	15-750	1.3-24.6	2.9-50
Barium (ppm)	88-9,000	47-2,000	79-2,700
Cadmium (ppm)	<5-2,210	1.1-46	0.18-100
Chromium (ppm)	21-1,900	13-520	12-1,500
Lead (ppm)	200-26,600	110-5,000	31-36,600
Mercury (ppm)	0.9-35	ND-1.9	0.05-17.5
Selenium (ppm)	0.48-15.6	ND-2.5	0.1-50
Total Dioxins (ppb)	5.23-10,883	ND-110	6.2-350
Total Furans (ppb)	3.73-3,187	ND-65	6.14-153.9
Total PCB's (ppb)	ND-250	ND-180	ND-32.15

1. ND = Below Detection Limit

Source: USEPA, Characterization of MSW Ashes and Leachate From MSW Landfills, Monofills, and Co-Disposal Sites, October, 1987.

The Toxic Characteristic Leaching Procedure (TCLP), and its predecessor the EP toxicity test, are utilized to determine the toxicity characteristics of municipal waste combustor ash. The TCLP is required for testing of hazardous wastes and some states have required ash to be tested with the TCLP procedure. In the Robbins permit issued by the IEPA, the EP toxicity test is required for the ash. The procedures are similar and involve subjecting an ash sample to an acidic solution which leaches the heavy metals. However, the appropriateness of the EP toxicity test and its replacement, the TCLP, have been questioned.

Field leachate tests from landfills which co-dispose of municipal waste ash and refuse, and monofills which dispose solely of ash, have found that the EP toxicity test and the TCLP overestimate the amount of heavy metals that may leach from the ash and potentially pose a threat to groundwater. According to a study sponsored jointly by the USEPA and the Coalition on Resource Recovery and the Environment, the EP toxicity test and the TCLP produce results which show leachate to be significantly more toxic than the liquid actually found in ashfills.

Current Federal and State Regulations. Municipal combustor ash is considered a solid waste and is regulated under the Resource Conservation and Recovery Act (RCRA). In Illinois the appropriate regulations are found in Title 35, Subtitle G - Waste Disposal, and are administered by the IEPA's Bureau of Land.

Both federal and state regulations contain a "household exclusion clause" which excludes municipal incinerators from RCRA's hazardous waste regulations. Under the federal (40 CFR 261(b)(1)) and state (35 Ill. Adm. Code 721.104(b)(1)) household exclusion clauses, a municipal waste incinerator shall not be deemed to be treating, storing, disposing or otherwise managing hazardous waste if the facility receives and burns only household waste and solid waste from commercial and industrial sources that do not contain hazardous waste. In addition, the facility must assure that hazardous wastes are not received at or burned in the incinerator.

Prior to May 2, 1994, the household exclusion clause was used to exclude municipal incinerator ash from hazardous waste regulations found in Subtitle C of RCRA. However, on May 2, 1994, the U.S. Supreme Court ruled that RCRA does not exempt the ash generated by municipal incinerators from hazardous waste regulations, even if only household and nonhazardous industrial waste are burned. The ruling requires that ash be tested and if found to be hazardous, be disposed as a hazardous waste (which means disposal in a hazardous waste landfill).

The IEPA classifies ash as a non-hazardous special waste. Specifically, it is designated an industrial process waste in Section 3.17 of the Illinois Environmental Protection Act. The IEPA has included ash testing provisions in the IEPA permit granted for the Robbins incinerator project.

As a special waste, municipal combustor ash must be disposed of and transported in accordance with Parts 809 and 811 of Subtitle G (35 Ill. Adm. Code 809, 811).

On March 26, 1993, the IEPA permitted the Gallatin National Company's landfill (in Fulton County, Illinois) to accept combustion ash from Hennepin County, Minnesota. The IEPA issued special conditions to the permit since the ash originates from outside Illinois and IEPA cannot monitor the ash at the source. The IEPA requires that grab samples of ash be tested monthly for heavy metals (lead, cadmium and mercury) and quarterly for the TCLP parameters. Any landfill that accepts ash in Illinois will be required to have adequate leachate collection and liner systems, as determined by IEPA.

The IEPA has set the following policy on landfills accepting combustion ash:

- The landfill must have a maximum of 10 feet of insitu liner.
- The landfill must have a leachate collection system.
- The landfill must have an adequate groundwater monitoring system.
- The landfill must have a policy of not disposing liquid in the landfill.

Ash Recycling. An alternative to disposal of combustor ash is to recycle the ash into a reusable product. This may include using ash in concrete for roads, concrete cinder blocks and artificial concrete reefs. Most projects completed to date have been experimental in nature and have yet to be approved for regular use.

ENERGY RECOVERY

Municipal waste can be combusted for volume reduction or for energy recovery. New municipal waste incinerators are being built for energy recovery because the sale of energy represents a significant revenue stream. The energy revenues in combination with the tipping fees represent the two revenue streams utilized to retire the capital debt and cover operating and

maintenance costs. Therefore, by maximizing the energy revenues the tipping fees can be minimized.

There are two types of energy that can be produced and sold by a municipal waste incinerator: thermal and electricity. A plant can be designed to produce only thermal (steam), only electricity or both (cogeneration). In addition, instead of selling energy directly, a refuse derived fuel (RDF) facility can produce fuel which can be sold and later converted to steam and/or electricity.

The most important aspect of producing energy from a municipal waste incinerator is to identify potential customers for the energy. A potential market must be evaluated to determine: 1) its energy needs and 2) its willingness to enter into a long-term (20 years) agreement. Generally, a steam market is preferable to an electricity market because a consistent steam market will generate more revenue. However, steam markets are more difficult to locate, whereas electricity markets are guaranteed by the Public Utilities Regulatory Policies Act (PURPA). In addition to PURPA, there is legislation in Illinois (HB 942, which later became Public Act 85-882) which deals with the sale of energy from municipal waste incinerators.

Steam Markets. The first energy market considered should be a steam market because of its lower initial capital costs. Ideally, the market should be a steam user that can consistently purchase the total amount of steam produced. The user should have a consistent demand for energy which optimizes the energy output of the incinerator. If a single user cannot be found then a second choice would be to find multiple markets within the same general area. Two other prerequisites of a viable steam market are: 1) the market must be willing to enter into a long-term (20 years) contract to purchase the steam, and 2) the market must be located within 1.5 miles of the municipal waste incinerator.

Multiple steam markets can be considered but two distinct disadvantages arise:

1. Energy sales agreements are significantly more complex than those required for energy sales to a single market. Agreements are usually developed on the basis of interruptible service, as opposed to guaranteed service.

2. Requirements for steam and condensate return piping increase substantially, depending on the relative location of the facility and markets. Construction of these items, in an area which is highly developed, can be extremely expensive. This leads to increased system construction costs and higher solid waste disposal costs.

Electricity Markets. If a suitable steam market cannot be identified, electricity markets are readily accessible to the facility. The vast array of electrical grids that currently exist allow for easy access by waste-to-energy plants. The sale of electricity from a waste-to-energy plant is guaranteed by the Public Utilities Regulatory Policies Act (PURPA). This ensures that electricity that is generated by non-utilities will be sold to a market. In order to maintain a steady income from electricity sales, a long-term contract is desirable.

PURPA. The Public Utilities Regulatory Policies Act (PURPA) was enacted in 1978 to encourage energy conservation and to reduce dependence on imported oil. PURPA is administered by the Federal Energy Regulatory Commission (FERC).

The sale of electricity is the predominant energy market choice for most of the municipal waste incinerators built in the U.S. Under PURPA, electric utilities (e.g. Commonwealth Edison) are required to purchase electricity from cogenerators and small power producers (i.e. municipal waste incinerators) which meet the "qualifying facility" criteria set forth in 18 CFR 292, Subpart B. Electric utilities are required to purchase energy from qualifying facilities at the utilities' "avoided cost". The avoided cost is the incremental cost to the utility if it had generated or purchased from another source the electricity purchased from the incinerator. In Illinois, the avoided cost rate is depressed because the utilities have excess generating capacity. However, in 1987, HB 942 (P.A. 85-882) was passed and established a more favorable buyback rate for qualifying facilities.

House Bill 942. P.A. 85-882 (commonly called HB 942) was enacted to encourage the development of alternative energy production facilities for the disposal of solid waste. The low avoided cost rate in Illinois is detrimental to the economics of building a municipal waste incinerator. The purpose of HB 942 is to enhance the short-term economics of incineration by offering a higher than avoided cost buyback rate. By increasing the energy revenues, the tipping fees can be lowered. Similar legislation encouraging incineration has been passed in several east coast states (e.g. New York, Connecticut).

Illinois' legislation is distinct from other avoided cost legislation in that the incinerator must pay back the difference between the legislated rate and the utilities' avoided cost rate. The payback must begin once the incinerator has retired its capital debt (usually a 20-year period). In effect, HB 942 amounts to an interest free loan to the incinerator.

The utilities in Illinois have accepted HB 942 because they are entitled to a tax credit equal to the amount by which payments for the electricity under HB 942 exceed their legal obligation under PURPA. In Illinois, the avoided cost rate is approximately $0.02 per kilowatt hour (kwh). Under HB 942, utilities will be required to pay a rate "equal to the average amount per kilowatt-hour paid from time to time by units of local government owning or served by the facilities". This rate will vary but it will be in an approximate range of $0.05-0.06 per kwh. The Illinois Commerce Commission (ICC) is responsible for implementing HB 942.

The following is a list of the key provisions of HB 942:

- To be deemed a "qualified solid waste energy facility" a facility must: 1) qualify as a cogeneration or small power production facility under PURPA, 2) utilize solid waste to comprise no less than 95% of the annual fuel loading, 3) guarantee that the throughput volume equals at least 66% of the design capacity, 4) be covered by a solid waste management plan, with a recycling goal of 25%, developed by the units of local government intended to be served by the facility, or covered by a solid waste energy facility plan, with a recycling goal of 25%, developed by the facility operator or owner, 5) make a good faith effort to

achieve the 25% recycling goal or rely on the units of local government to make a good faith effort to achieve a 25% recycling rate.

- Electric utilities are required by the ICC to enter into long-term contracts (not less than 20 years) to purchase electricity from qualified solid waste energy facilities.

- The purchase rate in the contracts must be a rate equal to the average amount paid by units of local government owned or served by the facility, excluding amounts paid for street lighting and pumping service.

- Public utilities are entitled to a tax credit equal to the amounts by which the payments for electricity exceed the rate mandated by PURPA.

- The incinerator must reimburse the State treasury for the reductions in payments to the Public Utilities Fund as a result of the electric utilities tax credit. The reimbursement payments must begin once the incinerator has retired its debt.

HB 942 should have a favorable impact on the short-term economics of incineration because it appears that it will lower tipping fees. The major question or uncertainty is how much of an impact HB 942 will have on tipping fees. Because of the repayment provision of HB 942, the owner of an incinerator will have to develop a financial plan which will allow for repayment.

In May, 1993, attempts were made in the Illinois General Assembly to eliminate the favorable buyback rate allowed in P.A. 85-882. Therefore, the long term viability of the favorable buyback rate is questionable.

Contracts. A long-term energy contract will enable the facility to realize a steady flow of income from the sale of energy. A contract will specify various conditions that will affect payment and the delivery of energy. Some common contract conditions are included below.

- Both sides will agree upon a base fee for a specific quantity of energy (i.e. pounds of steam or kilowatt hours of electricity.) Energy in excess of this value is usually bought at a reduced rate. If the amount of energy generated is less than the guaranteed amount, then the generator is responsible for paying the incremental cost of purchasing the energy from another generator. This is called a "put or pay" clause.

- The term of the agreement will be spelled out in the contract. A long-term agreement is necessary to insure proper retirement of debt service on the facility. Without a long-term contract, the income will be too uncertain and rely too heavily on tipping fee income. The terms of this agreement are usually required before financing can be obtained.

- The contract will give exact procedures for responding to shutdowns and other factors that may affect the generation of energy.

IMPLEMENTATION

The preceding sections have focused on the technical and environmental issues associated with incinerating municipal waste. This section examines the implementation issues that must be resolved before an incinerator can be built. It must be determined who will own and operate the facility; what type of procurement approach will be utilized; how the project risks will be allocated; how the project will be financed; and how flow control will be instituted. Resolving these issues is essential to the successful implementation of a municipal waste incinerator. These issues are examined in the following subsections.

Ownership and Operation Options. The first decision that must be made once a disposal technology has been chosen is who will own and operate the facility. This decision will impact the other implementation issues (i.e. procurement, risk management and financing). The four

different ownership and operation arrangements outlined in Chapter 6 for intermediate facilities are also appropriate for incinerators and include:

1. Public ownership and operation.

2. Public ownership, private operation.

3. Private ownership, public operation.

4. Private ownership and operation.

Once the ownership and operation issue has been resolved, the next step in the implementation process is to decide on the appropriate procurement approach.

Procurement. Procurement refers to the buying, renting, leasing or otherwise acquiring supplies, services, or construction. As with the intermediate facilities, the planning entity must determine the approach and method to be used to develop a municipal waste incinerator. The decision should be made after the planning entity has analyzed the following factors: 1) facility ownership and operation, 2) financing approach and 3) allocation of risk.

The three approaches that can be utilized by a public entity to procure a solid waste disposal facility, as discussed previously in Chapter 6, include Architect/Engineering (A/E), Turnkey, and Full Service.

Financial Responsibility. The issues of ownership and operation, procurement approach and risk allocation are mutually dependent. A decision concerning ownership will impact the procurement approach selected (and financing options), which in turn, will dictate how the project risks are allocated.

Incineration is a complicated and heavily regulated disposal option, and many projects have incurred significant cost overruns or been abandoned. As a result, public entities must

fully understand the many levels of risk and who bears the responsibility if there is a problem. Currently, the trend has been for the public sector to shift more of the risk to the private contractor. In return, the private contractor will expect to receive a larger portion of the profits. If a public entity chooses to assume the ownership of a incinerator, it becomes responsible for substantial risks.

Financing Issues. Developing a municipal waste incinerator is probably the most complex and expensive project a unit of local government will become involved with. Therefore, it is essential during the preliminary planning stages that the public entity understands the various options available concerning ownership and operation, procurement, risk allocation and financing.

Because of the complexity of an incinerator project, it is important that a project team be assembled. The team should include a bond counsel and a financial advisor early in the planning stages. During the preliminary project planning stages, the unit of local government will have to confront and make critical decisions (e.g. technology, ownership, financing). It is essential that the unit of local government have expert counsel so that it maintains control over the process. Only then can the unit of local government achieve the lowest cost for solid waste disposal at an acceptable financial risk.

There are three common elements to implementing a successful municipal waste incineration project: 1) control of the waste supply and revenues, 2) assurance of technology and economic feasibility, and 3) responsible parties assuming risk.

An adequate wastestream must be assured over the economic life of the project. Contracts must be entered into between the units of local government supplying the waste and the owner of the facility. These contracts are commonly referred to as "Put or Pay" contracts as discussed in Chapter 6.

The second component of assuring revenues is the contract between the incinerator and the energy market. This contract is referred to as a "Take or Pay" contract which requires that

the energy market commit to buying a minimum amount of energy over a set period of time. An alternative is to utilize PURPA which requires electric utilities to buy the energy produced by an incinerator.

Assurances must be made to the prospective bond investors and credit rating agencies that the project is economically sound. This requires that a qualified engineering consultant be hired to prepare a technology feasibility study on the proposed incinerator. Economic assurances must be made that adequate revenues will be generated by the tipping fees and energy revenues to insure payment of principle and interest on the bonds.

The financial track record of the parties assuming risk in the project must be scrutinized. If the private sector is going to be involved with the construction and/or operation of the facility, the guarantees made by the private sector will be closely scrutinized to insure that the private sector entity can financially support the risk it assumes.

Flow Control. The assurance of an adequate waste flow to the incinerator is essential to the financial feasibility of the project. This assurance of waste is commonly referred to as flow control. Units of local government achieve flow control through local ordinances, contracts or licenses. Flow control measures require haulers to collect the waste from a unit of local government and deliver it to a designated facility (e.g. incinerator).

Private haulers and disposal facility owners often threaten to challenge flow control on the grounds that it violates the Sherman Antitrust Act. However, in recent years, specific legislative language has been passed which reduces a unit of local government's exposure to an antitrust claim. The courts have held that if "state action" has been taken to pass flow control legislation which clearly expresses that flow control is a state policy, then units of local government are exempt from antitrust claims.

Illinois has taken such "state action" in several pieces of legislation. Flow control language is contained in P.A. 84-963 (Local Solid Waste Disposal Act), P.A. 84-846 (Municipal Joint Action Agency) and P.A. 85-14. Each piece of legislation has clearly expressed language

which allows local units of government to exercise flow control authority. Flow control has yet to be used in Illinois for directing waste flow to incinerators.

Recent case law has resulted in the weakening of flow control authority. On February 18, 1993, the 8th U.S. Circuit Court of Appeals in Minneapolis ruled that the Counties' (Marin and Faribault Counties) flow control ordinances were unconstitutional because they violated the Commerce Clause of the U.S. Constitution. In this case, (Waste Systems v. Marin and Faribault Counties (No. 92-1642)), the Counties tried to direct waste flow to a county-built composting facility with tipping fees at $72 per ton. The private hauler in the case hauls refuse from the Counties to his privately-owned landfill in Iowa, where the tipping fee is $30 per ton.

On January 29, 1993, in another federal district court case, (Waste Recycling Inc. v. Southeast Alabama Solid Waste Disposal Authority), the court ruled that the local authority's ordinances dictating the flow of refuse violated the Commerce Clause of the U.S. Constitution. In this case, four counties tried to impose flow control to the Authority's waste facilities. The court found that the purpose and effect of the ordinances were to finance the facilities by insulating the region from economic competition.

ECONOMIC ANALYSIS

Capital Cost. The capital cost of municipal waste incinerators with energy recovery built in 1990, 1991 and 1992 averaged $107,500 per design ton of capacity. This cost is expected to increase as additional air pollution control systems are required.

Nearly all the waste-to-energy facilities sized at or below 240 tons per day are modular mass burn facilities. The average capital cost, adjusted to 1993 dollars, for the 100 to 240 ton per day modular facilities built since 1987 is $108,500 per design of capacity. These facilities use acid gas scrubbers and particulate controls. At this average capital cost, a 300 ton per day facility will cost over $32.6 million. A review of capital cost data for 55 modular mass burn facilities indicate that there is no economy of scale for size range and category, i.e. the cost per

ton per day of waste processed does not decrease with increasing size. These cost factors show that by minimizing the size of the waste-to-energy facilities, even to the point of undersizing them, there are significant capital cost savings. For instance, a facility sized to handle a maximum of 200 tons per day would cost approximately $21.7 million.

The average operation and maintenance cost for incinerators in 1991 was $56 per ton. Using this average cost, the annual operation and maintenance cost for the DeKalb County facility burning 200 tons per day would be approximately $4.1 million.

Tipping Fee Estimates for Proposed Incinerators. Lake, Will and DuPage Counties have had detailed cost estimates performed to determine municipal waste incineration tipping fees. The cost estimates include debt service on capital costs, operation costs, ash disposal costs and revenues from energy sales.

For Lake County, the projected tipping fees in 1993 dollars range from $48.62 per ton to $69.81 per ton and were based on HB942 buyback rates. The cheaper option reflects the cost of building one large 1,200 TPD incinerator while the more expensive option is for one 600 TPD and two 300 TPD facilities.

Will County's tipping fee estimates, based on a 550 TPD mass burn incinerator, ranged from $57.50 to $79.13 per ton.

DuPage County's tipping fee estimates in 1992 dollars range from $68.72 per ton to $81.21 per ton. The DuPage County tipping fee estimates do not include a HB 942 buyback rate for electricity.

Reading Energy Company, the developer of the Robbins RDF facility proposed for southern Cook County, projects the tipping fees to be between $47.00 and $57.00 per ton in 1993 dollars.

To summarize, the projected tipping fees for municipal incineration with energy recovery in Illinois are approximately two to four times more expensive than the current landfill tipping fees in the DeKalb County region.

Comparison of Incineration Options. The State of Illinois' solid waste management hierarchy lists both incineration with energy recovery and incineration for volume reduction. Both options for incineration are technically and environmentally similar, but from an economic standpoint there is a considerable difference.

Incineration for energy recovery allows for an additional revenue stream as a result of energy sales. While steam and/or electricity generating and transmission equipment make incineration with energy recovery more expensive from a capital cost perspective, this expense is offset by the revenues generated. Tipping fees at incinerators without energy recovery would be more expensive than incinerators with energy recovery. As a result, all of the recently constructed incinerators and all of the planned incinerators are waste-to-energy facilities. Incineration for volume reduction is not an economically feasible waste disposal option.

Newer mass burn, modular facilities reportedly generate between 2.5 and 3.5 pounds of steam per pound of refuse burned. At a conservative sales price of $2 per 1,000 pounds of steam, the energy revenue is roughly $10 to $14 per ton of refuse burned.

The electricity generation rate for modular facilities range from 350 to 500 kilowatt-hours per ton of refuse burned. At an average buyback rate of 1.5 cents (the avoided cost for Commonwealth Edison) per kilowatt-hour, the energy revenue would equal $5.25 to $7.50 per ton of refuse. However, using a typical retail rate (assuming 6 to 7 cents per kilowatt-hour) as provided by HB942, the energy revenue would be between $21 and $35 per ton of refuse burned.

INCINERATION FOR ENERGY RECOVERY AND VOLUME REDUCTION RECOMMENDATIONS

Listed below are the preliminary recommendations for incineration to be considered by DeKalb County.

Incineration Facility.

- Based on the high capital and operating costs associated with incineration and the unclear regulatory atmosphere that currently exists, development of an incineration project for energy recovery and volume reduction is not a recommended alternative for DeKalb County at this time.

- The County should monitor the status of the NIU incineration report entitled, *Main Campus Incinerator and Health Center Incineration Study*. If the NIU incineration project is implemented, it is recommended that the County monitor the operation and viability of the project.

- In accordance with the State's preferred waste management hierarchy, components of the wastestream, for which viable markets exist, should be recycled instead of incinerated.

Plan Update.

- As landfill tipping fees in Illinois continue to increase, incineration may become more economically viable. It is recommended therefore that incineration for energy recovery and volume reduction be reviewed in the five year updates to assess its viability as a long-term waste management option for DeKalb County.

- It is also recommended that the federal and State rules and regulations regarding municipal waste combustion be monitored along with the status of other incineration projects in areas with the same characteristics as DeKalb County. This monitoring should be conducted as part of the five year updates to the County's Solid Waste Management Plan.

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CHAPTER 9
LANDFILLING

Landfills have long been a solution to our solid waste problems. In the past, little thought was put into their design, operation or closure. Today new standards are in place to control how landfills are designed, constructed, operated, closed, and maintained after closure, ensuring that they do not adversely impact the environment.

This chapter discusses pertinent information about DeKalb County's landfill options. The following sections are included in this chapter:

1. Background
2. Regulatory Overview
3. Site Selection
4. Solid Waste Processing Evaluation
5. Landfill Design
6. Disposal Capacity Requirements
7. Landfill Economics
8. Recommendations

BACKGROUND

Definitions. In order to better understand the discussions in the following sections, a brief review of the definitions of pertinent terms that appear in this chapter is presented below. The definitions are taken from the Illinois Environmental Protection Act and the current Illinois landfill regulations.

Chemical Waste. A non-putrescible solid waste whose characteristics are such that any contaminated leachate is expected to be formed through chemical or physical processes, rather than biological processes, and no gas is expected to be formed as a result.

Design Period. That length of time determined by the sum of the operating life of the solid waste landfill facility plus the post-closure care period necessary to stabilize the waste in the units.

Earth Liners. Structures constructed from naturally occurring soil material that has been compacted to achieve a low permeability.

Geomembranes. Manufactured membrane liners and barriers of low permeability used to control the migration of fluids and gases.

Geotextiles. Permeable manufactured materials used for purposes which include, but are not limited to, strengthening soil; providing a filter to prevent clogging of drains; collecting and draining liquids and gases beneath the ground surface.

Groundwater. Underground water which occurs within the saturated zone and within geologic materials where the fluid pressure in the pore space is equal to or greater than atmospheric pressure.

Hazardous Waste. A waste, or combination of wastes, which because of its quantity, concentration, or physical, chemical, or infectious characteristics may cause or significantly contribute to an increase in mortality or an increase in serious, irreversible, or incapacitating reversible illness; or pose a substantial present or potential hazard to human health or the environment when improperly treated, stored, transported, or disposed of, or otherwise managed, and which has been identified, by characteristics or listing, as hazardous pursuant to Section 3001 of RCRA of 1976, PL 94-580, or pursuant to Board regulations.

Inert Waste. Any solid waste that will not decompose biologically, burn, serve as food for vectors, form a gas, cause an odor, or form a contaminated leachate.

Landfill. A unit or part of a facility in or on which waste is placed and accumulated over time for disposal, and which is not a land application unit, a surface impoundment or an underground injection well.

Leachate. Liquid that has been or is in direct contact with a solid waste.

Municipal Solid Waste Landfill (MSWLF) Unit. A contiguous area of land or an excavation that receives household waste, and that is not a land application, surface impoundment, injection well, or any pile of non-containerized accumulations of solid, non-flowing waste that is used for treatment or storage.

Planning Period. That length of time in which the landfill will be in operation and will be the primary solution for the solid waste disposal requirements of the County. For DeKalb County, this theoretical time period is estimated to be from 1999 to 2018.

Putrescible Waste. A solid waste that contains organic matter capable of being decomposed by microorganisms so as to cause a malodor, gases, or other offensive conditions, or which is capable of providing food for birds and vectors. Putrescible wastes may form a contaminated leachate from microbiological degradation, chemical processes, and physical processes. Putrescible waste includes, but is not limited to, garbage, offal, dead animals, general household waste, and commercial wastes. All solid wastes which do not meet the definitions of inert or chemical wastes shall be considered putrescible wastes.

Regional Pollution Control Facility. Any waste storage site, sanitary landfill, waste disposal site, waste transfer station, waste treatment facility or waste incinerator that accepts waste from or that serves an area that exceeds or extends over the boundaries of any local general purpose unit of government.

Solid Waste. A waste that is defined as an inert waste, as a putrescible waste, as a chemical waste or as a special waste, and which is not also defined as a hazardous waste.

Special Waste. Any industrial process waste, pollution control waste or hazardous waste, except as determined pursuant to section 22.9 of the Illinois Environmental Protection Act.

REGULATORY OVERVIEW

Historically, landfills have provided an economical and acceptable method of waste disposal, but very little effort was made to prevent groundwater contamination and other adverse effects to the environment. More recently, concerns over groundwater and the environment have led to increased public and government scrutiny of landfills. In response, more stringent regulations have been promulgated at both the State and federal levels requiring higher standards for landfill design, operation, closure, and post-closure care.

Regulations which control the design and operation of landfills are constantly being written and rewritten in an effort to protect the environment more effectively, yet still allow for viable solutions to our solid waste management problems. The federal and State governments have different roles in regulating the solid waste industry, particularly landfills. The federal role is to establish the overall regulatory direction, provide the minimum standards necessary for the protection of the environment and human health, and provide states with technical assistance in planning and developing sound solid waste management programs. The actual planning, enforcement, and direct implementation of solid waste management programs remain primarily State and local functions; however, the federal government does have the right to enforce the appropriate regulations in a given state.

Federal Regulations. The regulations which control landfills have undergone major changes in the last few years. The federal regulations for landfills were originally addressed in "Criteria for the Classification of Solid Waste Disposal Facilities and Practices" (40 Code of Federal Regulations [CFR] Part 257), and were established in 1979 under the Resource

Conservation and Recovery Act (RCRA). The Hazardous and Solid Waste Amendments of 1984 directed the United States Environmental Protection Agency (USEPA) to assess and revise as necessary the federal landfill regulations of 1979. As a result, the USEPA published the revised regulations in the October 9, 1991 Federal Register. The revisions to Subtitle D of RCRA exclude Municipal Solid Waste Landfills (MSWLF's) from Part 257 and add a new Part 258 specifically for MSWLF's. The Part 258 regulations contain minimum criteria for MSWLF's, primarily in the form of performance standards. The intent of the revised regulations is for states to become approved for the implementation and enforcement of the regulations under individual state permitting programs. If approved by the USEPA, states are allowed some flexibility for alternative requirements and/or schedules.

State Regulations. There are two State agencies primarily responsible for the regulation of Illinois landfills. The Illinois Pollution Control Board (IPCB) is a seven member board of technically qualified people appointed by the Governor. The board is responsible for establishing the design, construction, operating and permitting requirements for solid waste disposal facilities in Illinois. The Illinois Environmental Protection Agency (IEPA) is the agency responsible for permitting solid waste disposal facilities and ensuring that they are designed, constructed and operated in compliance with the regulations.

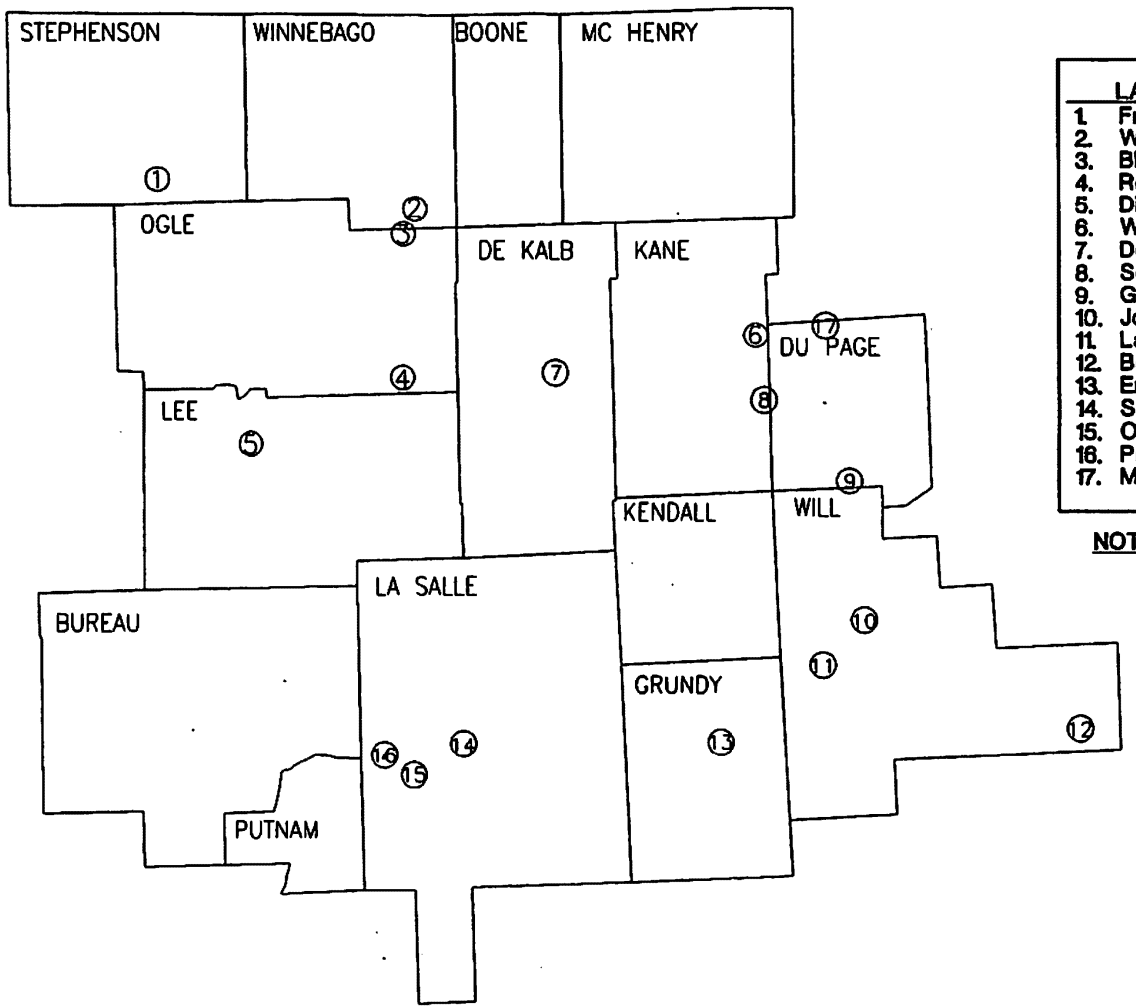
On September 18, 1990, sweeping amendments to the IPCB regulations became effective. The IPCB's previous landfill regulations, Title 35 Illinois Administrative Code (IAC) Part 807, were outdated, having been adopted in July 1973. The old regulations did not adequately address the problems of landfill gas monitoring and collection, groundwater monitoring, liners and leachate collection systems. The amendments added six new parts (35 IAC Parts 810 through 815) to the IPCB regulations. The intent of the new regulations contained in Parts 810 through 815 was to replace the old nonhazardous waste regulations contained in Part 807. For the most part, the new regulations were also intended to force existing facilities to close if they did not meet certain minimum standards. Existing facilities remaining open beyond September 18, 1992 were required to comply with many of the extensive regulations contained in Parts 810 through 815. The State extended the closure period for several facilities until October 9, 1993, when the Subtitle D regulations went into effect, so that they could fill up their remaining

capacity and close without having to make major modifications to the landfills. The IPCB adopted R93-10 (Identical in Substance Rule) in September 1993 to amend the Illinois landfill regulations such that they complied with the federal Subtitle D landfill regulations. On January 3, 1994 Illinois became an approved state by the USEPA. All landfills must comply with the Illinois landfill regulations as they are now amended. (See Appendix A for a summary of the Illinois landfill regulations).

A direct result of these new regulations is a substantial decrease in the number of permitted landfills in the State. In 1987 there were 147 permitted landfills with a total capacity of approximately 275 million cubic yards. Currently, there are about 70 permitted landfills in the State with a total capacity of approximately 325 million cubic yards. Even with the decrease in the number of permitted landfills, the total landfill capacity has steadily increased over the past few years due to the development of several large capacity landfills, replacing the small city or County landfills. Figure 9-1 shows the landfills currently open near Dekalb County and when their current capacity will be depleted.

DeKalb County Landfill is the primary disposal area for the County. It is located in Cortland and is operated by Waste Management. Approximately 98 percent of the County's non-hazardous waste was disposed there in 1993. At the current rate of waste intake, the landfill will deplete its capacity in 2009. Approximately eight percent of the waste deposited in DeKalb County Landfill came from outside counties such as Kane, Kendall, LaSalle, Lee, McHenry and Ogle Counties. The remaining two percent of the waste generated in DeKalb County was disposed of in other landfills, such as Rochelle Municipal Landfill, States Land Improvement, Winnebago Reclamation Landfill, Woodland Landfill, Peru Municipal Landfill, Davis Junction Landfill, and Morris Community Landfill. Figure 9-1 shows most of the these and other landfills in the region and their expected closure dates.

LANDFILLS AVAILABLE TO DEKALB COUNTY



	LANDFILL	EXPECTED CLOSURE DATE
1.	Freeport Municipal Landfill #4	2008
2.	Winnebago Reclamation	2041
3.	BFI/Davis Junction Landfill	1994
4.	Rochelle Municipal Landfill	2003
5.	Dixon Municipal Landfill	2029
6.	Woodland #1 & #2 Landfill	1999
7.	Dekalb County Landfill	2014
8.	Settler's Hill Landfill	2002
9.	Greene Valley Landfill	1997
10.	Joliet/CDT Landfill	1998
11.	Laraway/ESL Landfill	1994
12.	Beecher Landfill	1997
13.	Environtech Landfill	1994
14.	States Land Improvement Landfill	2000
15.	Oglesby Municipal Landfill	1997
16.	Peru Municipal Landfill	1995
17.	Mallard Lake Landfill	1997

NOTE: Expected closure date based on current permitted capacity and does not take into account future potential expansions.

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FIGURE 9-1

State Statutes Affecting Landfills. The Illinois Solid Waste Management Act (P.A. 84-1318) was adopted to reduce the State's reliance on land disposal and to encourage and promote alternate means of managing solid waste. The State's preferred hierarchy for solid waste management is as follows:

1. Volume reduction at the source.
2. Recycling and reuse.
3. Combustion for energy recovery.
4. Combustion for volume reduction.
5. Disposal in landfill facilities.

Although landfills are the least preferred option in the State's waste hierarchy, they are a necessary part of any solid waste management system. Even the most efficient waste management system will require landfills for non-recyclable materials, non-reusable materials, non-combustible materials and incinerator ash.

During the last few years, several statutes have been passed by the State to limit the total amount of waste and the toxicity of waste going into landfills and to increase recycling efforts. On July 1, 1990, landscape waste was banned from landfills, and if collected, must either go to a composting or land application facility. On September 1, 1990, lead-acid batteries were banned from landfills, and lead-acid battery dealers were required to accept used batteries for recycling. White Goods (large appliances) are also banned from landfills. The ban is due to the fact that many of the components may contain mercury, chlorofluorocarbons (CFCs), or polychlorinated biphenyls (PCBs). They may be landfilled if the hazardous components are removed and the landfill is a member of the Industrial Material Exchange Service(IMES). Disposal of automobile tires is also prohibited from landfills, unless they are shredded prior to disposal, and a program which actively seeks alternative uses for the tire scraps is initiated, such as IMES. Beginning July 1, 1996, disposal of used oil will be prohibited from landfills.

On January 1, 1987, the Solid Waste Management Fund was set up to authorize the State and local units of government to collect fees from solid waste landfills. Effective January 1, 1994, the State surcharge is $0.95/ton for landfills accepting over 150,000 cubic yards per year. The fee decreases for lower amounts of waste accepted. The State also collects a $0.12/ton fee for Subtitle D compliance requirements for landfills which accept over 150,000 cubic yards of waste per year. In addition to the State surcharge, a local unit of government may establish a surcharge to be used for local solid waste management purposes of up to $1.27/ton for landfills which accept over 150,000 cubic yards per year, with the fee decreasing for lower amounts of waste accepted. This fee also decreases for lower amounts of waste accepted. Thus, the maximum total State and local surcharge that a landfill may pay is $2.34. It should be noted that these fees are not the same as those paid under a Local Community Host Agreement.

Local Siting Approval. Section 39.2 of the Illinois Environmental Protection Act (P.A. 82-682) gives local units of government the authority to review siting applications for regional pollution control facilities (landfills are included in the definition of a regional pollution control facility). The local unit of government assigned to this task would be the DeKalb County Board or the incorporated municipality where the landfill would be located. Local siting approval is a prerequisite to submitting a permit application to the IEPA to develop and operate a new or expanded landfill facility. Any applicant proposing the development of a regional pollution control facility must demonstrate that the facility meets the following nine siting criteria:

1. The facility is necessary to accommodate the waste needs of the area it is intended to serve;

2. The facility is so designed, located and proposed to be operated that the public health, safety and welfare will be protected;

3. The facility is located so as to minimize incompatibility with the character of the surrounding area and to minimize the effect on the value of the surrounding property;

4. The facility is located outside the boundary of the 100-year floodplain, or the site is flood-proofed;

5. The plan of operations for the facility is designed to minimize the danger to the surrounding area from fire, spills, or other operational accidents;

6. The traffic patterns to or from the facility are so designed as to minimize the impact on existing traffic flows;

7. If the facility will be treating, storing or disposing of hazardous waste, an emergency response plan exists for the facility which includes notification, containment and evacuation procedures to be used in case of an accidental release;

8. If the facility is to be located in a county where the county board has adopted a solid waste management plan consistent with the planning requirements of the Local Solid Waste Disposal Act or the Solid Waste Planning and Recycling Act, the facility is consistent with that plan; and

9. If the facility will be located within a regulated recharge area, any applicable requirements specified by the Board for such areas have been met.

Currently, the status of Illinois' siting statute is uncertain. On October 22, 1993, the U.S. District Court for the Southern District of Illinois, in the case of TENNSV, Inc. v. IEPA, ruled that sections 3.32, 39.2 and 22.14(a) of the Illinois Environmental Protection Act (which define and regulate the siting of regional pollution control facilities) are unconstitutional, because they violate the commerce clause of the U.S. Constitution. In the decision it was stated that these sections "place more stringent requirements on facilities which accept waste from areas outside the boundaries of a local general purpose unit of government (which includes waste from outside the State of Illinois) than on those facilities which do not accept such waste." The IEPA, the Governor's office, and members of the General Assembly have evaluated the decision, and amendments to the State's siting law have been proposed.

Illinois Landfill Siting and Permitting Timeframe. Illinois has a two-step process for developing new landfill facilities. Step one is the local siting process which is codified in Section 39.2 of the Illinois Environmental Protection Act as discussed above.

Step two, the regulatory permitting process, does not begin until local siting approval has been granted. During step two, the landfill applicant must obtain permitting approval from the Illinois Environmental Protection Agency (IEPA) and possibly other State and federal agencies. The recently promulgated Illinois landfill regulations (35 IAC Parts 810-815) contain specific design, operating and permitting requirements.

Figure 9-2 shows that the minimum time required to site, permit and construct a new landfill facility is approximately four years. The legally mandated timeframes are italicized, while the remaining non-italicized timeframes are based on previous experience in Illinois. Four years is considered a minimum, and recent experience in Illinois indicates that the time necessary to develop a new landfill can be considerably longer.

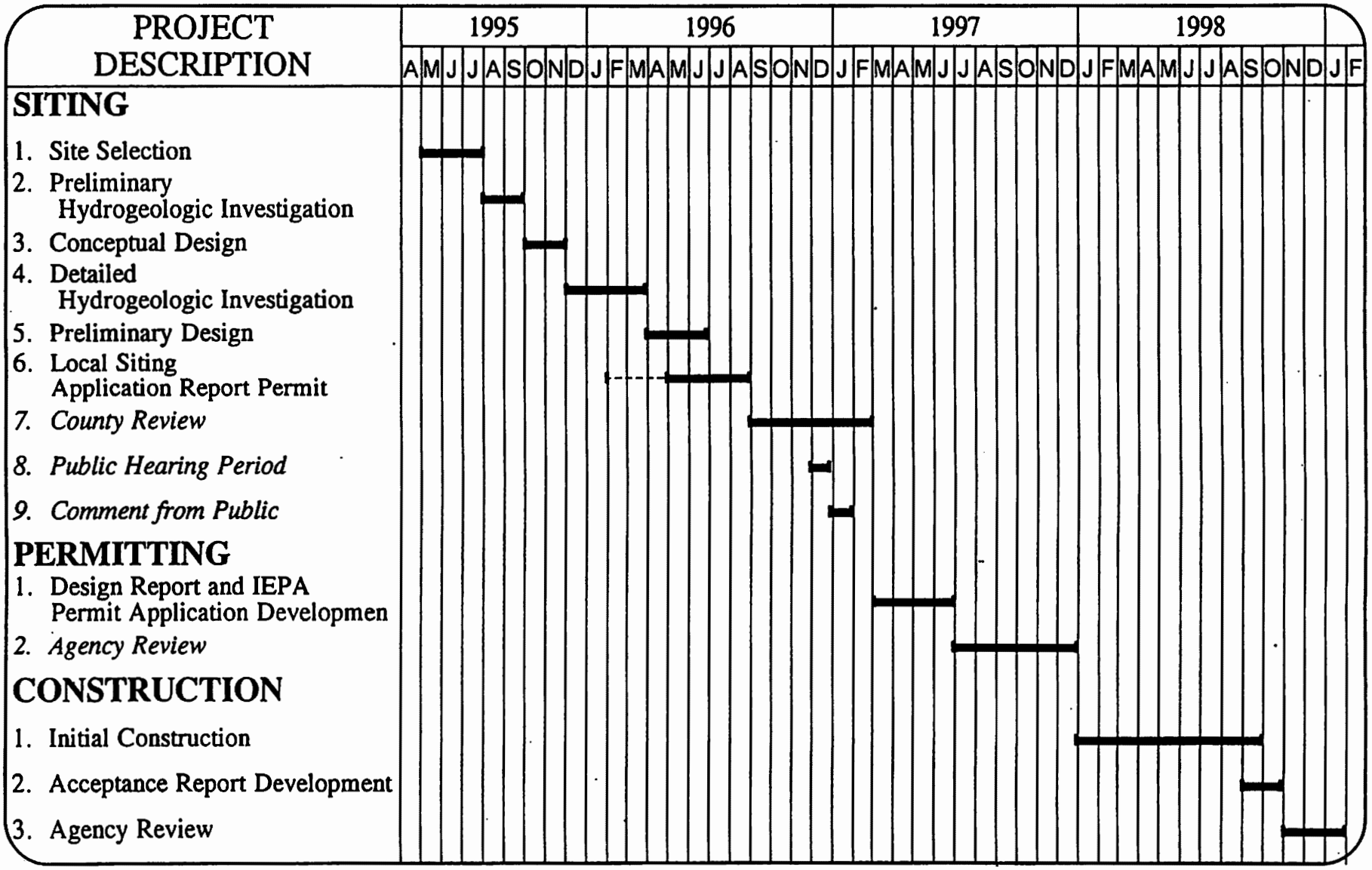
SITE SELECTION

Introduction. Siting a landfill is an important and difficult process in implementing any waste management system. Improved technologies in landfill design may allow for consideration of more potential sites; however, ensuring land use compatibility and environmental suitability requires a thorough evaluation of potential sites. The objective of a landfill site selection process is to establish a systematic approach to identify sites possessing the natural features to meet the regulatory requirements, to be acceptable to the public, to reduce the environmental risks, and still be financially viable. Figure 9-1 indicates that there are several landfills in the region which may provide disposal capacity to the County, including the DeKalb County Landfill which isn't expected to close until 2014. However, if the County decides to site a new landfill, it should follow these guidelines.

Public Involvement. Public involvement throughout the siting process is an important element in successfully siting a waste management facility. The first step in a landfill site selection process is the formation of a broad-based siting committee. Members typically represent various interests in the county including municipalities, businesses, citizens' organizations, local government agencies and at large members with appropriate expertise (e.g. engineers, planners, and scientists). Forming the siting committee is often the responsibility of the entity responsible for implementing the plan.

It is important to get the general public involved in the siting process, because their comments and ideas may be insightful and should be considered. Public hearings should be held to inform the public and give them the opportunity to express their concerns and ask questions.

CONCEPTUAL LANDFILL SITING AND PERMITTING TIMELINE



Activity (Months) ------- Variable Time Frame

Italicized Project Descriptions are Regulated Time Frames

FIGURE 9-2

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Educational information should be made available to them at the local library, so that they can develop an educated opinion of the situation, without relying on assumptions and disinformation.

Landfill Site Selection Process. Once a siting committee is formed, the actual development of the site selection procedure begins. The site selection procedure is typically broken down into two main phases. Phase I is the regional site screening phase, in which specific areas are eliminated by regulatory criteria, while Phase II involves the qualitative scoring of individual parcels or sites that are still eligible after Phase I.

Regional Site Screening. A regional site screening is used to evaluate a large area (i.e., the seven county region) and to identify potential sites. The necessary size for the landfill, ancillary facilities and buffer area should be determined and agreed to by the siting committee. This will be important during Phase II of the site selection process when individual parcels or sites will be identified based on the remaining suitable areas in the County after Phase I.

The regional screening will first identify areas which are considered to be unsuitable for landfill development. Typically, a regional site selection process is accomplished by screening based on the selected criteria. State and federal regulatory criteria are considered "pass/fail" criteria which exclude areas from further consideration. These regulatory pass/fail location criteria include:

1. Airports
2. Floodplains
3. Wetlands/Waters of the U.S.
4. Fault/Unstable Areas
5. Historic and Natural Areas
6. Areas Critical for Endangered or Threatened Species
7. Water Supply Wells
8. Sole Source Aquifers

9. Occupied Dwellings, Schools, and Hospitals

10. Geologically Unsuitable Areas

Additional pass/fail criteria may be developed by the siting committee. These criteria often reflect local policies and concerns of the County, primarily land use criteria. Examples include requiring extra acreage for a buffer zone around the landfill, requiring extra setback zones from schools, water wells, residences and prohibiting the location of a landfill in areas already developed or in high quality farmland areas.

These pass/fail criteria are then developed into a series of map overlays showing land areas unsuitable for a landfill. The individual maps are overlaid to develop a composite map showing only those areas remaining considered to be suitable for siting a landfill. The siting committee must be aware that if it decides to add additional pass/fail criteria that it may make the siting of a landfill overly restrictive and virtually impossible.

Individual Site Scoring. After potential landfill areas are identified through the regional screening process, Phase I, the site selection process shifts to Phase II, where individual sites are identified (based on the minimum size criteria), evaluated and scored. During Phase II each potential site is studied and scored based on the criteria and scoring procedure chosen by the siting committee. Each criteria is assigned a weight multiplier which varies depending on the concerns and priorities of the siting committee. The more important a criteria is, the higher the multiplier should be. Each individual site is then evaluated under each of the Phase II criteria selected by the siting committee. The more suitable a site is determined to be under each criteria, the higher the score it is given. The multiplier for that criteria is then applied to the score and the product is the total score for that criteria. All the total scores are then combined and the site with the highest sum of the total scores is deemed most appropriate. The criteria used to evaluate a potential landfill site may include those listed below:

1. Groundwater Protection

2. Surface Water Hydrogeology and Topography

3. Soil Conditions

4. Land Use Compatibility

5. Traffic Impacts, Site Access

6. Visual Screening

7. Number of Residences within a Specified Distance

8. Haul Distance

9. Soil Availability

10. Land Availability and Cost

11. Existing Buffers

12. Distance From Waste Generation Centroid

13. Availability of Utilities

Geographic Information System. Geographic Information System (GIS) is a useful tool to assist in the siting, screening and selection process. A GIS can assemble a complex assortment of paper maps and tabular information into an understandable array of "electronic" maps that can be easily received and analyzed according to any set of siting criteria.

The Illinois Solid Waste Management Act authorizes the Department of Energy and Natural Resources (DENR) to provide general siting assistance to local units of government. General siting assistance typically consists of a regional screening of specific siting criteria at a scale of approximately one inch to one mile. The process utilizes a GIS to compile the criteria selected by local authorities and to selectively eliminate unsuitable areas from consideration. The result is a series of maps that illustrate suitable areas of each individual siting criteria and a composite map of all siting criteria.

SOLID WASTE PROCESSING EVALUATION

The following section discusses the various levels of processing which may be used for the disposal of waste in a landfill. Although most of the waste disposed of in landfills is loose or unprocessed, there is a growing trend to process the waste before final disposal. The trend toward increased waste processing is due to the diminishing amount of landfill volume and the growing number of transfer stations and material recovery facilities in operation.

Unprocessed (Loose) Waste. Most of the waste being landfilled is unprocessed waste. When unprocessed waste arrives at a landfill by packer trucks or transfer trailers, it is dumped or tipped at the active portion of the landfill. The landfill operator then typically spreads and compacts the waste in two to three foot lifts. The in-place density of unprocessed or loose waste is typically between 800 and 1200 pounds per cubic yard. Higher densities have been achieved by decreasing the lift height and increasing the energy imparted by the compaction equipment. This will increase the capacity of the landfill, but will also increase the operating, maintenance and equipment costs over the life of the landfill. Daily cells are typically constructed in 8 to 15 foot lifts prior to adding intermediate or daily cover.

This procedure is common to most landfills, because of the relatively low costs and simplicity of the system. With the growing difficulty and expense of siting new landfills, more operators are looking for alternatives to maximize the air space in landfills, thus extending the life of the landfill. This has led to an increase in the number of processed waste landfills. Shredded waste and baled waste landfills are the most common forms of processed waste landfills. See Table 9-1 for a listing of advantages and disadvantages of unprocessed waste.

Shredded Waste. Waste can be shredded at a landfill or transfer station. High torque, low-speed shredders or hammermills are often used to process the bulky waste into a relatively homogeneous material 1.5 to 4 inches in maximum diameter. The final product is easy to work with and is aesthetically more desirable. The shredded waste is easy to compact and in-place densities of 1100 to 1500 pounds per cubic yard have been reported at shredded waste landfills. The actual machinery used in the shredding process should be based upon the materials to be

shredded, required processing capacity, and desired end product size. See Table 9-2 for a comparison of shredded waste to unprocessed waste.

TABLE 9-1. UNPROCESSED (LOOSE) WASTE
Advantages
1. Low capital costs associated with not having to build and operate a processing facility.
Disadvantages
1. Short landfill life due to low in-place density.
2. Daily cover requirements of at least 6 inches use up valuable air space and require material to be hauled across site or imported.
3. Landfill operations are difficult due to the bulk nature of unprocessed waste.
4. Poor aesthetics caused by blowing litter.
5. Unpleasant conditions arising from odor problems.
6. Public health impacts resulting from vectors.

TABLE 9-2. COMPARISON OF SHREDDED WASTE TO UNPROCESSED WASTE
Advantages
1. Landfill life is increased 35 to 50% over the life of an unprocessed (loose) waste landfill.
2. Daily cover requirements are easier to apply to a uniform working surface.[1]
3. Landfill operations are easier because of the homogeneous nature of shredded waste.
4. A more aesthetically pleasant landfill operation.
5. Minimization of odors.
6. Minimization of vectors.
7. Uniform settlement because of homogeneous material.
8. Adaptability to alternate solid waste management technologies.
Disadvantages
1. High capital costs associated with shredding equipment and facility.
2. Potential for explosion at the shredding facility.
3. Downtime due to maintenance and breakdowns.
Notes: 1. Daily cover can be eliminated if it is demonstrated that the shredding process 1) prevents blowing debris and 2) minimizes vectors, fires, and odors.

Compacted (Baled) Waste. Waste can be compacted and baled at a landfill or a transfer station. Generally, there are four different types of balers: 1) horizontal balers, 2) vertical balers, 3) two-ram balers, and 4) three-ram balers. The basic processes involved in baling are compaction and tying. Rams or pistons compress the waste in the compaction chamber. As the waste leaves the chamber, it is tied together with steel wire. A typical bale size is 3' x 4' x 6' and can weigh from 2000 to 4000 pounds. A fifth type of compaction equipment commonly used for solid waste is large volume solid waste compactors. Large volume compactors compact the waste into large monolithic bales prior to loading it into specially designed, reinforced transfer trailers. The type of baler used varies on the quantity and characteristics of the waste stream. However, two-ram balers and large volume compactors are most commonly used to compact solid waste. See Table 9-3 for a comparison of baled waste to unprocessed waste. Table 9-4 and Figure 9-3 show the effects of solid waste processing on landfill life.

TABLE 9-3. COMPARISON OF BALED WASTE TO UNPROCESSED (LOOSE) WASTE	
Advantages	
1.	Landfill life is increased 60 to 80% of the life of an unprocessed waste landfill.
2.	Daily cover requirements are easier to apply to a level surface.[1]
3.	Landfill operating efficiency is increased by requiring less equipment and personnel while improving the operating standards of the landfill.
4.	A more aesthetically pleasant landfill operation.
5.	Minimization of odors.
6.	Minimization of vectors.
7.	Long term maintenance costs less because of uniform and lower settlement rates.
8.	Less potential for fire.
9.	Lower transportation costs.
Disadvantages	
1.	High capital costs associated with baling equipment and facility.
2.	Downtime due to maintenance and breakdowns.
Notes: 1.	Daily cover can be eliminated if it is demonstrated that the process 1) prevents blowing debris and 2) minimizes vectors, fires and odors.

TABLE 9-4. EFFECTS OF SOLID WASTE PROCESSING ON DENSITY AND LANDFILL LIFE

Level of Processing	Typical in-Place Solid Waste Density (lb/c.y.)	Effective Density with 6" (min.) Daily Cover (lb/c.y.)[1]	Increase in Useful Life Achieved Through Waste Processing (6" Daily Cover)[2]	Effective Density with No Daily Cover (lb/c.y.)[3]	Increase in Useful Life Over Unprocessed Waste (No Daily Cover)[2]
Unprocessed Waste	900	720	---	---	---
Shredded Waste	1200	980	36%	1090	51%
Baled Waste	1400	1170	62%	1273	77%

Notes:

1. Effective density accounts for daily, intermediate and final cover
   Effective density = solid waste density/cover factor
   Cover factor = 1.25 for unprocessed waste
   Cover factor = 1.22 for shredded waste
   Cover factor = 1.20 for baled waste

2. Increase in useful life = $\frac{\text{Processed effective density - Unprocessed effective density}}{\text{Unprocessed effective density}}$

3. Effective density accounts for intermediate and final cover (Assumes no daily cover)
   Effective density = solid waste density/cover factor
   Cover Factor = 1.10 for processed waste

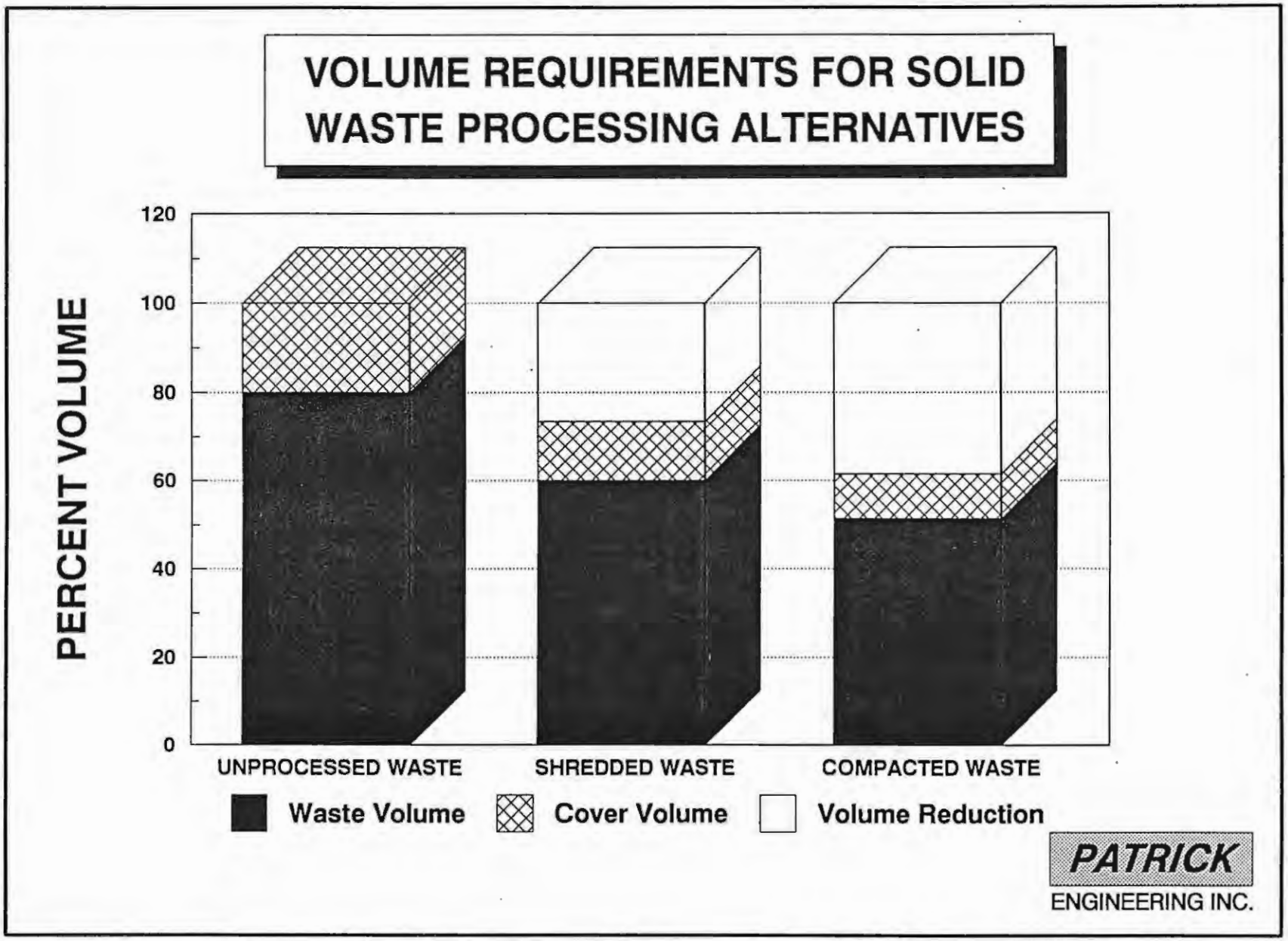

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FIGURE 9-3

LANDFILL DESIGN

Sizing Requirements. Landfills should be designed and constructed to accommodate the needs of the area it is serving for approximately 20 years. Landfill economics are characterized by economies of scale, i.e., the more waste a facility handles, the lower the tipping fee.

It is projected that DeKalb County needs approximately 4.16 million cubic yards of air space over the 20 year planning period. Assuming that the landfill will take all of the waste from the County and no waste from outside the County, a facility with a minimum size of approximately 132 acres would be required.

Landfill Design. Landfills in the past were typically designed to attenuate chemicals which leach out of the landfill as they flow through the unsaturated soil above the groundwater table. This concept has been shown to be ineffective since the chemicals could contaminate the groundwater, making it unsuitable for use as a drinking source. Instead of natural attenuation landfills, the landfills of today are designed to be containment landfills. Currently, landfills are designed with liners and leachate collection systems to prevent or minimize the leaching of chemicals out of the landfill.

The federal and State landfill regulations establish minimum design and performance standards. Specific site information and state-of-the-art technologies need to be incorporated into a design. The design engineer must incorporate all regulations, both current and those proposed to become effective within the operating period of the landfill, into the design and operating procedures for the landfill. A design feature which facilitates additional changes is to construct the landfill in cells and allow for phased development. Each cell is built individually and accepts waste for two to five years, depending on the size of the cell. The design and construction procedures for each new cell can be modified to meet any recently promulgated standards. The following overview discusses the minimum design requirements for the major components of a landfill.

Liner System. A liner system is used to prevent migration out of a landfill. Liners will vary depending on the local hydrogeology and soil conditions of the landfill. An engineered liner consists of a compacted layer of low permeability clay. Current regulatory standards require liner systems be constructed to achieve a maximum hydraulic conductivity of 1×10^{-7} centimeters per second (1.24 inches per year). A composite liner system may also be used. Composite liner systems include a synthetic membrane liner and a compacted clay liner. A synthetic membrane prevents advective flow through the liner unless the membrane is damaged or constructed improperly. Minimal amounts of contaminants may diffuse through the membrane via molecular diffusion. The compacted clay liner prevents or minimizes contaminant migration below the synthetic membrane.

The Illinois landfill regulations require, at a minimum, a 5-foot compacted, low permeability clay single liner system or a 3-foot compacted, low permeability clay liner with a 60 mil (1.5 millimeters thick) synthetic liner, usually made from high density polyethylene (HDPE). These regulations are minimums, and thicknesses are often increased or alternate liners are constructed.

Several types of bentonite liners are available for use in landfills. Bentonite liners have a thin layer of bentonite designed to swell up and minimize the flow of leachate if there is a leak in the synthetic membrane. Although bentonite liners may be permitted as a supplement to bottom liners, more practical applications are likely to be for final cover systems and/or side liners.

A double composite liner system is basically two composite liners combined in a single liner system. A double composite liner contains a primary liner and leachate collection system, and a secondary liner and leachate collection system. Double composite liners are required in most hazardous waste facilities, but with growing public concern about the protection of the groundwater, some municipal waste landfills are using double composite liners. The space between the primary and secondary liners can be used as a witness zone. Routine testing of water pumped through this area can determine if contaminants have passed through the primary liner.

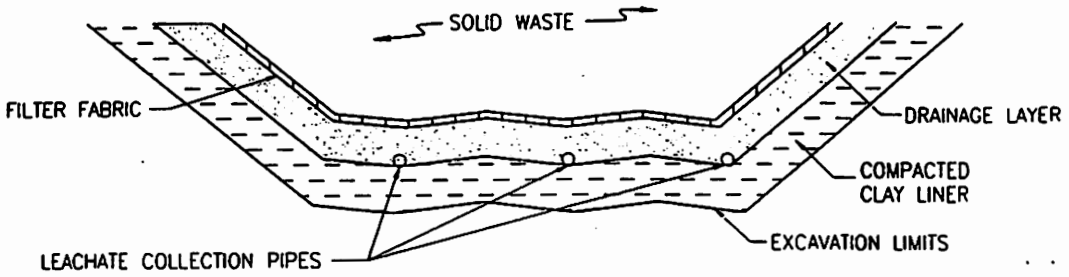
Figure 9-4 shows a cross section of the first three liner types with leachate collection systems.

Leachate Collection System. The leachate collection system works with the liner system to contain, collect and remove the leachate for treatment. A leachate collection system generally includes a filter fabric, a granular drainage blanket over the base of the landfill, and slotted or perforated leachate collection pipes in the drainage blanket. The filter fabric is generally used to provide a separation layer between the refuse and the drainage layer. The granular drainage blanket allows leachate to drain freely to the leachate collection pipes. The liner is sloped to drain leachate toward the collection pipes, which are typically spaced at 200 to 300 feet intervals. Also included in the collection system are cleanout risers to facilitate cleaning of the collection pipes. Collected leachate can be treated on site or taken to a waste water treatment facility if the facility is permitted to treat leachate.

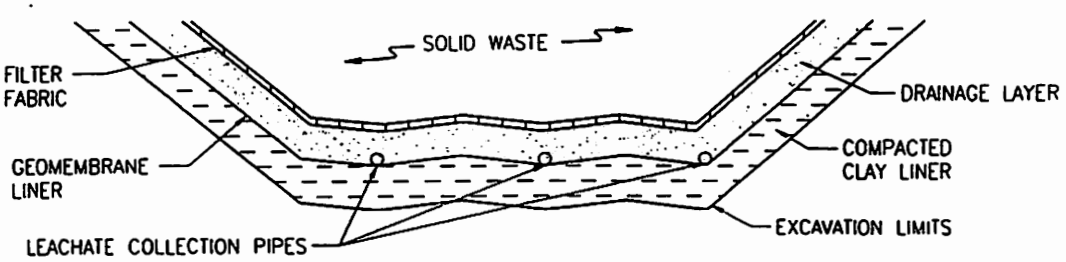
Leachate Recirculation. An emerging technology is leachate recirculation. Recirculating leachate increases the moisture content of the landfill. Biological activity will be enhanced, thus accelerating the rate of waste decomposition. This will increase the rate of settlement and the production of methane gas, which can be collected and used or sold as an energy source.

A proper leachate recirculation design distributes leachate evenly over the entire landfill. Although the design of a leachate recirculation system will require a thorough understanding of biological and physical principles, it will allow for the rapid decomposition of waste, yielding more air space, and provide quantities of methane which can be collected and sold as a fuel source. By making the waste more stable earlier in the life of the landfill, the capacity of the landfill will be increased and there will be fewer problems later in the life of the landfill, such as differential settlement and possible groundwater contamination after the landfill has closed. Some potential problems included with leachate recirculation include an increased potential for leachate popouts, methane migration and odors.

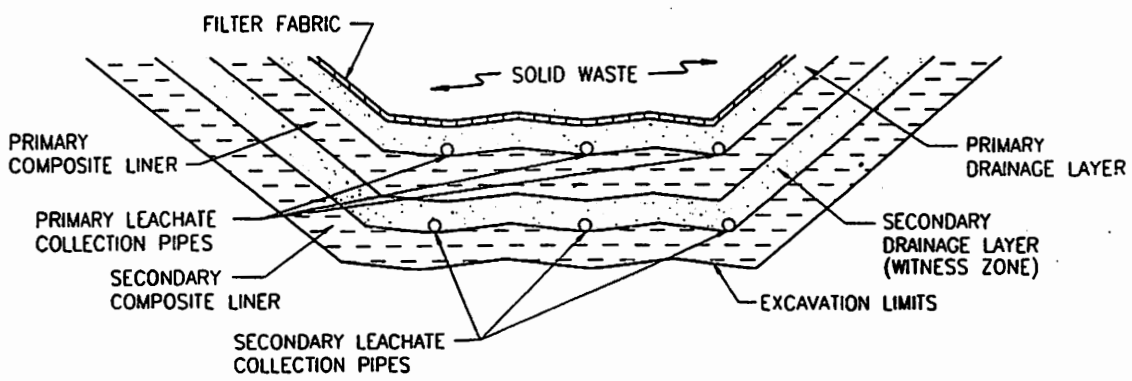
SCHEMATIC LANDFILL LINER SYSTEMS



SINGLE LINER SYSTEM



COMPOSITE LINER SYSTEM



COMPOSITE DOUBLE LINER SYSTEM

FIGURE 9-4

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Landfill Gas Control System. Biological decomposition of solid waste results in the production of landfill gases. Methane and carbon dioxide are the principle components of landfill gas. Landfill gas allowed to migrate freely throughout the landfill and surrounding areas may cause air pollution and result in dangerous conditions. Methane is highly combustible at concentrations between 5 and 15 percent in air. It can also travel through permeable zones in the soil and enter into nearby buildings. Although a lack of oxygen prevents combustion above 15 percent concentration, these levels still pose a threat to personnel due to the air becoming oxygen-starved and, therefore, unbreathable.

Gas collection systems can be passive or active. Passive systems utilize the pressure of the gases accumulated within the landfill to vent the gas to the atmosphere. New landfills are required to actively collect the landfill gases by mechanical means which produce a slight vacuum in the collection system in order to actively draw the gas out of the landfill. Collected landfill gas can be flared or processed as an energy source. The processing of landfill gas for beneficial use is strongly encouraged, but is not required.

Cover System. Landfill cover minimizes the infiltration of precipitation and maintains an aesthetically acceptable landfill.

Daily cover is applied at the end of each working day to the active portion of the landfill. Daily cover is required to be six inches of soil that 1) minimizes leachate production from precipitation, 2) eliminates direct access to the refuse by vectors, and 3) controls fires, odors and blowing litter. Alternate methods of daily cover such as tarps, foams or synthetic membranes can be approved if they satisfy the above requirements.

Intermediate cover is required for any area of the landfill which does not have final cover in-place and is inactive for more than 60 days. Regulatory standards require one foot of soil as intermediate cover.

Final cover is required to be a six foot thick soil cap, made up of three feet of compacted, low permeability clay and three feet of protective soil cover. The clay layer is to minimize the infiltration of precipitation and is required to have a maximum hydraulic conductivity of 1×10^{-7} centimeters per second. The upper soil layer is placed directly above the cap to protect the clay layer from freezing, desiccation, erosion, and to support vegetation. The final cover is sloped to promote runoff of precipitation from the landfill.

Stormwater Management. A proper design should include methods of routing all stormwater off the landfill and away from the site without causing erosion or scouring. The design must consider how the facility will handle stormwater drainage from initial construction through post-closure. If there is discharge of stormwater off the site, the facility may require a National Pollutant Discharge Elimination System (NPDES) permit. The NPDES permit regulates the discharge limitations, and the monitoring and reporting requirements for any discharge off of the site.

Groundwater Monitoring. Ideally, each new landfill should be designed and constructed to prevent the migration of leachate and chemicals out of the landfill and into the groundwater. However, both State and federal regulations require that a groundwater monitoring network be set up around and under the landfill to detect any potential leaks.

Before site development can begin, or a permit granted, an extensive hydrogeological study must be performed. The study must contain such information as subsurface geology, soil characteristics, aquifer characteristics, and the current concentrations of regulated groundwater parameters in the groundwater. From this knowledge, the most appropriate design of the landfill can be used, an effective groundwater monitoring network can be established, and the background concentrations of the regulated parameters can be established, from which all future analyses will be compared. Monitoring must be carried out quarterly during the life of the landfill and for a minimum of 30 years after closure. If contamination of the groundwater is detected, appropriate assessment and remediation procedures must be followed.

DISPOSAL CAPACITY REQUIREMENTS

Current Solid Waste Generation. DeKalb County landfilled approximately 72,582 tons of solid waste in 1993. This quantity includes residential waste, commercial and institutional waste, industrial waste, and construction and demolition waste.

Projected Solid Waste Landfill Rate. The projected County solid waste landfill rate is based on the worst case scenario over the 20 year planning period of 1999 through 2018. The maximum landfilling rate estimates determined in the Needs Assessments were used. Recent experience in Illinois indicates that it will take approximately 4 years to site, design, permit, and construct a new landfill. If the process begins in 1995, the landfill would hopefully be ready to accept waste in 1999. Also, any solid waste management plan must provide disposal capacity for 20 years.

The amount of waste from the County projected to be disposed in landfills during the 20 year planning period is approximately 1,731,000 tons or 5.77 million cubic yards, assuming 600 pounds per cubic yard. The actual landfill air space required is approximately 4.16 million cubic yards, assuming an effective solid waste density of 1000 pounds per cubic yard in the landfill and a cover factor of 1.20 (daily, intermediate and final cover accounts for 20 percent).

Options. There are two fundamental options available to the County to ensure disposal capacity for the 20 year planning period: 1) secure disposal capacity at an existing facility in or out of the County, or 2) develop a new in-County landfill capacity for the disposal of the County's solid waste (either by the public or private sector). To secure capacity at an existing landfill, the counties would have to negotiate for approximately 5.77 million gate cubic yards of disposal capacity, assuming the density of a gate cubic yard is approximately 600 lbs/C.Y.

When a private company develops a landfill in a municipality or county, there is often an agreement between the two parties. This agreement, called a Host Community Agreement, is a legally binding contract that guarantees that the private company will maintain certain design, operation and financial standards, above and beyond those required by State and federal

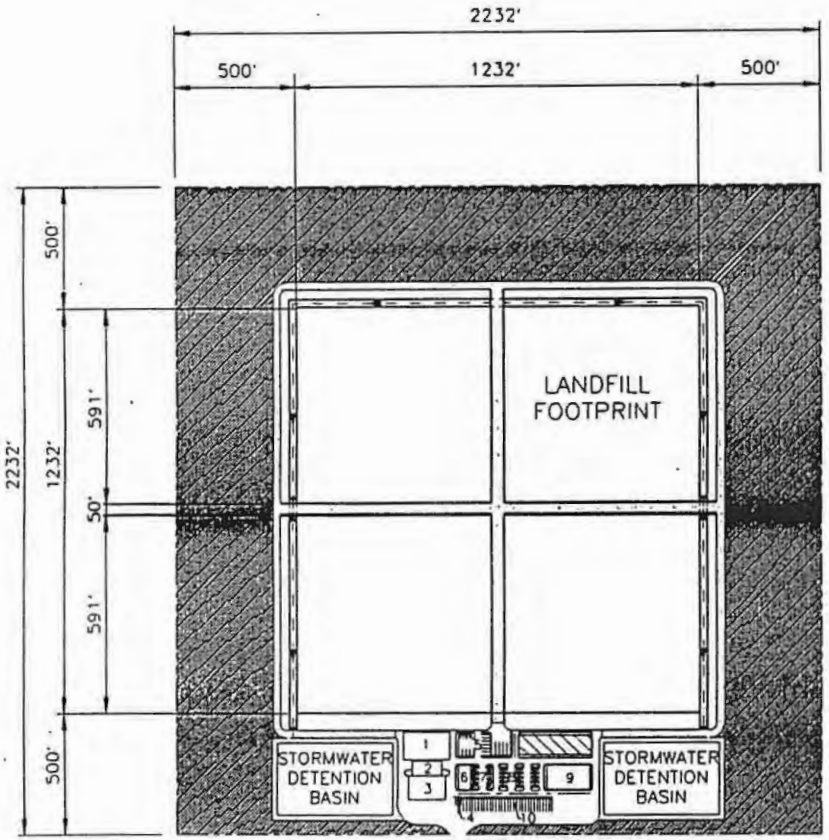
regulations. Some of the possible stipulations of the contract are guaranteed capacity for the municipality or county at the landfill, surrounding property value guarantee, a host benefit fee paid to the county for each ton of waste accepted to the landfill, and a groundwater well monitoring program for surrounding residents.

If the County decides to develop a new landfill, the minimum landfill area required is approximately 45 acres. The area was geometrically calculated based on the following assumptions:

1. The facility consists of four waste cells,
2. The landfill depth below grade is 30 feet,
3. The landfill height above grade is 90 feet,
4. The above grade side slopes on the face of the cell are 4:1,
5. The above grade side slopes on the interior of the cell are 2:1,
6. The below grade side slopes are 2:1.

The 45 acre landfill needed to dispose of the waste does not include room for ancillary facilities and a buffer zone. A 500 foot setback around a square 45 acre landfill would require a minimum of a 132 acre site. The 45 acre landfill represents the minimum landfill area necessary to meet the needs of the County only. Additional area would be required if the landfill imports waste from outside of the County or wishes to last longer than the 20 year planning period.

Figures 9-5 and 9-6 show the plan and cross-sectional views of the conceptual landfill.



DRAWING NOT TO SCALE

ANCILLARY FACILITIES	
1. SLAVE VEHICLE QUEING AREA. (50'x50')	6. ADMINISTRATION BUILDING (25'x50')
2. TRUCK WASHING AREA (90'x60')	7. VISITOR PARKING (55'x65')
3. MAINTENANCE BUILDING (125'x75')	8. EMPLOYEE PARKING (55'x65')
4. GATEHOUSE (20'x20')	9. GAS INCINERATION AREA (150'x100')
5. HEAVY EQUIPMENT STORAGE (150'x75') -- storage for heavy equipment vehicles.	10. OPTIONAL TRANSFER TRAILER PARKING (250'x65')

LEGEND

- SOIL STOCKPILE AREAS
- STORMWATER DRAINAGE CHANNEL
- ACCESS ROAD
- [3] ANCILLARY FACILITIES

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REV No	DATE	DESCRIPTION	DRN. BY	APP. BY

		DATE
PROJECT No.:	4298	
DESIGNED BY		
DRAWN BY	DJC	12/22/93
CHECKED BY		
APPROVED BY	PAS	12/22/93

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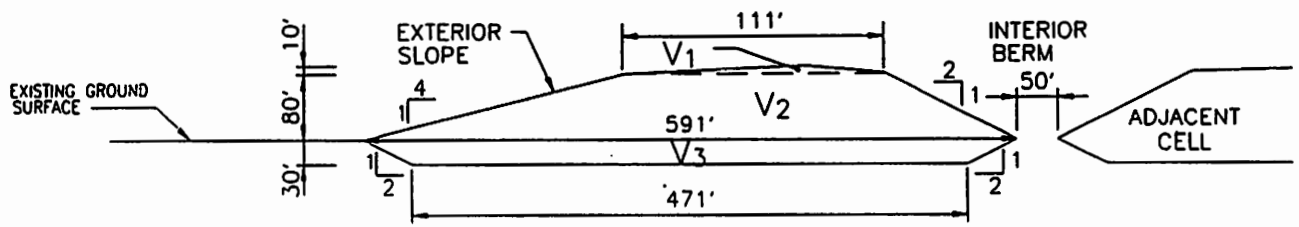
CONCEPTUAL LANDFILL CELL CROSS SECTION

FIGURE 9-5

TYPICAL CELL DIMENSIONS
CROSS-SECTION



DRAWING NOT TO SCALE

$V_{cell} = V_1 + V_2 + V_3$

$V_{cell} = \left[\frac{1}{3}H_1A_1 + \left[\frac{1}{3}H_2(A_1 + A_2 + \sqrt{A_1 \cdot A_2})\right] + \left[\frac{1}{3}H_3(A_2 + A_3 + \sqrt{A_2 \cdot A_3})\right]\right] \cdot \frac{1}{27}$

WHERE: $H_1 = 10'$
$H_2 = 80'$
$H_3 = 30'$
$A_1 = 111' \cdot 111' = 12{,}321$ SQ. FT.
$A_2 = 591' \cdot 591' = 349{,}281$ SQ. FT.
$A_3 = 471' \cdot 471' = 221{,}841$ SQ. FT.

V_{cell} = 738,073 cubic yards.

TOTAL LANDFILL VOLUME = $4 \cdot V_{cell}$ (4 EQUAL LANDFILL CELLS)
2,952,292 cubic yards

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REV. No.	DATE	DESCRIPTION	DRN. BY	APP. BY

PROJECT No.: 429B		DATE
DESIGNED BY		
DRAWN BY	DJE	12/22/93
CHECKED BY		
APPROVED BY	DAM	12/22/93

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CONCEPTUAL LANDFILL CELL CROSS SECTION

FIGURE 9-6

LANDFILL ECONOMICS

The cost of disposing waste or "tipping" at a solid waste landfill is a function of predevelopment, site development, operating, closure, and post-closure costs. This section discusses the factors which affect the cost of a solid waste landfill. The costs provided are approximate. These costs include a provision for operator overhead and profit of 35 percent of the operating costs. This makes the estimates very conservative.

Cost estimates are provided for four scenarios assuming the development of different size landfills. All four scenarios assume that the counties develop a new loose waste landfill.

- Scenario One assumes a new landfill for disposal of the average quantity of the DeKalb County waste expected to be landfilled during the 20 year planning period, or approximately 300 tons per day (TPD), assuming the landfill is open for 286 days per year.
- Scenario Two assumes the disposal of 100 TPD.
- Scenario Three assumes the disposal of 500 TPD.
- Scenario Four assumes the disposal of 1000 TPD.

An economic comparison of these scenarios shows the significant economies of scale which may be achieved by disposing of larger quantities of waste. The estimated tipping fee for developing a 300 TPD facility is approximately $39 per ton (1994 dollars). The estimated tipping fee for a 100 TPD, a 500 TPD, and a 1000 TPD facility are $73 per ton, $29 per ton, and $23 per ton (1994 dollars), respectively. Refer to Appendix B for detailed cost estimates of the 100, 500, and 1000 TPD facilities.

<u>Scenario One - Conceptual Cost Estimate for a 300 TPD Generic Solid Waste Landfill</u>. The costs in this section address the cost for a 300 TPD solid waste landfill which is designed to accept both putrescible and chemical waste as defined in the Illinois landfill regulations. The following assumptions were made when developing the cost estimates.

1. The facility consists of four waste cells.

2. The size of the footprint is 45 acres. Buffer zones of 500 feet were utilized on each side of the footprint. The total facility size is 132 acres.

3. The above grade side slopes on the face of the cells are 4:1. The above grade side slopes on the interior of the cells are 2:1. The below grade side slopes are 2:1.

4. The landfill depth below grade is 30 feet. The landfill height above grade is 90 feet.

5. The bottom liner consists of a 3-foot thick recompacted clay liner using on-site material and a single 60-mil HDPE liner. The side liners consist of recompacted clay and the synthetic liner.

6. A full leachate collection system and low-technology gas incineration is utilized.

7. Full-time Quality Assurance/Quality Control (QA/QC) is employed during liner and leachate collection system construction.

8. The site is relatively level with no tree or heavy brush coverage.

9. The initial waste area developed is 1/10 of the footprint area or about five acres.

10. Costs are given in 1994 dollars. Future costs are scaled using a 4.5 percent inflation rate, and an interest rate of 7.5 percent was used to estimate the debt service.

11. A 30 year post-closure care period was used.

12. Ancillary facilities are located within the 500 foot buffer and include security gate, scale and scale house, heavy equipment storage, maintenance facility, employee and visitor parking areas, and soil stockpile areas.

Pre-development Costs. The pre-development phase for a landfill in Illinois consists of selection of a site for the landfill, performing preliminary engineering and hydrogeologic studies to assess the suitability of the site for landfill development, obtaining local siting approval for the site under the SB-172 siting process, performing detailed engineering and hydrogeologic studies and designing the facility, and obtaining a development and operation permit from the IEPA.

The costs expected to be incurred during the pre-development phase are summarized in Table 9-5. These costs are approximate and may vary substantially.

TABLE 9-5. SCENARIO ONE: PRE-DEVELOPMENT COSTS

Cost Description	Quantity	Unit	Unit Price	Amount
Site Selection Process	1	Lump Sum	$40,000	$40,000
SB 172 Siting Process				
Project Need Study	1	Lump Sum	$50,000	$50,000
Preliminary Hydrogeological Study	1	Lump Sum	$80,000	$80,000
Preliminary Design	1	Lump Sum	$85,000	$85,000
Preliminary Operating Plan	1	Lump Sum	$20,000	$20,000
Land Use Study	1	Lump Sum	$20,000	$20,000
Traffic Study	1	Lump Sum	$35,000	$35,000
Public Hearings	1	Lump Sum	$60,000	$60,000
Land Costs				
Property	132	Acres	$3,000	$396,000
Option Costs	1	Lump Sum	$25,000	$25,000
Legal Survey	1	Lump Sum	$25,000	$25,000
Permitting Process				
Detailed Hydrogeological Study	1	Lump Sum	$250,000	$250,000
Detailed Design	1	Lump Sum	$75,000	$75,000
Legal Fees	1	Lump Sum	$100,000	$100,000
Public Education/Awareness	1	Lump Sum	$40,000	$40,000
			TOTAL	**$1,301,000**

Site Development Costs. Upon receipt of a permit for the solid waste landfill from the IEPA, a construction contract would be let for construction of the initial waste cell (approximately five acres, 10 percent of the footprint area), installation of the liners, leachate and gas collection systems, construction of fences, monitoring systems, entrance roads and building, installation of the utilities, scale, and landscaping of the site, all of which must be in place before the first load of waste is brought into the facility. During the construction period,

a registered professional engineer will be present to document that the construction is in compliance with the plans and permit. Upon certification by the engineer that the work is in compliance with the plans, the facility would be placed into operation. The estimated site development costs are summarized in Table 9-6.

TABLE 9-6. SCENARIO ONE: SITE DEVELOPMENT PHASE

Cost Description	Amount
Construction, Initial Development	
Site Preparation	$ 163,000
Mass Earthwork	$ 334,000
Stormwater	$ 236,000
Synthetic Liner	$ 71,000
Leachate Collection System	$ 81,000
Roads/Paving	$ 682,000
Curbs and Gutters	$ 13,000
Sidewalks	$ 1,000
Lighting	$ 46,000
Utilities	$ 65,000
Scale	$ 77,000
Landscaping	$ 65,000
Signage	$ 9,000
Fencing	$ 123,000
Field Office/Security	$ 100,000
Monitoring Wells	$ 73,000
SUBTOTAL	$ 2,139,000
Contractor Overhead and Profit (15 Percent)	$ 321,000
Buildings (Including Contractor Overhead and Profit)	$ 750,000
SUBTOTAL	$ 3,210,000
Contingency (15 Percent)	$ 482,000
Mobile Equipment	$ 1,080,000
SUBTOTAL	$ 4,772,000
Escalation Factor (9.2 Percent)	$ 439,000
TOTAL	**$ 5,211,000**

Notes: 1. Escalation factor represents escalation of costs midway between 1994 and 1998 at 4.5% per year.

Site Operation Costs. A sanitary landfill operation is an earthwork construction project that lasts the duration of the active site life. As refuse is brought in, soil for daily cover is excavated from the next cell. Excavation is managed so as to minimize double handling. Clay side seals and bottom seals are constructed of soil excavated from the next cell.

The site manager, equipment operators, laborer(s), gate attendant, and mechanic are permanently assigned to the project and continue with the construction of the remaining cells and final cover ahead of the rate of filling. The size of the construction force and number of pieces of equipment are determined so as to keep ahead of the incoming waste. The annual site operating costs are detailed in Table 9-7.

TABLE 9-7. SCENARIO ONE: ANNUAL OPERATING EXPENSES

Cost Description	Amount
Annual Operating Expenses	
Outside Construction	$ 515,000
Labor	$ 340,000
Equipment Operation and Maintenance	$ 174,000
Building Utilities	$ 28,000
Construction Testing, Documentation, and Layout	$ 126,000
Groundwater Monitoring	$ 37,000
Gas Monitoring	$ 34,000
Leachate Treatment	$ 26,000
Insurance	$ 250,000
TOTAL	**$ 1,530,000**

Notes:
1. Equipment includes: site manager's vehicle(1), site mechanic's vehicle(1), scraper(1) and bulldozer/compactor(1).
2. Labor includes: site manager(1), mechanic(1), gate attendant(1), and equipment operator(1).
3. Equipment assumed to have 10 year life with no salvage.
4. Outside construction includes: mass earthwork, synthetic liner, and leachate and gas collection systems.

Closure Costs. Final closure of the landfill facility will occur when all permitted fill areas have been completed in accordance with permitted plans. The tasks involved in the closure include placement of a clay cover cap, placement of fill to protect the clay cover from freezing, drying, and root penetration, placement of vegetative soil, seeding of the vegetative cover, certification of closure by a registered professional engineer, and filing of plat of the completed landfill. The costs associated with these tasks are shown in Table 9-8.

TABLE 9-8. SCENARIO ONE: CLOSURE COSTS

Cost Description	Amount
Clay Cover Placement	$ 28,800
Protective Soil Layer Placement	$ 24,000
Vegetative Soil Layer Placement	$ 4,800
Vegetation Establishment (Rye grass)	$ 4,700
Certification of Closure	$ 30,000
Prepare and File Plat	$ 3,000
TOTAL	**$ 95,300**

Post-Closure Costs. The post-closure care period begins upon issuance of a certificate of closure from the IEPA. During this period, inspection, maintenance, and repair of the closed facility will be performed. The tasks and associated annual costs of the post-closure period are shown in Table 9-9.

TABLE 9-9. SCENARIO ONE: POST-CLOSURE COSTS

Cost Description	Quantity	Unit	Unit Price	Amount
Site Inspection and Documentation	4	Quarterly	$ 3,500	$ 14,000
Cover Maintenance	2	Acres	$ 2,500	$ 2,500
Leachate Treatment	304,602	Gallons	$ 0.17	$ 51,782
Groundwater Monitoring	1	Lump Sum	$ 37,424	$ 37,424
Gas Monitoring	1	Lump Sum	$ 8,500	$ 8,500
			TOTAL	**$116,706**

Notes:
1. Post-closure costs are annual costs incurred for 30 years after closure.
2. Most of these estimates reflect costs expected only during the first 3 to 5 years of post-closure. Therefore, the total annual maintenance costs reflect a very conservative estimate.

Financing. Pre-development costs and site development costs are usually financed with debt for a publicly owned facility. Table 9-10 shows a bond sizing calculation assuming that revenue bonds are utilized to finance the pre-development costs and development costs. It was assumed the pre-development costs would be incurred during 1996-1997, and the development costs would be incurred during 1998. It was further assumed that bond repayment would occur over the 20 year period 1999-2018. Annual debt payments during this period would amount to $828,879 per year.

TABLE 9-10. SCENARIO ONE: CONCEPTUAL LANDFILL COSTS - BOND SIZING

Date of Financing:	January 1, 1996		
Construction Period:	January 1, 1996 through January 1, 1999		
Capitalized Interest Period:	January 1, 1996 through January 1, 1999		
Principal Repayment:	January 1, 1999 through January 1, 2019		
Bond Coupon Rate:	7.5 %		
Funds Earnings Rate:	5.0 %		
Issuance Costs:	4.0 %		
Sources of Funds		Uses of Funds	
Bond Issue	$ 8,450,000	Construction	$ 6,512,000
Interest Earnings	$ 1,128,457	Capitalized Interest	$ 1,901,250
Contingency	$ 1,672	Debt Reserve Fund	$ 828,879
		Issuance Costs	$ 338,000
TOTAL	$ 9,580,129	TOTAL	$ 9,580,129

Notes:
1. Assumes full construction fund earns interest for first two years, and half construction fund earns interest for third year.
2. Assumes full capitalized interest fund earns interest for one year, 2/3 of fund earns interest for one year, and 1/3 of fund earns interest for one year.
3. Assumes full debt reserve fund earns interest for three years.

Cost Summary. Table 9-11 summarizes the costs for the conceptual 300 TPD facility. This table includes pre-development, site development, operation, closure, and post-closure costs. Also included are local and State surcharges and an allowance for overhead, taxes, and profit for the private operator.

The estimated tipping fee for the conceptual facility is $38.58 per ton (1994 dollars). It should be noted that all costs are estimated for a conceptual facility, and that actual costs will vary depending on site specific factors.

TABLE 9-11. SCENARIO ONE: CONCEPTUAL LANDFILL COSTS - SUMMARY

Cost Description	Amount	Amount Per Ton
Annual Debt Service	$ 828,879	$ 9.57
Operating Expenses	$ 1,530,000	$ 17.67
Closure Fund	$ 4,763	$ 0.06
Post Closure Fund	$ 175,060	$ 2.02
SUBTOTAL	$ 2,538,702	$ 29.32
State/Local Surcharge	$ 202,579	$ 2.34
SUBTOTAL	$ 2,741,280	$ 31.66
Operator Overhead and Profit	$ 598,438	$ 6.91
TOTAL	**$ 3,339,718**	**$ 38.58**

Sensitivity Analysis. A sensitivity analysis was performed using the cost model to investigate the relationship between throughput and tipping fees. Changes were made in pre-development, development, operating, closure and post-closure costs which would be necessarily affected by a change in throughput and facility size, such as amount of land purchased, number of workers employed, and amount of equipment to manage the waste. The results, as seen in Table 9-12 and Figure 9-7 support the idea of economies of scale, where the tipping fee decreases as the throughput increases.

TABLE 9-12. ECONOMIES OF SCALE

THROUGHPUT (tons per day)	100	300	500	1000
TIPPING FEE ($/ton)	$ 73	$ 39	$ 29	$ 23

Notes: Tipping fees are given in 1994 dollars and are estimates.

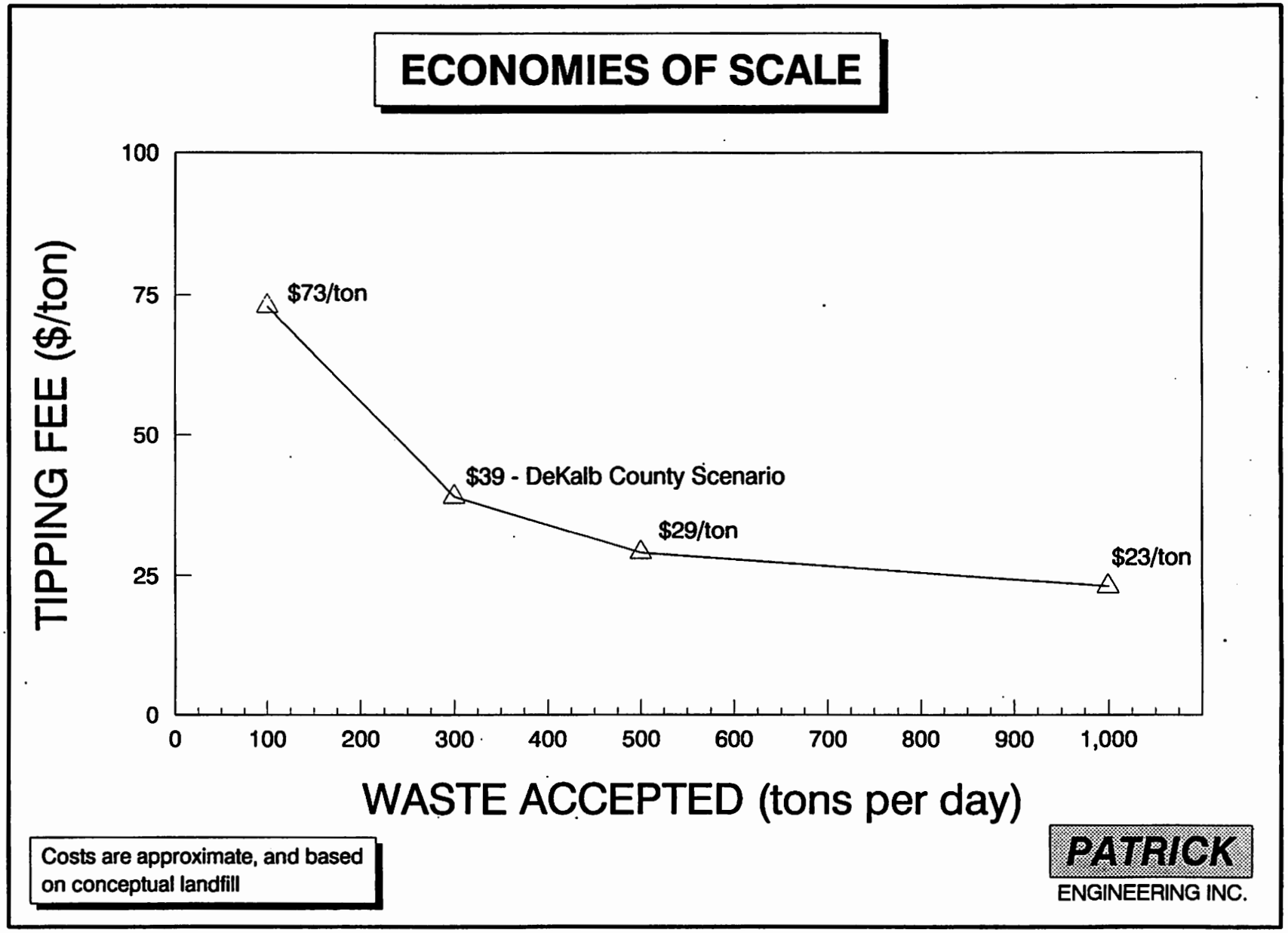

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FIGURE 9-7

Regional Landfill Capacity and Tipping Fees. Other landfills in the region are open and may provide service to the County if required. The location, tipping fee ($/ton), and throughput (TPD) of these regional facilities are given in Table 9-13. These landfills may not be able to handle all of the region's waste for the next 20 years, so some other waste management solutions may have to be developed.

TABLE 9-13. REGIONAL TIPPING FEES

County	Landfill	Tipping Fee[1,2] ($/ton)	Remaining[3] Capacity	Waste Taken In (tpd)
DeKalb	DeKalb County Landfill	$22.50	15 Years	101-500
Winnebago	Winnebago Reclamation	$13.75	47 Years	101-500
Stephenson	Freeport Municipal #4	$35.00	13 Years	101-500
Ogle	Rochelle Municipal #2	$23.58	9 Years	101-500
Ogle	Browning Ferris Industries	$39.00	1 Year	501-1000
Lee	Dixon Municipal Group #2	$16.25	36 Years	101-500
La Salle	Peru Municipal #2	$20.00	1 Year	101-500
La Salle	Oglesby Municipal	$20.00	3 Years	1-25
La Salle	States Land Improvement	$21.25	6 Years	101-500
Kane	Woodland Landfill	$21.40	5 Years	1000+
Kane	Settler's Hill	$37.50	8 years	1000+
DuPage	Mallard Lake	$23.88	5 Years	1000+
DuPage	Greene Valley	$23.48	3 Years	1000+
Grundy	Environtech, Inc.	$21.13	1 Year	501-1000
Will	Beecher Development Co.	$25.15	3 Years	501-1000
Will	CDT Landfill	$7.60	4 Years	501-1000

Notes:
1. Assumes waste arrives in packer trucks at density of 800 lb/cu. yd.
2. Tipping fees are from "Solid Waste Digest" June 1994.
3. Remaining capacity does not take into account possible expansions.

The existing tipping fees for some of the landfills in Table 9-13 are lower than the cost estimates described above. Part of this is because landfills designed and built today must meet tougher standards than those built years ago to ensure protection of the environment. Cutbacks

in operation and development can be made to reduce the cost without endangering the environment, and many of these landfills do that. Also, the estimates given above are only estimates; they are very conservative and are only intended to give an idea of what costs may be, depending on the size of the landfill.

LANDFILLING RECOMMENDATIONS

1. Given the disposal capacity available in DeKalb County (approximately 20 years at the DeKalb County Landfill) and the region (see Table 9-13, Volume I), DeKalb County should continue to rely on existing landfill disposal capacity for final disposal of the County's waste.

2. The County should adopt landfill siting criteria within two years of Plan adoption. No new landfill or landfill expansion should be sited in DeKalb County within this two year period, unless a need is demonstrated for a new landfill or landfill expansion.

3. The landfill siting criteria should be compatible with the County's Comprehensive Plan. As the County develops a Geographic Information System, the appropriate layers of landfill siting criteria should be of high priority.

4. The County's Solid Waste Coordinator should prepare an annual report on the region's disposal capacity and should submit it to the County Board.

5. DeKalb County should review its existing siting ordinance and filing fee requirement and make amendments, if necessary.

6. DeKalb County should enact a local surcharge ordinance (pursuant to Section 22.15(j) of the Illinois Environmental Protection Act) to assist in funding implementation of the Plan.

7. The DeKalb County Landfill should continue to be limited to its current service area as stipulated in the June 5, 1989 siting decision. However, if the service area is expanded, the owner/operator of the DeKalb County Landfill should negotiate a Host County Agreement with the DeKalb County Board prior to accepting waste from the expanded service area. Provisions of the Host County Agreement should include:

- No regulated hazardous waste shall be accepted for final disposal in the landfill.

- A host fee must be paid to the County. The host fee can either be calculated as a percentage of revenues or on a per ton basis. If the fee is calculated on a per ton basis, the per ton host fee will be adjusted annually based on an appropriate Consumer Price Index for DeKalb County.

- The landfill must guarantee long-term disposal capacity for DeKalb County's non-hazardous solid waste and non-hazardous special waste (contingent upon the landfill having proper permits from the IEPA to accept special waste). The length of the capacity guarantee will be agreed-upon by the landfill and the County.

- A property value protection program for existing homes within a site specific distance (to be negotiated by the landfill and the County).

- A domestic water well protection plan must be provided for existing water wells within a site specific distance (to be negotiated with the appropriate siting body).

- An indemnification agreement must be negotiated to indemnify and hold harmless the County and its officers, agents, and employees from liability associated with any and all operations at the landfill.

- An assignment of rights clause must be negotiated allowing the County the authority to approve or disapprove any transfer of ownership or other interest in the landfill. Such approval should not be unreasonably withheld.

- The landfill must allow the County (if appropriate) unrestricted access to all non-financial records associated with the landfill as required by State and federal statutes and regulations.

- If the landfill is owned by a private individual or corporation, an environmental contingency fund or an alternative environmental protection plan must be established. The environmental contingency fund or environmental protection plan is in addition to the financial assurance requirements of the state and federal regulations.

- A procedure, agreed upon by the County, to annually determine the remaining disposal capacity remaining at the landfill.

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CHAPTER 10
PUBLIC INVOLVEMENT AND EDUCATION

Public involvement and education play significant roles in planning and implementing waste management programs. Since all residents and businesses cannot be expected to embrace new programs wholeheartedly, it is critical that local governments work to involve and educate the public to ensure better understanding and support of programs. This chapter discusses the following: 1) technical background of public involvement and education; 2) the need for public involvement and education; 3) steps to develop a public involvement/education strategy; 4) public involvement methods; 5) education methods; and 6) recommendations.

BACKGROUND

This section provides a technical background, including pertinent definitions and legislation, regarding public involvement and education. This background is necessary for policy makers to understand education issues and develop an effective public involvement and education system.

Definitions. Definitions regarding public involvement and education are provided below to assist the reader. The terms have been defined by the Illinois Compiled Statutes unless otherwise indicated.

Integrated Waste Management. According to the USEPA's Decision Makers Guide to Solid Waste Management, this term refers to the practice of using several alternative waste management techniques to manage and dispose of specific components of the municipal waste stream. Waste management alternatives include source reduction and reuse, recycling, composting, incineration and landfilling.

Locally Undesirable Land Use (LULU). Typically a public works project that is necessary to fulfill a public need, but which is viewed by citizens as undesirable because of a perceived or real risk.

NIMBY ("Not in My Backyard"). As defined by the McGraw Hill Recycling Handbook, NIMBY refers to the fact that people want the convenience of products and the proper disposal of waste generated by their use of the products, provided the disposal area is not located near them.

Public Involvement and Public Education. According to the USEPA's Decision Makers Guide to Solid Waste Management, public involvement and public education encompass a broad scope of activities and techniques designed to help citizens participate in the decision making process, to convey information, to solicit citizen's concerns, to heighten public awareness and to motivate participation in programs.

Regional Pollution Control Facility. According to the Illinois Environmental Protection Act, a "regional pollution control facility" is any waste storage site, sanitary landfill, waste disposal site, waste transfer station, waste treatment facility or waste incinerator that accepts waste from or that serves an area that exceeds or extends over the boundaries of any local purpose unit of government.

Waste Reduction. Waste reduction refers to decreasing the quantity or type of materials that must be disposed through methods including source reduction, reuses, toxicity reduction, volume reduction and recycling.

Legislation. This section reviews significant legislation concerning public involvement and education.

Illinois Environmental Protection Act, Section 39.2 (SB172). This section of the Act states that the county board of the county or the governing body of the municipality shall approve or disapprove the request for local siting approval for each regional pollution control facility which is subject to such review. An applicant for local siting approval must submit sufficient details describing the proposed facility to demonstrate compliance. Local siting approval should only be granted if the proposed facility meets nine specific criteria. At least one

public hearing, preceded by public notice, is required to be held by the county board or the governing body of the municipality, in which sufficient records must be kept.

Solid Waste Planning and Recycling Act (SWPRA). The Act requires counties to form advisory committees, which includes representatives from local municipalities, citizen's organizations, industry, the private waste management industry, local recyclers and others, to review the plan during its preparation, make suggestions and propose any changes it believes appropriate. In addition, the Act requires counties to provide written public notice when plan development begins and periodic progress reports concerning the preparation of the plan. Prior to adoption, counties are required to submit copies of the proposed plan for a 90-day public review and comment period and must hold at least one public hearing on the proposed plan. Written responses of substantive public comments must accompany the plan when submitted for adoption.

NEED FOR PUBLIC INVOLVEMENT & EDUCATION

In order to be successful in implementing waste management projects, extensive public involvement programs and effective communication strategies should be employed. Decision makers should involve the public early in the waste management process. There are several reasons to involve the public and to effectively communicate with the public. First, it is important to adequately identify and address public needs and opinions in formulating programs and projects. Second, the public should be given a voice in decision making and the opportunity to unite in support of economical, safe and effective waste management practices. Third, it is critical to promote better understanding and more informed decision making concerning technical issues. The public has the responsibility to understand the full costs and liabilities for managing the wastes they produce. Fourth, it is necessary to ensure the public's acceptance and support of less popular, yet necessary projects. This may help avoid increased spending to overcome barriers to implementation. Fifth, the program's success will be dependant on its adoption by the public. And sixth, successful educational efforts may lead to averted disposal costs,

increased disposal capacity, and the prospect of better community relations. This section discusses specific planning and implementation needs for public involvement and education.

Planning Needs. Public involvement and education are necessary components of planning, particularly during the needs assessment, citizen advisory committee, and long-term review and adoption planning stages. Figure 10-1 depicts the timeframe associated with the planning process in Illinois.

Needs Assessments. The SWPRA requires counties and planning agencies to develop waste management needs assessments. Typically, the needs assessments characterize a county's waste generation, waste composition, existing waste management system, future waste projections and other related waste management issues. To ensure the county's needs are adequately addressed in the assessment, comprehensive research and studies are conducted to collect local information. A public hearing to review the findings of the report and a comment period are utilized to collect additional input and feedback from the public.

Citizens Advisory Committee. The SWPRA requires counties and planning agencies to form citizen advisory committees (CAC's) to educate members on planning alternatives and to encourage public input, participation and review of county plans. CAC's often include representatives from units of local government; local for-profit and not-for-profit waste management industry; commercial, institutional and industrial establishments; community groups; and residents-at-large. The purpose is to select a CAC which represents the broad interests of the county.

The function of the CAC is to review information about the local waste management situation, the full costs and liabilities associated with managing the waste, and the management and disposal options which are available and to then reach a consensus on recommendations for the plan. The recommendations are submitted to the county and provide valuable feedback and direction to the county's decision makers. This type of input can help build broad-based support for the chosen management scenario, which, in turn may lead to successful plan implementation.

PLANNING PROCESS

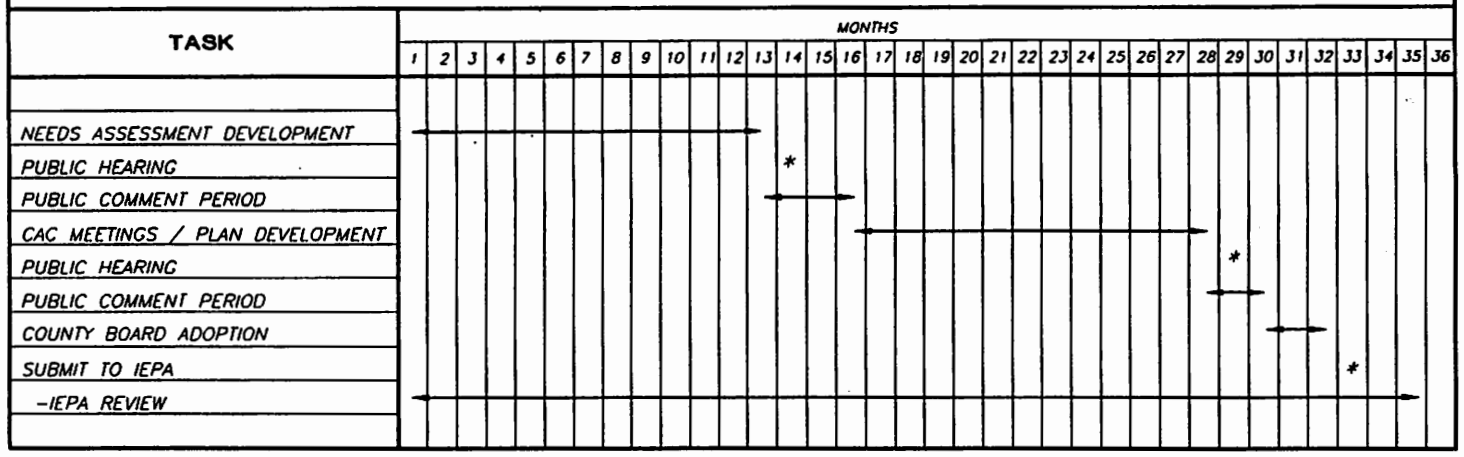

FIGURE 10-1

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To ensure that CAC's can effectively participate in the planning process, monthly meetings (which are announced to the public) are typically held for a one year period to review planning alternatives. Planning alternatives evaluated include: source reduction and reuse, household hazardous waste and toxicity reduction, recycling, intermediate facilities, composting processes, incineration and landfilling. For each planning alternative, information packets are distributed, oral presentations are given, draft chapters are developed and presented to the committee for review and comments, and recommendations, based on the feedback from a group with diverse interests, are developed though the consensus of the CAC.

Long-Term Plan. The SWPRA requires counties and planning agencies to develop plans to manage the county's waste for at least 20 years. Long-range waste management plans are typically based on information obtained from the needs assessment, CAC recommendations and public review and input. Once drafted, the plan is presented at a public hearing, and a 90-day comment period is announced. A document containing written responses to substantive comments made during the comment period is prepared and attached to the plan before adoption by the county board. The plan should provide clear guidance to policy makers and the public on which programs and projects to implement.

Implementation Needs. Public involvement and education are necessary components of implementation, particularly during the further refinement and implementation of waste management programs and the siting and permitting of waste management facilities.

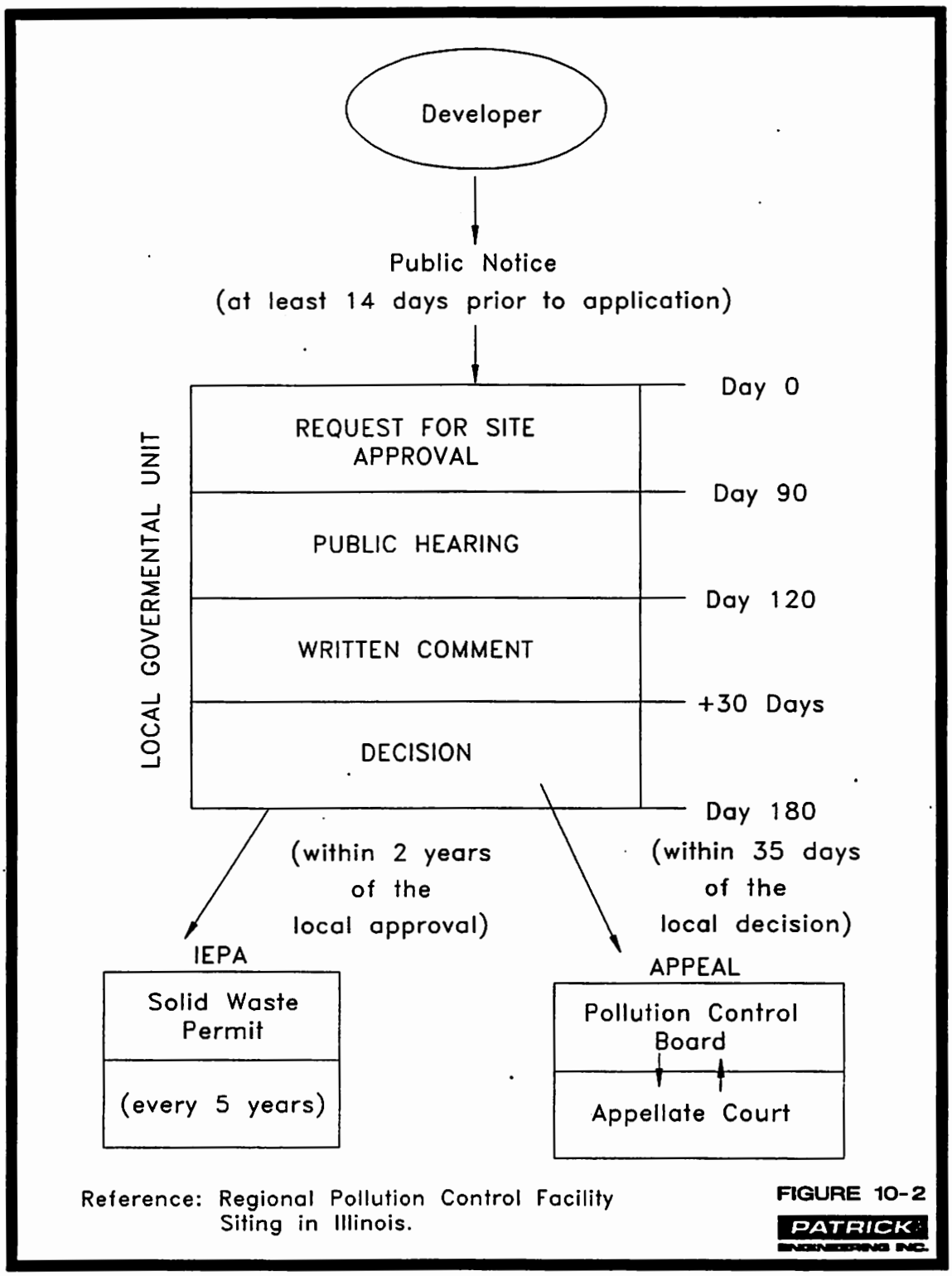
Waste Management Programs. The SWPRA requires counties and planning agencies to begin implementing their waste management plans within one year of adoption. The plans are also required to be designed to achieve 15 and 25 percent municipal waste recycling rates within three to five years respectively of plan implementation. For this reason, counties may pursue various waste reduction or final disposal programs which will require the understanding and support of their constituencies to insure successful implementation. As a result, public involvement and education measures, which create awareness and encourage people to conform with the program, may be necessary.

Siting Process. In Illinois, local siting approval must be granted prior to applying for permits and building regional pollution control facilities (RPCFs), such as transfer stations, mixed waste facilities, municipal waste composting facilities, landfills and incinerators. Siting applicants are required to obtain approval for the proposed RPCF from the county board or the governing body of the municipality in which the facility is to be located. The applicant must demonstrate to the satisfaction of the local governing body that the proposed facility can meet nine separate criteria relating to its establishment and operation. The application is often subjected to intense scrutiny. The local siting authority is responsible for reviewing the application and determining whether the information submitted by the applicant is sufficient to demonstrate compliance with nine siting criteria. A public hearing is held to provide the opportunity for the public to comment. Figure 10-2 portrays the different steps in the siting process and the statutory timeframes mandated by Section 39.2 of the Illinois Environmental Protection Act.

The siting of RPCFs may meet with opposition from local citizens, units of local government and other affected third parties, especially if the project is perceived to be a locally undesirable land use (LULU). The process often includes rigorous public participation and an exhaustive review process due to the controversial nature of siting such facilities. The public outcry associated with siting has become known as the NIMBY ("not in my backyard") phenomenon. Since opposition may prevent the development of needed sites, it is critical to effectively communicate with the public to gain their understanding and support. Without a comprehensive process for identifying community concerns and integrating them into the decision making process, decision makers can be faced with costly project delays and even cancellations. Special care should be taken to credibly and accurately communicate technical information to the public.

Permitting. If local siting is granted, the next step in the process is to submit a permit application to the IEPA (and possibly other regulatory agencies). The applicant must submit proof to the IEPA that the proposed location of the facility has been approved by the local county board or governing body of the municipality in which the facility is to be located before

THE LOCAL SITING PROCESS FOR REGIONAL POLLUTION CONTROL FACILITIES IN ILLINOIS



Reference: Regional Pollution Control Facility Siting in Illinois.

FIGURE 10-2

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the IEPA will begin reviewing the permit application. If the IEPA grants a permit, the applicant can begin construction or modification of the RPCF.

STEPS TO DEVELOP AN EDUCATION STRATEGY

Developing the education strategy includes identifying communicators, assessing needs, developing objectives, determining the target audience, selecting the appropriate education methods, and monitoring or evaluating the effectiveness of the program. These topics are discussed in more detail in the following sections.

Identify Communicator(s). The first step in developing an education strategy should be to inventory the existing waste management education programs and the parties responsible for conducting them, since these parties can provide valuable input and assistance. It will be necessary to determine who will organize, implement and oversee the county's comprehensive education effort. While developing the education strategy, it is important to build upon the existing programs and resources available. For example, the DeKalb County Natural Resource Education Consortium should be contacted to determine its interest in assisting the Solid Waste Coordinator with educational programs.

In many cases, a task force is created to combine forces to develop a comprehensive education program. Members may include the county's solid waste coordinator, various government agencies of interest, school board representatives, waste industry representatives, community group members, etc. The task force may be used to oversee the development of the entire education program.

Assess Needs. The next step is to determine the educational needs of the county, based on assessing the public's perception, knowledge, support and interest of waste management programs, as well as which communication techniques will appeal to the public. The purpose of this assessment is to determine how and where to best direct efforts and resources. Assessment methods may include administering public opinion surveys to residents and

businesses about their knowledge and attitudes on waste reduction and waste disposal, conducting interviews with community leaders, and working with the existing CAC to gather information.

Develop Objectives. Next, the objectives of the education effort, or the desired responses, should be determined. In other words, it will be necessary to determine the relationship between publicity goals and program goals and where the primary emphasis of educational efforts should be placed. Education should be designed to address all legislative requirements, such as public notice, review and comment opportunities. In addition, the activities chosen should promote and complement specific waste management options being considered or implemented as part of the county's waste management program. For example, if the county's first priority is to pursue multi-family recycling, then activities should be targeted toward multi-family residents and building managers.

Determine Target Audience. The next step should be to determine the target audience. For example, education efforts could be directed towards the general public, single-family households, multi-family households, commercial/institutional establishments, conditionally exempt small quantity generators, school children, consumers, etc. The different groups that exist and the ways these diverse groups receive information should be assessed. For example, if significant non-English speaking populations are present, such as in the City of Chicago, multi-lingual informational media may be necessary to effectively communicate with the public.

The McGraw Hill Recycling Handbook suggests that a portion of the public will participate in recycling whether the programs are aggressively promoted or not and regardless of the program's convenience. These individuals are probably motivated by a sincere environmental ethic. There is probably no need to "preach to the converted" or convince these people to participate. On the other hand, a small segment of the population will be unlikely to participate regardless of the level or types of publicity. It is probably not worthwhile to spend a significant amount of time or money trying to move the immovable. The majority of the population, however, can be affected by responsible information and promotional programs, and it is this larger segment that is important to know more about and to understand.

Select Methods. Once the education needs, objectives, and target audience are determined, a strategy should be determined to satisfy the county's information needs which fits within the county's budget and resource limits. Specific public involvement methods and education methods are discussed in the following sections. It should be noted that what constitutes a successful program in one community may not work in another community. Programs should be customized to appeal to each specific target group. In addition, to leave a lasting impression on the public, efforts need to be well timed, well planned and well organized. Public involvement and education efforts should also be on-going in order to attract new participants as well as to retain existing participants. Elements which lead to a successful program typically include the following:

- Answer the questions who, what, when, where, why and how.
- Are positive, motivating and create interest.
- Are clear, simple and brief.
- Use consistent symbols and logos.
- Use visuals and/or color.

In the USEPA's *Promoting Source Reduction and Recyclability in the Marketplace* study, five general principles, as listed below, were consistently found in programs and research to enhance the effectiveness of consumer-oriented programs designed to promote source reduction and recyclability:

- Attention-getting techniques for education programs must compete with other advertising. To be successful, educational programs must be of high quality and as sophisticated as other advertising in targeting appropriate messages to various audiences.
- Long-term changes in consumer behavior depend on changing basic consumer attitudes and motives. Consumer education programs should not be limited to short-term, non-durable incentives, but should be combined with self-sustaining motivation (having long-term durability).

- Household consumer awareness programs should make consumers feel that their participation will be a positive contribution to the solution of an important problem.

- In order to increase product choices available to consumers, upstream decision makers such as marketers, manufacturers, and product designers must be educated about the desirability and advantages of source reduction and product/packaging recyclability , as well as the economic and image enhancement.

- Definitions, labeling, and other important messages should be standardized, simple, and well publicized, so that they are readily recognized and understood by consumers.

Monitor/Evaluate Program Effectiveness. Once the methods are selected and implemented, a procedure for evaluating each of the program activities should be established. Program monitoring is needed to help refine or modify the program over time to ensure its effectiveness. Measurable goals, such as distributing a set amount of informational materials or visiting a set amount of schools, should be set to determine the progress of education efforts. The data gathered to evaluate an activity should be communicated back to the community. Feedback on the accomplishments of the program will serve as positive reinforcement for the county.

PUBLIC INVOLVEMENT METHODS

Decision makers should strive to involve the public in decision making throughout the waste management planning process. When developing a long-term plan or proposing to develop a public program or project, the public has a right to be involved in decision-making. Unfortunately, many issues presented before the public are extraordinarily complex. And in some cases, public misconceptions and misinformation can prevent some necessary programs and projects from ever being implemented. The support and acceptance of plans, programs and projects often hinges on an effective public involvement program. A public involvement program is essential to convey positive messages and to clearly communicate technical information in an understandable, meaningful and credible format. Table 10-1 overviews four public involvement methods.

TABLE 10-1. OVERVIEW OF PUBLIC INVOLVEMENT METHODS
Education Materials
Advisory Committees/Task Forces
Informational Workshops & Forums
Public Notices, Hearings, Review and Comment Opportunities

Education Materials. Prepare and distribute a variety of educational media to create better understanding and support for programs and projects. See the section entitled "Education Methods" for a discussion regarding education methods.

Advisory Committees/Task Forces. The McGraw Hill Recycling Handbook states that "advisory committees or task forces can serve as valuable allies during the planning process by building consensus, involving stake holders in the decision-making process, soliciting public input, harnessing local resources, educating possible opponents about the importance and value of the project, and shaping public opinion through involving local opinion leaders." It should be noted, however, that the role of an advisory committee in Illinois is strictly advisory and that each County Board is responsible for adopting the final contents of the plan.

To ensure that citizen advisory committees can effectively participate in the planning process, regular meetings (announced to the public) should be held. Information can be relayed to the members through information packets, presentations, and draft language or plans. In addition, feedback sessions should be held to build consensus among members. Special advisory committees may work well to inform and educate neighboring residents about the design and operation of the proposed facilities.

Informational Workshops and Forums. Informational workshops and forums held with groups, such as public officials, business leaders and the general public, are often helpful in educating the public on issues related to proposed plans, programs and projects. Generally materials, such as fact sheets or brochures, are distributed to assist the forum participants. A presentation, which may make use of exhibits, models, slides or even videos, is given to create

more understanding for the program or project. The forum gives the public a chance to learn and ask questions about the project or program and gives the public the opportunity to provide input or feedback on the project or program.

Public Notices, Hearings, Review and Comment Opportunities. The SWPRA requires that a public hearing and a 90-day public comment period be held to review the plan once it is prepared. The hearing is a good opportunity to acquaint the public with the plan and provides the public a forum to comment on the plan. The press should be notified about the meeting in order to announce the meeting to the public and to cover the meeting in the media.

EDUCATION METHODS

Implementing new waste management programs requires education, especially where citizen participation is needed. The education goal should be to explain the county's integrated waste management system and to promote a positive waste management ethic. This information will help the public understand the importance of waste management issues; make people and businesses more aware of their individual impact and the consequences of waste generation; help individuals take responsibility for the waste they generate by showing them new alternatives to their old behaviors; assist in mobilizing community support; and provide feedback on the results of the county's efforts. To be effective, communication with the public and promotion of the programs should be ongoing and should provide practical and easy-to-use information that can be incorporated into everyday activities. If people can be shown that changes in their behavior are in their own best interest, they are more likely to make significant changes. The overall success of an education program will depend on how well the program can rally the support and enthusiasm of the county's residents and business community. Seventeen education methods, as reviewed in Table 10-2, are described in this section.

TABLE 10-2. OVERVIEW OF EDUCATION METHODS
Information Clearinghouse/Reference Center
Publicity Campaign
Newsletter & Articles
Technical Assistance
Public Outreach
Posters & Exhibits
Intergovernmental & Waste Management Industry Communication
Government and Trade Associations
Media Relations
Local Directory
Guides, Manuals & Demonstrations
School Programs & Curricula
Extra-Curricular Activities
Model Programs
In-Store Shopper Awareness
Tours & Field Trips
Special Events
Recognition, Achievement Awards & Certification

Information Clearinghouse/Reference Center. The establishment of a local information clearinghouse/reference center is an important first step in an education campaign for waste management issues in general. The function of this center should be to maintain a library of resources including informational materials, books, videos and current research; to supply information upon request; and to provide technical advice upon request (discussed further below). The information resources available at the reference center should cover topics such as source reduction and reuse, household hazardous waste, recycling, intermediate facilities and transfer stations, landscape waste management, municipal waste composting, incineration for energy recovery and volume reduction, landfilling and other waste management issues.

There are several state and national information clearinghouses that have been successful in distributing information, providing technical advice, and conducting new research and publishing data. A reference center in the county could obtain most of its information resources from a variety of regional, state and national organizations. The following State-wide associations and agencies have been known to provide informational materials and/or distribute regular newsletters (see additional listings under "Government, Public Interest and Trade Oriented Associations" section):

- Greater Chicago Recycling Industry Council (GCRIC)
- Illinois Composting Council (ICC)
- Illinois Counties Solid Waste Management Association (ILCSWMA)
- Illinois Department of Energy and Natural Resources (ENR) Clearinghouse
- Illinois Environmental Protection Agency (IEPA)
- Illinois Hazardous Waste Research and Information Center (HHRIC)
- Illinois Industrial Materials Exchange Service (IMES)
- Illinois Recycling Association (IRA)
- Illinois Association of Environmental Service Companies
- Illinois Environmental Council
- National Recycling Coalition (NRC)
- National Solid Waste Management Association (NSWMA)
- Solid Waste Association of North America (SWANA)
- Solid Waste Assistance Program (SWAP)
- University of Illinois Cooperative Extension Service (CES)
- University of Illinois Office of Solid Waste Management
- United States Environmental Protection Agency (USEPA) Office on Solid Waste

Publicity Campaign. An important counterpart to the reference center is a publicity campaign where information is mass-distributed rather than distributed upon request only. Promotion should be tailored to the needs of each county. Typically, publicity campaigns may include brochures, flyers, information handouts, fact sheets, newsletters/articles (discussed further below), posters/exhibits (discussed further below), press releases (discussed further below) and special events (discussed further below). Public service announcements may also be prepared for local newspaper, radio stations or cable television press coverage. As budgets allow, paid advertising campaigns for newspapers, radio, television and billboards could also be utilized to convey waste management messages.

Often a logo, slogans, themes, a spokesperson or symbol is chosen to represent the education effort in a publicity campaign. Slogans or themes are often used in communities to kick-off and/or sustain programs. For example, Macon County, Illinois, adopted the slogan "Macon A Difference" for its source reduction and recycling program. The Mobious loop has come to be the universal symbol of recycling. It is important to use logos and symbols consistently throughout the program.

Educational materials may be distributed through mass mailings; newspapers, magazines, radio or television; distributions centers such as government buildings, schools, public libraries; or personal contact. Other forms of advertisement may include envelope stuffers in public utility, banks, and government or disposal bills or mailings; messages or programs on cable access TV stations; transportation advertising at bus stops, train stations or on bus/cab signage; messages on employees' pay stubs or retail receipts; messages while the phone is on hold or on a answering machine. Some communities have prepared special informational sheets to be distributed to new residents by "welcome wagon" representatives or realtors. Businesses with marquees or reading boards may dedicate messages for special events.

More specific program information can be inserted into recycling bins at the time of collection. In addition, messages or logos can be placed on recycling bins, collection vehicles and printed grocery bags (used to discard refuse). Door hangers/stuffers may be used to inform residents when they are not using the curbside program appropriately.

Street signs stating "This is a recycling neighborhood" may be used to reinforce community pride over their programs and inform visitors of the county's programs and environmental ethic. Ecological or "green" premiums & souvenirs, such as cloth shopping bags, reusable ceramic mugs, recycled paper stationary, or recycled plastic rulers, with an appropriate message, are sometimes distributed to get the message across.

Newsletters/Articles. A regular newsletter or newspaper column can sustain community interest in a waste management program. The newsletter should keep the county informed of program developments, provide feedback on the results of efforts by the county, and present new findings and research in the field. A key element of a successful newsletter is the development of a good mailing list. Newsletters can be distributed to local governments, haulers, recycling centers, businesses, associations, chambers of commerce, homeowner associations, community groups, environmental clubs, schools, libraries, etc. Examples of waste management newsletters include Belvidere/Boone County's *Alternatives Waste Management Newsletter* and the Solid Waste Agency of Northern Cook County's (SWANCC's) *Resources Solid Waste Alternative Update*.

Some communities have tapped into other existing newsletters by preparing and distributing articles or news packets to associations for their newsletters, such as homeowners associations, business groups, schools, colleges, church groups, community organizations, environmental clubs, etc. In addition, some communities have arranged to have a regular waste management column in the local newspaper, or have prepared editorials for newspapers, radio or television.

Technical Assistance. Personal contact is an important component of the education program. During the implementation of new programs, government staff and hauler representatives are often besieged with questions, comments and concerns with the new program. A solid waste coordinator often spends a great deal of time on the phone responding to public inquiry by answering questions such as "Where is the nearest recycling center?" and "What can I do with the leftover paint stored in my basement?" and by conveying or clarifying program information. Some communities with large populations have instituted special hot-line phone

numbers specifically designed to answer waste management oriented questions and have developed extensive programs or manuals to train telephone operators. For example, the State of Minnesota has a hazardous waste hotline operated by trained staff who utilize a training manual outlining prepared responses. Some programs have set up answering machines which provide information on recorded messages and ask the caller to leave a name and address if there is an interest in receiving any further information through the mail.

Staff members are often responsible for providing other forms of technical assistance to the developers of waste management programs, such as municipalities, haulers, recycling centers or businesses. Staff members may also be trained to perform waste audits upon request of commercial/institutional establishments.

Public Outreach. Many communities have developed speaker bureaus, in which speakers are trained to provide oral and/or multi-media presentations to residents, businesses, school children, teachers, community/civic groups, leaders of community/civic groups, or virtually anyone requesting the service. Often, a local college video production class or club is willing to take the challenge of developing a local waste management video to be shown during the presentations. In some cases, communities have held workshops, conferences, seminars or expositions to reach the public on specialized issues. For example, the Village of Lisle has sponsored workshops regarding household hazardous waste, multi-family recycling and the procurement of reusable/recycled products.

Posters and Exhibits. Several communities have developed and displayed posters and exhibits to spread the word on waste reduction and waste management issues and to increase interest. Posters and exhibits are often displayed in lobbies or on public bulletin boards at government buildings, businesses, schools, libraries, museums, churches, grocery stores, retail malls or at table tents at public events. Posters may depict the county's symbol, theme or other vital program information. Public displays, such as the accumulation of an average family's waste generated over a one week period, have been used to make people more aware of the effects of their waste habits: Exhibits, models, or videos may be used to illustrate more complex or technical waste management elements.

Intergovernmental & Waste Management Industry Communications. Forums may provide the county with an excellent opportunity to exchange information and stay in touch with the concerns of government representatives, haulers, recycling centers, landfills, etc.; to keep track of waste management developments; and to report the progress of county programs. The county's solid waste coordinator may want to share information, such as model ordinances, or prepare an annual report to keep local government representatives and the local waste management industry informed of local developments. For example, DuPage County prepared a comprehensive 18-page *Waste To Date Annual Report* in 1991 to keep local decision-makers aware of recent program developments and of the County's recycling rates for 1991 relative to the State's goals.

Government, Public Interest and Trade Oriented Associations. There are several state and national government, public interest and trade/industry oriented associations that the solid waste coordinator, public officials, waste management industry representatives and other interested parties may become involved with to learn more about advancements within the industry. Many of these associations prepare and distribute regular newsletters and informational materials to their members. In addition, meetings, conferences and workshops are often sponsored by these associations to relay information and to provide networking opportunities. The following waste management-oriented associations and agencies are present in Illinois:

Regional and State Government Agencies:

- Unites States Congress Office of Technology Assessment
- United States Environmental Protection Agency (USEPA)

Regional and State Associations:

- Greater Chicago Recycling Industry Council (GCRIC)
- Illinois Association of Environmental Services Companies
- Illinois Recycling Association (IRA)
- Illinois Environmental Protection Agency (IEPA)

- Illinois Department of Energy and Natural Resources (ENR)
- Solid Waste Association of North America (SWANA)
- National Solid Waste Management Association (NSWMA)
- Illinois Composting Council (ICC)
- Illinois Counties Solid Waste Management Association (ILCSWMA)
- National Recycling Coalition (NRC)
- Illinois Environmental Council

Annual conferences and expositions held in the Illinois region include the IRA annual conference, the Illinois Association of Environmental Service Companies' annual conference, the Midwest Recycling Conference & Exposition, the Global Education Youth Conference, and the World Recycling Conference and Exposition. Several other State organizations also sponsor meetings, workshops and conferences.

Many national associations also exist to serve waste management information needs. A listing of government, public interest and trade/industry associations is provided below.

National Government-Oriented Associations:

- American Legislative Exchange Council
- American Public Administration Association
- American Public Work's Association's Institute for Solid Wastes
- Association of State and Territorial Solid Waste Management Officials
- Coalition on Resource Recycling and the Environment/U.S. Conference of Mayors
- Environment and Energy Study Institute
- National Association for Counties Solid Waste Action Coalition/National League of Cities
- Solid Waste Association of North America
- National Conference of State Legislators
- National Governors Association
- National Resource Recovery Association/U.S. Conference of Mayors

National Public-Interest Oriented Associations

- Americans For the Environment
- Center for Environmental Education
- Center for Environmental Information
- Citizen's Clearinghouse for Hazardous Waste
- Council on Economic Priorities
- Environmental Action
- Environmental Action Foundation
- Environmental Defense Fund
- Environmental Law Institute
- Environmental Policy Institute
- Environmental Safety
- Worldwatch Institute
- Fund for Renewable Environment and Energy
- Greenpeace
- INFORM
- Institute for Energy and Environmental Research
- Institute For Local Self Reliance
- Keep America Beautiful
- League of Conservation Voters
- League of Women Voters
- National Center for Policy Alternatives
- National Resource Council of America
- National Resource Defense Council
- U.S. Public Interest Research Group
- Work on Waste, USA

National Industry/Trade Oriented Associations

- Aluminum Association Inc.
- American Iron & Steel Institute
- American Newspaper Publisher's Association
- American Paper Institute
- American Petroleum Re-refiners
- American Planning Association
- American Recycling Association
- American Retreaders Association

- Association of Container Reconditioners
- Can Manufacturers Institute
- Center for Plastic's Recycling Research
- Central States Glass Recycling Program
- Composite Can & Tube Institute
- Council on Plastics & Packaging in the Environment
- Council for Solid Waste Solutions
- Fiber Box Association
- Flexible Packaging Institute
- Food Service and Packaging Institute
- Glass Packaging Institute
- Institute of Scrap Recycling Industries
- Keep America Beautiful
- U.S. Chamber of Commerce
- National Association of Plastic Container Recovery
- National Environmental Development Association
- National Soft Drink Association
- National Tire Dealers and Retreaders Association
- Paperboard Packaging Council
- Plastics Institute of America
- Polystyrene Packaging Coalition
- Pro-Environment Packaging Council
- Recycled Products International Trade Association
- Society of Plastics Industry
- The Composting Council
- Steel Recycling Institute
- Technological Association of Pulp and Paper Industries
- Tire Retread Information Bureau
- United Association of Used Oil Services

Media Relations. Developing positive press relations, with local media representatives including newspaper, radio and television, may be the most important step in educating the public. It may be beneficial to assist the press (and to assure coverage) by preparing regular press releases, public service announcements or press kits; announcing (or notifying the press about) special events; having someone available for comment who is knowledgeable about programs; providing copy-ready pictures; allowing media interviews; and scheduling press

conferences. It is important to meet with press regularly, particularly local newspaper reporters, in order to educate them on technical waste management issues, to familiarize them with the county's program, and to keep them informed of program developments and issues. The press needs to be informed so they have a full understanding of the issues. This can be accomplished through sharing public information with them or by taking them on tours of local waste management facilities. Most importantly, it may be helpful to work with the press to eliminate any bias, misinformation or semantics in reporting. For example, the use of the term "dump" is often used by the press when referring to landfills. Although the word choice may be unintentional, this outdated term connotes the primitive, unkept open dumps used to dispose of waste in the past. The term "landfill" is a preferred term, since it more appropriately refers to the highly regulated, sanitary landfills which are used to dispose of waste today.

Local Directory. A listing which details the local reuse and recycling opportunities to residents and businesses may become a valuable education tool. Although many services and systems often exist to reuse and recycle materials, residents and businesses are not always aware of the opportunities available to them. The City of Seattle has recently published a comprehensive guide *Use It Again, Seattle*, which contains listings of repair services, reuse outlets and renting services available in Seattle. DuPage County's *Recycling Yellow Pages* lists reuse and recycling opportunities including drop-off and buy-back recycling centers, curbside programs, haulers, landfills, paint exchanges, resale and thrift shops, clothes closets, milk delivery services, diaper services, food banks, landscape waste management alternatives and more. Some communities have arranged to provide a listing of opportunities in the local Yellow Pages Telephone Directory under "recycling" or "reuse" or within community pages section.

Guides, Manuals and Demonstrations. In some cases it may be helpful to develop specialized guides, manuals or demonstrations which provide instruction on the "how to's" of programs. For example, a component of many management plans is to conduct waste audits in business settings. SWANCC prepared the *Waste Reduction in the Workplace 8-Step Manual* to assist businesses conduct self-audits and to develop in-house waste reduction programs. Several Cooperative Extension Service units have established composting demonstration sites and "Master Composter" programs, which help educate people about how to reduce and recycle

landscape waste. The State of Georgia has sponsored 15 compost demonstration sites throughout the state and passed legislation which requires all schools to have working compost bins on-site. Demonstrations concerning the management of landscape waste held throughout the country have included working compost piles, mulching equipment, composting toilets and composting worms for food waste.

School Programs & Curricula. The classroom provides an opportune place for students to learn about waste reduction, from incorporating waste management issues into lesson plans, implementing an in-house waste reduction program to gain first-hand experience, and conducting special activities and events to create awareness and interest. It may be easiest to teach waste reduction practices to children, before they develop any undesirable waste management habits. In addition, children are likely to bring their waste reduction behaviors home and create awareness in their households among their parents, family members and friends. Although many school programs are "youth based" and directed towards grades K-12, environmental awareness and education should be incorporated at college and university settings as well.

Several curricula and activity guides have been developed to demonstrate waste reduction to students. For instance, one possible activity for a junior high class would be to estimate the types and amount of waste generated by the average student and then to investigate the "life-cycle" and destination of the different waste materials. The ENR Clearinghouse provides numerous educational curricula and teaching materials on waste reduction including:

Sample Lesson Plans (K-2, 3-4, 5-6, 7-8)
Solid Waste Videos (a teachers guide to selected videotapes)
Solid Waste Activity Packet for Teachers
The Three R's (a newsletter for elementary teachers)
Solid Waste: From Problems to Solutions (a teacher's handbook)
Recycle Our Available Resources (ROAR) Book (4-8)
All Trashed Out (K-6)

It is very important to involve local teachers in the development of lessons for the classroom. ENR has established the Three R's Project which trains county representatives to facilitate teacher workshops featuring waste management issues.

Schools are an ideal setting for in-house waste reduction programs, since school children and student environmental clubs are often willing participants of the program. In many locations, writing paper and corrugated cardboard are easily recyclable. Other items such as aluminum cans and juice containers may also be recyclable. Source reduction may include double-sided copying and the use of chalkboards instead of paper.

Special activities and events many include inviting waste reduction experts to give presentations to classrooms, student groups, environmental clubs or even for school assemblies; planning field trips to visit waste management facilities or exhibits; or holding a waste reduction poster contest, a recyclable art contest or a waste management science fair. Promotional materials may also be distributed to students to bring home with them.

The School Recycling Assistance Program (SCRAP), a unique program funded by DuPage County, provides consulting and education services to DuPage schools free of charge. SCRAP representatives train teachers, administrators, school staff, students and parent groups about waste reduction. SCRAP offers a variety of services to schools including providing various educational presentations, assisting in the development of in-house source reduction and recycling programs, preparing a monthly newsletter for DuPage schools, holding teacher workshops, and serving as a source of information for lesson plans, literature, special projects and events, field trips and sources of recycled products. Schools which meet certain environmental criteria may earn Earth Flags from SCRAP. Other well known school programs have been organized by Community Recycling Center in Champaign County, the McHenry County School District in McHenry County and the North Shore Ecology Center in Northern Cook County. Teaching students about waste management is essential for developing a responsible waste management ethic among a county's future residents. In addition to future benefits, student- or youth- oriented programs can have an immediate pay off by bringing waste reduction messages home to parents.

Extra-Curricular Activities. Outside of school programs, there are many other activities which are conducive to learning about waste management programs. Activities relating to waste management are often worked into youth-oriented organizations, such as youth groups, church

groups, 4-H clubs, junior achievement clubs, scouts and school clubs. These groups may have speakers come in to give presentations about waste management programs and issues; plan field trips; or work on specific projects to earn badges. For example, Girl Scouts and Boy Scouts have merit badges that focus on ecology, recycling, litter clean-up and civic pride. Adult-based organizations, including civic organizations, community groups, environmental clubs, business associations, etc. often have speakers come in and give presentations on waste management programs and issues; sponsor public service projects, such as volunteering at recycling centers; or donate funds, to a school waste reduction education program, for example. Since waste reduction is a seemingly popular issue, information on these programs may be easily found through many other avenues, such as at public libraries, book stores, museums, and in public television and radio programs.

Model Programs. Model source reduction programs identify businesses within the community which are successfully reducing, reusing and recycling their waste streams and procuring recycled products to serve as "models" for the county. In order to serve as models, businesses may be assisted to develop and incorporate waste reduction procedures into their existing operations.

Model Community is a non-profit program operating in Illinois which trains volunteers to help transform ordinary businesses, schools, government facilities and civic organizations into "models" of waste reduction. Model Community is an on-going program where a business or entire community is certified as a model by meeting standards in the areas of source reduction, toxicity reduction, purchasing recycled products and recycling. The center provides training services, materials and other resources to help in establishing a Model Community program.

To date, over 80 businesses, offices and shops in eight Illinois communities have participated with Model Community to become models. The model businesses range from florists to supermarkets and from bait shops to manufacturers. For example, in Urbana, Record Service recycles cardboard and paper including CD box packaging. Jerry IGA stores in Urbana and Champaign label products for least waste, recyclable packaging and non-toxic products.

Illinois Power sends old power poles to the Department of Conservation to be reused as fences and ships out asphalt and concrete to be crushed and reused as gravel on highways.

Local governments should establish in-house waste reduction programs to set a good example and show their commitment towards the county's waste reduction efforts.

In-Store Shopper Awareness. An in-store shopper awareness program may be used to provide information at grocery stores, retail outlets or malls on how to reduce the toxicity and volume of waste, which products have packaging compatible to local recycling collections and which materials or material packaging contain recycled materials. An awareness program which focuses on careful purchasing decisions may exhibit posters and information pamphlets at stores, or may institute a labeling system at stores to indicate the relative public health and environmental impacts of certain products (by using colored stickers near product displays, for instance). The labeling system could be set up with the assistance of local stores and chambers of commerce. This system could help consumers to make better purchasing decisions and to become more aware of the true disposal cost of their purchases.

There are several examples of shopper awareness programs that have been tried in the United States, with varying levels of success. In the Package Labeling Program in Palo Alto, California, color-coded stickers rating the packaging material (refillable, recyclable and costly to recycle) were affixed to all shelves containing wine, beer and soft drinks. In addition, posters and a news conference were used to advertise the program. Although the program succeeded in increasing shopper awareness of reuse and recycling, the program did not cause significant changes in purchasing decisions. The researchers concluded that shoppers need to be made aware of their personal contribution to the waste management problem before their shopping habits will change.

In Wisconsin, a shopper awareness program was coordinated with an incentive program. Twelve Red Owl Grocery Stores instituted cash refunds of two to four cents for the reuse of shopping bags, egg cartons and milk/soda containers. The conclusions drawn from the program were that the program was dependent on advertising, the program participants needed continual

reminders, it was important that the store showed enthusiasm and commitment and it cost the stores very little since consumer refunds were equivalent to the stores' cost of the packaging material, especially since the advertising cost was incorporated into the stores' regular newspaper advertising program.

A new type of grocery store has been developed in Northern Illinois which incorporates many waste reduction practices. Whole Foods in Chicago and Fresh Fields in Naperville, which appear to be typical modern grocery stores from the outside, are fundamentally different from traditional grocery stores on the inside. In terms of the waste reduction advances, these health-oriented stores offer large bulk food sections, provide refill machines for a variety of products, carry products which are minimally packaged or packaged with "environmentally-correct" materials, only offer non-toxic and alternative cleaning products, provide organic food sections (from fruits and vegetables, to ketchup and cereals), and provide many materials made from recycled and non-toxic materials (including paper towels, toilet tissue, stationery, etc.). These stores allow consumers to purchase materials in an environmentally conscious way (with little or no effort on behalf of the consumer) and may help create a larger demand for these types of products from manufacturers. Reports indicate that several more stores will be located in Northern Illinois before long. The success of these stores may impact the way all grocery stores will operate in the future.

Tours and Field Trips. One of the best ways for the public to better understand waste management concepts is to actually visit an operating waste management facility, such as a recycling center, material recovery facility (MRF), composting facility, transfer station or landfill. During the analysis of waste management plans, public officials, the media and the public may benefit from first hand knowledge of how certain facilities actually work. Many facilities, such as MRFs and landfills, commonly provide tours for interested parties, especially school children, since this opportunity may prove to be an excellent learning experience. DuPage County, for example, is scheduled to open a full-scale education center for the public at its MRF in 1994. Plans for the center include a viewing area of the facility's recycling processing operations, a library containing waste management resources and a large meeting area

for multi-media waste management presentations. The Museum of Science and Industry in Chicago has an outstanding exhibit featuring waste reduction and waste management.

Special Events. A fun way to spread the word on waste management programs may be through holding special events or incorporating promotional activities in existing events. Several communities have developed events specifically tailored to waste management issues, such as Earth Day festivities, Eco-Fairs, and Recycling Awareness Week. Many other communities get involved with existing local events and expositions, such as county fairs, spring carnivals, October-Fests, holiday festivities, home-shows, etc., to publicize their programs. Examples include featuring exhibits or displays; attending information booths; working to have prominent recycling collections and signage at the event; and marching or entering a waste reduction float in a parade and collecting recyclables from the crowd. Another idea is to sponsor community collections, drives, contests, games, or projects for youth groups, organizations, school children, etc. These activities often spur friendly rivalry and a sense of spirit, while promoting waste management issues.

Recognition/Achievement Awards/Certification. Residents, businesses, public officials, etc. should be encouraged, recognized and reinforced for their outstanding efforts regarding the county's waste management program. Achievement awards, which may be publicized in local papers or at public functions, may provide recognition of significant waste reduction efforts; demonstrate the commitment of local leaders to waste management programs; and maintain public awareness of the waste management program. Certification programs may also be established to encourage neighborhoods, apartment buildings, businesses, etc. to reach waste reduction goals. For example, if businesses reach certain reduction, reuse, recycling and procurement standards, they may be eligible to receive certification as an "earth-friendly" business, which may be advertized through stickers on storefront windows or decals on store cash registers. Businesses may be interested in awards and certification for the public and community relations benefits they may accrue.

PUBLIC INVOLVEMENT AND EDUCATION RECOMMENDATIONS

Listed below are the preliminary recommendations on public involvement and education to be considered by DeKalb County.

Education Program.

- An extensive education program should be the cornerstone of DeKalb County's solid waste management plan. Education will be the most effective long-term solution in changing the attitudes and behavior of consumers and producers. Components of the education program should include:

  - An informational clearinghouse.
  - A publicity campaign.
  - Educational curricula.
  - Waste audit assistance.
  - A regular newspaper column and/or newsletter.
  - An emphasis on homeowner management of landscape waste.
  - Public achievement awards to businesses and individuals.

  A variety of educational materials have already been developed for use in other regions of Illinois and the nation, and these materials should be acquired and held for distribution in the Solid Waste Coordinator's office and each public library throughout the region. The educational materials should explain the need for and benefits of source reduction, recycling and other waste management issues in plain, direct language. These materials may already exist throughout the region, so the Coordinator should inventory them to avoid duplication and identify areas of need.

The Solid Waste Coordinator should contact the DeKalb County Natural Resource Education Consortium to determine its interest in assisting in the solid waste management educational program.

- In order to implement an effective educational curricula, a survey should be conducted of current school curriculum on waste reduction, and revisions or additions to the curriculum should be developed and implemented. The County's Regional Superintendent of Schools would be a logical coordinator for this effort. Once the Solid Waste Coordinator is appointed, he or she should work closely with the Regional Superintendent to assist schools with curriculum enhancement.

- The Solid Waste Coordinator should publish a periodic newsletter to publicize the various waste reduction methods available to the public as well as information regarding waste management in general. In addition, the Coordinator should utilize every opportunity available to pass on information regarding the need to reduce the generation of waste. These opportunities include: public outreach at various community events, posters and exhibits, media relations, in-store shopper awareness programs with the cooperation of store management, and the creation of local waste reduction directories.

- A hazardous waste management education program is also central to hazardous waste reduction. The education program should focus on explaining the potential health and environmental impacts of household hazardous wastes and the substitutes available for hazardous products. This information should be incorporated into all components of the broader source reduction education program, including informational handouts, newsletters, question and answer sessions, information displays in stores, and school curriculum. There are several well designed information handouts available from the ENR clearinghouse concerning household hazardous waste.

The education program should also be targeted toward likely conditionally exempt small quantity generators of hazardous waste. Waste audit information should be offered to these businesses as well as assistance in determining the feasibility and structure of possible cooperative agreements among these businesses.

Waste Audits.

- One of the most important tasks provided by the Solid Waste Coordinator should be to provide extensive technical assistance to interested local businesses regarding waste audit performance. It is also recommended that the County conduct waste audits of its facilities and implement source reduction programs to provide an example to local businesses and municipalities. The waste audits should examine the procurement practices of County facilities and the available alternatives for procurement. Depending on the findings of the waste audit, the County should consider establishing a procurement policy that favors source reducing products (as well as recycled products). The results of the County and local business waste audits should be compiled in a report and published through whatever means are appropriate.

Training Courses.

- It is recommended that the County's Cooperative Extension Service conduct Master Recycler and Master Gardener training courses in order to increase awareness, education and practical training of residents throughout the region regarding waste reduction and composting. This is one of the least expensive methods of waste reduction education programs available to the County.

Networking.

- In order to remain abreast of waste management issues on the state and federal levels, the Coordinator should be involved with trade associations. These organizations provide membership with newsletters, informational materials, workshops, meetings, conferences and networking opportunities.

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CHAPTER 11
IMPLEMENTATION OPTIONS

Implementation of DeKalb County's Solid Waste Management Plan will require the cooperation of the public sector and the private sector. In order to facilitate this cooperation, it will be necessary to develop an implementation mechanism that will address the need for political cooperation and that will provide the necessary statutory authority to fully implement the waste reduction and final disposal components of the proposed Plan.

IMPLEMENTATION STATUTES

County Statutes. The following subsections describe the laws that address the implementation options available to county governments.

Section 5-1047 of the Illinois Counties Code states that:

> "A county board may furnish grounds or other facilities for the disposal, treatment or recycling of garbage, waste and refuse by sanitary landfill methods or other appropriate technologies and may charge a reasonable fee on the basis of weight for disposal, treatment or recycling at such facility, and may acquire property necessary or appropriate for such disposal grounds or other facilities. . . . In order to secure repayment of revenue bonds issued to finance regional pollution control facilities, to further this State's policies and purposes, to advance the public purposes served by resource recovery, and to authorize the implementation of those solid waste management policies counties deem in the public interest, any county which has prepared a solid waste management plan or is a signatory to a plan providing for the management of solid waste generated by more than one county or municipality, shall have the authority to require by ordinance, license, contract or other means that all or any portion of solid waste, garbage, refuse and ashes generated within the unincorporated areas of a county be delivered to a regional pollution control facility designated by the county board or a transfer station serving such facility for treatment or disposal of such material.

This section allows counties to own, operate and/or contract out the operation of disposal or recycling facilities. In addition, counties are authorized to require waste generated within their boundaries to be directed to a particular disposal facility.

Further, section 5-1048 of the Illinois Counties Code states that:

> A county board may contract with any city, village, incorporated town, or any person, corporation, or other county, or any agency created by intergovernmental agreement. . . in relation to the collection and final disposition . . . of garbage, waste refuse, and ashes. The county board may also contract with an organization or institution organized and conducted on a not-for-profit basis for the purpose of recycling garbage and refuse."

This section authorizes counties to contract with a unit of local government, corporation or agency created by intergovernmental agreement for waste collection and disposal services. Interestingly, this section also states that counties may contract with not-for-profit organizations for the purpose of recycling refuse.

Section 5-8002 to 8004 of the Illinois Counties Code states that:

> The county board in any county is authorized to: license annually garbage disposal areas, and license annually vehicles of any kind which are used in hauling garbage to such disposal ares except such vehicles owned or operated by any incorporated city, village or town used in hauling garbage to any garbage disposal area maintained by such city, village or town.
>
> The county board in any county may fix the annual amounts of fees, terms and manner of issuing and revoking licenses. . . . The fees for licenses shall not exceed the following: (1) for each garbage disposal area, $500 per annum. (2) For each vehicle used in hauling garbage to a garbage disposal area, $50 per vehicle per annum.
>
> Any county board desiring to avail its county of the provisions of this Division may do so by ordinance. Such ordinance shall also set out the rules and regulations adopted by the county board under the authority granted in this Division.

In other words, counties have the authority to license garbage disposal areas and vehicles used to collect garbage, and set conditions and fees for those licenses.

Section 5-15010 of the Illinois Counties Code states that:

> The county shall have the authority to control and regulate the disposal of sewage, refuse and any other wastes from any premises within the borders of the county. . . and to this end may adopt suitable ordinances.
>
> For the purposes of controlling and regulating the disposal of wastes throughout the county, the county board may appoint a county solid waste committee to develop and implement a solid waste management plan.
>
> The county board is further authorized to adopt any procedures necessary to implement any such plan and provide by ordinance, license, contract or other means that the methods of disposal of solid waste shall be the exclusive methods of disposal to be allowed anywhere within the borders of the county, notwithstanding the fact that competition may be displaced or that such ordinance, license, contract or other measure may have an anti-competitive effect. Notwithstanding the above granted authority the county shall not have the authority to control or regulate the collection of waste within the corporate boundaries of any municipality.
>
> The county is hereby authorized to construct or purchase and operate a . . . waste management system to improve or extend any such system so acquired from time to time, as provided in this Division. The county may furnish. . . waste management service to individuals, municipal corporations or other corporations and may impose and collect charges or rates for furnishing . . . waste management service, as provided in this Division. Any county which owns and operates or which may hereafter own and operate a . . . waste management system may enter into and perform contracts. . . with any municipal, public utility or other corporation, or any person or firm, for the furnishing by the county . . . waste management service. Such contracts may provide for periodic payments to the county of a share of the amounts necessary to pay or provide for the expenses of operation and maintenance of the . . . waste management system (including insurance), to pay the principal of and interest on any revenue bonds issued hereunder, and to provide an adequate depreciation fund as hereinafter provided and to maintain such other reserves and sinking funds as may be deemed necessary or desirable by the county for the payment of the bonds or the extension or improvement of the . . . waste management system, as the case may be. Any county may also enter into and perform contracts. . . with any such corporation, person or firm for the leasing, management or operation of a . . . waste management system.

This section authorizes counties to enact flow control ordinances, construct or purchase and operate a waste management system, and collect charges or rates for furnishing that service. Counties may also enter into contracts for the provision of waste management services. Counties **do not** have the authority to control or regulate the collection of waste within the boundaries of a municipality.

Nowhere in these statutes are counties given the same authority as municipalities to impose a garbage collection tax or service charge to secure funding for waste collection services. Counties are allowed to contract with other parties for this service, but no provision exists for counties to compel residents to pay for them as municipalities can.

Township Refuse Collection and Disposal Act. This Act takes effect when the electors authorize the board of trustees to exercise the power conferred by this Act, but does not apply in any township in which a county ordinance or regulation is in effect regulating the collection and disposal of municipal waste. Specifically, the township board of trustees may make contracts for the collection, recycling, composting and/or disposal of municipal waste. The board of trustees are also authorized to declare the unincorporated area of the township a "special refuse collection and disposal district" for tax purposes. Therefore, township officials may impose a tax to fund the collection, recycling, composting and/or disposal of municipal waste within its jurisdiction. In addition, townships may adopt and implement recycling programs separate from the county's plan, as long as it substantially conforms with or exceeds the requirements of the county's plan.

Solid Waste Planning and Recycling Act (SWPRA). The focus of this Act is more related to developing solid waste management plans than implementing them. The SWPRA, unlike the other legislation discussed in this section, does not contain specific provisions for creation of a governing authority, financing authority, contractual authority, and explicit flow control authority. However, there are several provisions in the Act which either implicitly or explicitly address implementation issues. These provisions are as follows:

- Section 4 (e) - Counties may, by intergovernmental agreement, jointly create and administer their solid waste management plans, provided that such joint plans fulfill all the requirements of this Act.

- Section 7 (a) - Each county shall begin implementation of its waste management plan, including the recycling program, within one year of adoption of the Plan. The county may enter into written agreements with other persons, including a municipality or persons transporting municipal waste on the effective date of this Act, pursuant to which the persons undertake to fulfill some or all of the county's responsibilities under this Act. A person who enters into an agreement shall be responsible with the county for the implementation of such programs.

  (b) In implementing the recycling program, consideration for the collection, marketing and disposition of recyclable materials shall be given to persons engaged in the business of recycling within the county on the effective date of this Act, whether or not the persons were operating for profit.

  If a township within the county is operating a recycling program on the effective date of the Plan which substantially conforms with or exceeds the requirements of the recycling program included in the Plan, the township may continue to operate its recycling program, and such operation shall constitute, within the township, implementation of the recycling program included in the Plan. A township may at any time adopt and implement a recycling program that is more stringent than that required by the county waste management plan.

  (c) The Department shall assist counties in implementing recycling programs under this Act, and may, pursuant to appropriation, make grants and loans from the Solid Waste Management Fund to counties or other units of local governments that are implementing approved waste management plans, to be used for capital assistance or for the payment of recycling diversion credits or for other purposes, in accordance with such guidelines as may be adopted by the Department.

These two sections allow counties to "jointly administer" their Plan (Section 4(c)) and to enter into written agreements with other parties to fulfill some or all of the planning responsibilities under the Act (Section 7(a)). Clearly, under the SWPRA, counties have the authority to enter into intergovernmental agreements and written agreements in order to coordinate the implementation of the Plan. It is also important to note that implementation must begin within one year of adoption of the Plan.

An area of uncertainty, that has recently been commented on by the Illinois Attorney General, is whether the SWPRA gives a county the authority to mandate recycling programs within the incorporated areas of the county. The Attorney General's written opinion (dated November 20, 1991, File No. 91-034) stated that "a county is generally authorized to require implementation of recycling programs in both incorporated and unincorporated areas of the county".

Another area of uncertainty under the SWPRA involves the issue of flow control authority and whether a county government is granted the authority to direct waste generated within **both** the incorporated and unincorporated areas of the county. The SWPRA does not contain explicit flow control authority language, but it does appear to grant implicit flow control authority to counties in incorporated areas. The Attorney General (AG) has provided his opinion that counties "may require all waste generators . . . to send recyclable waste to a county-owned or approved facility (dated March 24, 1994, file number 94-006)." In other words, the AG has determined that counties have the authority to enact flow control for recyclables.

These two issues, recycling and flow control authority in incorporated areas, strike at the heart of plan implementation. Unfortunately, the SWPRA does not provide clear direction on these issues and it may ultimately require either a legislative amendment or a court ruling to clarify the intent of the SWPRA. One way to avoid the uncertainty of the SWPRA's implementation authority is to enter into intergovernmental agreements with local units of government that are affected by these jurisdictional control issues. The following subsections discuss the various intergovernmental cooperation mechanisms available for implementing DeKalb County's Plan.

Another issue upon which the Attorney General has provided an opinion regards a county's authority to require waste haulers and waste operators to report the amount of waste generated and recycled. In order that a county determine its municipal waste recycling rate (as required bythe SWPRA), both the amount of waste generated and recycled must be known. The AG's opinion states that, "in order for the county to determine whether a plan will or does result in a specific percentage of waste being recycled, it is necessary that the county collect

information concerning the amount of waste generated and the amount recycled. Without such information, measuring compliance would be impossible (dated March 24, 1994, file number 94-006)." In order to maintain the goodwill of area waste haulers and waste operators, a county should stipulate that the information obtained from them is proprietary and, therefore, beyond the Freedom of Information Act. This will insure that the information may not be used by a competitor.

Local Solid Waste Disposal Act (LSWDA). The LSWDA was approved in September of 1985 prior to the passage of the Solid Waste Management Act and the SWPRA. Since 1985, the LSWDA has been amended several times and most recently was amended to bring it closer into conformance with the SWPRA regarding the definition of terms and required contents of a plan. Section 4 of the LSWDA expressly authorizes units of local government to enter into intergovernmental agreements to prepare or implement solid waste management plans. It also allows a unit of local government to delegate any power to another unit of local government to prepare or implement a plan.

Section 6 of the LSWDA gives flow control authority to municipalities within their corporate borders and to counties within the unincorporated areas. The flow control authority in Section 6 is set forth in accordance with the provisions of the Illinois Municipal Code and the county statutes. The flow control authority authorized in these two statutes is explicitly stated as opposed to the language (or lack of) in the SWPRA.

Under the county statutes, a county board is granted additional powers besides flow control. These powers include the authority to: 1) "furnish grounds or other facilities for disposal, treatment or recycling of garbage, waste and refuse . . .", 2) "acquire property necessary or appropriate for such disposal grounds or other facilities", and 3) "issue and sell revenue bonds".

With the authority granted in the LSWDA, the Illinois Municipal Code, and the county statutes, counties and municipalities have the ability to enter into intergovernmental agreements, build the appropriate waste management facility(ies), issue revenue bonds to pay for the

facility(ies), and direct their waste to the facility(ies) to secure payment of the revenue bonds. Under this implementation option, a county would take the lead for the implementation of the plan and delegate any powers to municipalities that would be necessary to implement the plan.

Counties, because of the mandate of the SWPRA, have the responsibility for planning for the proper management of the entire county's waste. As a result, many counties have decided to continue to take a lead position for implementation of the plan. However, it should be noted that typically most of the waste generated in a given county comes from the municipalities. As a result, it is necessary to provide a mechanism for other units of local government (municipalities and townships) to have input into the decision-making process.

Intergovernmental Cooperation Act. The Intergovernmental Cooperation Act (ICA), "authorizes state and local governing bodies to cooperate in the performance of their responsibilities by contracts and other agreements". This authority is derived from Article VII, Section 10 of the Illinois Constitution.

Section 3 of the ICA states that:

> Any power or powers, privileges or authority exercised or which may be exercised by a public agency of this State may be exercised and enjoyed jointly with any other public agency of this State and jointly with any public agency of any other state or of the United States to the extent that the laws of such other state or of the United States do not prohibit joint exercise or enjoyment.

Section 9 of the ICA states that:

> Any county may participate in an intergovernmental agreement under this Act notwithstanding the absence of specific authority under State law to perform the service involved provided that the unit of local government contracting with the county has the authority to perform the service.

These two sections explain that counties may delegate powers which they posess to another public agency, or jointly exercise those powers by jointly entering into an intergovernmental agreement as long as they posess the powers they are delegating or agreeing to jointly administer.

Section 3.2 of the ICA was specifically drafted for the purpose of implementing solid waste management plans. Under Section 3.2:

> Any two or more municipalities, counties or combination thereof may, by intergovernmental agreement, establish a Municipal Joint Action Agency to provide for efficient and environmentally sound collection, transportation, processing, storage and disposal of municipal waste. Any such Agency shall itself be a municipal corporation, public body politic and corporate.

Section 3.2 also includes specific provisions for: 1) the establishment of a governing body, 2) planning, constructing, owning, leasing, managing, operating, and closing waste projects, 3) executing contracts, 4) adopting, amending and repealing ordinances, 5) issuing revenue bonds, 6) flow control authority, 7) eminent domain authority, and 8) entering into project use agreements. The powers granted to a Municipal Joint Action Agency (MJAA) are more specific and wider in scope than the County lead model discussed earlier.

A MJAA becomes a distinct unit of local government. Several MJAA have been formed in Illinois. The composition of these MJAA's may vary from only municipalities, a mix of municipalities and a county government, to only counties. By forming a MJAA, units of local government formally commit to sharing authority and responsibility. The MJAA then becomes the lead agency for implementation.

It should be noted that the flow control language in the ICA is more encompassing than the LSWDA's language. The ICA language allows the parties to provide that "the method of collection, transportation, processing, storage and disposal shall be the exclusive methods to be allowed . . . " whereas the LSWDA's language is restricted to the "methods of disposal". The significance of this difference is that under the ICA, a MJAA can clearly flow control its

recyclables, but under the LSWDA, it appears a unit of local government can only flow control its waste destined for "disposal".

Solid Waste Disposal District Act (SWDDA). The SWDDA authorizes the creation of solid waste disposal districts. Such districts shall:

> Be responsible for the collection and transportation of solid waste. Such districts may establish, with the prior approval of the Environmental Protection Agency, facilities in one or more locations for the disposal, treatment or conversion of the solid waste.

In order to create a solid waste disposal district, not less than one percent of the voters in any county having less than 3,000,000 population (i.e., excluding Cook County) may petition the circuit court of the county to order the question of whether to create a district be submitted to the voters of the county. Districts may be formed by not more than five adjoining counties so long as the petition is accompanied by the written approval of the IEPA. A single township or not more than five adjoining townships not already included within a district may also petition the circuit court to have the voters of the township(s) decide whether to form a district. If a single or multi-county or township district is formed, the district is coextensive with the boundaries of the single or multi-county or township.

Once the petition has been filed, the circuit clerk issues a notice of the time and place for a hearing on the petition. The circuit judge then determines whether the petition was properly filed. If it is, the judge will order that a referendum be held. The majority of the voters, in each township, must approve of the creation of a district.

The SWDDA also contains specific guidance on the formation and operating procedures of the governing authority. The district must be managed by a five member board of trustees. The Act contains a procedure for allocating trustees if more than one county or township is included in the district. Trustees must be qualified voters, residents of the county or township, not hold public office and not be officers of a political party. The presiding officer of the County Board, with the advice and consent of the County Board, appoints the trustees. In the

case of a township district, the township supervisor, with the consent of the township's board of trustees, appoints the trustees.

Once formed, the district has numerous powers, including the ability to:

- Construct, acquire and operate disposal facilities,
- Contract with other governmental bodies or with private industry for disposal of solid waste. (The SWDDA does not contain the explicit flow control authority of the LSWDA or the ICA. As a result, the legal authority of the district to flow control waste needs to be further explored if this option is to be seriously considered),
- Make and publish ordinances, rules and regulations,
- Charge and collect reasonable fees for the use of facilities and services,
- Levy a tax on all taxable property within the district at a rate not exceeding .05 percent,
- Issue tax anticipation notes,
- Issue revenue bonds, and
- Issue general revenue bonds pursuant to the approval of the legal voters of the district.

A solid waste management district has powers similar to that of a MJAA except for the explicit granting of flow control authority. However, the units of local government within the district may be able to utilize the flow control authority specifically granted to them under Illinois statutes.

COMPARISON OF IMPLEMENTATION OPTIONS

DeKalb County has three primary options for establishing an implementation framework with the necessary powers to implement this Plan:

- An intergovernmental agreement between the county and municipalities in the county under the LSWDA.

- Municipal Joint Action Agency (MJAA) under the ICA, joining the county and the municipalities in the region.

- Solid waste district under the SWDDA.

Table 11-1 provides a comparison of the advantages and disadvantages of these three options.

IMPLEMENTATION RECOMMENDATIONS

Listed below are the preliminary recommendations on which entity(ies) should be responsible for implementing the Plan.

- DeKalb County should be the lead unit of local government responsible for overseeing implementation of the Plan.

- DeKalb County should strongly encourage each municipality to enact a resolution to recognize and accept the DeKalb County Solid Waste Management Plan.

- DeKalb County should contact the municipalities to determine their interest in signing an intergovernmental agreement to more clearly define the roles and responsibilities of the County and municipalities in implementing the Plan.

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TABLE 11-1. COMPARISON OF IMPLEMENTATION OPTIONS		
Option	Advantages	Disadvantages
County Lead Under the LSWDA	Requires less time and expense than forming a new unit of local government (MJAA) or a solid waste disposal district.	The difficulty involved in arriving at a consensus with the other units of local government (townships, municipalities) that offers them a voice in the decision-making process.
	Allows County Government and other units of local government within the County the flexibility to create their own decision-making or governing process instead of having it legislatively prescribed.	The County, as the lead unit of government, may be responsible for assuming a larger share of the cost and risk associated with plan implementation.
		The County may have to assume responsibility for enforcing the mandates of the plan on municipalities and townships. The political and economic ramifications of this cannot be overlooked.
Municipal Joint Action Agency	The potential political and economic tension between units of local government within the County concerning plan implementation can be minimized through the formation of a joint governing authority.	The time and expense required to form a distinct and new unit of local government. This may be negatively perceived by the public.
	The implementation powers (e.g. flow control) of the MJAA are more encompassing and specific than those under the County lead or district options. This should facilitate more efficient and effective plan implementation.	The County and the units of local government's flexibility to develop their own decision-making or governing process is limited.
	The cost and risk of plan implementation is distributed among the members of the MJAA.	
Solid Waste Disposal District	The implementation powers of the district are more encompassing and specific than those under the County lead option.	The process required to establish a district is cumbersome, costly and offers no guarantee of voter approval.
	The district is permitted to utilize general obligation bonds, if approved by voters, for financing the development of facilities.	The rules associated with number of trustee(s) and selection of the Board of Trustees may not result in a Board of Trustees representative of the entire County.
	The district is allowed a source of funding through the property tax levy authority.	The SWDDA does not contain explicit flow control language.

APPENDIX A

SUMMARY OF STATE LANDFILL REGULATIONS

REGULATORY OVERVIEW		
Standard	**Compliance**	**Current Illinois Landfill Criteria Title 35 Illinois Administrative Code Parts 810-815**
A. Location Restrictions		
A1. Airports		Title 35 Sections 811.302(e), 814.302(c), and 814.402(c) • Not within 10,000 feet of any runway used by turbojet aircraft without written permission from FAA. • Not within 5,000 feet from any runway used by piston aircraft without written permission from FAA. Title 35 Sections 811.302(f), 814.302(c), and 814.402(c) • The airport and FAA must be notified within 7 days of a permit being filed with the IEPA for any new MSWLF within a five mile radius of an airport runway.
A2. Floodplains		Title 35 Sections 811.102(b), 814.302(a), and 814.402(a) • Shall not 1) restrict the flow of a 100-year flood, 2) reduce the temporary water storage capacity, or 3) result in washout of solid waste.
A3. Wetlands/Waters of the U.S.		Title 35 Sections 811.102(d), 811.102(e), 811.103, 814.302, and 814.402 • Compliance with Section 404 of the Clean Water Act. • May not result in the destruction or adverse modification of the habitat of any endangered species. • Runoff from disturbed areas will be prevented. • Run-on to undisturbed areas will be prevented.
A4. Fault Areas A5. Seismic Impact Zones A6. Unstable Areas		Title 35 Sections 811.304, 811.305, 814.302, and 814.402 • The material beneath the unit shall have sufficient strength to support the weight of the unit during all phases of construction and operation. • The solid waste disposal unit shall be designed to achieve a factor of safety against bearing capacity failure and slope failure. • In calculating factors of safety,, both long term (in tens or hundreds of years) and short term (over the design period of the facility) conditions expected at the facility shall be considered. • The potential for earthquake and blast induced liquefaction shall be taken into effect in the design.
A7. Scenic Rivers		Title 35 Sections 811.102(a), 811.302(a) • Shall meet all requirements under the Wild and Scenic River Act. (Portions of the Vermillion River are the only Scenic River listed in Illinois.)
A8. Historic and Natural Areas		Title 35 Section 811.102(c) • Shall not pose a threat of harm or destruction to features for which a 1) Historic Site, 2) Archaeological Site, 3) Natural Landmark, or 4) Natural Area was designated.

REGULATORY OVERVIEW		
Standard	**Compliance**	**Current Illinois Landfill Criteria Title 35 Illinois Administrative Code Parts 810-815**
A9. Endangered Species		Title 35 Section 811.102(d) • Shall not jeopardize or take any endangered species, result in the destruction of critical habitat for such species, or contribute to the taking of endangered or threatened species.
A10. Water Quality Management Plan		Title 35 Section 811.102(f) • Shall not cause a violation of any are-wide or statewide water quality management plan for non-point source pollution.
A11. Water Supply Wells Setback		Title 35 Section 811.302(a) • No part of the unit shall be located within the setbacks established in Sections 14.2 and 14.3 of the Act, i.e., within 200 feet of a potable water supply well. The setback distance may be increased up to 1,000 feet for community water supply wells and 2,500 feet for community water supply wells withdrawing groundwater from an alluvial deposit located within 1,000 feet of public waters.
A12. Sole-Source Aquifers		Title 35 Section 811.302(b) • No part of the unit shall be located within 1,200 feet vertically or horizontally of a sole source aquifer, unless an impermeable situation exists below the unit. (No sole source aquifers are known to have been designated in Illinois.)
A13. Roads and Highways		Title 35 Section 811.302(c) • A facility located within 500 feet of a township or county road or state or interstate highway shall have its operations screened from view by a barrier no less than 8 feet in height.
A.14 Occupied Dwellings, Schools, and Hospitals		Title 35 Section 811.302(d) • No part of a unit shall be located within 500 feet of an occupied dwelling, school or hospital.
B. Operating Criteria		
B1. Hazardous Waste		Title 35 Section 811.109(b) • A sign shall be posted at the entrance to the facility stating that disposal of hazardous waste is prohibited. Title 35 Section 811.323 • A load checking program shall be implemented for the purpose of detecting hazardous waste including: 1) Random inspections, 2) Recording inspection results, 3) Training and 4) Handling regulated. Title 35 Section 811.406 • A load checking program that meets the requirement of Section 811.323 shall be implemented for the regulation of hazardous waste disposal.

REGULATORY OVERVIEW		
Standard	**Compliance**	**Current Illinois Landfill Criteria Title 35 Illinois Administrative Code Parts 810-815**
B2. Special Waste		Title 35 Section 811.402 • A sign shall state that disposal of hazardous waste is prohibited and whether or not the facility is permitted to accept special waste. Title 35 Section 811.403 • Special waste shall be accompanied by a manifest. Title 35 Section 811.404 • Each special waste shall be accompanied by a special waste profile identification sheet. Title 35 Section 811.405 • Copies of any special waste information shall be kept on-site through post-closure.
B3. Waste Placement		Title 35 Section 811.321 • Placement of wastes shall begin in the lowest part of the unit. Initial waste placement prohibits heavy equipment use on the leachate collection and drainage system until 5 feet of waste has been mounded over the system.
B4. Daily Cover Material Requirements		Title 35 Section 811.106 • Six inches of clean soil material or alternate materials achieving equivalent performance.
B5. Intermediate Cover		Title 35 Section 811.313 • All waste which is not to be covered within 60 days of placement by another lift shall have a cover equivalent to that provided by 1 foot of compacted clean soil material. All intermediate cover shall be graded to maximize runoff and minimize infiltration and standing water.
B6. Disease Vector Control		Title 35 Section 811.107(i) • Control the population of disease and nuisance vectors.

REGULATORY OVERVIEW		
Standard	**Compliance**	**Current Illinois Landfill Criteria Title 35 Illinois Administrative Code Parts 810-815**
B7. Explosive Gas Control		Title 35 Section 811.311 • A landfill gas management system is required for putrescible waste landfills if 1) methane is detected at a concentration of 50% the LEL in the air, below the ground surface, or at the point of compliance, 2) methane greater than 25% the LEL is detected in any building on or near the facility, 3) odor are detected beyond the property boundary, or 4) leachate is recycled. • Gas venting systems shall be utilized only as temporary mitigation until the completion of an active system. • If methane levels exceed the above levels, the owner or operator will notify the Agency and take steps to protect human health. • A gas collection system shall transport gas to a central point or points for processing. Title 35 Section 811.312 • The processing of landfill gas for use is strongly recommend but is not required. No gas may be discharged directly to the atmosphere unless treated. Gas shall be treated or burned on-site prior to discharge in accordance with a permit issued pursuant to 35 Ill. Adm. 200-245.
B8. Landfill Gas Monitoring		Title 35 Section 811.310 • Gas monitoring devices shall be designated and located to provide a representative sample of all parameters to be measured. All gas monitoring devices and the ambient air shall be sampled monthly for the entire operating period and for a minimum of 30 years after closure for MSWLF's, 5 years for on-site landfills, and 15 years for all others. All buildings within a facility shall be monitored for methane.
B9. Open Burning/Clean Air Act		Title 35 Section 811.107(f) • Open burning is prohibited except in accordance with 35 Ill. Adm. Code 200 through 245. Title 35 Section 811.310 and 811.311 • Landfill gas must be combusted before release to the atmosphere, and it is recommended that it be processed for energy use.
B10. Leachate Collection and Disposal System		Title 35 Section 811.309 • Leachate shall flow freely form the collection system to a leachate management system. A leachate management system consists of any of the following: 1) On-site treatment and pre-treatment, 2) Storage, 3) Off-site treatment, 4) Recycling. Representative samples of leachate shall be collected and tested once per quarter or once per year for any monitored constituents if not detected.
B11. Access Requirements		Title 35 Section 811.109(a) • Access shall be restricted to prevent unauthorized entry at all times.

REGULATORY OVERVIEW		
Standard	**Compliance**	**Current Illinois Landfill Criteria Title 35 Illinois Administrative Code Parts 810-815**
B12. Run-On/Run-off Control Systems B13. Surface Water Requirements		Title 35 Section 811.103 • Run-off from disturbed areas must meet the requirements of 35 Ill. Adm. Code 304 and 309. All discharge structures shall be designed to prevent erosion and scouring. • Run-on from undisturbed areas shall be diverted around the disturbed areas.
B14. Liquid Restrictions for MSWLF units		Title 35 Section 811.107(m) • Bulk or noncontainerized liquid waste may not be placed in MSWLF units, unless the containers are small household wastes, recirculated leachate, or gas condensate.
B15. Record Keeping Requirements		Title 35 Section 811.110(d), 811.112, and Parts 812 and 813 • The owner or operator of a MSWLF must record and retain all information submitted to the Agency pursuant to Part 812 and 813, and the following: compliance with location standards; inspection records, training procedures, and notification procedures; gas monitoring results and remediation plans; design documentation for placement of leachate or gas condensate in unit; monitoring, testing, or analytical data pertaining to the groundwater monitoring program; and cost estimates and financial assurance documentation.
B16. Survey Controls		Title 35 Section 811.104 • All boundaries should be inspected annually and should also be surveyed and clearly marked for identification by a professional land survey at least every 5 years. Control monuments shall be established to check vertical elevations.
B17. Compaction		Title 35 Section 811.105 • All wastes shall be deposited at the lowest part of part of the active face, and compacted to the highest achievable density.
B18. Phasing of Operation		Title 35 Section 811.107(a) • Waste shall be placed in a manner and rate that mass stability is provided during all phases of the operations.
B19. Size and Slope of Working Face		Title 35 Section 811.107(b) • The working face of the unit shall be no larger than is necessary, and contain slopes no stepper than 2 to 1 (horizontal to vertical).
B20. Equipment		Title 35 Section 811.107(c) • Equipment shall be maintained and available for use at the facility during all hours of operation.
B21. Utilities		Title 35 Section 811.107(d) • All utilities necessary for safe operation shall be available at the facility at all times.

REGULATORY OVERVIEW		
Standard	**Compliance**	**Current Illinois Landfill Criteria Title 35 Illinois Administrative Code Parts 810-815**
B22. Maintenance		Title 35 Section 811.107(e) • The operator shall maintain and operate all systems and structures in a manner that facilitates proper operations.
B23. Dust Control		Title 35 Section 811.107(g) • The operator shall implement methods for controlling dust 50 as to prevent wind dispersal of particulate matter.
B24. Noise Control		Title 35 Section 811.107(h) • The facility shall be designed, constructed and maintained to minimize the level of equipment noise audible outside the facility.
B25. Fire Protection		Title 35 Section 811.107(j) • The operator shall institute fire protection measures.
B26. Litter Control		Title 35 Section 811.107(k) • Daily checks are to be made for litter accumulations followed by collection and disposal of any litter. All solid waste haulers should have covers to prevent litter, unless the nature of the solid waste cannot cause litter during transportation to the facility.
B27. Mud Tracking		Title 35 Section 811.107(l) • The facility shall implement methods to prevent tracking of mud by hauling vehicles onto public roadways.
B28. Salvaging		Title 35 Section 811.108 • Salvaging may not interfere with the operations of the facility and must be performed in a safe and sanitary manner.
B30. Load Checking Program		Title 35 Section 811.323 • The owner or operator shall implement a load checking program which discourages the disposal of regulated hazardous, special, or banned wastes.
C. Design Criteria		
C1. Design Period		Title 35 Section 811.303 • The design period for putrescible and chemical waste disposal shall be the estimated operating life and plus 30 years (20 years for units which recirculate leachate).
C2. Foundation Stability		Title 35 Section 811.304 • The unit shall be designed to achieve the desired safety factors against bearing capacity failure and slope failure for static and seismic conditions in both long and short term conditions.

REGULATORY OVERVIEW		
Standard	**Compliance**	**Current Illinois Landfill Criteria Title 35 Illinois Administrative Code Parts 810-815**
C3. Foundation Construction		Title 35 Section 811.305 • The foundation shall be of sufficient strength and be clean of debris or be replaced. Work with frozen soil is prohibited.
C4. Liner Systems		Title 35 Section 811.306 • All units shall be equipped with a stable leachate drainage and collection system with a compacted earth liner during all stages of construction and operation. A compacted earth liner should be 5 feet thick with a hydraulic conductivity of $1x10^{-7}$ cm/sec, unless a composite liner with a geomembrane 60 mls thick and a 3 feet thick compacted earth liner is used.
C5. Leachate Drainage		Title 35 Section 811.307 • A leachate drainage system shall be designed to maintain a maximum head of leachate 0.3 meters above the liner. The drainage layer shall be no less than 0.3 meters thick and shall have a hydraulic conductivity equal to or greater than $1x10^{-3}$ cm/sec.
C6. Leachate Collection		Title 35 Section 811.308 • The leachate collection system shall be designed and constructed to function for the entire design period, including 30 years after closure.
C7. Final Slope and Stabilization		Title 35 Section 811.322 • All slopes shall be designed to support vegetation and minimize erosion. No standing water shall be allowed anywhere on the unit. Title 35 Section 811.110(a), and (b), and (c) • The final slopes and contours shall blend with the surrounded topography, safely pass runoff without erosion, and minimize the need for further maintenance
D. Groundwater Monitoring and Corrective Action		
D1. Hydrogeologic Investigation		Title 35 Section 811.315 • A hydrogeologic site investigation shall be used to provide information to perform a groundwater impact assessment and to establish a groundwater monitoring system. The investigation shall be conducted in three phases prior to submission for a permit.
D2. Groundwater Impact Assessment		Title 35 Section 811.317 • A groundwater impact assessment must be prepared to assess the impacts of seepage from the unit. A contaminant transport mover must be run for the facility along with a sensitivity analysis to ensure the applicable groundwater quality parameters are not exceeded within 100 years.

REGULATORY OVERVIEW		
Standard	**Compliance**	**Current Illinois Landfill Criteria** **Title 35 Illinois Administrative Code Parts 810-815**
D3. Groundwater Monitoring Systems		Title 35 Section 811.318(a), (b), (c), and (d) • A groundwater monitoring network shall be designed, constructed and operated to detect potential discharges to groundwater. The monitoring wells shall be constructed and cased to prevent direct contamination and clogging of the screen.
D4. Groundwater Sampling and Analysis Requirements		Title 35 Section 811.318(e) • The groundwater monitoring program shall include consistent sampling and analysis procedures to assure that monitoring results can be relied upon to provide data representative of groundwater quality in the zone being monitored.
D5. Detection Monitoring Program		Title 35 Section 811.319(a) • All monitoring points shall be sampled quarterly for at least fifteen years past closure (30 years for MSWLF units). Groundwater should be analyzed for all parameters for which there exists a board established standard or which are expected to be in the leachate. An assessment monitoring program shall be implemented for any statistically significant increase.
D6. Assessment Monitoring Program		Title 35 Section 811.319(b) and (c) • An assessment monitoring program shall confirm the source of the contamination and provide information needed to carry out a groundwater impact assessment. • The additional constituents incorporated by reference at Section 810.104 shall be monitored to determine the extent of contamination.
D7. Remedial Action		Title 35 Section 811.319(d) • For landfills other than MSWLF's, a plan for remedial action must be implemented within 90 days and continue until all constituents are below the maximum concentrations. Title 35 Section 811.324 • For MSWLF's, an assessment of the corrective action measures must be initiated within 14 days of the groundwater impact assessment, or a confirmed increase above the groundwater quality standards attributable to solid waste and completed within 90 days. • The assessment must address the effectiveness, efficiency, costs, time, and any other requirements of any potential corrective action measures.
D8. Selection of Remedy		Title 35 Section 811.325 • Within 90 days of completion of the corrective action measures assessment, a remedy must be chosen which will be protective of human health and the environment, be able to attain the groundwater quality standards, and prevent further release of contamination. Any part of the corrective action measures which affects these criteria must be considered when selecting an action. A schedule for initiation and completion of the remediation must also be developed.

REGULATORY OVERVIEW		
Standard	**Compliance**	**Current Illinois Landfill Criteria Title 35 Illinois Administrative Code Parts 810-815**
D9. Implementation of a Corrective Action		Title 35 Section 811.326 • A program which meets the requirements of 811.325 will be initiated according to the developed schedule. Any interim measures necessary to protect human health and the environment will be taken until initiation of the program. Notification will be made to the Agency concerning the productivity, problems or completion of the action.
D10. Groundwater Quality Standards		Title 35 Section 811.320 • The applicable groundwater standards should be established based on 1) the background concentrations determined by one year of sampling, or 2) a board adjusted standard. The zone of attenuation for compliance purposes is 100-feet or the property boundary.
D11. Plugging of Drill Holes		Title 35 Section 811.316 • All drill holes shall either be plugged or converted into monitoring wells.
E. Closure and Post-Closure Care		
E1. Final Cover		Section 811.314 • A final cover system consisting of at least 3 feet of low permeability ($1x10^{-7}$ cm/sec) material or an equivalent geomembrane, and a final protective layer of 3 feet capable of supporting vegetation. • For MSWLF units, the final cover must have a maximum permeability less than or equal to the permeability of the liner system.
E2. Closure Plan		Title 35 Section 811.110(d) • The operator will maintain a written plan describing all actions to close the unit. • Closure shall be initiated within 30 days of the final receipt of waste or one year from the final receipt of waste if there is a reasonable likelihood that more waste will be received. • Closure activities must be completed within 180 days of initiation of closure activities. Notification must be placed on the deed of the landfill property stating that the property was used for a landfill and that its use is restricted pursuant to 811.111(d)
E3. Post-Closure Care Requirements		Title 35 Section 811.112 • The operator will clean-up the site by properly disposing of any waste and removing all equipment and structures not necessary for the post closure land use. Quarterly inspections of the final cover will take place for 5 years (30 years for MSWLF units), after which period they may be reduced. Any areas that do not conform to a smooth uniform final cover will be corrected. • The use of property after closure of an MSWLF unit is restricted to activities which will not effect the integrity of the final cover, liners system, or other component of the containment system.

REGULATORY OVERVIEW		
Standard	**Compliance**	**Current Illinois Landfill Criteria Title 35 Illinois Administrative Code Parts 810-815**
F. Quality Assurance		
F1. Key Personnel		Title 35 Section 811.502 • A third party shall be appointed as a construction quality assurance (CQA) officer. Title 35 Section 811.503 • The CQA officer shall be present to provide supervision and assume responsibilities for the inspection of all major design features.
F2. Inspection		Title 35 Section 811.504 • A sampling program shall be implemented for all construction activities.
F3. Sampling		Title 35 Section 811.504 • A sampling program shall be implemented for all construction activities.
F4. Documentation		Title 35 Section 811.505 • A daily summary report shall be prepared by the CQA.
F5. Foundation and Subbases		Title 35 Section 811.506 • The CQA officer shall ensure that the site investigation is carried out in accordance with the plans, and record all observations and modifications.
F6. Compacted Earth Liner		Title 35 Section 811.507 • Construction of the clay liner shall be tested and inspected. A test liner shall be constructed prior to construction of the landfill liner to verify the suitability of the materials and construction procedures.
F7. Geomembrane		Title 35 Section 811.508 • The CQA officer shall exercise professional judgement while constructing a geomembrane system.
F8. Leachate Collection		Title 35 Section 811.509 • The CQA officer shall exercise professional judgement in the construction of the leachate collection system.
G. Financial Assurance Criteria		
G1. Applicability		Title 35 Section 811.700 • This subpart does not apply to the State of Illinois or any local governments, provided that any other persons who conduct such a waste disposal operation provide financial assurance for closure and post closure. • MSWLF units must demonstrate financial assurance by April 9, 1998, or within 120 days after selection of a remedy for corrective action.

REGULATORY OVERVIEW		
Standard	**Compliance**	**Current Illinois Landfill Criteria** **Title 35 Illinois Administrative Code Parts 810-815**
G2. Closure		Title 35 Section 811.704 • A written cost estimate for the closure of all parts of the facility based on premature closure and third party implementation.
G3. Post-Closure Care		Title 35 Section 811.704 • A written cost estimate of post closure care based on: 1) groundwater monitoring, 2) cover placement and stabilization, 3) alternate landfill gas disposal, 4) cost estimates beyond the design period.
G4. Corrective Action		Title 35 Section 811.704 • If required to undertake corrective action measures, a written estimate of the costs to hire a third party to perform the corrective action in accordance with Section 811.326 is required.
G5. Revisions		Title 35 Section 811.705 • Closure and post closure costs shall be upgraded with each new application for permit renewal or in an increase of the cost estimate. • Cost estimate shall be adjusted annually during the following time period: the active life of the unit for closure, the active life and post-closure care period for post-closure, and until the corrective action program is completed in accordance with Section 811.326 for corrective action.
G6. Mechanisms		Title 35 Sections 811.706 - 811.715 • The available mechanisms for financial assurance include: 1) a trust fund (811.710), 2) surety bond quaranteeing payment (811.711), 3) surety bond quaranteeing performance (811.712), 4) letter of credit (811.713), 5) closure insurance (811.714), 6) self insurance (811.715), 7) use of multiple financial mechanisms (811.707), 8) use of financial mechanism for multiple sites (811.708), 9) trust fund for unrelated sites (811.709).
G7. Financial Assurance		Title 35 Section 811.701 • The owner or operator shall maintain financial assurance equal to or greater than the current cost estimate.
G8. Release		Title 35 Section 811.702 • The agency releases the owner or operator from financial requirements pursuant to 35 Ill. Adm. Code 813.403(b), or if alternative financial assurance is substituted.
G9. Application of Proceeds and Appeals		Title 35 Section 811.703 • The agency may enforce financial instruments on order the modification of closure and post closure care that proceeds from financial assurance.

APPENDIX B

LANDFILLING COST ESTIMATES

CONCEPTUAL COSTS FOR 100, 500, AND 1000 TPD LANDFILLS

Scenario Two - Conceptual Cost Estimate for a 100 TPD Generic Solid Waste Landfill. The costs in this section address the cost for a 100 TPD solid waste landfill which is designed to accept both putrescible and chemical waste as defined in the Illinois landfill regulations. The following assumptions were made when developing the cost estimates:

1. The facility consists of one waste cell.

2. The size of the footprint is 15 acres. Buffer zones of 500 feet were utilized on each side of the footprint. The total facility size is 74 acres.

3. The above grade side slopes on the face of the cell are 4:1. The below grade side slopes are 2:1.

4. The landfill depth below grade is 30 feet. The landfill height above grade is 80 feet.

5. The bottom liner consists of a 3-foot thick recompacted clay liner using on-site material and a single 60-mil HDPE liner. The side liners consist of recompacted clay and the synthetic liner.

6. A full leachate collection system and low-technology gas incineration is utilized.

7. Full-time QA/QC is employed during liner and leachate collection system construction.

8. The site is relatively level with no tree or heavy brush coverage.

9. The initial waste area developed is 1/20 of the footprint area or about one acre.

10. Costs are given in 1993 dollars. Future costs are scaled using a 4.5 percent inflation rate, and an interest rate of 7.5 percent was used to estimate the debt service.

11. A 30 year post-closure care period was used.

12. Ancillary facilities are located within the 500 foot buffer and include security gate, scale and scale house, heavy equipment storage, maintenance facility, employee and visitor parking areas, and soil stockpile areas.

Pre-development Costs. The pre-development phase for a landfill in Illinois consists of selection of a site for the landfill, performing preliminary engineering and hydrogeologic studies to assess the suitability of the site for landfill development, obtaining local siting approval for the site under the SB-172 siting process, performing detailed engineering and hydrogeologic studies and designing the facility, and obtaining a development and operation permit from the IEPA.

The costs expected to be incurred during the pre-development phase are summarized in Table B-1. These costs are approximate and may vary substantially.

Site Development Costs. Upon receipt of a permit for the solid waste landfill from the IEPA, a construction contract would be let for construction of the initial waste cell (approximately one acre, 5 percent of the footprint area), installation of the liners, leachate and gas collection systems, construction of fences, monitoring systems, entrance roads and building, installation of the utilities, scale, and landscaping of the site, all of which must be in place before the first load of waste is brought into the facility. During the construction period, a registered professional engineer will be present to document that the construction is in compliance with the plans and permit. Upon certification by the engineer that the work is in compliance with the plans, the facility would be placed into operation. The estimated site development costs are summarized in Table B-2.

TABLE B-1. SCENARIO TWO: PRE-DEVELOPMENT COSTS				
Cost Description	Quantity	Unit	Unit Price	Amount
Site Selection Process	1	Lump Sum	$ 20,000	$ 20,000
SB 172 Siting Process				
Project Need Study	1	Lump Sum	$ 50,000	$ 50,000
Preliminary Hydrogeological Study	1	Lump Sum	$ 70,000	$ 70,000
Preliminary Design	1	Lump Sum	$ 85,000	$ 85,000
Preliminary Operating Plan	1	Lump Sum	$ 20,000	$ 20,000
Land Use Study	1	Lump Sum	$ 20,000	$ 20,000
Traffic Study	1	Lump Sum	$ 20,000	$ 20,000
Public Hearings	1	Lump Sum	$ 45,000	$ 45,000
Land Costs				
Property	74	Acres	$ 3,000	$ 222,000
Option Costs	1	Lump Sum	$ 25,000	$ 25,000
Legal Survey	1	Lump Sum	$ 25,000	$ 25,000
Permitting Process				
Detailed Hydrogeological Study	1	Lump Sum	$225,000	$ 225,000
Detailed Design	1	Lump Sum	$ 75,000	$ 75,000
Legal Fees	1	Lump Sum	$100,000	$ 100,000
Public Education / Awareness	1	Lump Sum	$ 30,000	$ 30,000
			TOTAL	$1,032,000

Site Operation Costs. A sanitary landfill operation is an earthwork construction project that lasts the duration of the active site life. As refuse is brought in, soil for daily cover is excavated from the next cell. Excavation is managed so as to minimize double handling. Clay side seals and bottom seals are constructed of soil excavated from the next cell.

The site manager, equipment operators, laborer(s), gate attendant, and mechanic are permanently assigned to the project and continue with the construction of the remaining cells and final cover ahead of the rate of filling. The size of the construction force and number of pieces of equipment are determined so as to keep ahead of the incoming waste.

TABLE B-2. SCENARIO TWO: SITE DEVELOPMENT PHASE	
Cost Description	Amount
Construction, Initial Development	
Site Preparation	$ 183,000
Mass Earthwork	$ 120,000
Stormwater	$ 201,000
Synthetic Liner	$ 24,000
Leachate Collection System	$ 58,000
Roads / Paving	$ 388,000
Curbs and Gutters	$ 15,000
Sidewalks	$ 2,000
Lighting	$ 72,000
Utilities	$ 72,000
Scale	$ 108,000
Landscaping	$ 45,000
Signage	$ 9,000
Fencing	$ 92,000
Field Office / Security	$ 95,000
Monitoring Wells	$ 91,000
SUBTOTAL	$1,575,000
Contractor Overhead and Profit (15 Percent)	$ 236,000
Buildings (Including Contractor Overhead and Profit)	$ 471,000
SUBTOTAL	$2,281,000
Contingency (15 Percent)	$ 342,000
Mobile Equipment	$ 577,000
SUBTOTAL	$3,201,000
Escalation Factor (9.2 Percent)	$ 294,000
TOTAL	**$3,495,000**

Notes:
1. Escalation factor represents escalation of costs midway between 1993 and 1997 at 4.5% per year.

TABLE B-3. SCENARIO TWO: ANNUAL OPERATING EXPENSES	
COST DESCRIPTION	AMOUNT
Annual Operating Expenses	
Outside Construction	$ 212,000
Labor	$ 270,000
Equipment Operation and Maintenance	$ 86,000
Building Utilities	$ 18,000
Construction Testing, Documentation, and Layout	$ 194,000
Groundwater Monitoring	$ 40,000
Gas Monitoring	$ 34,000
Leachate Treatment	$ 17,000
Insurance	$ 250,000
TOTAL	**$1,121,000**

Notes:
1. Equipment includes: site manager's vehicle(1), mechanics vehicle(1), grader(1), and bulldozer/compactor(1).
2. Labor includes: site manager(1), gate attendant(1), mechanic(1), equipment operator(1), and laborer(1).
3. Equipment assumed to have 10 year life with no salvage.
4. Outside construction includes: mass earthwork, synthetic liner, and leachate and gas collection systems.

Closure Costs. Final closure of the landfill facility will occur when all permitted fill areas have been completed in accordance with permitted plans. The tasks involved in the closure include placement of a clay cover cap, placement of fill to protect the clay cover from freezing, drying, and root penetration, placement of vegetative soil, seeding of the vegetative cover, certification of closure by a registered professional engineer, and filing of plat of the completed landfill. The costs associated with these tasks are shown in Table B-4.

TABLE B-4. SCENARIO TWO: CLOSURE COSTS	
COST DESCRIPTION	AMOUNT
Clay Cover Placement	$ 9,300
Protective Soil Layer Placement	$ 7,800
Vegetative Soil Layer Placement	$ 1,500
Vegetation Establishment (Rye grass)	$ 1,200
Certification of Closure	$35,000
Prepare and File Plat	$ 2,500
TOTAL	$57,300

Post-Closure Costs. The post-closure care period begins upon issuance of a certificate of closure from the IEPA. During this period, inspection, maintenance, and repair of the closed facility will be performed. The tasks and associated annual costs of the post-closure period are shown in Table B-5.

TABLE B-5. SCENARIO TWO: POST-CLOSURE COSTS				
Cost Description	Quantity	Unit	Unit Price	Amount
Site Inspection and Documentation	4	Quarterly	$ 2,500	$10,000
Cover Maintenance	1	Acres	$ 2,500	$ 2,500
Leachate Treatment	49,252	Gallons	$ 0.17	$ 8,373
Groundwater Monitoring	1	Lump Sum	$39,880	$39,880
Gas Monitoring	1	Lump Sum	$ 8,500	$ 8,500
			TOTAL	$69,253

Notes:
1. Post-closure costs are annual costs incurred for 30 years after closure.
2. Most of these estimates reflect costs expected only during the first 3 to 5 years of post-closure. Therefore, the total annual maintenance costs reflect a very conservative estimate.

Financing. Pre-development costs and site development costs are usually financed with debt for a publicly owned facility. Table B-6 shows a bond sizing calculation assuming that revenue bonds are utilized to finance the pre-development costs and development costs. It was

assumed the pre-development costs would be incurred during 1995-1996, and the development costs would be incurred during 1997. It was further assumed that bond repayment would occur over the 20 year period 1998-2017. Annual debt payments during this period would amount to $576,292 per year.

TABLE B-6. SCENARIO TWO: CONCEPTUAL LANDFILL COSTS - BOND SIZING			
Date of Financing:	January 1, 1995		
Construction Period:	January 1, 1995 through January 1, 1998		
Capitalized Interest Period:	January 1, 1995 through January 1, 1998		
Principal Repayment:	January 1, 1998 through January 1, 2018		
Bond Coupon Rate:	7.5 %		
Funds Earnings Rate:	5.0 %		
Issuance Costs:	4.0 %		
Sources of Funds		Uses of Funds	
Bond Issue	$5,875,000	Construction	$4,527,000
Interest Earnings	$784,506	Capitalized Interest	$1,321,895
Contingency	$660	Debt Reserve Fund	$576,292
		Issuance Costs	$235,000
TOTAL	**$6,660,167**	**TOTAL**	**$6,660,167**

Notes:
1. Assumes full construction fund earns interest for first two years, and half construction fund earns interest for third year
2. Assumes full capitalized interest fund earns interest for one year, 2/3 of fund earns interest for one year, and 1/3 of fund earns interest for one year.
3. Assumes full debt reserve fund earns interest for three years.

Cost Summary. Table B-7 summarizes the costs for the conceptual 100 TPD facility. This table includes pre-development, site development, operation, closure, and post-closure costs. Also included are local and state surcharges and an allowance for overhead, taxes, and profit for the private operator.

The estimated tipping fee for the conceptual facility is $79.10 per ton (1993 dollars). It should be noted that all costs are estimated for a conceptual facility, and that actual costs will vary depending on site specific factors.

TABLE B-7. SCENARIO TWO: CONCEPTUAL LANDFILL COSTS - SUMMARY		
Cost Description	Amount	Amount Per Ton
Annual Debt Service	$ 576,292	$20.15
Operating Expenses	$1,121,000	$39.20
Closure Fund	$ 2,864	$ 0.10
Post Closure Fund	$ 103,879	$ 3.63
SUBTOTAL	$1,804,035	$63.08
State / Local Surcharge	$ 28,432	$ 0.99
SUBTOTAL	$1,832,467	$64.07
Operator Overhead and Profit	$ 429,710	$15.02
TOTAL	**$2,262,177**	**$79.10**

Scenario Three - Conceptual Cost Estimate for a 500 TPD Generic Solid Waste Landfill. The costs in this section address the cost for a 500 TPD solid waste landfill which is designed to accept both putrescible and chemical waste as defined in the Illinois landfill regulations. The following assumptions were made when developing the cost estimates:

1. The facility consists of four equal waste cells.

2. The size of the footprint is 66 acres. Buffer zones of 500 feet were utilized on each side of the footprint. The total facility size is 166 acres.

3. The above grade side slopes on the exterior face of the cells are 4:1. The above grade side slopes on the interior face of the cells are 2:1. The below grade side slopes are 2:1.

4. The landfill depth below grade is 30 feet. The landfill height above grade is 90 feet.

5. The bottom liner consists of a 3-foot thick recompacted clay liner using on-site material and a single 60-mil HDPE liner. The side liners consist of recompacted clay and the synthetic liner.

6. A full leachate collection system and low-technology gas incineration is utilized.

7. Full-time QA/QC is employed during liner and leachate collection system construction.

8. The site is relatively level with no tree or heavy brush coverage.

9. The initial waste area developed is 1/20 of the footprint area or about 3 acres.

10. Costs are given in 1993 dollars. Future costs are scaled using a 4.5 percent inflation rate, and an interest rate of 7.5 percent was used to estimate the debt service.

11. A 30 year post-closure care period was used.

12. Ancillary facilities are located within the 500 foot buffer and include security gate, scale and scale house, heavy equipment storage, maintenance facility, employee and visitor parking areas, and soil stockpile areas.

Pre-development Costs. The pre-development phase for a landfill in Illinois consists of selection of a site for the landfill, performing preliminary engineering and hydrogeologic studies to assess the suitability of the site for landfill development, obtaining local siting approval for the site under the SB-172 siting process, performing detailed engineering and hydrogeologic

studies and designing the facility, and obtaining a development and operation permit from the IEPA.

The costs expected to be incurred during the pre-development phase are summarized in Table B-8. These costs are approximate and may vary substantially.

TABLE B-8. SCENARIO THREE: PRE-DEVELOPMENT COSTS

Cost Description	Quantity	Unit	Unit Price	Amount
Site Selection Process	1	Lump Sum	$ 40,000	$ 40,000
SB 172 Siting Process				
Project Need Study	1	Lump Sum	$ 50,000	$ 50,000
Preliminary Hydrogeological Study	1	Lump Sum	$100,000	$ 100,000
Preliminary Design	1	Lump Sum	$ 85,000	$ 85,000
Preliminary Operating Plan	1	Lump Sum	$ 30,000	$ 30,000
Land Use Study	1	Lump Sum	$ 30,000	$ 30,000
Traffic Study	1	Lump Sum	$ 30,000	$ 30,000
Public Hearings	1	Lump Sum	$ 60,000	$ 60,000
Land Costs				
Property	166	Acres	$ 3,000	$ 498,000
Option Costs	1	Lump Sum	$ 25,000	$ 25,000
Legal Survey	1	Lump Sum	$ 25,000	$ 25,000
Permitting Process				
Detailed Hydrogeological Study	1	Lump Sum	$300,000	$ 300,000
Detailed Design	1	Lump Sum	$ 75,000	$ 75,000
Legal Fees	1	Lump Sum	$100,000	$ 100,000
Public Education / Awareness	1	Lump Sum	$ 50,000	$ 50,000
			TOTAL	**$1,498,000**

Site Development Costs. Upon receipt of a permit for the solid waste landfill from the IEPA, a construction contract would be let for construction of the initial waste cell (approximately three acres, 5 percent of the footprint area), installation of the liners, leachate

and gas collection systems, construction of fences, monitoring systems, entrance roads and building, installation of the utilities, scale, and landscaping of the site, all of which must be in place before the first load of waste is brought into the facility. During the construction period, a registered professional engineer will be present to document that the construction is in compliance with the plans and permit. Upon certification by the engineer that the work is in compliance with the plans, the facility would be placed into operation. The estimated site development costs are summarized in Table B-9.

TABLE B-9. SCENARIO THREE: SITE DEVELOPMENT PHASE

Cost Description	Amount
Construction, Initial Development	
Site Preparation	$ 282,000
Mass Earthwork	$ 490,000
Stormwater	$ 265,000
Synthetic Liner	$ 104,000
Leachate Collection System	$ 167,000
Roads / Paving	$ 839,000
Curbs and Gutters	$ 42,000
Sidewalks	$ 3,000
Lighting	$ 89,000
Utilities	$ 155,000
Scale	$ 108,000
Landscaping	$ 83,000
Signage	$ 19,000
Fencing	$ 138,000
Field Office / Security	$ 201,000
Monitoring Wells	$ 182,000
SUBTOTAL	$3,167,000
Contractor Overhead and Profit (15 Percent)	$ 475,000
Buildings (Including Contractor Overhead and Profit)	$1,094,000
SUBTOTAL	$4,736,000
Contingency (15 Percent)	$ 710,000
Mobile Equipment	$1,004,000
SUBTOTAL	$6,450,000
Escalation Factor (9.2 Percent)	$ 593,000
TOTAL	**$7,043,000**

Notes:
1. Escalation factor represents escalation of costs midway between 1993 and 1997 at 4.5% per year.

Site Operation Costs. A sanitary landfill operation is an earthwork construction project that lasts the duration of the active site life. As refuse is brought in, soil for daily cover is excavated from the next cell. Excavation is managed so as to minimize double handling. Clay side seals and bottom seals are constructed of soil excavated from the next cell.

The site manager, equipment operators, laborer(s), gate attendant, and mechanic are permanently assigned to the project and continue with the construction of the remaining cells and final cover ahead of the rate of filling. The size of the construction force and number of pieces of equipment are determined so as to keep ahead of the incoming waste.

TABLE B-10. SCENARIO THREE: ANNUAL OPERATING EXPENSES

Cost Description	Amount
Annual Operating Expenses	
Outside Construction	$ 802,000
Labor	$ 340,000
Equipment Operation and Maintenance	$ 166,000
Building Utilities	$ 41,000
Construction Testing, Documentation, and Layout	$ 194,000
Groundwater Monitoring	$ 50,000
Gas Monitoring	$ 34,000
Leachate Treatment	$ 38,000
Insurance	$ 250,000
TOTAL	**$1,915,000**

Notes:
1. Equipment includes: site manager's vehicle(1), mechanics vehicle(1), grader(1), bulldozer/compactor(1) and scraper(1).
2. Labor includes: site manager(1), gate attendant(1), mechanic(1), equipment operator(2), and laborer(1).
3. Equipment assumed to have 10 year life with no salvage.
4. Outside construction includes: mass earthwork, synthetic liner, and leachate and gas collection systems.

Closure Costs. Final closure of the landfill facility will occur when all permitted fill areas have been completed in accordance with permitted plans. The tasks involved in the closure include placement of a clay cover cap, placement of fill to protect the clay cover from freezing, drying, and root penetration, placement of vegetative soil, seeding of the vegetative cover, certification of closure by a registered professional engineer, and filing of plat of the completed landfill. The costs associated with these tasks are shown in Table B-11.

TABLE B-11. SCENARIO THREE: CLOSURE COSTS

Cost Description	Amount
Clay Cover Placement	$ 42,000
Protective Soil Layer Placement	$ 35,000
Vegetative Soil Layer Placement	$ 7,000
Vegetation Establishment (Rye grass)	$ 5,000
Certification of Closure	$ 35,000
Prepare and File Plat	$ 2,500
TOTAL	**$126,500**

Post-Closure Costs. The post-closure care period begins upon issuance of a certificate of closure from the IEPA. During this period, inspection, maintenance, and repair of the closed facility will be performed. The tasks and associated annual costs of the post-closure period are shown in Table B-12.

TABLE B-12. SCENARIO THREE: POST-CLOSURE COSTS				
Cost Description	Quantity	Unit	Unit Price	Amount
Site Inspection and Documentation	4	Quarterly	$ 2,500	$ 10,000
Cover Maintenance	3	Acres	$ 2,500	$ 7,500
Leachate Treatment	446,189	Gallons	$ 0.17	$ 75,852
Groundwater Monitoring	1	Lump Sum	$49,760	$ 49,760
Gas Monitoring	1	Lump Sum	$ 8,500	$ 8,500
			TOTAL	**$151,612**

Notes:
1. Post-closure costs are annual costs incurred for 30 years after closure.
2. Most of these estimates reflect costs expected only during the first 3 to 5 years of post-closure. Therefore, the total annual maintenance costs reflect a very conservative estimate.

Financing. Pre-development costs and site development costs are usually financed with debt for a publicly owned facility. Table B-13 shows a bond sizing calculation assuming that revenue bonds are utilized to finance the pre-development costs and development costs. It was assumed the pre-development costs would be incurred during 1995-1996, and the development costs would be incurred during 1997. It was further assumed that bond repayment would occur over the 20 year period 1998-2017. Annual debt payments during this period would amount to $1,807,352 per year.

Cost Summary. Table B-14 summarizes the costs for the conceptual 500 TPD facility. This table includes pre-development, site development, operation, closure, and post-closure costs. Also included are local and state surcharges and an allowance for overhead, taxes, and profit for the private operator.

The estimated tipping fee for the conceptual facility is $30.23 per ton (1993 dollars). It should be noted that all costs are estimated for a conceptual facility, and that actual costs will vary depending on site specific factors.

TABLE B-13. SCENARIO THREE: CONCEPTUAL LANDFILL COSTS - BOND SIZING			
Date of Financing:	January 1, 1995		
Construction Period:	January 1, 1995 through January 1, 1998		
Capitalized Interest Period:	January 1, 1995 through January 1, 1998		
Principal Repayment:	January 1, 1998 through January 1, 2018		
Bond Coupon Rate:	7.5 %		
Funds Earnings Rate:	5.0 %		
Issuance Costs:	4.0 %		
Sources of Funds		Uses of Funds	
Bond Issue	$11,085,000	Construction	$8,541,000
Interest Earnings	$1,480,140	Capitalized Interest	$2,494,125
Contingency	$737	Debt Reserve Fund	$1,087,352
		Issuance Costs	$443,400
TOTAL	**$12,565,877**	**TOTAL**	**$12,565,877**

Notes:
1. Assumes full construction fund earns interest for first two years, and half construction fund earns interest for third year.
2. Assumes full capitalized interest fund earns interest for one year, 2/3 of fund earns interest for one year, and 1/3 of fund earns interest for one year.
3. Assumes full debt reserve fund earns interest for three years.

TABLE B-14. SCENARIO THREE: CONCEPTUAL LANDFILL COSTS - SUMMARY		
Cost Description	Amount	Amount Per Ton
Annual Debt Service	$1,087,352	$ 7.60
Operating Expenses	$1,915,000	$13.39
Closure Fund	$ 6,356	$ 0.04
Post Closure Fund	$ 227,418	$ 1.59
SUBTOTAL	$3,236,126	$22.63
State / Local Surcharge	$ 334,620	$ 2.34
SUBTOTAL	$3,570,746	$24.97
Operator Overhead and Profit	$ 752,071	$ 5.26
TOTAL	**$4,322,818**	**$30.23**

Scenario Four - Conceptual Cost Estimate for a 1000 TPD Generic Solid Waste Landfill. The costs in this section address the cost for a 1000 TPD solid waste landfill which is designed to accept both putrescible and chemical waste as defined in the Illinois landfill regulations. The following assumptions were made when developing the cost estimates:

1. The facility consists of four equal waste cells.

2. The size of the footprint is 115 acres. Buffer zones of 500 feet were utilized on each side of the footprint. The total facility size is 240 acres.

3. The above grade side slopes on the exterior face of the cells are 4:1. The above grade side slopes on the interior face of the cells are 2:1. The below grade side slopes are 2:1.

4. The landfill depth below grade is 30 feet. The landfill height above grade is 90 feet.

5. The bottom liner consists of a 3-foot thick recompacted clay liner using on-site material and a single 60-mil HDPE liner. The side liners consist of recompacted clay and the synthetic liner.

6. A full leachate collection system and low-technology gas incineration is utilized.

7. Full-time QA/QC is employed during liner and leachate collection system construction.

8. The site is relatively level with no tree or heavy brush coverage.

9. The initial waste area developed is 1/20 of the footprint area or about six acres.

10. Costs are given in 1993 dollars. Future costs are scaled using a 4.5 percent inflation rate, and an interest rate of 7.5 percent was used to estimate the debt service.

11. A 30 year post-closure care period was used.

12. Ancillary facilities are located within the 500 foot buffer and include security gate, scale and scale house, heavy equipment storage, maintenance facility, employee and visitor parking areas, and soil stockpile areas.

Pre-development Costs. The pre-development phase for a landfill in Illinois consists of selection of a site for the landfill, performing preliminary engineering and hydrogeologic studies to assess the suitability of the site for landfill development, obtaining local siting approval for the site under the SB-172 siting process, performing detailed engineering and hydrogeologic studies and designing the facility, and obtaining a development and operation permit from the IEPA.

The costs expected to be incurred during the pre-development phase are summarized in Table B-15. These costs are approximate and may vary substantially.

Site Development Costs. Upon receipt of a permit for the solid waste landfill from the IEPA, a construction contract would be let for construction of the initial waste cell (approximately six acres, 5 percent of the footprint area), installation of the liners, leachate and gas collection systems, construction of fences, monitoring systems, entrance roads and building, installation of the utilities, scale, and landscaping of the site, all of which must be in place before the first load of waste is brought into the facility. During the construction period, a registered professional engineer will be present to document that the construction is in compliance with the plans and permit. Upon certification by the engineer that the work is in compliance with the plans, the facility would be placed into operation. The estimated site development costs are summarized in Table B-16.

TABLE B-15. SCENARIO FOUR: PRE-DEVELOPMENT COSTS				
Cost Description	Quantity	Unit	Unit Price	Amount
Site Selection Process	1	Lump Sum	$ 50,000	$ 50,000
SB 172 Siting Process				
Project Need Study	1	Lump Sum	$ 50,000	$ 50,000
Preliminary Hydrogeological Study	1	Lump Sum	$125,000	$ 125,000
Preliminary Design	1	Lump Sum	$ 85,000	$ 85,000
Preliminary Operating Plan	1	Lump Sum	$ 30,000	$ 30,000
Land Use Study	1	Lump Sum	$ 30,000	$ 30,000
Traffic Study	1	Lump Sum	$ 40,000	$ 40,000
Public Hearings	1	Lump Sum	$ 60,000	$ 60,000
Land Costs				
Property	240	Acres	$ 3,000	$ 720,000
Option Costs	1	Lump Sum	$ 25,000	$ 25,000
Legal Survey	1	Lump Sum	$ 25,000	$ 25,000
Permitting Process				
Detailed Hydrogeological Study	1	Lump Sum	$400,000	$ 400,000
Detailed Design	1	Lump Sum	$ 75,000	$ 75,000
Legal Fees	1	Lump Sum	$100,000	$ 100,000
Public Education / Awareness	.1	Lump Sum	$ 60,000	$ 60,000
			TOTAL	**$1,875,000**

TABLE B-16. SCENARIO FOUR: SITE DEVELOPMENT PHASE	
Cost Description	Amount
Construction, Initial Development	
Site Preparation	$ 302,000
Mass Earthwork	$ 861,000
Stormwater	$ 368,000
Synthetic Liner	$ 183,000
Leachate Collection System	$ 263,000
Roads / Paving	$ 1,126,000
Curbs and Gutters	$ 55,000
Sidewalks	$ 4,000
Lighting	$ 111,000
Utilities	$ 180,000
Scale	$ 108,000
Landscaping	$ 120,000
Signage	$ 20,000
Fencing	$ 165,000
Field Office / Security	$ 235,000
Monitoring Wells	$ 273,000
SUBTOTAL	$ 4,374,000
Contractor Overhead and Profit (15 Percent)	$ 656,000
Buildings (Including Contractor Overhead and Profit)	$ 1,969,000
SUBTOTAL	$ 6,999,000
Contingency (15 Percent)	$ 1,050,000
Mobile Equipment	$ 1,394,000
SUBTOTAL	$ 9,443,000
Escalation Factor (9.2 Percent)	$ 869,000
TOTAL	**$10,312,000**

Notes:
1. Escalation factor represents escalation of costs midway between 1993 and 1997 at 4.5% per year.

Site Operation Costs. A sanitary landfill operation is an earthwork construction project that lasts the duration of the active site life. As refuse is brought in, soil for daily cover is excavated from the next cell. Excavation is managed so as to minimize double handling. Clay side seals and bottom seals are constructed of soil excavated from the next cell.

The site manager, equipment operators, laborer(s), gate attendant, and mechanic are permanently assigned to the project and continue with the construction of the remaining cells and final cover ahead of the rate of filling. The size of the construction force and number of pieces of equipment are determined so as to keep ahead of the incoming waste.

TABLE B-17. SCENARIO FOUR: ANNUAL OPERATING EXPENSES

Cost Description	Amount
Annual Operating Expenses	
Outside Construction	$1,372,000
Labor	$ 435,000
Equipment Operation and Maintenance	$ 229,000
Building Utilities	$ 76,000
Construction Testing, Documentation, and Layout	$ 252,000
Groundwater Monitoring	$ 65,000
Gas Monitoring	$ 40,000
Leachate Treatment	$ 66,000
Insurance	$ 250,000
TOTAL	**$2,785,000**

Notes:

1. Equipment includes: site manager's vehicle(1), scraper(1), bulldozer/compactor(2), grader(1) and water wagon(1).
2. Labor includes: site manager(1), gate attendant(1), mechanic(1), equipment operator(3), and laborer(2).
3. Equipment assumed to have 10 year life with no salvage.
4. Outside construction includes: mass earthwork, synthetic liner, and leachate and gas collection systems.

Closure Costs. Final closure of the landfill facility will occur when all permitted fill areas have been completed in accordance with permitted plans. The tasks involved in the closure include placement of a clay cover cap, placement of fill to protect the clay cover from freezing, drying, and root penetration, placement of vegetative soil, seeding of the vegetative cover, certification of closure by a registered professional engineer, and filing of plat of the completed landfill. The costs associated with these tasks are shown in Table B-18.

TABLE B-18. SCENARIO FOUR: CLOSURE COSTS

Cost Description	Amount
Clay Cover Placement	$ 74,000
Protective Soil Layer Placement	$ 61,000
Vegetative Soil Layer Placement	$ 12,000
Vegetation Establishment (Rye grass)	$ 9,000
Certification of Closure	$ 35,000
Prepare and File Plat	$ 10,000
TOTAL	**$201,000**

Post-Closure Costs. The post-closure care period begins upon issuance of a certificate of closure from the IEPA. During this period, inspection, maintenance, and repair of the closed facility will be performed. The tasks and associated annual costs of the post-closure period are shown in Table B-19.

Financing. Pre-development costs and site development costs are usually financed with debt for a publicly owned facility. Table B-20 shows a bond sizing calculation assuming that revenue bonds are utilized to finance the pre-development costs and development costs. It was assumed the pre-development costs would be incurred during 1995-1996, and the development costs would be incurred during 1997. It was further assumed that bond repayment would occur over the 20 year period 1998-2017. Annual debt payments during this period would amount to $1,551,328 per year.

TABLE B-19. SCENARIO FOUR: POST-CLOSURE COSTS				
Cost Description	Quantity	Unit	Unit Price	Amount
Site Inspection and Documentation	4	Quarterly	$ 2,500	$ 10,000
Cover Maintenance	5	Acres	$ 2,500	$ 12,500
Leachate Treatment	777,830	Gallons	$ 0.17	$132,231
Groundwater Monitoring	1	Lump Sum	$64,580	$ 64,580
Gas Monitoring	1	Lump Sum	$10,000	$ 10,000
			TOTAL	**$229,311**

Notes:
1. Post-closure costs are annual costs incurred for 30 years after closure.
2. Most of these estimates reflect costs expected only during the first 3 to 5 years of post-closure. Therefore, the total annual maintenance costs reflect a very conservative estimate.

TABLE B-20. SCENARIO FOUR: CONCEPTUAL LANDFILL COSTS - BOND SIZING			
Date of Financing:	January 1, 1995		
Construction Period:	January 1, 1995 through January 1, 1998		
Capitalized Interest Period:	January 1, 1995 through January 1, 1998		
Principal Repayment:	January 1, 1998 through January 1, 2018		
Bond Coupon Rate:	7.5 %		
Funds Earnings Rate:	5.0 %		
Issuance Costs:	4.0 %		
Sources of Funds		Uses of Funds	
Bond Issue	$15,815,000	Construction	$12,187,000
Interest Earnings	$2,111,912	Capitalized Interest	$3,558,375
Contingency	$2,391	Debt Reserve Fund	$1,551,328
		Issuance Costs	$632,600
TOTAL	**$17,929,303**	**TOTAL**	**$17,929,303**

Notes:
1. Assumes full construction fund earns interest for first two years, and half construction fund earns interest for third year
2. Assumes full capitalized interest fund earns interest for one year, 2/3 of fund earns interest for one year, and 1/3 of fund earns interest for one year.
3. Assumes full debt reserve fund earns interest for three years.

Cost Summary. Table B-21 summarizes the costs for the conceptual 1000 TPD facility. This table includes pre-development, site development, operation, closure, and post-closure costs. Also included are local and state surcharges and an allowance for overhead, taxes, and profit for the private operator.

The estimated tipping fee for the conceptual facility is $22.58 per ton (1993 dollars). It should be noted that all costs are estimated for a conceptual facility, and that actual costs will vary depending on site specific factors.

TABLE B-21. SCENARIO FOUR: CONCEPTUAL LANDFILL COSTS - SUMMARY

Cost Description	Amount	Amount Per Ton
Annual Debt Service	$1,551,328	$ 5.42
Operating Expenses	$2,785,000	$ 9.74
Closure Fund	$ 10,062	$ 0.04
Post Closure Fund	$ 343,967	$ 1.20
SUBTOTAL	$4,690,357	$16.40
State / Local Surcharge	$ 669,240	$ 2.34
SUBTOTAL	$5,359,597	$18.74
Operator Overhead and Profit	$1,098,529	$ 3.84
TOTAL	**$6,457,751**	**$22.58**

TABLE B-22. ECONOMIES OF SCALE

	100 TPD Facility	500 TPD Facility	1000 TPD Facility
Tipping Fee ($/Ton) (1993 Dollars)	$79.10	$30.32	$22.58

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