United States
Environmental Protection
Agency

Office of Research and
Development
Washington DC 20460

EPA/625/R-95/006
September 1995

EPA

Solid Waste Options for Municipal Planners

Version 3.1

A Software Tool for Preliminary Planning

User Documentation

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U.S. Environmental Protection Agency
Office of Research and Development
National Risk Management Research Laboratory
Cincinnati, OH 45268

ACKNOWLEDGMENTS

This user documentation for *Solid Waste Options for Municipal Planners* (SW-Options) was developed under the auspices of the U.S. Environmental Protection Agency (EPA), Center for Environmental Research Information (CERI), and written by the University of Dayton Research Institute (UDRI). Eastern Research Group, Inc. (ERG), a contractor to CERI, provided support in program testing and enhancement and in this document's creation.

EPA wishes to acknowledge the following individuals for their role in this documentation project:

Randy Revetta, of CERI, who directed system enhancements and coordinated prerelease testing of the SW-Options program and oversaw the creation of this user guidance. Also, Jim Kreissl and Dan Murray, both of CERI, who made important contributions to the development of SW-Options.

The many representative users of SW-Options, who applied their day-to-day familiarity with solid waste issues to evaluation of the program before its release. Foremost among these are Stephen Cosper and Janet Brandhorst, environmental engineers at the U.S. Army Corp of Engineers, Construction Engineering Research Laboratories (USACERL). (A military-specific version of this user guide has been developed under their auspices to facilitate the use of SW-Options at military installations.)

Others who reviewed SW-Options while it was in development and provided invaluable suggestions include: Steve Brachman, former Resource Recovery Manager for the city of Milwaukee, WI, now at the University of Wisconsin; Melinda Carpenter, District Recycling Specialist, Wisconsin Department of Natural Resources; John Hendren, Office of Recycling and Waste Reduction, Illinois Department of Energy and Natural Resources; Annie Holland, Principal Investigator at USACERL, Champaign, IL; Jennifer Kunde, Recycling Coordinator, Greenfield, WI; Thomas Lynch, Supervisor, Bureau of Facility Management, Division of Solid Waste, New York State Department of Environmental Conservation; and C. James Martel, Environmental Engineer, U.S. Army Cold Regions Research and Engineering Laboratory.

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CHAPTER 1

INTRODUCTION: THE *SOLID WASTE OPTIONS FOR MUNICIPAL PLANNERS* SOFTWARE PROGRAM

Municipalities face many challenges in managing nonhazardous solid waste. For instance, landfills are reaching capacity throughout the country, tipping fees are increasing, and regulations affecting the disposal and recycling of municipal solid waste (MSW) are being promulgated at all levels of government. Municipal planners need a single source of preliminary information on designing and implementing an integrated MSW program that balances economics with regulatory requirements and ensures an environmentally responsible program. *Solid Waste Options for Municipal Planners* (SW-Options), developed by the U.S. Environmental Protection Agency (EPA), was designed to address that need.

SW-Options is a computerized planning tool that provides municipal planners with a method for developing preliminary strategies for managing MSW that minimize cost and maximize landfill diversion. This guide is designed to facilitate use of SW-Options by providing all information necessary to operate the software.

This chapter presents an overview of SW-Options operation[1] and a brief summary of the Resource Conservation and Recovery Act, the federal law that provides a context for MSW planning. Chapter Two provides technical information related to installing and running the SW-Options software program. Chapter Three provides information about the SW-Options user interface. Chapter Four describes the on-line tutorial. Chapter Five explains how to describe communities and waste management districts and how to construct a waste management scenario. Chapter Six explains how to generate reports about the districts and communities and the waste management scenarios constructed.

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[1] SW-Options is intended as a supplement to EPA's *Decision-Maker's Guide to Solid Waste Management* (EPA/530/SW-89/072); however, the program is updated from this document to reflect 1993 waste stream composition averages.

Appendix A provides examples of management scenario reports that can be generated by SW-Options. Appendix B provides a scenario development worksheet that allows the user to anticipate information that SW-Options will solicit for scenario development. Appendix C describes estimation methods used by the program to develop cost values and presents a schematic of the software's decision logic pathway. Appendix D provides listings of state solid waste information. Appendix E presents a listing of EPA and state waste management offices. Appendix F is a comment form for providing feedback on the usefulness of SW-Options.

1.1 OVERVIEW

1.1.1 Program Design

SW-Options is a PC-based software application developed for the EPA's Center for Environmental Research Information. It is designed to assist people responsible for evaluating and selecting municipal solid waste management strategies, especially those aimed at reducing the amount of waste going to landfills. SW-Options allows the user to perform realistic preliminary evaluations of different methods of managing municipal solid waste in an individual community or in a multi-community district. The data input requirements for constructing a waste management scenario (i.e., a set of choices for collecting and processing a solid waste stream) are minimal.

The software is set up to evaluate waste management approaches within a waste management district. An individual community can be evaluated, however, by defining a district composed only of that community. Combining two or more communities into a waste management district allows the user to evaluate the benefits of economies of scale (e.g., operating larger facilities). Once a district is defined by selecting communities that the user has described to the software, the program can assess scenarios for treating the member communities' wastes in a common manner.

Thus, to generate information about the effects of implementing certain waste management approaches, the user first enters information about each community to be included

in the district. The user then selects a set of waste management options to explore, creating a district-specific waste management scenario.

The user of SW-Options needs no prior waste management experience and very little computer experience. User-friendly menus and data screens prompt the user at each step. Command keys allow the user to access help information, definitions, and lists of the advantages and disadvantages of available options as appropriate to the particular step in development of a waste management scenario. During the scenario development process, SW-Options provides information about the costs and benefits of selected options and their effects on the district's waste stream. For example, if the user provides the program with a landfill tipping fee, SW-Options will calculate the avoided landfilling cost and present this estimate on-screen in the landfill summary during scenario construction as well as in the scenario cost report. After completing one or more scenarios, the program generates these comprehensive reports that detail the economic effects and waste diversion achievements associated with each scenario, either individually or in a comparative format. The user has the option of viewing these reports on screen or printing them.

1.1.2 Program Cost Values

SW-Options uses many technical and economic modeling factors for calculating realistic data on the effects of implementing specific waste management options. The default values built into the software for these factors are carefully chosen to reflect the nation's experiences with different waste management technologies. Although program cost calculations are based on 1990 data, the user has the option of adjusting inflation rates. The user can select an inflation rate for other years as listed in SW-Options based on the Consumer Price Index. Alternatively, the user can input a different year and an inflation rate.

Because SW-Options calculates costs based on national averages and trends, the cost information generated by the program does not account for geographic, demographic, legislative, or other potentially significant factors. An exception is that the user can change defaults for collection program participation rates to reflect characteristics unique to a community or region

(within realistic limiting ranges).[2] Once changed, the program defaults to the user-selected values until again revised.

Furthermore, because markets are so unpredictable for many recovered resources, SW-Options does not estimate market values for recovered materials or energy. Rather, the program asks the user to enter local market values for any recovered, beneficial product so that the software can complete the needed economic calculations.

Methods used by the program to calculate cost information are provided in Appendix C.

1.1.3 Program Use

SW-Options is intended to provide the user with cost information and other program output that facilitates comparison of waste management options, not to plan a detailed municipal waste management budget. In this way, the program provides a useful starting point for understanding the decision-making process. Because solid waste management is a rapidly evolving and complex field, the program user should seek additional training and expert consultation when developing a budget and implementation plan. Information concerning solid waste management generally as well as particular regulatory considerations is available from Federal and state officials (see Appendix E for a list of contacts that includes Army offices).

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[2] Most of the models in SW-Options are "technology" models, for which technical effectiveness and costs are based on measured results as reported in actual application. Such models are fixed (i.e., not modifiable by the user). Models involving citizen participation in source segregation programs, however, incorporate two factors: a "participation rate," indicating the percentage of the population that will cooperate in the effort, and an "effectiveness rate," which measures how successful the average participant will be in the function. Thus, for example, if 50 percent of a community's population is participating in a program to separate aluminum cans, those participants would be expected to capture an estimated 90 percent of the aluminum cans in the waste stream that they control. Because effectiveness rates are relatively fixed throughout the United States for different waste stream constituents, those values are fixed within SW-Options. Because participation rates depend strongly on local economic conditions, community makeup, and local education programs, however, the user may vary these rates.

1.2 SUMMARY OF SW-OPTIONS PROGRAM OPERATION

To define a district, at a minimum the user must identify the population and geographic location of the member communities. SW-Options then will generate waste stream quantities and compositions for the individual communities based on national averages. If the user has more detailed information available about the individual communities, that data can be entered and SW-Options will use it in lieu of national average values. For more case-specific output, the user may enter actual measurements of communities' waste tonnages and/or compositions.

Once the member communities of a waste management district have been identified, SW-Options will calculate a population centroid for the district, based on the user-defined community populations and locations. This calculation is performed in a manner similar to that in which the "center of mass" of a complexly shaped body is calculated (i.e., by calculating a weighted average location wherein the weighting factors are the populations of individual communities). Thus, the district centroid will be located closest to the larger communities. Thereafter, SW-Options will use this centroid as the "default" location of any new waste management facilities called for in the user's selection of waste management approaches. The user may always override this default location by selecting specific geographic locations for new waste management facilities.

A waste management scenario (i.e., a combination of specific waste management approaches) is constructed by the user responding to the questions asked throughout SW-Options. Because the program is interactive, the specific sequence of questions posed depends on the user's answers to preceding questions. For example, if the user chooses to construct a scenario that includes a material recovery facility, then subsequent questions will address issues about, for instance, which materials should be recovered and whether the district wants to utilize source separation. Ultimately, the user's responses result in the selection by the software of specific models. SW-Options uses algorithms associated with these models to estimate the effect of the chosen waste management approaches on that district's solid waste. These results are tabulated in generally one-page reports generated by the program.

Appendix C provides explanation of estimation methods used by SW-Options and presents a schematic of the logic pathway the software "follows" in response to the various user decisions made throughout the program.

1.3 LAWS AND REGULATIONS REGARDING SOLID WASTE MANAGEMENT

Federal, state, and local regulations provide a framework within which all solid waste management must be conducted. The overarching federal law in regard to waste management, however, is the Resource Conservation and Recovery Act (RCRA). While the SW-Options software was written to present management choices in the context of RCRA's broader goals, the software does not factor in specific requirements. Rather, SW-Options is designed as a tool to assist planners throughout the country in making preliminary assessments about various solid waste management options. Information generated by SW-Options is intended to be used as the basis of further planning that takes into account local requirements.

This section provides a brief summary of RCRA as a context for the use of SW-Options to facilitate making preliminary decisions about managing MSW. For more specific regulatory information, software users are advised to contact officials responsible for issuing permits to operators of solid waste management facilities (see Appendix E).

1.4.1 The Federal Resource Conservation and Recovery Act

Since its passage in 1976, RCRA has stood as the primary Federal solid waste management statute (Public Law 94-580).[3] Fundamentally, the law establishes broad goals concerning protection of human health and the environment from unsound waste disposal

[3] RCRA replaced the Solid Waste Disposal Act of 1965 and the Resource Recovery Act of 1970. It has been amended numerous times by passage of various laws and amendments, including the Solid Waste Disposal Act of 1980 (PL 96-482) and the Hazardous and Solid Waste Amendments of 1984 (PL 98-616). As used in this discussion, RCRA incorporates all of these laws and amendments.

practices. In this context, RCRA encourages reductions in the volume and toxicity of wastes, conservation of natural resources, and utilization of energy and materials that are recoverable from solid waste.

RCRA addresses the handling and disposal of various types of waste, focusing on solid (nonhazardous) waste in Subtitle D (Title 40 of the Code of Federal Regulations, Parts 240-258). This section of the statute includes guidelines to assist states in developing comprehensive waste management plans for regional solid waste management *districts*. These plans must ensure that a facility's solid waste disposal practices are environmentally sound and that an effective program of resource conservation is in place. Additionally, the plans must include information on facility management responsibilities, the availability of capacity for continued operation, an approach for upgrading or closing landfills that have reached capacity, and a mechanism for encouraging public participation in decision-making. The guidelines are sufficiently flexible to allow for the unique waste management needs of individual states.

All such plans are required to undergo review by EPA, which has responsibility for developing national policy and regulations for the implementation of RCRA. If EPA determines that a plan meets minimum standards and is therefore acceptable, the Agency designates the state in which the facility is located to be the solid waste management authority. EPA delegates most planning and operational responsibilities to these waste management authorities, while providing them with technical and financial assistance.

A district, as interpreted by EPA, typically comprises a county (e.g., several cities and towns) or a group of counties. This concept of waste management by district is central to the SW-Options program, encouraging the user to assess potential benefits associated with economies of scale.

Although RCRA specifically addresses approaches for handling and disposing of wastes, its broader goal is to encourage resource conservation and recovery. As a result, policymakers and regulators are giving increasing emphasis to waste minimization and the beneficial use of recyclable materials.

CHAPTER 2

GETTING STARTED: HOW TO INSTALL AND RUN SW-OPTIONS

This chapter outlines the technical requirements for installing and running SW-Options. It also provides instructions for making a backup copy of the SW-Options diskette, running the SW-Options installation program, and running the SW-Options application.

2.1 TECHNICAL REQUIREMENTS

SW-Options is designed to run on IBM PCs or IBM-compatible computers, AT or better, with DOS version 3.3 or higher. Although a color monitor is not a requirement, it is recommended. This section outlines SW-Options' requirements for hard disk space and random access memory (RAM).

2.1.1 Hard Disk Space

The SW-Options files occupy approximately 1.25 megabytes (Mb) of hard disk memory. Therefore, to *install* SW-Options on a hard disk drive, a user must have at least 1.25 Mb of hard disk space available. To *run* SW-Options from a hard disk drive (especially in low-RAM environments), however, a user will probably need additional hard disk space to accommodate temporary files created by SW-Options. (SW-Options uses these files to save portions of the program on the hard disk, freeing up conventional memory for other parts of the application.) As a general rule, about 1.5 Mb of hard disk space is needed to install and run SW-Options.

Although running the program from a floppy disk is technically feasible, the user is strongly advised against this approach. Operating from the hard disk drive is critical for ensuring that sufficient storage space is available for the user to construct waste management scenarios that assess a variety of options.

2.1.2 Free RAM

SW-Options is designed to run on machines with at least 640 kilobytes (Kb) of RAM, of which approximately 520 Kb must be free. Users operating computers close to this threshold should check the amount of free memory before running SW-Options. To run a simple check, type "CHKDSK" at the DOS prompt. DOS returns several lines of information, including a line indicating the number of "bytes free," which is the amount of free RAM. Some of the free RAM, however, might be unavailable to SW-Options, depending on the user's system configuration. Certain parameters specified in the CONFIG.SYS file, such as file buffers and stacks, reduce the amount of RAM available to applications. Each file buffer, for example, consumes about 500 bytes. Thus, it is possible that a system that seems to have more than 520 Kb of free memory has memory problems when running the program because not enough RAM is available to SW-Options.

2.1.3 Memory Problems

In most cases when a memory problem occurs, it can be solved by increasing the hard disk space, conventional memory, or overall RAM available to SW-Options. Conventional memory is the PC's primary 640 Kb of RAM. Any RAM beyond the 640 Kb of conventional memory is used by SW-Options if there is an expanded or extended memory manager installed. SW-Options may fail due to shortages of conventional memory or may fail when the combination of disk space and expanded/extended RAM are insufficient for temporary swap files. Additional space often can be created on the hard disk by removing or compressing large files. Available conventional RAM often can be increased by removing or unloading any terminate-stay-resident (TSR) files, by reducing the number of file buffers or stacks allocated in the CONFIG.SYS file, or by loading necessary TSRs or device drivers in high memory using an expanded or extended memory manager. For specific guidance on increasing available memory, consult a DOS manual or the manual for your expanded or extended memory manager. In most cases, a memory shortfall will result in a warning or error message, after which SW-Options will terminate. In certain cases, however, the memory shortfall prevents even the error processing, and the system may lock up and fail to respond to any user input.

2.2 MAKING A BACKUP COPY OF SW-OPTIONS

All of the files needed to operate SW-Options are contained on one 3½-in., double-sided, high-density, 1.4 Mb diskette. Before installing SW-Options, make a backup copy of the SW-Options diskette. Any command or utility for copying diskettes can be used; the following instructions are for using the DOS command DISKCOPY:

1. Insert the SW-Options diskette in drive A.
2. Type "A:" and press <Enter> to ensure that drive A is the current drive.
3. Type "DISKCOPY" and press <Enter>.
4. Insert the source and target diskettes in drive A as prompted by DOS. The original SW-Options diskette is the source diskette. Any diskette of the same size, capacity, and format can be used as a target diskette. Executing the DISKCOPY command overwrites *all* existing files on the target diskette.

2.3 INSTALLING SW-OPTIONS

The SW-Options diskette contains an installation program that expands all of the SW-Options files and saves them to a directory specified by the user. This directory, hereafter referred to as the SWO operating directory, can be located either on a hard disk drive or a local area network (LAN) drive.

SW-Options was *not* designed to run in a Windows environment. Thus, the user operating in Windows must exit before running the SW-Options installation program.

To run the SW-Options installation program, use the following steps:

1. Place the SW-Options diskette in drive A.
2. At the DOS prompt, type "A:INSTALL" and press <Enter>.
3. Follow the instructions on the screen. The installation program confirms that the minimum hardware requirements are met, prompts the user to specify an

operating drive and directory for SW-Options, and copies the SW-Options files from the diskette to the specified directory.

SW-Options requires that the number of open files that DOS can access be greater than or equal to 50. Thus, if the FILES= command in the CONFIG.SYS file is set to less than 50, the installation program saves the original CONFIG.SYS file as CONFIG.SWO and modifies the CONFIG.SYS file to allow DOS to access 50 open files.

SW-Options should always be installed from the original install disk. Thus, if after installing the program the user decides to operate it from another PC, SW-Options should be installed again from the original install disk.

2.4 RUNNING SW-OPTIONS

SW-Options runs like any other DOS application. To run SW-Options, use the following steps:

1. At the DOS prompt, change to the SWO3_1 operating directory (type "cd\SWO3_1" and press <Enter>).

2. Type "SWO" and press <Enter>.

The program will begin to run, automatically accessing an on-line tutorial that explains use of the SW-Options application. At completion of the tutorial (or by exiting the tutorial by pressing <Esc>), the program accesses the Main Menu, from which the user can begin describing communities and districts to the program and then construct waste management scenarios (see Chapter 5). On subsequent uses after the user has defined at least one community, the program will access the Main Menu directly; the user can return to the tutorial at any time from this menu.

CHAPTER 3

INTERACTING WITH SW-OPTIONS: HOW TO UNDERSTAND AND CONTROL THE SW-OPTIONS USER INTERFACE

This chapter describes the SW-Options user interface, which consists of a series of menus and command keys that allow the user to interact with the program in the development of waste management scenarios. This chapter also explains the SW-Options on-line help system and screen saver feature.

3.1 PROGRAM DESIGN

3.1.1 The On-Line Tutorial

The first time the user runs SW-Options, an on-line tutorial explaining use of the software automatically appears on the screen. This same tutorial will continue to appear at startup until the user defines a community. Thereafter, the tutorial can be accessed from the Main Menu. To use the tutorial, which takes about 10 minutes to complete, simply press <Enter> when prompted. To exit the tutorial before completing it, press <Esc> repeatedly. To exit the tutorial from the final screen, press <Enter>. (The on-line tutorial is described further in Chapter Five.)

3.1.2 The Main Menu

After the user exits the on-line tutorial, the Main Menu appears on the screen. This menu presents the user with the following options: describe a community; define a district; construct a waste management scenario; view or print the results of a waste management scenario(s); re-enter the on-line tutorial; a note about the purpose of SW-Options; change certain program defaults; or exit SW-Options. Bracketed numbers to the right of the first four

menu options indicate the sequence a user must follow to construct a scenario for which cost-benefit reports can be generated. When the user elects to work on a waste management scenario, a series of menus and data screens guides the user through the process of describing a community, defining a district, and selecting waste management approaches. (See Chapter Five for more detailed instructions.) Command keys are displayed at the bottom of each screen. Pressing these keys provides additional information or help.

Most users will enter and exit SW-Options several times to learn more about solid waste management and to develop additional scenarios, as their schedules permit. Each time the user re-enters SW-Options, the program will access the tutorial until the user defines a community. Thereafter, the Main Menu appears on the screen at the beginning of each SW-Options session.

3.2 SYSTEM INPUTS

SW-Options is driven primarily by two types of user inputs: menu selections and commands. As described below, menus allow the user to either access the principal features of SW-Options or respond to questions raised by the program. Command keys are active at specific points in the program, allowing the user to access particular functions as appropriate (e.g., a screen defining relevant terms for selecting a particular waste management approach). Ways in which the user interacts with the program through menus and command keys are further explained in the on-line tutorial. Other than these types of inputs, the program requires that the user inputs a minimal amount of actual scenario-specific data, as explained in Chapter Five.

3.2.1 Selecting Menu Options

A menu consists of a menu title (e.g., Main Menu) and two or more menu options. These options are displayed on the left half of the computer screen. Menu options either access available features or enable the user to respond to a question posed by the program. Figure 3-1 shows a typical menu. To select a menu option, highlight the desired option and press <Enter>.

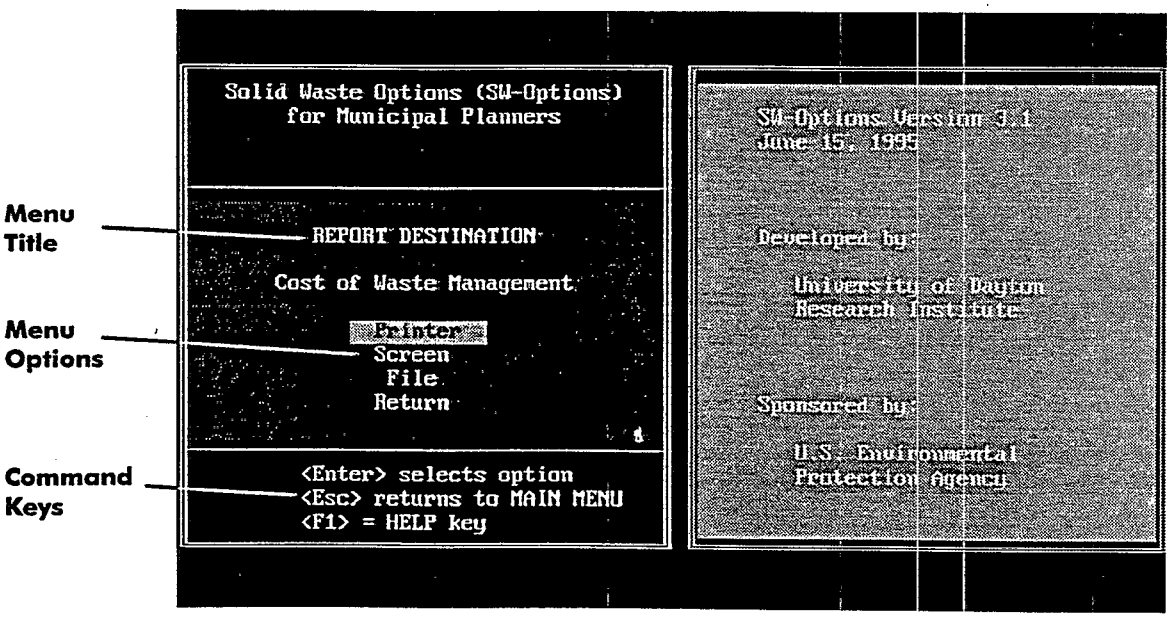

Figure 3-1. **A typical SW-Options menu (with default program title window activated).**

In some cases, the user can choose more than one option from a menu. In these cases, highlight the first option and press the <Spacebar>. Then highlight the second option and press the <Spacebar>. Continue highlighting options and pressing the <Spacebar> until all desired options are selected. Selected options appear in yellow on the screen. To deselect an option, highlight the selected option and press the <Spacebar>. After selecting all desired options, press <Enter> to continue. Figure 3-2 shows a menu in which two options have been selected.

3.2.2 Executing Commands

The available command keys are displayed at the bottom of each screen (e.g., <F1>, <F2>). To execute a SW-Options command, press the appropriate key for the desired command. Certain functions are available only when the user is performing a specific task (e.g., viewing a data list or constructing a waste management scenario). Table 3-1 describes the SW-Options command keys and indicates when each is available.

3.3 THE ON-LINE HELP SYSTEM

The on-line help system provides a quick way to obtain information about system operation. The SW-Options help system is context sensitive; that is, it provides information about whatever program feature is currently being used. To access the on-line help system, press command key <F1>. A purple information screen will be displayed.

Figure 3-3 shows a typical help screen. In this case, the help information appears in a window next to the program content already on the screen and continues to a second page. In other cases, the help information fills the entire screen. To exit the help system, press <Enter>.

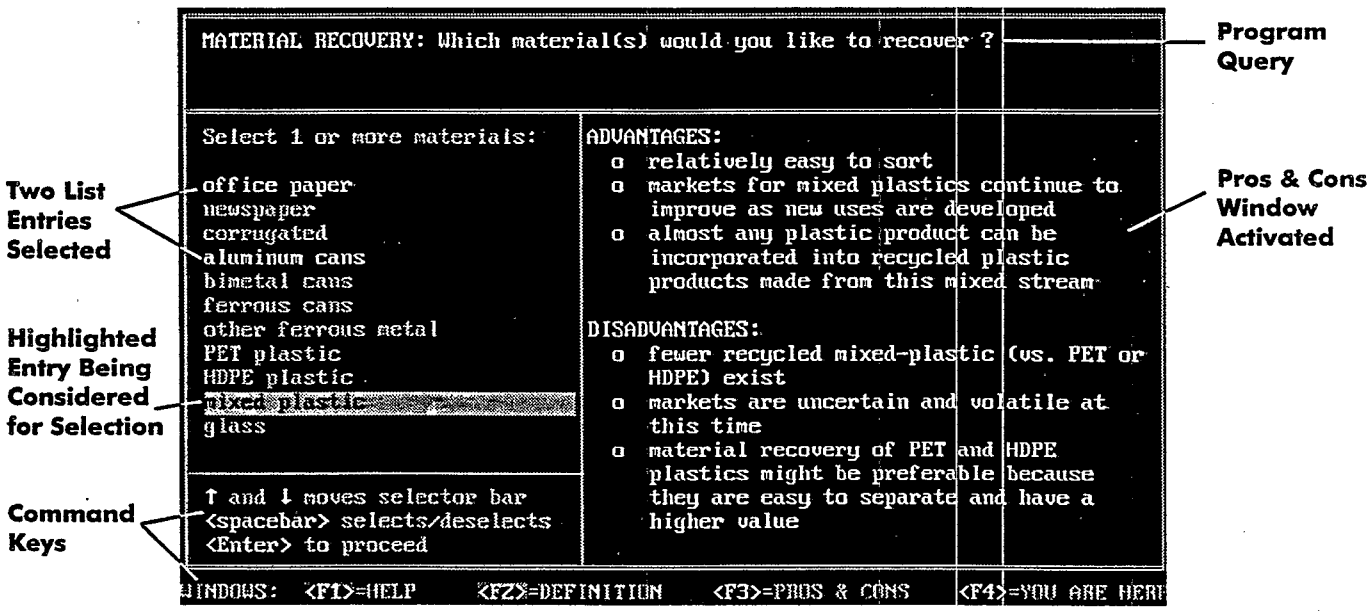

Figure 3-2. Sample multiple-choice menu with two options selected.

Table 3-1

SW-Options Command Functions

Key: Function	Availability	Description
F1: Help	At all times (except when using the on-line tutorial)	Activates the on-line help system
F2: Terms	When constructing a scenario	Activates the term-definition window, where terms in a menu or question are defined
F3: Pros & Cons	When constructing a scenario	Activates the pros and cons window, where advantages and disadvantages of the management option are listed
F4: You Are Here	When constructing a scenario	Allows user to review outline of questions in scenario construction
F10: Inflation Rates	From the Set Program Defaults option in the Main Menu	Allows user to change annual inflation rate defaults for cost program calculations from 1990 values; alternatively, the user can select an inflation rate for other years as listed in the program or input data for a year and rate not listed
	When describing a community	Allows user to view profile of waste stream based on estimating approach selected
	When defining a district	Allows user to select communities to include in district
Enter: Accept/Next	When using the on-line tutorial	Moves the tutorial to the next page of text
	When viewing an on-line help screen	Exits the on-line help system
	At all other times	Accepts selected menu or data list choice and proceeds to the next menu or step
Spacebar: Select/Deselect	When viewing multiple-choice lists	Selects or deselects entry from a multiple-choice list

Table 3-1 (continued)

Key: Function	Availability	Description
Esc: Done/Exit	When using menus or viewing lists	Quits current screen or menu, returning user to the previous screen or menu
	When entering data	Returns user to the previous line of the data entry form
	When using the on-line tutorial	Prior to completion of the tutorial, exits the on-line tutorial, bringing up the Main Menu
↑/↓	When using menus or viewing information	Moves highlight cursor between menu items or information lines
←/→	When using function keys F1, F2, F3	Moves user to next text screen
	When inputting data at various points in the program	Moves user back and forth between data entry fields
PgUp: Scroll Up a List of Items	When viewing information	Scrolls window text to previous page
PgDn: Scroll Down a List of Items	When viewing information	Scrolls window text to next page
Insert: Add	When viewing a data list	Adds a new item to the displayed list. Switches between insert and overstrike modes
Delete: Remove	When viewing a data list or selecting menu options	Removes the highlighted item from the displayed list
Control Enter: Accept/Done	When inputting data at various points in the program	Allows user to accept data as presented on screen (i.e., to accept program default values) and to exit the screen

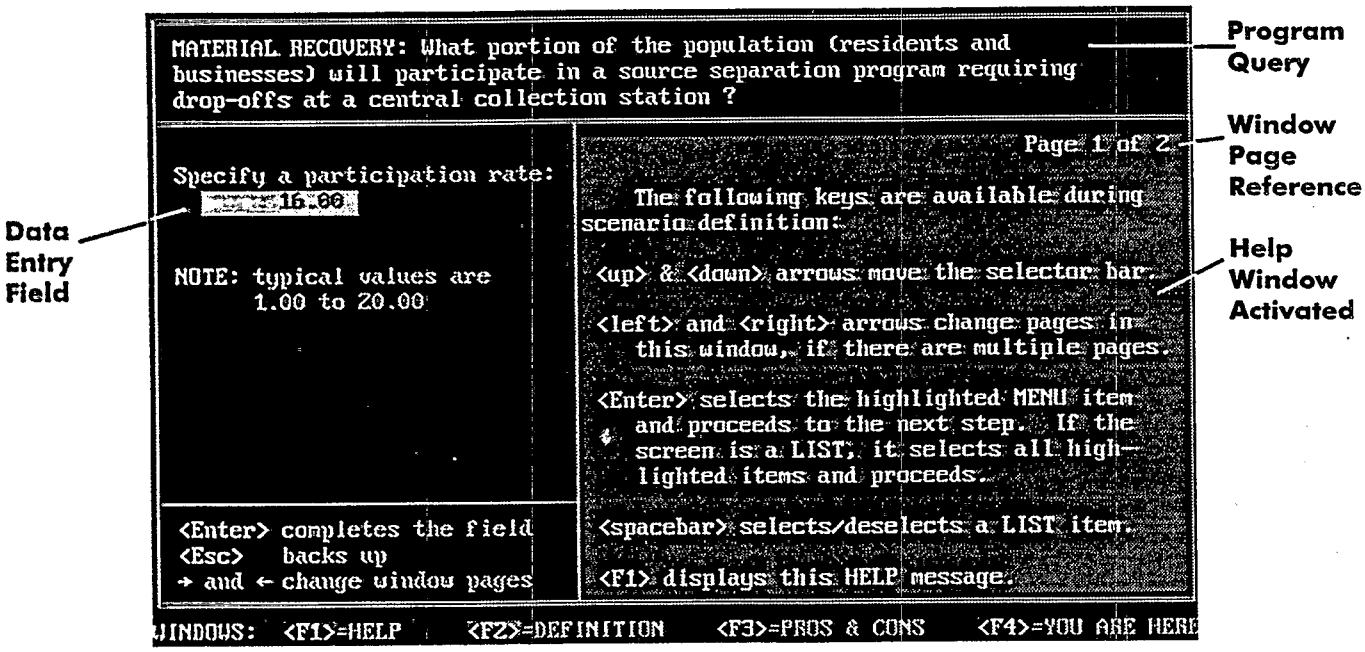

Figure 3-3. Sample data entry screen with help window activated.

3.4 THE SCREEN SAVER FEATURE

The screen saver feature protects the video monitor. Whenever the user pauses for 10 minutes without pressing a key, SW-Options displays a blank screen and "goes to sleep" until the user "wakes it up" by pressing any key.

CHAPTER 4

LEARNING MORE ABOUT SW-OPTIONS: HOW TO USE THE SW-OPTIONS ON-LINE TUTORIAL

This chapter describes the SW-Options on-line tutorial. The tutorial explains how to use SW-Options and how to get the most out of the information and reports the program generates.

4.1 ACCESSING THE ON-LINE TUTORIAL

The first time a user enters SW-Options, the on-line tutorial appears on the screen automatically. The tutorial continues to appear on the screen each time the user begins a new SW-Options session until the user works on a waste management problem. Thereafter, the Main Menu appears at the beginning of each session. To enter the on-line tutorial from the Main Menu, select option 5 (TUTORIAL SESSION).

4.2 USING THE ON-LINE TUTORIAL

The SW-Options on-line tutorial consists of a sequence of text and information screens. Figure 4-1 shows an example of a tutorial screen. To proceed to the next screen, press <Enter>. The on-line tutorial takes about 10 minutes to complete.

4.3 EXITING THE ON-LINE TUTORIAL

To exit the on-line tutorial before completing it, press <Esc> repeatedly until the Main Menu appears. To exit the tutorial from the last tutorial screen, press <Enter>.

TUTORIAL: Introduction — Page 3 of 20

SW-Options is user-friendly; thus, no prior solid waste management experience and almost no computer experience are necessary to use SW-Options. SW-Options is designed to evaluate waste management options for user-defined solid waste management districts. There are four stages:

1) Define one or more communities, the amount of waste they create, and the waste stream composition. National averages and other methods are available as estimates if you do not know the answers.

2) Group the communities into one or more waste management districts. You must also define the centroid of the district.

3) Specify one or more waste management scenarios. The available options deal with recycling, composting, incineration, energy recovery, and waste handling. Each option is supported by a set of "windows" containing definitions, advantages and disadvantages and a special "You are here" map. You should define several scenarios to learn how combinations of waste management options effect each other.

4) Print the results in a variety of formats.

<Enter> proceeds to next page — <Esc> backs up one page

Figure 4-1. Sample tutorial screen.

CHAPTER 5

WORKING ON SOLID WASTE MANAGEMENT APPROACHES: HOW TO DESCRIBE A COMMUNITY, DEFINE A DISTRICT, AND CONSTRUCT A SCENARIO

This chapter explains how to work on a solid waste management strategy, which SW-Options defines as data consisting of three related sets of information: descriptions of communities, definition of a waste management district, and construction of one or more solid waste management scenarios.

SW-Options was developed primarily for use by municipalities and designed to encourage solid waste management within multi-community districts to promote the benefits of economies of scale. Thus, program users must define the communities that make up a district before constructing waste management scenarios.

5.1 INITIATING WORK ON A WASTE MANAGEMENT STRATEGY

To work on a solid waste management strategy, the user first must define a district by describing the communities to be included in the district. Then the user must construct one or more waste management scenarios (i.e., select waste management methodologies to apply to that district). This involves entering data and selecting options as prompted by a series of data entry screens and menus. Figure 5-1 illustrates the scenario construction concept as described in the SW-Options on-line tutorial.

To access the data screens and menus, the user makes a selection from the Main Menu (Figure 5-2), which provides options that allow the user to describe a community, define a district, and construct waste management scenarios for the district. Waste management scenarios can be evaluated for individual communities by defining a district that is composed of that single community. Table 5-1 describes these options in more detail.

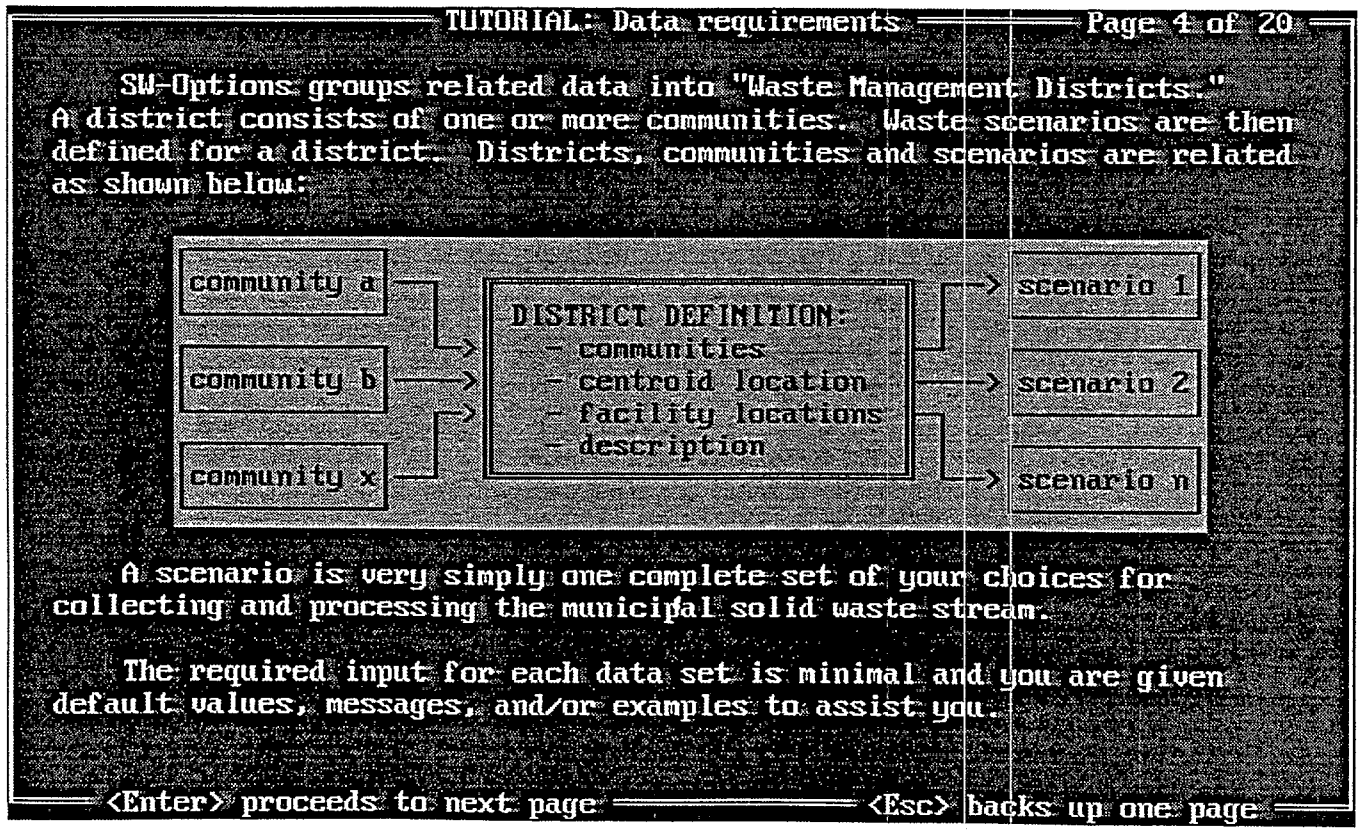

Figure 5-1. Schematic of the process for constructing solid waste management scenarios.

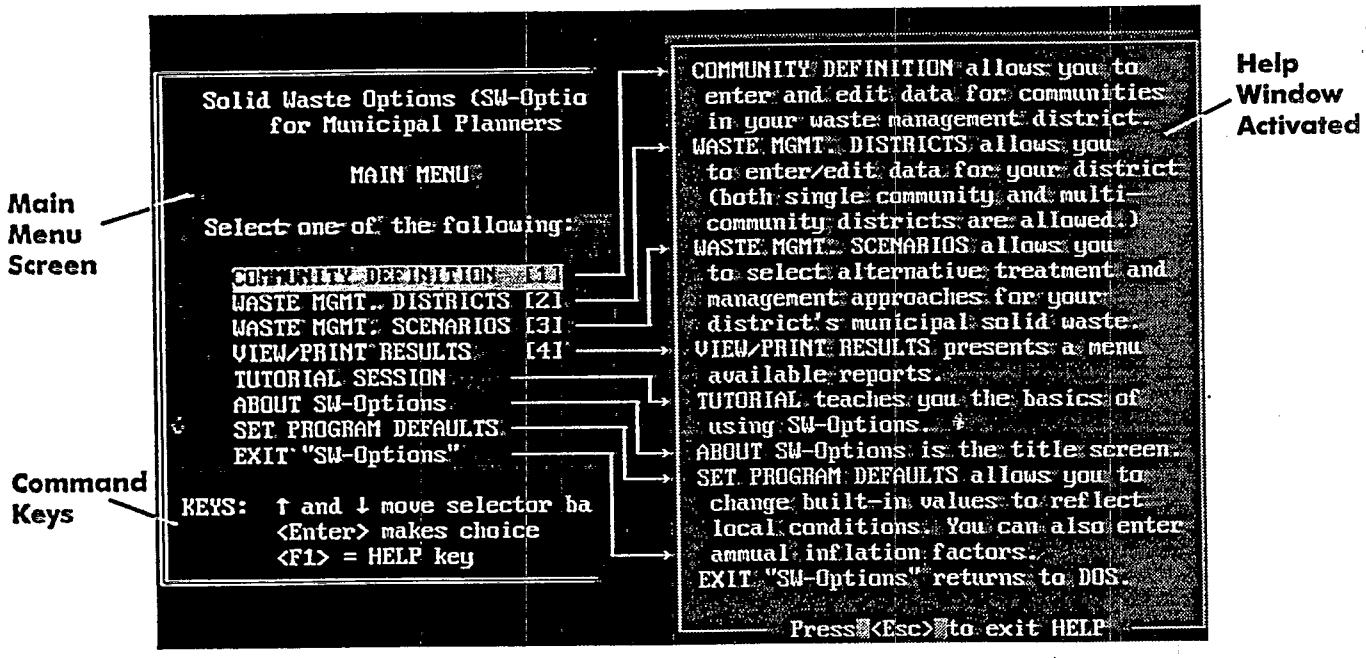

Figure 5-2. The Main Menu with the help window activated.

Table 5-1

Data Entry Options From Main Menu

Option	Description
Community description	Permits the user to describe a community, including its population, area, and solid waste stream. Also permits the user to modify or delete existing community descriptions.
Waste management district	Permits the user to select communities to include in a solid waste management district. Also permits the user to modify or delete existing district definitions.
Waste management scenarios	Permits the user to select a combination of waste management options (i.e., construct a waste management scenario). Also permits the user to modify or delete a waste management scenario.

Once a scenario is constructed, the program will calculate cost information based on the 1990 inflation rate. The user can alter this default basis at any time before or after scenario construction by selecting SET PROGRAM DEFAULTS from the Main Menu. Once in the program defaults screen, the user can access a screen for changing the inflation rate by pressing command key <F10>. The user will be presented with inflation rates for 1991, 1992, and 1993 from which to select a default basis (Figure 5-3). Alternatively, the user can input a year and inflation rate not listed. (A list of SW-Options' command keys and their function and availability is provided in Table 3-1.)

5.2 DESCRIBING A COMMUNITY

SW-Options can use information about a community to estimate the amount and assess the composition of solid waste generated. The program first prompts the user for general information about the community (e.g., location, population). One of these preliminary questions asks the user if the community is subject to a ban on the landfilling of yardwaste. (The user can refer to Appendix D for a list of states that have such bans in effect.) By answering "yes" to the yardwaste ban question, the user will subsequently be precluded by the program from including that community's yardwaste in scenarios that involve composting.

The program then asks the user to select a method for defining the amount and composition of the community's waste stream. The user can choose to use estimates generated by SW-Options (based on national population-based averages or the community's commercial makeup) or the user can enter actual waste stream data (if reliable data exist for the community).

5.2.1 Describing a Community for the First Time

To describe a community for the first time, select option 1 (COMMUNITY DESCRIPTION) from the Main Menu. Because no communities have been defined yet, a COMMUNITY INFORMATION data entry form will automatically appear. Otherwise, a list of

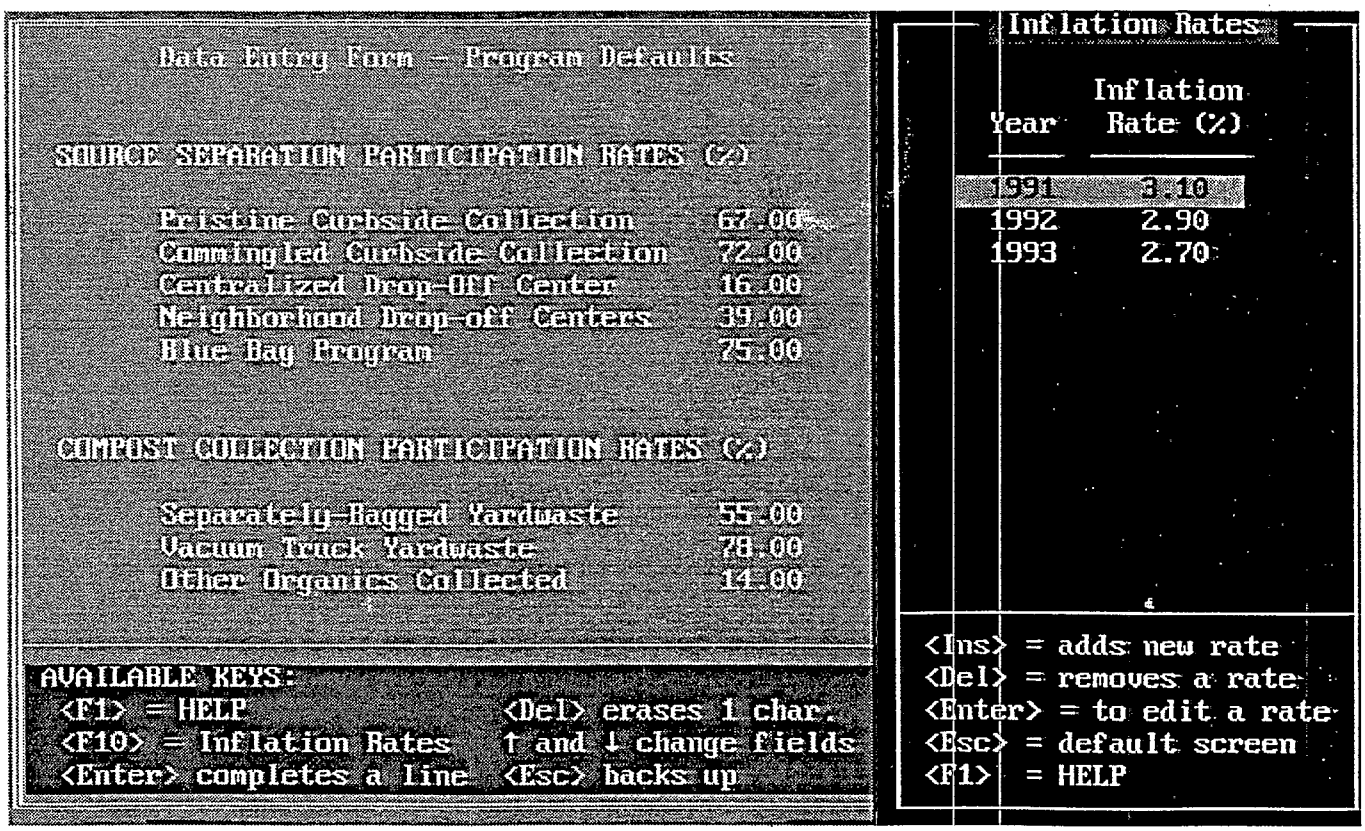

Figure 5-3. **The program defaults screen with the inflation rate window activated.**

previously defined communities will appear allowing you to select one of them or to "insert" a new community. Figure 5-4 shows a sample COMMUNITY DESCRIPTION screen that lists the names of several communities described by the user.

To describe a community using the COMMUNITY INFORMATION data entry form (see Figure 5-5), follow the steps listed below:

1. Type the name of the community in the highlighted "Community name" field and press <Enter>. The highlighting will move to the "Population" field.

2. Enter the population of the community using a whole number and no commas and press <Enter>. The highlighting will move to the "Area" field.

3. Enter the number of square miles that the community comprises and press <Enter>. The highlighting will move to the "Longitude" field.

4. Enter the longitude and latitude of the geographic center of the community. This information is used in calculating transportation costs in multi-community districts. The latitude and longitude of a community can be obtained from your county engineer's office or from the information desk of your local public library.[1] If this information cannot be readily obtained, the user can enter zeros as default integers each time the program prompts for latitude and longitude; note, however, that using this default will prevent SW-Options from calculating scenario transporation costs.

5. Type "y" or "n" to answer yes or no to each question that SW-Options raises about the community's local laws concerning waste disposal, pressing <Enter> after each answer.

6. Type a brief (three line) description of the community and press <Enter>.

After you have completed the COMMUNITY INFORMATION data entry form (see Figure 5-6), SW-Options asks you to select a method for estimating the size and composition of the community's solid waste stream. Select one method, highlight it, and press <Enter>. Table 5-2 lists the available options and describes the respective methods. After you select a solid waste stream estimation method and answer any related questions, SW-Options displays a

[1] SW-Options will accept longitude and latitude integers for locations throughout the world. The program's distance calculations may be skewed, however, if the user defines a district that overlaps the international dateline.

COMMUNITY DESCRIPTION

Community Name	Population	Area (sq mi)
ADMINISTRATION	2200	5
ANYWHERE	40000	25
ARBORVILLE	45000	8
FORT ABC	20000	150
HOUSING	3200	2

AVAILABLE KEYS: ↑ and ↓ move selector bar
<Enter> selects a community for editing
<Insert> adds a new community
<Delete> removes a community
<Esc> returns to data entry menu

Figure 5-4. **Sample COMMUNITY DESCRIPTION screen listing names of user-described communities.**

```
Data Entry Form - COMMUNITY INFORMATION
Complete this form to ADD a new community

Community Name:
Population        0        Area:        0 square miles
(W/E) W Longitude:   0.000 degrees   0 minutes   0.0 seconds
(N/S) N Latitude :   0.000 degrees   0 minutes   0.0 seconds

State deposit legislation (bottle bill) enacted?        (no/yes)
Community grass/leaf collection ban in place?           (no/yes)

DESCRIPTION OF THE COMMUNITY AND/OR WASTE MANAGEMENT PROBLEMS:

KEYS: <Enter> completes a line          → ← move around in a field  OR
      <Ctrl-Enter> completes the screen        toggle no/yes field
      <Esc> backs out of this form        <Delete> erases 1 character
      <F10> view waste stream description     <F1> = HELP key
```

Figure 5-5. **The COMMUNITY INFORMATION data entry form.**

```
                Data Entry Form - COMMUNITY INFORMATION
                 Edit the form to MODIFY this community

     Community Name: ARBORVILLE
          Population:   45000      Area:        8 square miles
 (W/E) W. Longitude:  85.000 degrees   0 minutes   0.0 seconds
 (N/S) N. Latitude :  38.000 degrees   0 minutes   0.0 seconds

 State deposit legislation (bottle bill) enacted? no   (no/yes)
 Community grass/leaf collection ban in place?    no   (no/yes)

 DESCRIPTION OF THE COMMUNITY AND/OR WASTE MANAGEMENT PROBLEMS:
    A small town with a small commercial area along Main Street
    and a fairly large mall on the outskirts near the
    interstate.

KEYS: <Enter> completes a line              → ← move around in a field  OR
      <Ctrl-Enter> completes the screen       toggle no/yes field
      <Esc> backs out of this form          <Delete> erases 1 character
      <F10> view waste stream description     <F1> = HELP key
```

Figure 5-6. Example of a completed COMMUNITY INFORMATION data entry form.

Table 5-2

Methods for Assessing a Community's Solid Waste Stream

Option	Description
Population-based estimate	SW-Options estimates the amount and composition of the community's solid waste stream based on national averages for communities of its size. A summary of the program's estimates then appears on the screen.
Business-based estimate	SW-Options prompts the user to enter data about the community's commercial makeup, then estimates the amount and composition of the community's solid waste stream based on national averages for communities with a similar makeup. A summary of the program's estimates then appears on the screen.
Actual known mass only	SW-Options prompts the user to enter the amount of the community's solid waste stream (in annual tonnage). The program then estimates the composition of the waste stream based on national averages for communities of that size. A summary of the program's estimates then appears on the screen.
Actual known mass and composition	SW-Options prompts the user to enter the amount of the community's solid waste stream (in annual tonnage) and the proportion of this mass by various types of solid waste. A summary of this information then appears on the screen.

summary of the community's solid waste stream. After reviewing this summary, press any key to return to the Main Menu.

5.2.2 Modifying a COMMUNITY INFORMATION Data Entry Form

To modify a COMMUNITY INFORMATION data entry form for a community already in the program's data files, select option 1 (COMMUNITY DESCRIPTION) from the Main Menu. A list of communities previously described will appear on the screen. The name of the last community described will be highlighted. To modify this community description, press <Enter>. To modify another community description, highlight the name of the community and press <Enter>. A completed COMMUNITY INFORMATION data entry form containing the information previously input for that community will appear.

When modifying a community description (refer to the steps described in Section 5.2.1), simply press <Enter> to retain a previously entered value or type over the existing value and press <Enter> to change it. Do this for each field in the form. Then choose a solid waste stream estimation method, review the resulting solid waste stream summary, and press any key to return to the Main Menu.

5.2.3 Adding and Deleting Communities

For most assessments of solid waste management options, the user will wish to describe more than one community to define a multi-community waste management district. The user also may wish to compare the impacts of specific waste management approaches when applied to communities with differing characteristics. If sections of a community have different characteristics, the user may wish to define these sections as separate communities. Then, the user could construct waste management scenarios for each "community" in its own "district" or combine the different "communities" into a composite "district" equivalent to the actual community. The multi-community district approach would allow the user to assess combined waste management impacts on the overall community.

To describe an additional community, select option 1 (COMMUNITY DESCRIPTION) from the Main Menu. A list of communities will appear on the screen. Press <Insert> to add a community, then complete the data entry form that appears (as directed in Section 5.2.1).

To delete a community, select option 1 (COMMUNITY DESCRIPTION) from the Main Menu. A list of communities will appear on the screen. Highlight the community to be deleted, then press <Delete>. The completed COMMUNITY INFORMATION data entry form for that community will appear on the screen. Press <Enter> to delete it (or press <Esc> to exit the screen without deleting the community).

Note that SW-Options will not allow you to delete a community if it is included in a multi-community district (see Section 5.3). In such a case, the community to be deleted first must be removed from any districts in which it is included. After deleting a community, the list of communities will reappear on the screen, allowing you to confirm the deletion. Press <Esc> to return to the Main Menu.

5.3 DEFINING A DISTRICT

Defining a district allows the user to evaluate the effect of several neighboring communities taking a cooperative approach to solid waste management. SW-Options regards districts as the basic entity for development of waste management scenarios. Thus, to evaluate waste management options for a single community, the user must define a district that contains that community alone.

To evaluate waste management scenarios for a multi-community district, the user must first describe each community individually. The procedures used to define, modify, and add or delete a district are quite similar to those for a community.

5.3.1 Defining a District for the First Time

To describe a district for the first time, select option 2 (WASTE MGMT. DISTRICTS) from the Main Menu. A WASTE MANAGEMENT DISTRICT data entry form will appear. To complete this form follow the steps listed below:

1. Type a brief title in the highlighted "District name" field and press <Enter>. Then input the current landfill tipping fee and press <Enter>. (SW-Options uses this rate [$/ton] to calculate avoided landfilling costs.) The highlighting will move to the "Local transportation rate" field. (SW-Options uses this rate [$/ton-mile] to calculate the cost of transporting solid waste to the district's waste management facilities.) Complete this field, press <Enter>, and the highlighting will move to the "district yardwaste/grassban in place?" field (see Appendix D for a list of states with such bans in effect). (By answering "yes" to the yardwaste ban question, the user will subsequently be precluded from including yardwaste composting in scenarios for that district.) Toggle "yes" or "no," press <Enter>, and the highlighting will move to district description. Enter a brief description of the waste management district into this nine-line field.

2. Press <Enter> and a list of user-defined communities will be presented. Use the <Up> and <Down> arrow keys to highlight a community to be included in the district and press <F10>. Once a community is selected, a check mark appears to the left of the name of the community in the "In District" column.

   To remove a community from a district, move the highlight to the community name and press <F10>. To edit information about a community, highlight the community name and press <Enter>. Then proceed as directed in Section 5.2. To incorporate a community that has not yet been defined to the program, press <Insert> and a blank COMMUNITY INFORMATION data entry form will appear.

3. When you have finished selecting communities to include in the district, press <Esc>. The COORDINATES OF DISTRICT SOLID WASTE FACILITIES data entry form will appear. This form allows you to indicate the desired locations for district facilities. The longitude and latitude of the district's population centroid is automatically calculated by the program from information on the locations and populations of member communities. This screen shows the geographic coordinates of this centroid and uses it as the default value for the locations of any other waste management facilities common to the district (e.g., compost facility, energy recovery facility, material recovery facility).

   If the user wishes to site facilities at another location, longitudes and latitudes for those facilities must be entered. (Because the district's centroid is calculated using data on the user-described communities, it cannot be changed by the user, even though the location of facilities can be changed.)

4. Type <Ctrl> and <Enter> simultaneously to preserve the entered or selected location values.

5. With definition of the district complete, press <Esc> to return to the WASTE MANAGEMENT DISTRICTS list and then press <Esc> again to return to the Main Menu.

5.3.2 Modifying a District Definition

To modify the definition of a particular district, select option 2 (WASTE MGMT. DISTRICTS) from the Main Menu and a list of previously defined districts will appear on the screen. Highlight the district to be edited and press <Enter>. The completed WASTE MANAGEMENT DISTRICT data entry form for that district will appear on the screen. Complete this form as directed in Section 5.3.1. When modifying information in the form, press <Enter> to retain an entered value or type over the value and then press <Enter> to complete a change. After completing the modification, press <Esc> to return to the Main Menu.

5.3.3 Adding and Deleting Districts

To describe an additional district, select WASTE MGMT. DISTRICTS from the Main Menu. A list of defined districts will appear on the screen. Press <Insert> to add a district, then complete the data entry from that appears (as directed in Section 5.3.1).

To delete a previously defined district, select option 2 (WASTE MGMT. DISTRICTS) from the Main Menu and a list of districts will appear on the screen. Highlight the district to be deleted and press <Delete>. The completed WASTE MANAGEMENT DISTRICT data entry form for that district will appear on the screen. Press <Enter> to finalize the deletion or press <Esc> to retain the district. After deleting an entry from the list of defined districts, press <Esc> to return to the Main Menu.

5.4 CONSTRUCTING A SCENARIO

Integrated solid waste management involves combining techniques and programs to manage the solid waste stream. The integrated approached should involve considering the solid waste management hierarchy as established by EPA: source reduction, recycling/composting, incineration, and landfilling. Although each municipality will use different combinations of these strategies, the hierarchy is a useful tool for setting goals and planning.

SW-Options explicitly allows the user to choose any waste management strategy except source reduction. Nonetheless, source reduction is the first option to consider in the solid waste management hierarchy. It is a front-end, nontraditional waste management approach that emphasizes eliminating wastes before they are generated. Effective source reduction programs address issues such as purchasing/specifications, industrial processes, and evaluation of "normal business practices." Because of this complexity, it is not possible for a tool like SW-Options to help plan source reduction programs in any meaningful way. One can use SW-Options, however, to compare current solid waste management practices to hypothetical scenarios. The program calculates landfill diversion, comparative costs, and amounts of recycled materials.

5.4.1 Overview

A waste management scenario is a set of choices concerning the collection and processing of a district's solid wastes. The user constructs a scenario by choosing one or more (any combination) waste management options (see complete list in Table 5-3).

Scenario development constitutes the decision-making component of the SW-Options program. As in all waste management, option selections often involve tradeoffs. Thus, decisions about how to manage certain refuse components as they enter the waste stream can have an impact on decisions concerning downstream processing. For example, a decision to recycle paper will reduce the amount of that waste stream component as a fuel for energy recovery incineration.

Table 5-3

Users Choices for Waste Management Scenarios

Option	Description	Choices Within Option
Material recovery	Separation and processing of waste materials for reuse in place of raw or virgin materials	User selects specific recyclable materials to recover and methods to collect those materials.
Composting	Collection of organic materials (e.g., yardwaste) to allow them to decompose into a nuisance-free product with potential value as a soil conditioner or mulch material	User selects specific waste materials to compost, how these materials will be collected, and how they will be composted.
Energy recovery	Processing of some part of the waste stream to utilize its heat content to produce steam, electricity, or refuse-derived fuel	User selects one or more types of energy recovery; if fuel, user also selects what type of facility to support.
Incineration	Burning of wastes to reduce the amount of material going to landfills	User reconsiders whether to use an energy recovery facility (i.e., for steam or electricity) and whether to process incineration ash before sending it to a landfill.
Special collection programs	Collection of certain wastes (e.g., tires and hazardous household wastes) that can cause problems in landfills	User selects specific special wastes to collect.
Landfilling	Disposal of solid, nonhazardous wastes and incinerator ash at designated sites	User reviews amount of solid waste generated by the district and amount diverted as a result of selected waste management options. User also has option of siting a new landfill (e.g., if existing landfill is full).

Throughout the waste management scenario construction process, command keys can be used to present information on screen about the waste management choices being offered: Pressing <F2> provides definitions of terms and <F3> provides information about important pros and cons regarding the particular waste management option. Command key <F4> (i.e., the You Are Here function) allows the user to review an outline of the scenario development process that highlights topics for a specific waste management option (e.g., when constructing the incineration component of a scenario, the user can view an outline emphasizing the incineration-related topics). Figure 5-7 shows an example of this program function as described in the SW-Options on-line tutorial. The function is intended to allow the user to assess the extent of the question sequence, as well as scenario development generally, and to gauge the time required to complete it. **This can be an important consideration when constructing a scenario because the user *must* complete the sequence and all subsequent scenario components in order to save inputs to the program.**

The user can generate reports on waste management costs and on waste diversion after constructing a single waste management scenario. By constructing several scenarios, however, the user can compare the costs and waste diversion achievements of different combinations of waste management approaches.

5.4.2 Constructing a Scenario for the First Time

To construct a waste management scenario for the first time, select option 3 (WASTE MGMT. SCENARIOS) from the Main Menu and a list of districts will appear. Identify the district for which the scenario is being constructed. (If the district is not listed, it has not yet been defined. Press <Esc> to return to the Main Menu and follow the steps for defining a district as listed in Section 5.3.1.) After a district has been selected, the first waste management option (material recovery) will appear on the screen (see Figure 5-8). (Notice that this screen shows the terms definition information window, which is displayed by default; to obtain other information, press <F1>, <F3>, or <F4>.)

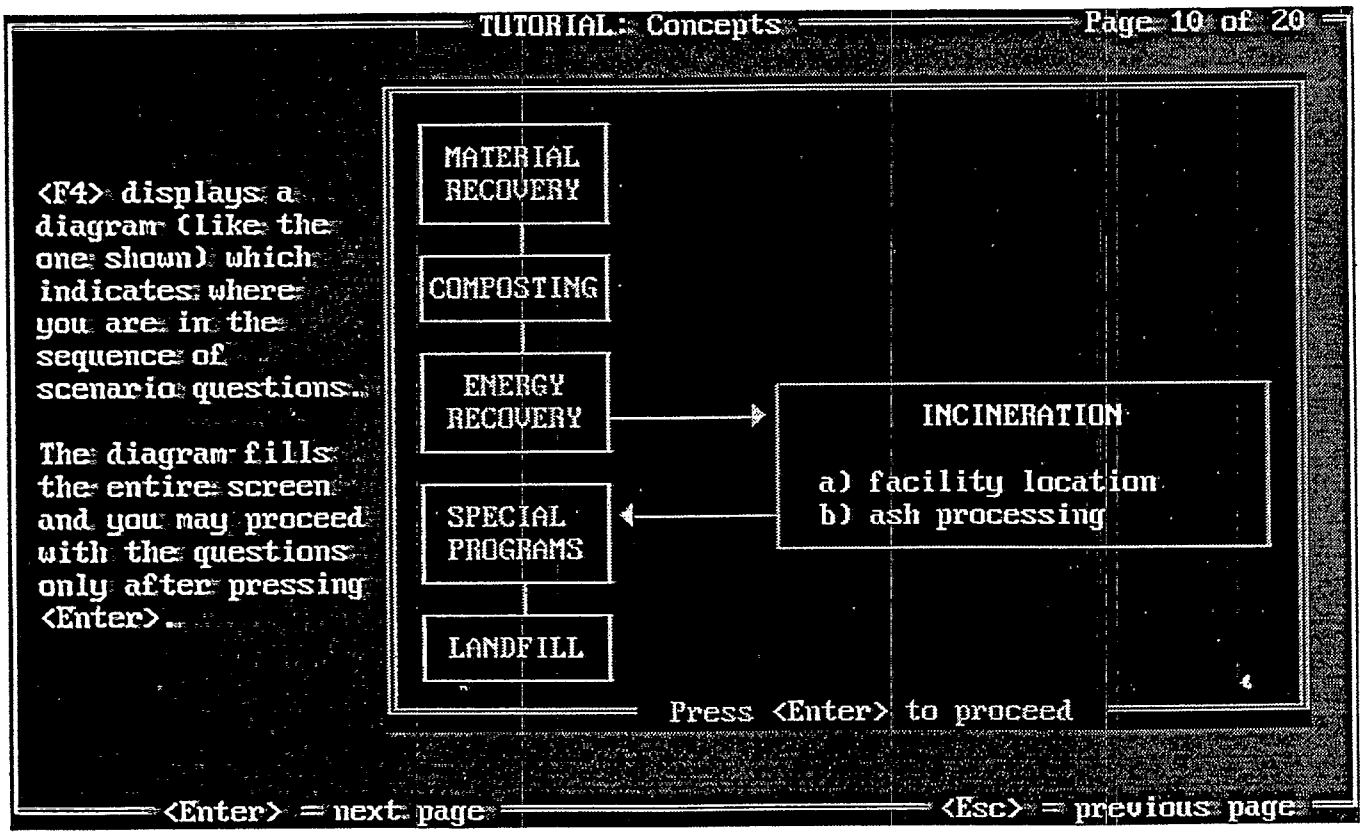

Figure 5-7. **Example of a You Are Here window outlining progress in scenario construction, as described in the SW-Options on-line tutorial.**

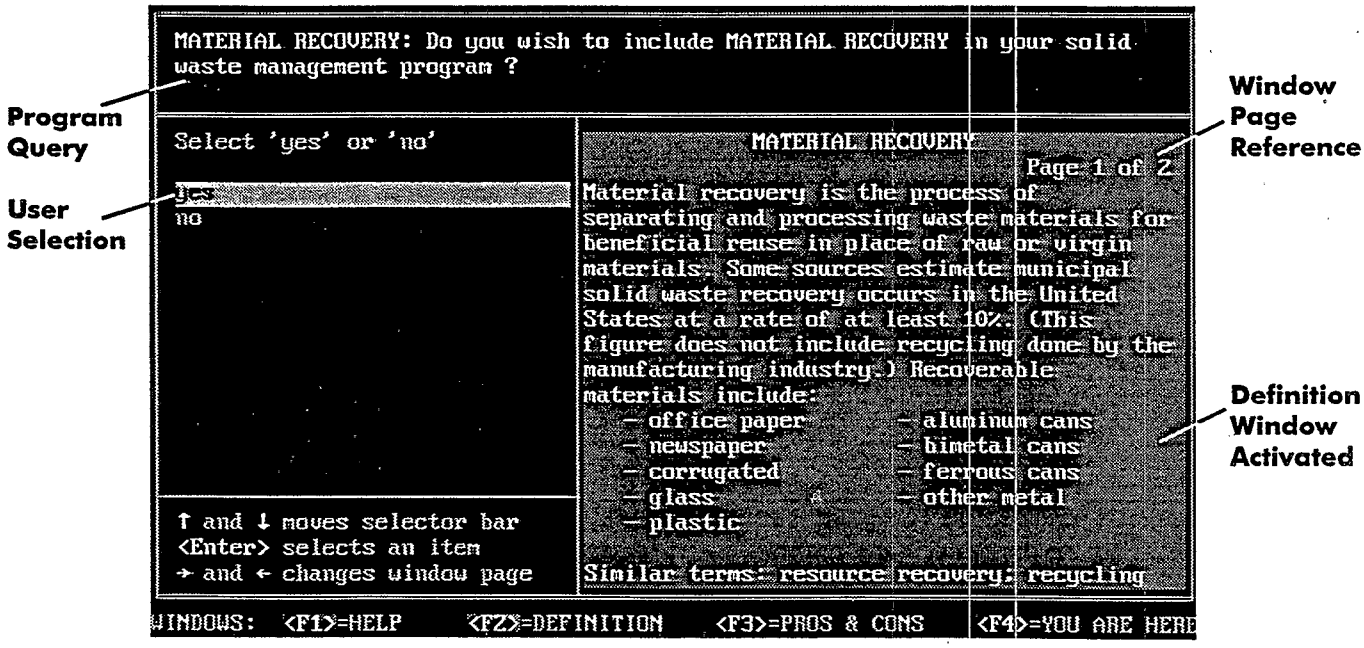

Figure 5-8. Sample MATERIAL RECOVERY option screen in the waste management scenario construction sequence, with the definitions window activated.

To include the first management option (material recovery) in the waste management scenario, highlight "yes" and press <Enter>. To reject this option, highlight "no" and press <Enter> and the program will advance to the next management option.

If material recovery is selected for inclusion in the waste management scenario, a menu appears asking you to define the desired geographic location of a district material recovery facility. The program allows you to default to the calculated location of the district's population centroid.[2] When this menu is completed, a different menu showing a list of recyclable materials appears on the screen. Select the materials to be collected for recycling (use the <Spacebar> to select individual items) and press <Enter>. SW-Options will then ask other, related questions (e.g., whether the recoverable items will be source separated, how the materials will be collected). After all questions for material recovery have been answered, SW-Options will present a summary of the costs (i.e., capital costs and operating costs) and waste diversion achievements associated with implementing this option. Press <Enter> to proceed to the next management option (composting).

Proceed through the four other waste management options (as listed in Table 5-3) and respond to the option-specific questions as prompted. After answering all questions concerning each selected option, the program will present a summary of estimated cost and waste diversion results. A final sequence of questions asks the user about whether a new landfill needs to be sited.

For scenarios that involve material recovery, energy recovery, incineration, or whole waste composting, SW-Options automatically accounts for "white goods" (i.e., oversized steel appliances, such as stoves, that are easily separated out of the waste stream). The program design assumes, based on common practice, that white goods are recovered and sold at the market price specified by the user for recovered ferrous material. Thus, if the user constructs a

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[2]The default location for any waste management facility in a district is established when the district is first defined. Either the default location is based on user-selected facility locations or the SW-Options program calculates the longitude and latitude of the district population centroid. However, the user can override the default location for a particular scenario by entering longitude and latitude values for the facility's site. This will not change the default values used in other scenarios for the district.

scenario involving a material recovery facility handling aluminum, paper, and plastics, SW-Options will automatically include separation of white goods.

Once you have completed the management options sequence, the program will present a summary of the costs of transporting wastes to the district's processing facility (or facilities) under this scenario. The program allows you to view itemized lists of these costs by community and by district before you complete the scenario by assigning it a name. The name you give the scenario should indicate the unique characteristics of the waste management approach.

After naming the scenario, press <Enter> to return to the Main Menu.

5.4.3 Modifying a Scenario

To modify a scenario, select option 3 (WASTE MGMT. SCENARIOS) from the Main Menu and a list of previously defined districts will appear on the screen. Highlight the appropriate district and press <Enter> to advance to a list of scenarios. Select the scenario to be modified and press <Enter> to proceed through the scenario's options sequence as described in Section 5.4.1.

5.4.4 Adding, Deleting, and Copying Scenarios

To construct an additional scenario or to delete one that has already been constructed, select option 3 (WASTE MGMT. SCENARIOS) from the Main Menu and a list of previously defined districts will appear on the screen. Highlight the appropriate district and press <Enter> to advance to a list of scenarios. As instructed by command keys listed at the bottom of this screen, press <Insert> to add a scenario, or highlight a scenario and press <Delete> to remove it from the list. From this screen, the user also can copy a scenario for modification and add it to the list. This is especially useful for comparing scenarios that have only minor differences because it avoids reconstruction of the scenario in its entirety.

CHAPTER 6

GENERATING REPORTS: HOW TO VIEW OR PRINT SW-OPTIONS REPORTS

This chapter explains how to generate reports. The reports are based on information the user has provided about a district and its waste stream and on the waste management scenario or scenarios the user has constructed.

6.1 SELECTING A TYPE OF REPORT

SW-Options produces four types of reports: (1) District Description reports, (2) Cost of Waste Management reports, (3) Waste Diversion Summary reports, and (4) Scenario Comparisons reports. Appendix A presents samples of each type of report.

District Description reports can be generated once the user has defined a waste management district and the communities or communities in the district. Similarly, the other reports can be generated only after the user has constructed one or more waste management scenarios. Table 6-1 describes the four types of reports generated by SW-Options and indicates when each is available.

Because the user defines the district, describes the community or communities in the district, and constructs the waste management scenario(s), the reports generated by SW-Options are situation specific. Thus, a single waste management scenario applied to two different communities will generate disparate results. Similarly, estimated costs presented in a report are based on the operation of waste management systems sized for the quantity of constituents in a particular community's waste stream, after accounting for each processing step. Thus, if the user chooses both material recovery and incineration, the incineration facility's size will be based on the amount of material remaining after material recovery.

Table 6-1

Report Options

Report Type	Description	Availability
District description	Summarizes the data the user entered about a district and its waste stream.	Once the user has defined a district and its waste stream
Cost of waste management	Lists the waste management options the user selected for a scenario and the associated capital and annual operating costs. These represent costs for the selected options beyond the community's current costs. However, the report also provides estimates of economic benefits resulting from the sale of recovered materials (the user must enter local market value estimates for recovered materials) as well as an estimate of avoided landfilling costs (the user must enter a tipping fee when defining a waste management district).	Once the user has defined a district and constructed a scenario
Waste diversion summary	Lists the annual tonnage for each constituent in the waste stream and the annual tonnage recycled, composted, converted to energy, and disposed in a landfill. Any incineration residue (ash) going to a landfill is listed at the bottom of the table. (The amount of waste diverted depends on the efficiency of the technologies employed at the facility, the participation rate of residents and businesses, and the combination of waste management options selected.)	Once the user has defined a district and constructed a scenario
Scenario comparisons	Presents a side-by-side comparison of the waste diversion achievements of the various waste management scenarios constructed (up to four scenarios per page) along with the composite capital and operating cost estimates for each.	Once the user has defined a district and constructed two or more scenarios

SW-Options presents estimates associated with each waste management scenario: costs of selected approaches, revenues from the sale of recovered materials, and landfill cost-avoidance benefits. This information is intended to facilitate decision-making based on scenario comparisons. Because these are estimates only, however, they should *not* be used for planning a community's solid waste management budget.

SW-Options generates estimates on the sale of recyclables, compost, or recovered energy based on user input regarding local market values. This user input is required for the program to generate estimates because market prices can vary widely by region and economic situation. In the absence of data on the local market, the user can compare program-generated estimates of the amount of material/energy that results from various scenarios. In contrast, only if the user provides a tipping fee when defining a waste management district will SW-Options generate an estimate of avoided landfilling costs in the scenario cost report (i.e., the program does not include a default for tipping fees). The user can develop a more comprehensive comparison of cost-avoidance benefits by constructing a scenario based exclusively on landfilling and then juxtaposing cost and waste diversion estimates against those for other scenarios.

6.2 VIEWING OR PRINTING REPORTS

To view or print a report, select option 4 (VIEW/PRINT RESULTS) from the Main Menu and a list of report options will appear on the screen. Select the desired type of report and another screen will appear listing waste management districts defined to the program. For certain types of reports, after selecting a district, a third screen will appear listing scenarios constructed for the district.

Once selections for a report are made, SW-Options gives the user the choice of viewing the report on screen or printing it out; another option allows the user to save the report to a separate file. After printing or saving, SW-Options returns to the report selection list; the user can return to the list after viewing a report by pressing <Esc>. The user can then exit the list by highlighting "Return to Main Menu."

APPENDIX A

SAMPLE OUTPUT REPORTS FROM SW-OPTIONS

This appendix presents samples of each of the following four types of reports that can be generated by SW-Options:

- District description report
- Cost of waste management report
- Waste diversion summary
- Scenario comparison report

DISTRICT DESCRIPTION

DISTRICT: TWOTOWNS DISTRICT

INFLATION RATE SINCE 1990 THRU 1993: 8.95%

****

DISTRICT WASTE PROCESSING FACILITIES

WASTE PROCESSING FACILITY	GEOGRAPHIC LOCATION (longitude, latitude)
District Centroid:	(97.548W, 39.221N)
Material Recovery Facility:	(97.548W, 39.221N)
Compost Facility:	(97.548W, 39.221N)
Energy Recovery Facility:	(97.548W, 39.221N)
Incinerator:	(97.548W, 39.221N)
Landfill:	(97.548W, 39.221N)

NOTE: Facility locations are presented even if such facilities are not required.

****

COMMUNITIES IN WASTE MANAGEMENT DISTRICT

COMMUNITY NAME	POPULATION	AREA (sq mi)	LONGITUDE (deg)	LATITUDE (deg)	MILES FROM CENTROID
ARBORVILLE	50000	25	(97.613W,	38.843N)	25.4
MALLTOWN	80000	16	(97.500W,	39.500N)	18.8

PAGE 1

WASTE MANAGEMENT SCENARIO COST REPORT
SEP 4,1995

DISTRICT: TWOTOWNS DISTRICT
SCENARIO: Recycle and sell

WASTE MANAGEMENT OPTIONS	CAPITAL COSTS ($K)	ANNUAL OP COSTS ($K)	ANNUAL INCOME ($K)
MSW SOURCE SEPARATION (SS) AND COLLECTION			
SS recyclables? : yes	354	25	
Collection method: neighborhood dropoff sites			
SS compostables? : yes	0	404	
Compost feedstock: yardwaste only			
leaf collection: separate truck			
SPECIAL WASTE COLLECTION PROGRAMS		90	
household hazardous : yes			
construction/demolition: no			
motor oil : no			
tires : yes			
MATERIAL RECOVERY FACILITY: yes	2,183	824	9
office paper : no			
newspaper : yes			
corrugated : yes			
aluminum cans : yes			
bimetal cans : yes			
ferrous cans : yes			
other ferrous : yes			
PET plastic : yes			
HDPE plastic : yes			
other plastic : yes			
glass : yes			
COMPOST FACILITY : forced aeration	394	78	82
feedstock : yardwaste only			
REFUSE-DERIVED FUEL: no			
fuel type :			
INCINERATION OF MSW: no			
heat recovery : none			
ASH PROCESSING :			
approach :			
NEW LANDFILL : no			
duration of use :			
SCENARIO COST SUMMARY	2,931	1,421	9(
AVOIDED COST OF LANDFILLING:			18:

WASTE STREAM DIVERSION SUMMARY
SEP 4,1995

DISTRICT: TWOTOWNS DISTRICT
SCENARIO: Recycle and sell

Constituent	original MSW mass (tons/yr)	recycled mat'l (tons/yr)	composted mat'l (tons/yr)	mass to energy rec. (tons/yr)	MSW to landfill (tons/yr)
office paper	3139.7				3139.7
newspaper	5817.6	1588.2			4229.4
corrugated	11727.6	3258.8			8468.8
other paper	14036.2		0.7		14035.5
yardwaste	14682.6		7122.5		7560.1
aluminum cans	433.6	157.4	0.0		276.2
bimetal cans	542.0	196.8	0.0		345.2
ferrous cans	1236.6	401.7			834.9
other ferrous metal	1846.9				1846.9
other aluminum	554.1				554.1
white goods	1662.2	1662.2			
other metals	554.1				554.1
glass	5564.7	1484.4	0.1		4080.1
PET plastic	291.1	102.5			188.6
HDPE plastic	1766.6	589.1			1177.5
mixed plastic	6279.4	1591.8			4687.5
food	6187.0				6187.0
wood	6094.7				6094.7
rubber	2770.3				2770.3
textiles	2770.3				2770.3
miscellaneous	2862.7				2862.7
TOTALS	90819.9	11033.0	7123.4	0.0	72663.5

Percentage of waste (by mass) diverted from the landfill: 20.0 %

WASTE MANAGEMENT SCENARIO COMPARISON FOR:
TWOTOWNS DISTRICT
SEP 4,1995

SCENARIO 1: Recycle and sell
SCENARIO 2: Recycle/incinerate and recover

MUNICIPAL SOLID WASTE	SCENARIO 1	SCENARIO 2
Total MSW Mass (TPY):	90819.9	90819.9
Mass To Landfill (TPY):	72663.5	0.0
Vol. To Landfill (cu yd):	805215	0
MATERIAL RECOVERY FACILITY		
Recycled materials (TPY):	11033.0	13546.9
Fraction of original MSW:	12.1 %	14.9 %
COMPOSTING FACILITY		
Composted MSW (TPY):	7123.4	7123.4
Recycled materials (TPY):	0.0	0.0
Fraction of original MSW:	7.8 %	7.8 %
REFUSE-DERIVED FUEL PLANT		
Refuse-derived fuel(TPY):	0.0	36514.5
Recycled materials (TPY):	0.0	2513.9
Fraction of original MSW:	0.0 %	43.0 %
Energy value (MMBtu):	0	620234
INCINERATION		
MSW to incinerator (TPY):	0.0	33635.1
White goods removed(TPY):	0.0	0.0
Other metal removed(TPY):	0.0	0.0
Ash to landfill (TPY):	0.0	6224.9
Aggregate produced (TPY):	0.0	0.0
Energy recovered (MMBtu):	0	147256
GRAND TOTALS		
CAPITAL ($):	2931000	48369000
ANNUAL OPERATING ($):	1420550	4648550
ANNUAL INCOME ($):	89556	217754218
LANDFILL COST ($):	0	0
DIVERSION FROM LANDFILL:	20.0 %	93.1 %

KEY: TPY = tons/year; MMBtu = millions of Btu's

APPENDIX B

WASTE MANAGEMENT SCENARIO WORKSHEET

This appendix provides a worksheet for sketching out preliminary information for a waste management scenario on paper before constructing one in the SW-Options program.

A. COMMUNITY DESCRIPTION

Community name _____

Population _____

Area (square miles) _____

Location (longitude and latitude) _____

Bottle bill (yes or no)[1] _____

Yardwaste ban (yes or no)[2] _____

Community description _____

Estimating basis

- Population based (yes or no) _____
- Business/community based (yes or no) _____
  - (if yes, provide annual sales and demographic data)
- Actual known mass (yes or no) _____
  - (if yes, provide know mass)
- Actual known mass and composition _____
  - (if yes, provide data on known mass and composition)

---

[1] See Appendix D for a list of states with a bottle bill in effect.

[2] See Appendix D for a list of states with a yardwaste ban in effect. Note that a "yes" answer to this question will preclude the user from including yardwaste composting as a waste management approach when subsequently constructing a scenario.

B. DISTRICT DEFINITION

District name _____

Local transportation rate _____

Yardwaste ban _____

District description _____

Communities in district _____

C. SCENARIO CONSTRUCTION

1. Do you wish to include MATERIAL RECOVERY in your solid waste management scenario? (Choose yes or no.) _____

Where will you locate the material recovery facility (longitude and latitude)? _____

Which material(s) would you like to recover? (Choose one or more.)

office paper	____	other ferrous metal	____
newspaper	____	PET plastic	____
corrugated	____	HDPE plastic	____
aluminum cans	____	mixed plastic	____
bimetal cans	____	glass	____
ferrous cans	____		

What recycling revenues can you anticipate for the selected materials ($/ton)?

Would you like the recoverables to be source separated (i.e., by the residents and businesses)? (Choose yes or no.) _____

How do you wish to collect these source-separated recyclables? (Choose one.)

separate collection pristine _____

separate collection commingled _____

centralized drop-off center _____

neighborhood drop-off sites _____

blue bag _____

What percentage of the population do you anticipate will participate in the collection program? _____

2. **Do you wish to include COMPOSTING in your solid waste management scenario? (Choose yes or no.)** _____

Where will you locate the composting facility (longitude and latitude)? _____

From which of the following do you wish to derive your compost feedstock (raw material)? (Choose one.)

yardwaste only _____

source-separated (SS) organics _____

whole processed municipal solid waste (MSW) _____

yardwaste and SS organics _____

yardwaste and processed MSW _____

What composting revenues can you anticipate for the selected materials ($/ton)?

Which method of composting will you use? (Choose one.)

low-rate static pile _____

mechanically turned windrows _____

forced aeration _____

What percentage of the population do you anticipate will participate in the composting program? _____

How do you wish to collect leaves? (Choose one.)

separate truck _____

vacuum truck _____

3. **Do you wish to include ENERGY RECOVERY in your solid waste management scenario? (Choose yes or no.)** _____

If yes, which energy recovery option do you wish to use? (Choose one.)

steam _____

electricity _____

refuse-derived fuel (RDF) _____

Where will you locate the energy recovery facility (longitude and latitude)? _____

What energy recovery revenues can you anticipate ($/unit)? _____

Do you wish to process the ash before it is landfilled? (Choose yes or no.) _____

4. **If you do not plan to include energy recovery in your scenario, do you wish to incinerate the remaining waste stream to reduce its volume? (Choose yes or no.)** _____

If yes, where will you locate the incinerator (longitude and latitude)? _____

Would you like to reconsider an energy recovery facility? (Choose yes or no.) _____

Which form of energy do you wish to recover? (Choose one.)

steam _____

electricity _____

What energy recovery revenues can you anticipate ($/unit)? _____

Do you wish to process the ash before it is landfilled? (Choose yes or no.) _____

In which type of ash processing do you have an interest? (Choose one.)

recover metals only _____

recover metals and form aggregate _____

5. **Do you wish to implement other SPECIAL COLLECTION PROGRAMS that will benefit the environment? (Choose yes or no.)** _____

For which item(s) do you wish to establish special collection programs? (Choose one or more.)

household hazardous waste _____

construction/demolition waste _____

motor oil _____

tires _____

6. **Do you wish to site a new landfill for the district? (Choose yes or no.)** _____

Where will you locate the new landfill (longitude and latitude)? _____

How many years do you want the landfill to operate? _____

How will the landfill be owned and operated (public or private)? _____

What is a good estimate of the cost of land in your area ($/acre)? _____

APPENDIX C

ESTIMATION METHODS AND DECISION LOGIC USED IN SW-OPTIONS

C.1 INTRODUCTION

SW-Options encompasses a large number of models used to simulate the effects of different, presently available technologies, and the user selects certain of these models as a result of the decisions that he or she makes in the program. The program asks the user questions about how the user wants to manage waste and the appropriate models are then applied, based on the answers that the user gives. Waste management technologies include methods for separating constituents in the waste stream, for converting constituents to useful products, or for destroying undesirable constituents.

Because so many of the separation, conversion, and destruction technologies depend on the physical and chemical characteristics of the different constituents in the waste stream, SW-Options is built around models that deal with each of the constituent components in the waste stream individually. Thus, it is important to have realistic, representative values of the total mass and of the composition of the waste stream of interest.

The national average waste generation rate and composition data included in this version of SW-Options have been updated from prior versions to conform with values reported in the EPA report entitled *Characterization of Municipal Solid Waste in the United States: 1994 Update* (EPA/530/R-94/042). If users have more thorough knowledge available about the individual communities they wish to study, that knowledge may be entered and SW-Options will use it in lieu of national average values.

For most of the estimation algorithms incorporated into the software, calculations are based on the annual tonnage of each of the 21 waste stream categories shown in the community waste characteristic screen. A data file is then generated for each community in which the

estimated annual mass of each constituent is retained. Throughout the program, calculations are always performed on each individual constituent to more realistically estimate the effect of processes that affect the various constituents differently. The software also includes a data file containing estimates of the density, moisture content, British thermal unit (Btu) content, and ash content of each constituent category; thus, regardless of what constituents are subsequently "removed" for special processing (e.g., composting or material recovery), reasonable estimates can be made of characteristics of the remaining portion of the waste stream. In this way, SW-Options is able to estimate the important characteristics for subsequent processing and to provide more realistic interpretations of the effectiveness of such subsequent processing.

Within a waste management district, transportation distances are calculated as "great circle" distances between communities and the facility locations. Transportation costs are estimated by multiplying the relevant distance times the tonnage of wastes to be transported over that distance and then that result is multiplied by the local transportation cost as entered by the user. Since the default location is the population-weighted centroid, transportation cost estimates will be minimized whenever the default location is used.

The logic in SW-Options is sequential. Thus, if earlier waste management decisions have resulted in some change in the waste stream, then the waste stream to which later models are applied is that "changed" waste stream that remains after earlier decisions have been implemented. Figure C-1 shows the logic pathway that the waste stream "follows" depending on the user's decisions throughout the program.

C.2 WASTE COLLECTION

SW-Options does *not* include any estimation procedures for regular mixed municipal waste collection. It assumes that the community's present waste collection procedures will be retained and that actual data about the ongoing process will be more useful than any estimate that could be calculated in such a software tool.

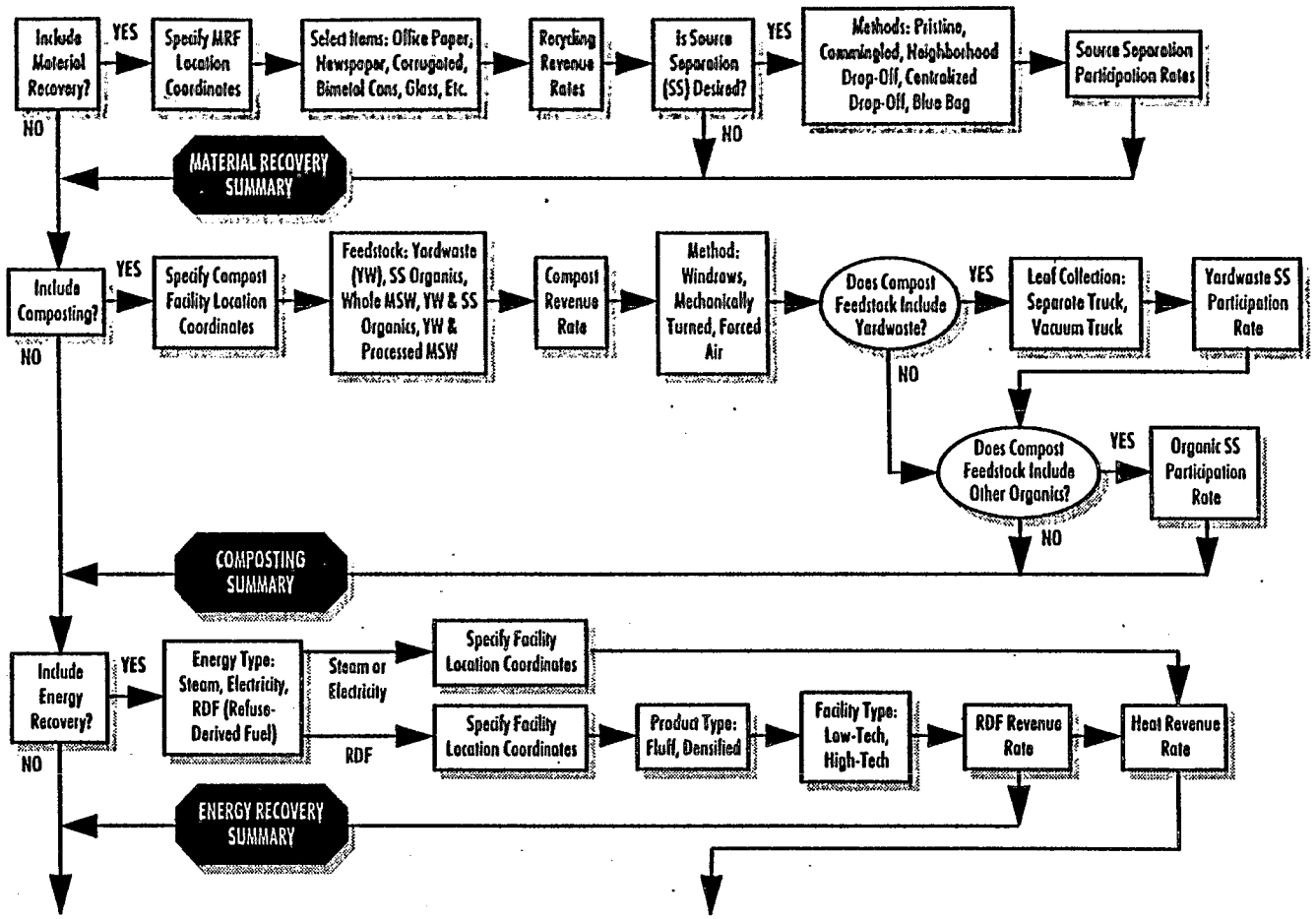


Figure C-1. SW-Options logic pathway schematic.

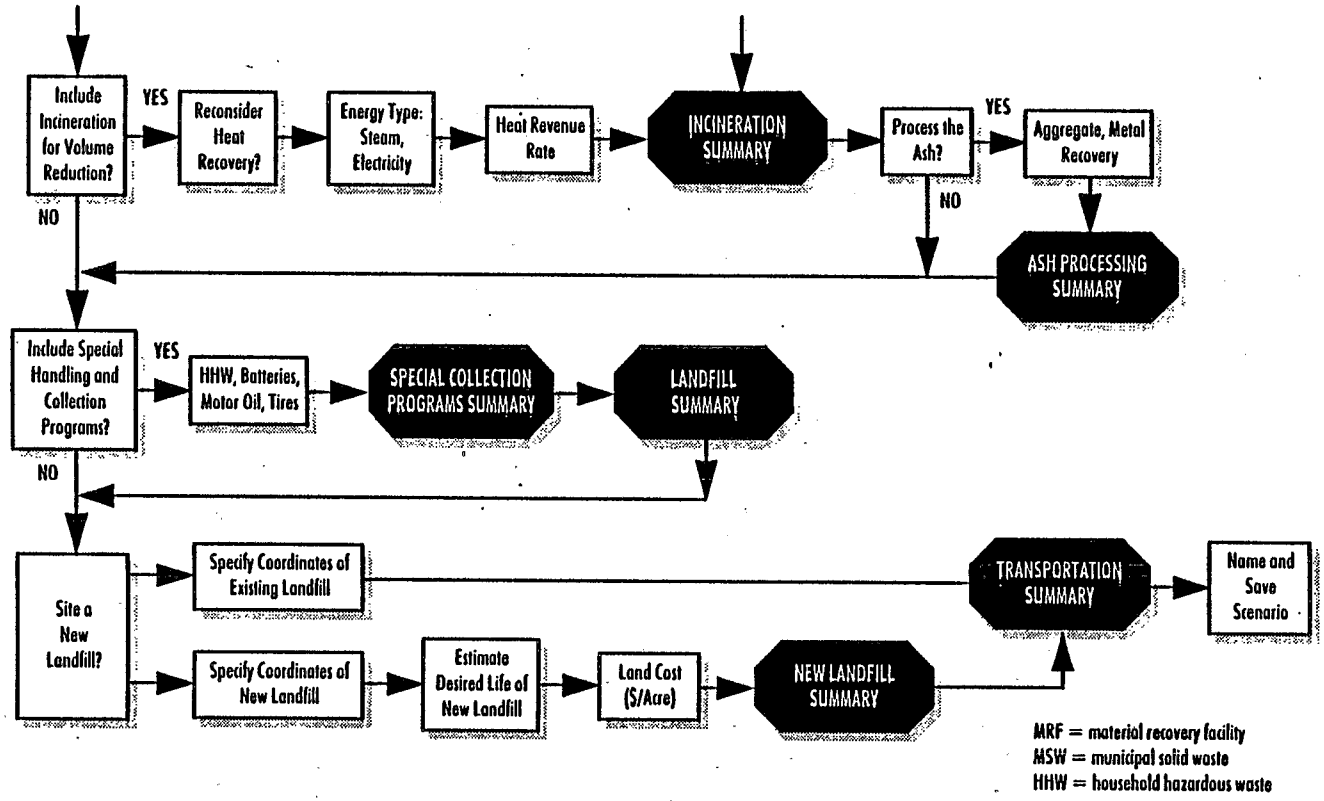


Figure C-1. SW-Options logic pathway schematic (continued).

The software does include some waste collection estimating procedures for special collection programs (see Section C.6). Many of the waste management options modeled within the software depend on separate collection of source separated and separately collected wastes. This is true for some material recovery procedures and for some waste composting options. In any source separation/collection program, the amount of waste actually collected depends on three factors: the tonnage available in the selected waste categories to be separated, the participation rate (i.e., the percent of the population actively participating in separating the selected categories), and the effectiveness of the citizens in separating the selected materials. If a source separation strategy is selected, the user is asked to estimate the participation rate for the community. A tonnage to be collected is then estimated by multiplying the participation rate times the effectiveness factor (built into the software for separable waste constituent categories) times the estimated annual tonnage of the category to be separated. The tonnage of all selected categories is added together and this is the annual tonnage used to estimate the size facility then needed for specific programs (e.g., the size of the material recovery facility needed).

Whenever separate collection programs are selected by the user, an estimate is made of the number of new trucks that will be required for that separate collection based on the tonnage to be collected and the population of the selected communities. From this, capital and operating costs are estimated based on data obtained by phone contact with vendors of specially designed separate collection vehicles. The transportation cost for separately collected waste is estimated using the tonnage calculated multiplied by the distance from the individual communities to the location of the waste processing facility for which those wastes are destined. This amount is then multiplied by the user-entered transportation cost.

C.3 MODELING MATERIAL RECOVERY FACILITIES

MRFs are specially designed facilities at which incoming waste streams are processed to produce "cleaned," recyclable materials ready for market. MRFs can accept source separated wastes that have been kept separate through collection and delivery, source separated wastes that have been commingled during collection, or whole mixed wastes. Estimation of the effectiveness and cost of an MRF is based on the EPA handbook, *Material Recovery Facilities for Municipal*

Solid Waste (EPA/625/6-91/031). Depending on the selections that the user makes in the program, the effectiveness of a MRF will be estimated by different factors. If whole mixed waste is to be processed, the effectiveness of the MRF's operation is estimated using the values shown in Table C-1 for a whole waste MRF. If some form of source separation is chosen, then the effectiveness of the MRF will depend on three factors:

- The participation rate as entered by the user (realistic default values are built into the program if the user cannot estimate a better number).
- The effectiveness of citizens in separating the constituents chosen for recovery.
- The effectiveness of the MRF in processing specific constituents for market.

The effectiveness of the citizens in a community is assumed to be relatively constant. Participation rates may vary, but the effectiveness of that portion of the community that actually participates will be essentially unchanged. Both the citizen effectiveness estimates and the MRF effectiveness values are shown in Table C-1.

One category of waste materials is handled in a unique manner—white goods. This category comprises oversized bulky items such as appliances, usually containing primarily ferrous materials, that are difficult to handle and process in many solid waste processing technologies. Thus, the software makes the assumption that if the user selects an MRF, a composting facility, or any energy recovery options, then white goods will be removed from the waste stream for sale as scrap ferrous.

The estimate of the size and cost of an MRF will depend on three factors:

- The number of material categories to be handled
- The daily throughput capacity required
- The annual tonnage to be processed

The number of materials to be processed is selected by the user when responding to the question of "which materials do you wish to recover?" (e.g., selecting newspaper, aluminum cans, and

Table C-1

Values for Estimating Processing Effectiveness of Material Recovery Facilities (Percent Captured)

Material Category	Waste Generator Separation Effectiveness	MRF Effectiveness: For Separated Waste	MRF Effectiveness: For Separated Then Commingled Waste	MRF Effectiveness: For Whole Waste
Office paper	85	95	90	0
Newspaper	70	100	95	50
Corrugated paper	75*	95	95	70
Aluminum cans	95	98	95	70
Bimetal cans	95	98	95	70
Ferrous cans	85	98	95	70
Other ferrous	0*	NA	NA	70
PET	95	95	95	85
HDPE	95	90	90	65
Mixed plastics	65	100	90	50
Glass	76	90	75	35

Note: Use of blue bags for collecting recyclables results in an effective reduction of materials delivered to the MRF because of bag breakage and other losses. This reduction is estimated at 20 percent.

*Except for bimetal and ferrous cans, it is assumed that the waste generator will not separate more than a miniscule fraction of the "other ferrous" category of wastes. (White goods are treated separately in the software.)

PET = polyethylene terephthalate
HDPE = high-density polyethylene

polyethylene terephthalate [PET] would result in three material categories to be processed). The throughput capacity is estimated based on the sum of the internally calculated annual tonnage for the specific materials chosen. This number is divided by 250 (assuming 250 operating days per year) and then multiplied by 1.25 as an estimate of the actual capacity needed assuming the maximum daily tonnage processed exceeds the average by 25 percent. This "surge capacity" estimate is used to estimate the capital cost of the facility based on the numbers shown in Table C-2. Operating costs are estimated from the calculated estimate of annual tons processed (with no surge capacity factor) multiplied by the values shown in Table C-3.

Both capital and operating cost estimators are stored in the program as 1990 dollars and these are inflated using the inflation factors shown in the SET PROGRAM DEFAULTS screen reached from the software's Main Menu. Default values of inflation factors are included in SW-Options based on the published Consumer Price Index (CPI) for years 1991, 1992, and 1993. The user may elect to use other inflation factors than the CPI and also can enter inflation factors for years after 1993. The software will inflate the 1990 cost estimates by year up to the last year entered into the screen. If the user wishes to estimate costs for some future startup date, then the user should enter inflation factor estimates for outyears.

C.4 MODELING COMPOST OPERATIONS

Composting is a biological process for converting organic materials into a useful soil amendment material. Theoretically any organic constituent in the solid waste stream can be composted. In practice, however, plastics, rubber, and leather are so slow to degrade that the software estimates that such materials are not affected by composting. If the user selects composting as a candidate waste processing operation, then the software asks which constituents are to be considered as feedstock to the composting operation. The user may select separately collected yardwaste, source separated organics from the mixed municipal waste stream, whole mixed waste, or yardwaste and source separated organics. For both yardwaste and source separated organics, the assumption is made that these will be separately collected for delivery to the composting facility. The user may enter a participation rate or allow the software to supply a default value for participation rate.

Table C-2

Estimated Capital Costs for Material Recovery Facilities ($/TPD)

Number of Recoverable Categories Handled	Capacity Range (TPD Input)			
	< 50	50-100	100-500	>500
1	31,000	27,000	2,400	20,000
2	31,000	27,000	2,400	20,000
3	34,500	30,500	27,500	22,500
4	37,500	33,500	29,500	24,000
5	40,000	36,000	31,000	25,000
6	41,000	36,900	31,800	25,500
7	42,000	37,800	32,600	26,000
8	43,000	38,700	33,400	26,500
9	44,000	39,600	34,200	27,000
10	45,000	40,500	35,000	27,500
11	46,000	41,400	35,800	28,000

Note: All costs in 1990 dollars.

TPD = tons per day

Table C-3

Estimated Annual Operating Cost for Material Recovery Facilities ($/Total Tons)

Number of Recoverable Categories Handled	Capacity Range (TPD Input)			
	< 50	50-100	100-500	>500
1	44.0	35.0	28.0	21.0
2	44.0	35.0	28.0	21.0
3	53.0	41.0	32.0	22.5
4	60.0	46.0	35.0	24.0
5	65.0	50.0	37.0	25.0
6	69.8	53.5	39.2	26.0
7	74.6	57.0	41.4	27.0
8	79.4	60.5	43.6	28.0
9	84.2	64.0	45.8	29.0
10	89.0	67.5	48.0	30.0
11	93.8	71.0	50.2	31.0

Note: All costs in 1990 dollars.

If yardwaste is selected for composting, the software assumes that these materials will be bagged and set at curbside for separate collection. Because many communities have special autumn pickups for fallen leaves, the software allows the user to add additional special collection vehicles for the autumn leaves. **It should be noted that the software also allows users to specify that the district has a ban on collecting bagged yardwaste. SW-Options then assumes that yardwaste is not available as a compost feedstock.** If the user wishes to estimate the effect of yardwaste composting, the user should redefine the communities and district so that yardwaste collection is not banned and then assess the effect of yardwaste composting in a special scenario.

If yardwaste composting is selected, the software asks the user for a participation rate and then applies a citizen effectiveness rate of 90 percent to the calculated tonnage (i.e., those participating will deliver 90 percent of the available yardwaste to curbside for collection) and a processing effectiveness of 98 percent. If source separated organics are chosen for composting, the software also asks for a participation rate, but tonnage delivered is calculated using the effectiveness rates shown in Table C-4; process effectiveness is still estimated at 98 percent. If whole waste is chosen for composting, then no separate collection effort is used. All of the waste (i.e., that remaining if some has been removed at an MRF) is assumed to be delivered to the compost facility and mechanically processed to separate the compostable materials. The separation process modeled is similar to that used in the refuse-derived fuel (RDF) models later in the program. The effectiveness of the separation process is shown in Table C-5.

As with the MRF calculations, the estimate of costs is based on the quantity of waste received at the compost facility. Capital costs are estimated using an estimate of the daily capacity needed assuming a 250 day per year receiving schedule and a 25 percent additional surge capacity. Operating costs are based on the total tonnage processed per year as calculated from the user-selected options of which waste to compost. Table C-6 shows the cost estimator numbers for capital and operating costs for the three types of compost operations modeled in SW-Options.

Table C-4

Values for Estimating Results of Source Separation of Household Organics by Generator for Composting

Target Materials	Capture (% of Available Mass)
Office paper	70
Newspaper	70
Corrugated paper	40
Other paper	70
Yardwaste*	1
Food waste	80
Wood	60
All other categories	0
Noncompostable Inorganics Inadvertently Captured	
All plastics	0.5
Rubber	50
Textiles	10
All other categories	0

* Yardwastes are dealt with primarily by means of other choices the user can make when selecting materials to be composted. It is assumed that even when yardwaste composting is not selected, some yardwastes would be present, mixed in with other household organics.

Note: SW-Options assumes that the available mass of certain categories of household waste materials is extremely small. For these categories, even if 100 percent of the total available mass were captured—whether intentionally or inadvertently—the amount sent to composting would be negligible. Thus, although the program assumes that 50 percent of rubber in the household waste stream is inadvertently captured for composting, this amount would constitute an essentially inconsequential input, given that the total available mass of materials such as elastic bands on newspapers or vegetable packaging is quite small.

Table C-5

Values for Estimating Processing Effectiveness for "Whole Waste" Composting Operations

Waste Category	Percent of Input to Compost	Percent of Input to Recovered Material
Office paper	50	0
Newspaper	70	0
Corrugated paper	60	0
Other paper	50	0
Yardwaste	23	0
Aluminum cans	0	70
Bimetal cans	0	85
Ferrous cans	0	85
Other ferrous	0	85
Other aluminum	3	20
White goods	0	100
Other metals	0	0
Glass	5	30
PET	10	40
HDPE	20	50
Mixed plastic	10	30
Food waste	30	0
Wood	40	0
Rubber	40	0
Textiles	40	0
Miscellaneous	0	0

Note: Input materials not captured are returned to the waste stream for subsequent processing or disposal.

Table C-6

Estimated Capital and Operating Costs for Composting Operations

Type of Operation	Capital Costs ($/TPD)	Annual Operating Costs ($/Tons Processed)
Low-rate static pile	9,000	6.25
Mechanically turned windrows	11,000	8.00
Forced aeration or in vessel	13,000	10.50

Note: All costs in 1990 dollars.

C.5 MODELING ENERGY RECOVERY AND INCINERATION

Energy recovery options available in the software include two approaches based on heat recovery incinerators (HRIs) and two on RDF production. Incineration processes are modeled assuming good operating practice with extensive air pollution control equipment included. Energy available for recovery is estimated using the composition of the stream remaining for incineration, with the heat content (higher heating value in Btu/lb) and ash and moisture content of each constituent remaining in the waste stream. Incineration facilities accept all of the remaining waste and combust it. The model estimates the energy released along with the ash residue produced in the incinerator. As with other process models, capital costs are estimated based on daily capacity required (with a 25 percent surge capacity), whereas operating costs are based on total annual tonnage processed. Cost estimates assume that for capacities above 500 tons per day (TPD) a field-erected unit would be used, whereas for below 500 TPD a combination of modular units would be used. Estimating factors for capital and operating costs are provided in Table C-7 for incinerators with no energy recovery as well as for HRIs equipped to recover either steam or electricity.

RDF production assumes that all of the remaining waste is delivered to the facility and that the waste must be processed to separate the combustible fraction for generating a marketable fuel product. Three output streams are estimated: a fuel fraction, separated recyclables, and a reject stream. The recyclables are available for recovery and the rejects then pass on to any further processing. The software includes models of two types of RDF production facilities, a low-tech and a high-tech option. The low-tech option is similar to a "whole waste" MRF, given that it is based on minimal mechanical processing, but involves hand sorting and low-energy process operations such as trommel screens and shear shredders. Separation effectiveness estimating factors for the low-tech option are shown in Table C-8.

The high-tech RDF production facility option is modeled assuming a processing concept similar to that developed in the 1970s in which hammermill-shredded wastes are separated by sophisticated mechanical processes to produce fuel, recyclables, and rejects. Such processes capture more of the waste stream, but at a higher cost. The separation effectiveness estimates used for high-tech RDF facilities in SW-Options are given in Table C-9. Facility cost estimates

Table C-7

Estimated Capital and Operating Costs for Incineration Facilities

Type of Facility	Cost Factor	Capacity Range (TPD Input) < 50	> 500
No energy recovery	Capital ($/TPD)	80,000	70,000
	Annual operating ($/annual tons)	20	11
With steam generation	Capital ($/TPD)	100,000	80,000
	Annual operating ($/annual tons)	25	15
With electric generation	Capital ($/TPD)	140,000	130,000
	Annual operating ($/annual tons)	27	16

Note: All costs in 1990 dollars.

Table C-8

Values for Estimating Processing Effectiveness for "Low-Tech" Refuse-Derived Fuel Facilities

Waste Category	Percent of Input to RDF	Percent of Input to Recovered Material
Office paper	40	0
Newspaper	60	0
Corrugated paper	60	0
Other paper	50	0
Yardwaste	0	0
Aluminum cans	0	70
Bimetal cans	0	85
Ferrous cans	0	85
Other ferrous	0	85
Other aluminum	0	20
White goods	0	100
Other metals	0	0
Glass	0	30
PET	20	30
HDPE	60	0
Mixed plastic	10	0
Food waste	0	0
Wood	20	0
Rubber	20	0
Textiles	20	0
Miscellaneous	0	0

Note: Input materials not captured are returned to the waste stream for subsequent processing or disposal.

Table C-9

Values for Estimating Processing Effectiveness for "High-Tech" Refuse-Derived Fuel Facilities

Waste Category	Percent of Input to RDF	Percent of Input to Recovered Material
Office paper	85	0
Newspaper	85	0
Corrugated paper	80	0
Other paper	60	0
Yardwaste	80	0
Aluminum cans	2	70
Bimetal cans	0	80
Ferrous cans	0	80
Other ferrous	0	85
Other aluminum	5	0
White goods	0	100
Other metals	0	0
Glass	10	0
PET	90	0
HDPE	90	0
Mixed plastic	70	0
Food waste	70	0
Wood	70	0
Rubber	70	0
Textiles	70	0
Miscellaneous	0	0

Note: Input materials not captured are returned to the waste stream for subsequent processing or disposal.

are based on the type of operation chosen, with capital costs estimated from daily capacity required, whereas operating costs are estimated using annual tonnage processed through the facility. Cost-estimating factors for capital and operating costs for both options are provided in Table C-10.

If incineration or heat recovery incineration is chosen, the user also has the option to select processing of the ash produced prior to its being sent to the landfill. Ash may be processed for recovery of magnetic metals or the ash can be more fully processed to recover magnetic metals and process the residue into a material similar to construction aggregate.

C.6 MODELING SPECIAL COLLECTION PROGRAMS

The three types of special collection programs the user can include in a waste management scenario capture the following materials:

- Household hazardous waste (HHW)
- Tires
- Used oil

The methods for estimating costs are based on simple estimates of the quantity of materials entering the waste stream per year in the district that the user has defined. These quantity estimates form the basis of the cost estimate. The estimated annual tonnage is multiplied by the cost of operating a collection program and disposing of the collected material. Because the quantities collected are small relative to the annual wastes generated in the defined district, the software assumes that each special collection program can be operated at existing waste management facilities with available personnel, minimizing additional labor costs. Thus, the cost of disposal is the primary factor in calculating an annual cost for each program.

For HHW collection programs, the software estimates the quantity of the waste by assuming that 1 percent of the population will participate at each scheduled collection (assumed to be once per year) by delivering defined hazardous materials to a central collection facility.

Table C-10

Estimated Capital and Operating Costs for Refuse-Derived Fuel Facilities

Type of Facility	Cost Factor	Capacity Range (TPD input) < 50	50-100	100-500	>500
Low tech	Capital ($/TPD)	48,000	40,000	32,000	24,000
	Annual operating ($/total tons)	58	44	33.25	22.50
High tech	Capital ($/TPD)	100,000	75,000	60,000	55,000
	Annual operating ($/total tons)	58	44	33.25	22.50

Note: All costs in 1990 dollars.

Further, the software estimates that each participant will deliver an average of 6 gallons of waste, which then must be handled and disposed as hazardous. A base disposal cost of $500 per ton is assumed for hazardous waste handling and disposal. Because HHW programs require operator training as well as advertising and insurance, the software assumes an annual operating cost of $4 per person participating plus a fixed cost of $10,000 per year. Combining this with the disposal cost, the annual cost is estimated as:

Annual cost = $10,000 + 0.16 x population

(Note that cost estimates are in 1990 dollars and are inflated to current values by the user-selectable inflation values that the software utilizes for all cost factors.)

The method for estimating the cost of a used oil collection and disposal program is similar. The software proceeds on the worst case assumption that the collected oil must be disposed as a hazardous material at $500 per ton. The quantity of oil is estimated by making the following assumptions:

- Used oil collected will be generated primarily through use of personal vehicles
- The number of vehicles operated is one vehicle per four persons
- Each car is driven 20,000 miles per year
- Automotive oil is changed every 10,000 miles
- An oil change yields 2.5 gallons of used oil
- Five percent of the population changes their own oil
- Half of these "do-it-yourselfers" will participate in a drop-off program

Thus, the annual cost of an oil collection program is estimated as:

Annual cost = 0.0625 x population

For tire collection programs, a similar logic is used. The exception, however, is that tires are assumed to be nonhazardous and thus can be land disposed at minimal cost after they are slit to prevent movement within the fill. The annual disposal cost is estimated at $50 per ton. As

with used oil, the software assumes that the number of personal vehicles in the district is equal to one quarter of the population and that each car is driven an average of 20,000 miles per year. The software also assumes that a set of tires lasts an average of 40,000 miles and that the average weight of a tire is 30 pounds. Thus, the annual cost of a tire collection program is estimated as:

Annual cost = 0.09375 x population

C.7 LAND DISPOSAL

SW-Options works on the assumption that a district's wastes are presently being landfilled. Thus, all wastes removed from the waste stream as a result of selecting other waste disposal options are assumed to be "diverted" from land disposal. If the user enters present costs for waste disposal (i.e., tipping fees), SW-Options will calculate the costs avoided by such waste diversion as one of the economic benefits of the waste management scenario selected. Other benefits include the market prices for recovered materials such as recyclables and compost. Market prices must be entered by the user because the software cannot reliably predict local market prices, especially for the highly volatile markets typical of the recycled materials industries. The most reliable estimates of market prices can be obtained by contacting local buyers of recovered materials such as scrap metal dealers and waste paper recovery operations. Information can also be obtained from industry groups such as the National Recycling Coalition or the Steel Recycling Institute.

The amount of material remaining to be land disposed is estimated by SW-Options as that amount of waste that has not been removed by all prior waste management methods included in the scenario as the user has defined it.

Finally, the user has the option of estimating the cost of a new landfill. This estimation starts with the tonnage remaining to be disposed after all other operations and uses the density of individual constituents to estimate an annual volume to be disposed. Next, a total annual volume "in the ground" is estimated and an annual "operating" area calculated assuming that

operations can go to a depth of 20 feet below the current ground level and continue to a depth of 20 feet above the current level. Operating volume also includes estimates for daily cover soil and a final cover on a finished fill area. Total land requirements then are estimated from the user-defined "landfill life desired" with an additional 30 percent more land for onsite roads, circumferential buffers, and other operational requirements.

Costs for establishing a new landfill are estimated in 1990 dollars and then inflated as are other costs in SW-Options. Estimating factors include land acquisition costs (based on calculated land required times a user-entered local land purchase price), siting costs (including a fixed factor and an annual capacity factor), predevelopment and engineering design costs ($1.50 per total tons disposed), construction costs ($5.00 per total ton disposed), closure costs (dependent on total tons disposed as well as annual capacity), and an addition for general uncertainty. Note that the tonnage to be disposed includes neither increase nor decrease in annual tonnage over the life of the new fill. Table C-11 shows the cost estimation factors for siting a new landfill as used in SW-Options.

It should be noted that siting a new landfill is one of the most sensitive issues in waste management. Citizen opposition to any new waste management facility is important and opposition to landfills tends to be especially strong. The estimate of costs for siting a new landfill may be particularly low if the user's community has a history of active opposition to new waste management operations. Moreover, the estimation method used in the program is not as reliable as the other cost-estimating procedures used throughout SW-Options.

C.8 A FINAL NOTE

The models described are presented as they exist within the SW-Options software. The user is urged to evaluate these models with respect to their appropriateness for the communities being studied. The bases for these models include a wide variety of sources, including EPA documents and presentations, vendor-supplied information, and the authors' own experiences in solid waste processing technology evaluations. The user can modify many of the important values used in the software, but the essential logic is fixed.

Table C-11

Estimated Costs Associated With a New Landfill (Lifetime $)

Activity (Technical Factor)	Capacity Range (TPY) < 25,000	25,000 to 100,000	>500
Land acquisition	*	*	*
Siting cost	50,000	50,000 + 0.75 x TPY	125,000 + .25 x TPY
Predevelopment and engineering design	$1.50 x TT	1.50 x TT	1.50 x TT
Construction cost	$5.00 x TT	5.00 x TT	5.00 x TT
Lifetime operation	10.00 x TT	10.00 x TT	10.00 x TT
Closure cost	2.00 x TT	2.50 x TT	3.00 x TT
Uncertainty factor	2.00 x TT	2.25 x TT	2.50 x TT

Note: As indicated, some costs are based on annual capacity (TPY) and others on total tons (TT) where TT = TPY x Lifetime.

*L (Acres) = ($1.8365 \times 10^{-4} \times TT$)
Land Cost = L multiplied by user-entered local cost of land ($/Acre)

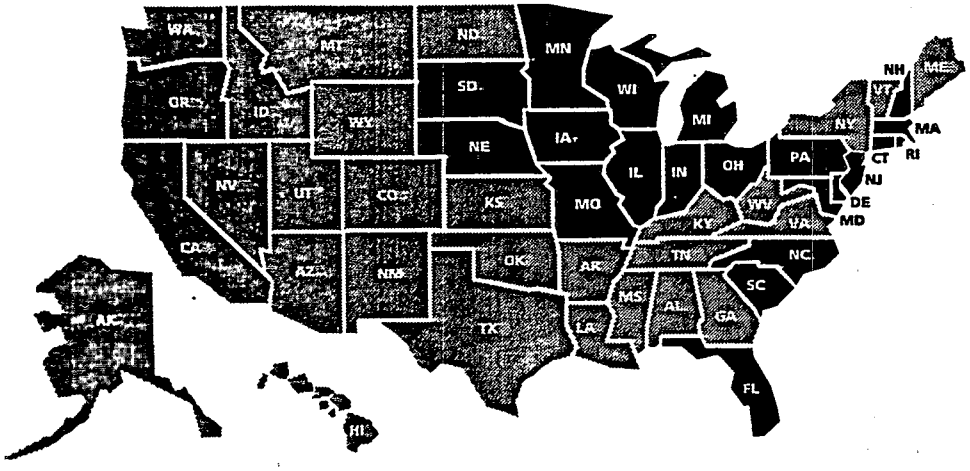
TPY = tons per year
TT = total tons

SW-Options is not intended to serve as a design tool, but rather as an aid for readily performing preliminary evaluation of possible waste management approaches at the local level. Thus, the software's primary function is utilized if it provides the user with a greater understanding of the relative strengths and weaknesses of different waste management approaches being considered for a community.

APPENDIX D

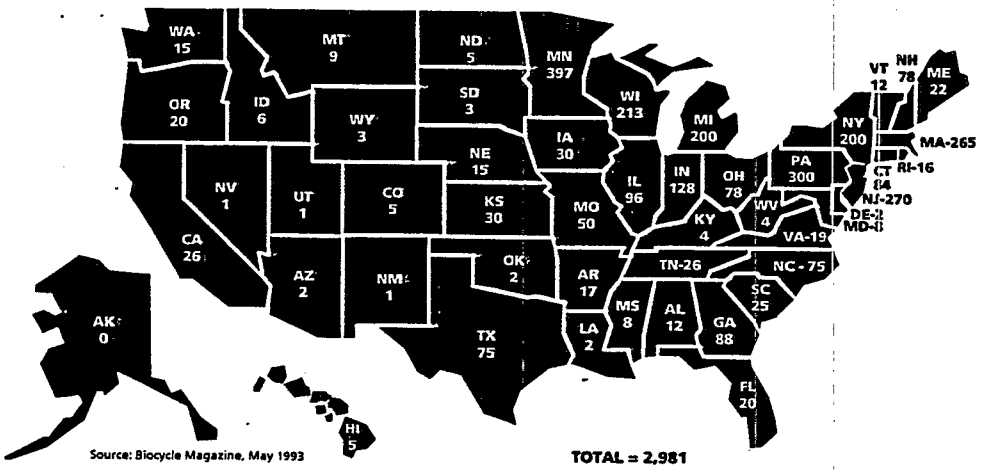
YARDWASTE BANS, COMPOSTING PROGRAMS, AND BOTTLE DEPOSIT RULES BY STATE

STATES THAT BAN YARDWASTE FROM LANDFILLS (as of May 1994)



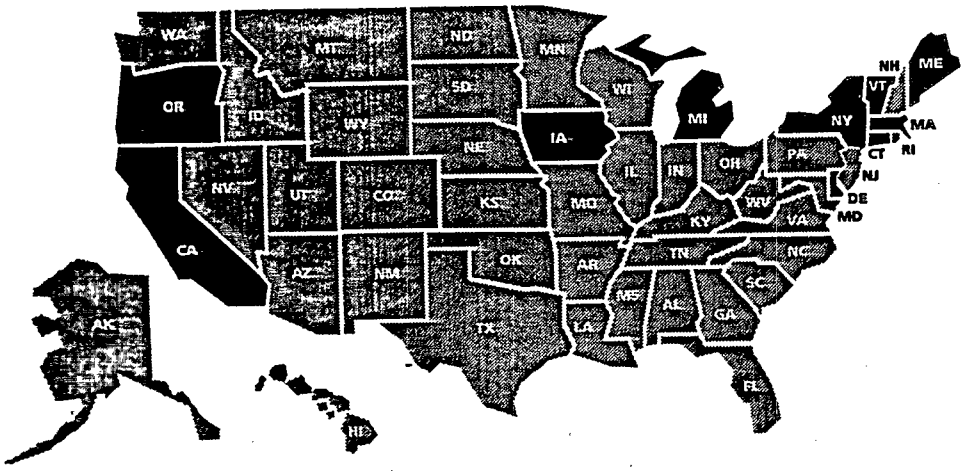
Connecticut
Delaware
Florida
Illinois
Indiana
Iowa
Maryland
Massachusetts
Michigan
Minnesota
Missouri
Nebraska
New Hampshire
New Jersey
North Carolina
Ohio
Pennsylvania
South Carolina
South Dakota
Wisconsin

NUMBER OF YARDWASTE COMPOSTING PROGRAMS BY STATE (as of May 1994)



Source: Biocycle Magazine, May 1993

STATES WITH A BOTTLE DEPOSIT RULE IN EFFECT (as of May 1994)



California
Connecticut
Delaware
Iowa
Maine
Massachusetts
Michigan
New York
Oregon
Vermont

APPENDIX E

FEDERAL ENVIRONMENTAL HOTLINES AND SOLID WASTE AND RECYCLING ASSOCIATION OFFICES

FEDERAL HOTLINES FOR INFORMATION RELATED TO SOLID WASTE MANAGEMENT

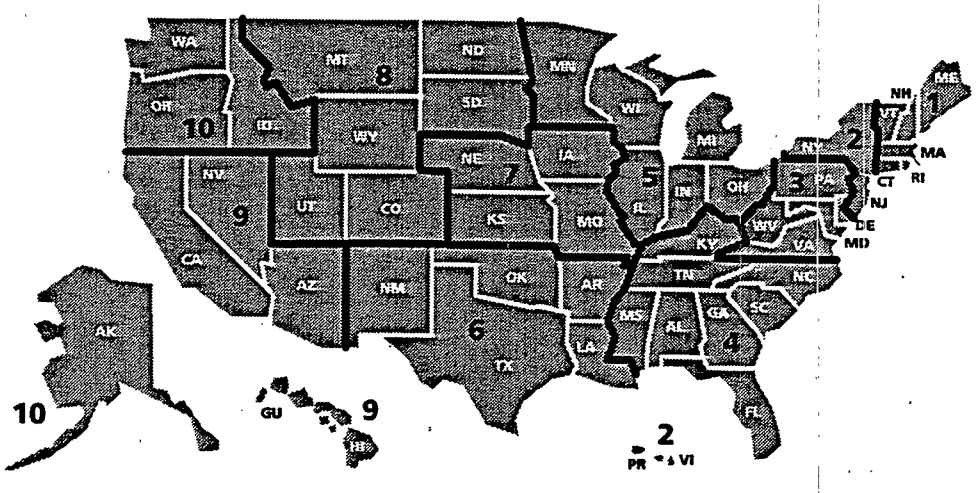
U.S. EPA RCRA HOTLINE

800-424-9346

U.S. EPA RECYCLED PRODUCTS HOTLINE

800-424-9345

U.S. EPA REGIONAL SOLID WASTE OFFICES



REGION 1
CT, MA, ME, NH, RI, VT

U.S. EPA - Region 1
JFK Federal Building
(MC-HER-CAN6)
Boston, MA 02203
Tel: 617-573-9670
Fax: 617-573-9662

REGION 2
NJ, NY, PR, VI

U.S. EPA - Region 2
26 Federal Plaza
(MC-2AWM/HSWP)
New York, NY 10278
Tel: 212-264-9638
Fax: 212-264-7613

REGION 3
DC, DE, MD, PA, VA, WV

U.S. EPA - Region 3
841 Chestnut Street
(MC-3HW53)
Philadelphia, PA 19107
Tel: 215-597-7936
Fax: 215-580-2013

REGION 4
AL, FL, GA, KY, MS, NC, SC, TN

U.S. EPA - Region 4
345 Courtland Street, NE
(MC-4WD-RCRA-FF)
Atlanta, GA 30365
Tel: 404-347-2091
Fax: 404-347-5205

REGION 5
IL, IN, MI, MN, OH, WI

U.S. EPA - Region 5
77 West Jackson Boulevard
(MC-HRP-8J)
Chicago, IL 60604-3590
Tel: 312-886-0976
Fax: 312-353-4788

REGION 6
AR, LA, NM, OK, TX

U.S. EPA - Region 6
1445 Ross Avenue
(MC-6H-HW)
Dallas, TX 75202-2733
Tel: 214-655-6761
Fax: 214-655-6762

REGION 7
IA, KS, MO, NE

U.S. EPA - Region 7
726 Minnesota Avenue
(MC-STPG)
Kansas City, KS 66101
Tel: 913-551-7947
Fax: 913-551-7063

REGION 8
CO, MT, ND, SD, UT, WY

U.S. EPA - Region 8
999 18th Street - Suite 500
(MC-8HWM-WM)
Denver, CO 80202-2466
Tel: 303-293-1667
Fax: 303-293-1488

REGION 9
AZ, CA, HI, NV

U.S. EPA - Region 9
75 Hawthorne Street
(MC-H-3-1)
San Francisco, CA 94105
Tel: 415-744-2091
Fax: 415-744-1044

REGION 10
AK, ID, OR, WA

U.S. EPA - Region 10
1200 Sixth Avenue
(MC-HW107)
Seattle, WA 98101
Tel: 206-553-6522
Fax: 206-553-8509

STATE MUNICIPAL SOLID WASTE OFFICES

ALABAMA

Solid Waste Section
Land Division
Alabama Department of
Environmental Management
Montgomery, AL 36130
Tel: 205-271-7726
Fax: 205-271-7950

ALASKA

Hazardous & Solid Waste Section
Environmental Quality Division
Alaska Department of
Environmental Conservation
410 Willoughby Avenue - Suite 105
Juneau, AK 99801-1795
Tel: 907-465-5150
Fax: 907-465-5164

ARIZONA

Solid Waste Unit
Office of Waste Programs
Arizona Department of
Environmental Quality
3033 North Central Avenue
Phoenix, AZ 85012
Tel: 602-207-4121
Fax: 602-207-4236

ARKANSAS

Solid Waste Division
Department of Pollution Control & Ecology
8001 National Drive
P.O. Box 9583
Little Rock, AR 72209
Tel: 501-570-2659
Fax: 501-562-2541

CALIFORNIA

California Integrated Waste
Management Board
8800 Cal Center Drive
Sacramento, CA 95626
Tel: 916-255-2182
Fax: 916-255-2228

COLORADO

Solid Waste & Incident
Management Section
Colorado Department of Health
4210 East 11th Avenue
Denver, CO 80220
Tel: 303-331-4822
Fax: 303-331-4401

CONNECTICUT

Waste Engineering & Enforcement Division
Connecticut Department of
Environmental Protection
165 Capitol Avenue
Hartford, CT 06106
Tel: 203-566-8844
Fax: 203-566-5255

DELAWARE

Solid Waste Management Branch
Delaware Department of Natural Resources
and Environmental Control
89 Kings Highway
P.O. Box 14010
Dover, DE 19903
Tel: 302-739-3820
Fax: 302-739-5060

DISTRICT OF COLUMBIA

Solid Waste Management Administration
District of Columbia Department of
Public Works
2750 South Capitol Street, SE
Washington, DC 20032
Tel: 202-767-8512
Fax: 202-404-1311

FLORIDA

Solid Waste Section
Florida Department of
Environmental Regulation
Twin Towers Office Building
2600 Blair Stone Road
Tallahassee, FL 32399-2400
Tel: 904-922-6104
Fax: 904-488-6579

GEORGIA

Solid Waste Program
Environmental Protection Division
Georgia Department of Natural Resources
4244 International Parkway - Suite 100
Atlanta, GA 30354
Tel: 404-362-2695
Fax: 404-354-6612

HAWAII

Solid Waste Management Division
Hawaii Department of Health
500 Ala Moana Boulevard
5 Waterfront Plaza
Honolulu, HI 96813
Tel: 808-588-4240
Fax: 808-588-4370

IDAHO

Division of Environmental Quality
Idaho Department of Health & Welfare
1410 North Hilton
Boise, ID 83706
Tel: 208-334-5860
Fax: 208-334-0576

ILLINOIS

Solid Waste Management Section
Illinois Environmental Protection Agency
2200 Churchill Road
P.O. Box 19276
Springfield, IL 62794-9276
Tel: 217-785-8604
Fax: 217-524-4193

INDIANA

Solid Waste Branch
Office of Solid &
Hazardous Waste Management
Indiana Department of
Environmental Management
105 South Meridian Street
Indianapolis, IN 46225
Tel: 317-232-3501
Fax: 317-232-3403

IOWA

Environmental Protection Division
Iowa Department of Natural Resources
Wallace State Office Building
Des Moines, IA 50319
Tel: 515-261-6284
Fax: 515-281-8895

KANSAS

Solid Waste Section
Bureau of Air & Waste Management
Kansas Department of
Health & Environment
Forbes Field - Building 740
Topeka, KS 66620-0001
Tel: 913-296-1594
Fax: 913-296-1592

KENTUCKY

Solid Waste Permitting Branch
Division of Waste Management
Kentucky Department of
Environmental Protection
18 Reilly Road - Fort Boone Plaza
Frankfort, KY 40601
Tel: 502-564-6716
Fax: 502-564-4245

LOUISIANA

Solid Waste Division
Office of Solid & Hazardous Waste
Louisiana Department of
Environmental Quality
P.O. Box 82178
Baton Rouge, LA 70884-2178
Tel: 504-785-0249
Fax: 504-785-0299

MAINE

Bureau of Hazardous Materials &
Solid Waste Control
Maine Department of
Environmental Protection
State House Station 17
Augusta, ME 04333
Tel: 207-289-2651
Fax: 207-289-7826

MARYLAND

Waste Management Administration
Maryland Department of the Environment
2500 Broening Highway
Baltimore, MD 21224
Tel: 410-631-3364
Fax: 410-631-3321

MASSACHUSETTS

Division of Solid Waste
Massachusetts Department of
Environmental Protection
One Winter Street
Boston, MA 02108
Tel: 617-292-5961
Fax: 617-556-1049

MICHIGAN

Waste Management Division
Michigan Department of Natural Resources
P.O. Box 30241
Lansing, MI 48933
Tel: 517-373-9523
Fax: 517-373-4797

MINNESOTA

Solid Waste Section
Ground Water & Solid Waste Division
Minnesota Pollution Control Agency
520 Lafayette Road North
St. Paul, MN 55155
Tel: 612-296-7340
Fax: 612-296-9707

MISSISSIPPI

Non-Hazardous Waste Branch
Bureau of Pollution Control
Mississippi Department of
Natural Resources
P.O. Box 10385
Jackson, MS 39289-0385
Tel: 801-961-5047
Fax: 801-354-6612

MISSOURI

Solid Waste Management Program
Missouri Department of Natural Resources
P.O. Box 176
Jefferson City, MO 65102
Tel: 314-751-5401
Fax: 314-526-3902

MONTANA

Solid Waste Program
Montana Department of
Health & Environmental Sciences
Coswell Building
Helena, MT 59620
Tel: 406-444-1430
Fax: 406-444-1499

NEBRASKA

Integrated Waste Management Section
Nebraska Department of
Environmental Control
P.O. Box 98922
Lincoln, NE 88509
Tel: 402-471-2186
Fax: 402-471-2902

NEVADA

Nevada Division of
Environmental Protection
123 West Nye Lane - Capitol Complex
Carson City, NV 89710
Tel: 702-667-5872
Fax: 702-885-0868

NEW HAMPSHIRE

Waste Management Division
New Hampshire Department of
Environmental Services
P.O. Box 95
Concord, NH 03301
Tel: 603-271-3505
Fax: 603-271-2456

NEW JERSEY

Solid Waste Management Division
New Jersey Department of
Environmental Protection & Energy
840 Bear Tavern Road (CN-414)
Trenton, NJ 08825-0414
Tel: 609-530-8591
Fax: 609-530-8899

NEW MEXICO

Solid Waste Bureau
New Mexico Environment Department
1190 St. Francis Drive
Santa Fe, NM 87502
Tel: 505-827-2853
Fax: 505-827-2909

NEW YORK

Division of Solid Waste
New York Department of
Environmental Conservation
50 Wolf Road
Albany, NY 12233
Tel: 518-457-6603
Fax: 518-457-1283

NORTH CAROLINA

Solid Waste Section
North Carolina Department of
Environmental Health &
Natural Resources
P.O. Box 27687
Raleigh, NC 27611-7687
Tel: 919-733-0692
Fax: 919-733-4810

NORTH DAKOTA

Solid Waste Program
North Dakota Department of Health
P.O. Box 5520
1200 Missouri Avenue
Bismarck, ND 58502-5520
Tel: 701-221-5166
Fax: 701-221-5200

OHIO

Division of Solid &
Hazardous Waste Management
Ohio Environmental Protection Agency
1800 Watermark Drive
P.O. Box 1049
Columbus, OH 43266-0149
Tel: 614-644-3181
Fax: 614-644-2329

OKLAHOMA

Solid Waste Division
Oklahoma Department of
Environmental Quality
P.O. Box 53551
1000 Northeast 10th Street
Oklahoma City, OK 73117-1212
Tel: 405-745-7100
Fax: 405-745-7133

OREGON

Hazardous & Solid Waste Division
Oregon Department of
Environmental Quality
811 Southwest Sixth Avenue
Executive Building
Portland, OR 97204
Tel: 503-229-5356
Fax: 503-229-6124

PENNSYLVANIA

Division of Municipal & Residual Waste
Bureau of Waste Management
Pennsylvania Department of
Environmental Regulation
P.O. Box 6472
Harrisburg, PA 17105-8472
Tel: 717-783-7381
Fax: 717-787-1904

RHODE ISLAND

Waste Management Division
Rhode Island Department of
Environmental Protection
9 Hayes Street
Providence RI, 02908
Tel: 401-277-2797
Fax: 401-277-2017

SOUTH CAROLINA

Division of Solid Waste Management
Bureau of Solid &
Hazardous Waste Management
South Carolina Department of
Health & Environmental Control
2600 Bull Street
Columbia, SC 29201
Tel: 803-734-5200
Fax: 803-734-4901

SOUTH DAKOTA

Office of Waste Management
South Dakota Department of
Environment & Natural Resources
500 East Capitol
Pierre, SD 57501-3181
Tel: 605-773-4222
Fax: 605-773-5286

TENNESSEE

Division of Solid Waste Management
Tennessee Department of
Environment & Conservation
701 Broadway
Customs House - 4th floor
Nashville, TN 37247-3530
Tel: 615-741-3424
Fax: 615-741-4666

TEXAS

Municipal Solid Waste Division
Texas Natural Resources
Conservation Commission
P.O. Box 13087
Austin, TX 78711-3087
Tel: 512-908-6692
Fax: 512-908-6717

UTAH

Solid Waste Program
Division of Solid & Hazardous Waste
Utah Department of Environmental Quality
Salt Lake City, UT 84114-4866
Tel: 801-538-6170
Fax: 801-538-8118

VERMONT

Management Division
Vermont Department of
Environmental Conservation
103 South Maine Street
Waterbury, VT 05871-0407
Tel: 802-244-7831
Fax: 802-244-5141

VIRGINIA

Virginia Department of Waste Management
101 North 14th Street
James Monroe Building - 11th floor
Richmond, VA 23219
Tel: 804-225-2667
Fax: 804-225-3753

WASHINGTON

Solid & Hazardous Waste Program
Washington Department of Ecology
P.O. Box 47600
Olympia, WA 96504-7600
Tel: 206-459-6316
Fax: 206-438-7484

WEST VIRGINIA

Waste Management Section
West Virginia Division of
Environmental Protection
1356 Hansford Street
Charleston, WV 25301
Tel: 304-558-5929
Fax: 304-558-0256

WISCONSIN

Solid Waste Management Section
Bureau of Solid &
Hazardous Waste Management
Wisconsin Department of Natural Resources
P.O. Box 7921
Madison, WI 53707
Tel: 608-288-0520
Fax: 608-287-2788

WYOMING

Solid Waste Program
Wyoming Department of
Environmental Quality
122 West 25th Street
Hershler Building - 4th floor
Cheyenne, WY 82002
Tel: 307-777-7752
Fax: 307-777-5973

STATE RECYCLING ASSOCIATION OFFICES

ARKANSAS

Arkansas Recycling Coalition
2705 Chapman Road
Springdale, AR 72764
501-756-2900

ARIZONA

Arizona Recycling Coalition
101 South Central
Phoenix, AZ 85004
602-256-3170

CALIFORNIA

California Resource Recovery Association
4395 Gold Trail Way
Loomis, CA 95659-8901
916-652-4450

NORTHERN CALIFORNIA

Northern California Recycling Association
651 Pine Street
4th Floor - North Wing
Martinez, CA 94553-0095
510-682-3582

COLORADO

Rocky Mountain Recycling
10748 El Dorado Place
Englewood, CO 80111
303-774-1253

CONNECTICUT

Connecticut Recyclers Coalition
P.O. Box 4038
Old Lyme, CT 06371
203-774-1253

FLORIDA

Recycle Florida
7501 North Jog Road
West Palm Beach, FL 33412
407-471-2700

GEORGIA

Roy F. Westin, Inc.
1880-H Beaver Ridge Circle
Norcross, GA 30071
404-448-0644

HAWAII

Recycling Association of Hawaii
162 North King Street
Honolulu, HI 96817
808-599-1976

ILLINOIS

Illinois Recycling Association
407 South Dearborn Street
Chicago, IL 60605
312-939-2985

INDIANA

Indiana Recycling Coalition
P.O. Box 20444
Indianapolis, IN 46220-0444
317-283-6226

IOWA

Iowa Recycling Association
2742 Southeast Market Street
Des Moines, IA 50317
515-265-4275

KENTUCKY

Kentucky Recyclers Association
2207 Eastern Avenue
Covington, KY 41014
606-356-8555

MARYLAND

Maryland Recyclers Coalition, c/o COG
777 North Capitol Street, NE
Suite 300
Washington, DC 20002-4201
202-962-3358

MASSACHUSETTS

MassRecycle
112 Elm Street
Pittsfield, MA 01201
413-445-4556

MICHIGAN

Michigan Recycling Coalition
P.O. Box 10240
Lansing, MI 48901
213-469-9595

MINNESOTA

Recycling Association of Minnesota
P.O. Box 292
Circle Pines, MN 55014
612-481-1143

MISSOURI

Missouri State Recycling Association
P.O. Box 331
St. Charles, MO 63301
314-947-9766

MONTANA

Associated Recyclers of Montana
450 Charles Street
Billings, MT 59101
406-252-5721

NEBRASKA

Nebraska State Recycling Association
1615 Howard Street
Omaha, NE 68102
402-444-4188

NEVADA

Nevada Recycling Coalition
P.O. Box 70393
Reno, NV 89507-0393
702-829-6872

NEW HAMPSHIRE

Northeast Resource Recovery Association
P.O. Box 721
Concord, NH 03302
603-224-6996

NEW JERSEY

Association of New Jersey Recyclers
120 Finderne Avenue
Bridgewater, NJ 08807
908-722-7575

NEW YORK

New York State Association for Recycling
46 East Bridge Street
Oswego, NY 13126
315-349-8329

NORTH CAROLINA

North Carolina Recycling Association
7330 Chapel Hill Road - Suite 207
Raleigh, NC 27607
919-851-8444

NORTH DAKOTA

North Dakota Recyclers Association
P.O. Box 1196
Bismarck, ND 58502
701-223-6850

OHIO

Association of Ohio Recyclers
1300 Weathervane Lane
Akron, OH 44313
216-867-5225

OREGON

Association of Oregon Recyclers
P.O. Box 15279
Portland, OR 97215
503-255-5087

PENNSYLVANIA

Pennsylvania Resources Council
P.O. Box 88
Media, PA 19063
215-565-9131

RHODE ISLAND

Rhode Island Recycling Association
51 Bridge Street
Newport, RI 02840
401-847-7242

SOUTH CAROLINA

South Carolina Recycling Association
1205 Pendleton Street - Suite 517
Columbia, SC 29201
803-734-0143

SOUTH DAKOTA

Recycling Coalition of South Dakota
P.O. Box 84041
Sioux Falls, SD 57105
605-334-7839

TENNESSEE

Tennessee Recycling Coalition
401 Church Street - 14th Floor
Nashville, TN 37243-0455
615-532-0074

TEXAS

Recycling Coalition of Texas
P.O. Box 2359
Austin, TX 78768
512-476-2981

VIRGINIA

Virginia Recycling Association
2735 Hartland Road
Falls Church, VA 22043
703-204-0680

VERMONT

Association of Vermont Recyclers
P.O. Box 1244
Montpelier, VT 05601-1244
802-229-1833

WISCONSIN

Associated Recyclers of Wisconsin
1340 East Waterford
St. Francis, WI 53235
414-744-1688

WASHINGTON

Washington State Recycling Association
203 East Fourth Street - Suite 422
Olympia, WA 98501
206-352-8737

APPENDIX F

COMMENT FORM

SOLID WASTE OPTIONS SOFTWARE
(SW-Options)

Eastern Research Group, Inc.

COMMENT FORM

Please complete this form and return it to Linda Diamond.

ERG FAX: 617-674-2851

Mail to: ERG, Inc., 110 Hartwell Ave., Lexington, MA 02173-3198

USER INFORMATION (To be completed by user)

Your Name: _____ Date: _____

Characterize this request as one of the following: ____ Problem ____ Enhancement ____ Open Issue

DESCRIPTION

(Where applicable, identify the form, page, and field involved. Attach any supporting material.)

SOFTWARE DEVELOPMENT TEAM INFORMATION

(To be completed by ERG software development personnel.)

Received by: _____ Date: _____

Assigned to: _____ Date: _____

Comments: (Use reverse side if necessary.)

ERG Software Applications Development Group