DOCUMENTATION FOR THE FRAMES-HWIR TECHNOLOGY SOFTWARE SYSTEM, VOLUME 11: SYSTEM USER'S GUIDE

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Summary

The U.S. Environmental Protection Agency (EPA) is developing a comprehensive environmental exposure and risk analysis software system for agency-wide application. The software system will be applied to the technical assessment of exposures and risks relevant to the Hazardous Waste Identification Rule (HWIR). The software system adapted to automate this assessment is the Framework for Risk Analysis in Multimedia Environmental Systems (FRAMES), developed by the Pacific Northwest National Laboratory (PNNL). The process used to develop the FRAMES-HWIR Technology Software System includes steps for requirements analysis, design, specification, and development with testing and quality assurance composing a critical portion of each step. This report documents how the FRAMES-HWIR Technology Software System is used and what the user can expect from it.

The user of this document is anyone who is running the FRAMES-HWIR Technology Software System for the assessment of risks under the HWIR project. It is especially important for first-time or occasional users to refer to this document to ensure the computer they are using meets the requirements of the FRAMES-HWIR Technology Software System. Frequent users may want to refer to the input and output files and the protocols of using the FRAMES-HWIR Technology Software System.

The key elements of the document are

1)   Overview of FRAMES-HWIR Technology Software System
2)   Requirements of the computer, operating system, and user
3)   Input and output files of the FRAMES-HWIR Technology Software System
4)   Functions associated with the FRAMES-HWIR Technology Software System
5)   Help associated with FRAMES-HWIR Technology Software System.

Acronyms and Abbreviations

ASCII	American Standard Code for Information Interchange
COP	Computational Optimization Processor
DSP	Distribution Statistics Processor
ELP	Exit Level Processor
EPA	U.S. Environmental Protection Agency
FRAMES	Framework for Risk Analysis in Multimedia Environmental Systems
GRF	Global Results File
HWIR	Hazardous Waste Identification Rule
IBM	International Business Machines
MET	meteorological
MHz	megahertz
MMSP	Multimedia Multipathway Simulation Processor
PC	personal computer
PNNL	Pacific Northwest National Laboratory
PSOF	Protective Summary Output File
RAM	random access memory
RSOF	Risk Summary Output File
RVP	Risk Visualization Processor
SDP	Site Definition Processor
SLP	Site Layout Processor
SSF	Site Simulation Files
SUI	System User Interface

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1.0 Introduction

The U.S. Environmental Protection Agency (EPA) is developing a comprehensive environmental exposure and risk analysis software system for agency-wide application. The software system will be applied to the technical assessment of exposures and risks relevant to the Hazardous Waste Identification Rule (HWIR). The HWIR is designed to determine quantitative criteria for allowing a specific class of industrial waste streams to no longer require disposal as a hazardous waste (that is, to exit Subtitle C) and to allow disposal in Industrial Subtitle D facilities. Hazardous waste constituents with concentrations less than these exit criteria levels would be reclassified as nonhazardous wastes under the Resource Conservation and Recovery Act.

The software system adapted to automate this assessment is the Framework for Risk Analysis in Multimedia Environmental Systems (FRAMES), developed by the Pacific Northwest National Laboratory (PNNL). The FRAMES-HWIR Technology Software System consists of a series of components within a system framework (Figure 1.1). The process used to develop the FRAMES-HWIR Technology Software System includes steps for requirements analysis, design, specification, and development with testing and quality assurance composing a critical portion of each step. This process is described in a number of documents, as listed in Section 5.0. This document provides an overview and detailed description of the application and use of the FRAMES-HWIR Technology Software System.

1.1 Document Overview

This document provides the user with information to conduct risk simulations for the HWIR project using the FRAMES-HWIR Technology Software System. It provides information on the requirements, operating procedures, example simulation, software help, and references associated with the software system. This document assumes that all software and databases required for the FRAMES-HWIR Technology Software System have been properly installed on the computer and the hardware associated with the computer meets the software requirements (Section 2.1). The document also assumes the computer is running Windows® 95. The user then activates the software system by clicking on the software system icon. This action will execute the software system interface. Through this System User Interface (SUI), the user can configure the system by defining locations of databases, data files, and processor and module executables. The user can also manage the risk simulations by defining the site, chemicals, source types, waste levels, storage level, and number of iterations to be processed. Finally, the user can query the status of the simulations and can stop and resume processing.

This document provides the user information on requirements and operation of the FRAMES-HWIR Technology Software System. Specifications for the system processors and the computational modules are described in *Documentation of the FRAMES-HWIR Technology Software System, Volume 8: Specifications*. Section 1.0 of this user document is an introduction to the document and its purpose; Section 2.0 provides the system, user, and file requirements; Section 3.0 describes the operational function of the system; Section 4.0 provides a description of an example simulation; and Section 5.0 lists the references cited in this document. Other components developed by PNNL are described in companion documents, as listed in the reference list; the system itself is documented in a summary report entitled *Overview of the FRAMES-HWIR Technology Software System*.
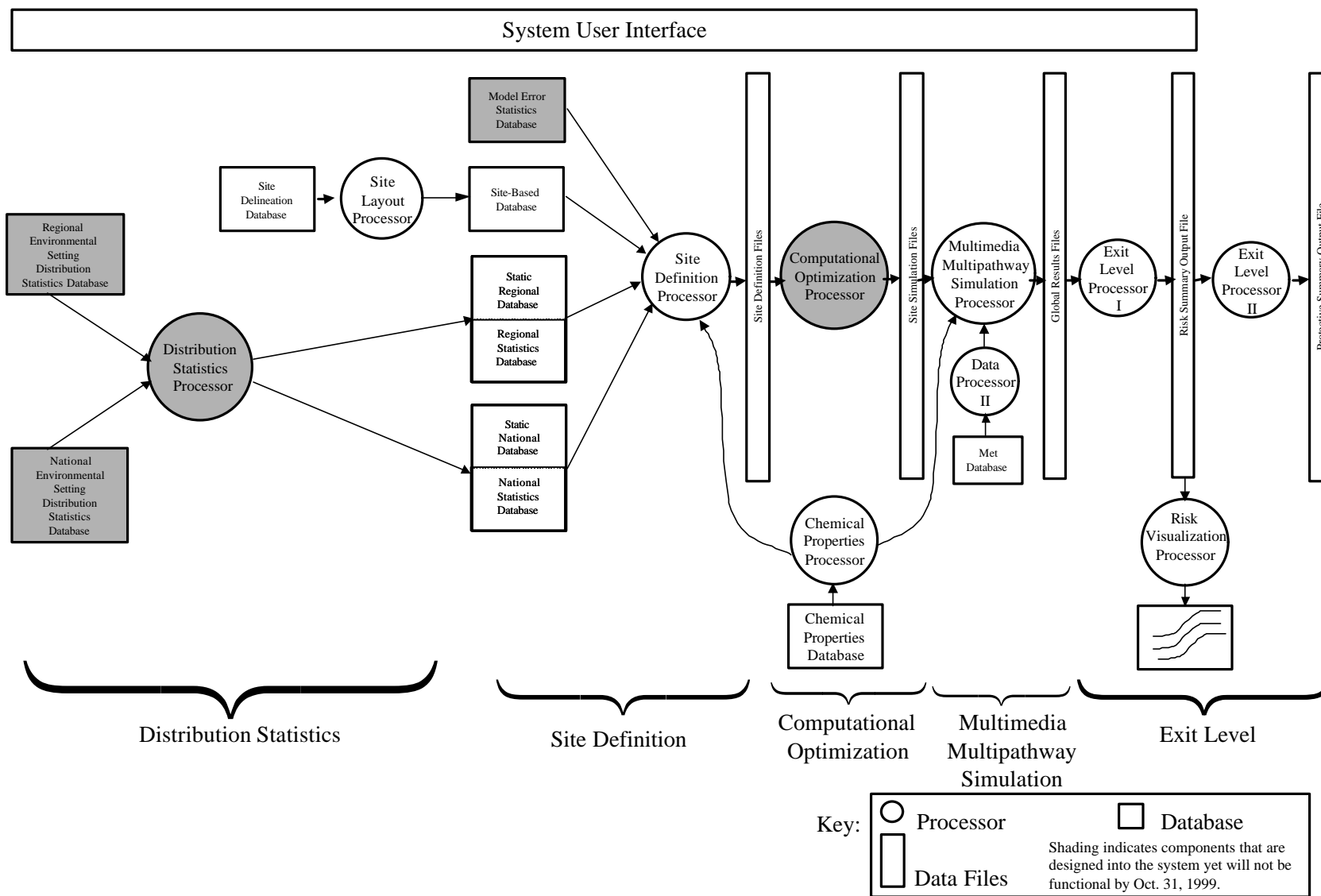
Figure 1.1 Overview of the FRAMES-HWIR Technology Software System

1.2

1.2 System Overview

The FRAMES-HWIR Technology Software System consists of a user interface and a series of processors within a system framework. The interface and processors work together to answer the question: *"At what concentration level, before disposal, would a particular chemical be nonhazardous to humans and the environment near a particular disposal facility?"* The user provides input through the system user interface to select the facilities to be evaluated, which types of waste management units to use, which chemicals to consider, and the location of files containing key information. This information is used as input to the definition of a particular site.

The user provides input through the SUI to select the site to be evaluated, which types of sources to consider, which chemicals to consider, waste concentration levels, and the location of files containing key information. This information is used as input to characterize a site and its potential impacts to surrounding receptors. In this context, site refers to a waste management facility, which might contain one or more waste management unit modules, such as aerated tanks, landfills, land application units, surface impoundments, or waste piles. The list of modules included in the Multimedia Multipathway Simulation Processor (MMSP) are source modules (aerated tank, land application unit, landfill, surface impoundment, and waste pile), environmental fate and transport modules (air, watershed, waterbody network, aquifer, and vadose zone), foodweb and foodchain modules (farm foodweb, terrestrial foodweb, and aquatic foodchain), and exposure and risk modules (human and ecological). Processors that are included in the FRAMES-HWIR Technology Software System are the Distribution Statistics Processor (DSP), the Site Layout Processor (SLP), the Site Definition Processor (SDP), the Computational Optimization Processor (COP), the MMSP, the Exit Level Processors (ELPs), or the Risk Visualization Processor (RVP). All modules and processors interact with the SUI. In addition, the system accesses the site-based, static regional database, regional statistics database, static national database, and national statistics database and produces the Risk Summary Output Files (RSOFs) and the Protective Summary Output Files (PSOFs).

Whenever possible, data collected at actual waste management facilities are used to fill the databases from which site information is defined. However, when such data are not available, the system selects appropriate information from either regional or national data of the same type. For example, if a site in Georgia were missing data related to rainfall, the system would select a distribution of regional rainfall data or, if that is not available, a distribution of national rainfall data is used to provide the necessary information.

The system collects data from databases specified by the user to create a full definition of a particular site. This information is used by a group of models to simulate transport of contamination through the environment. The system then assesses risks through a complex modeling protocol that looks at release of contaminants in a variety of ways; transport of those contaminants through the environment; exposure of humans, animals, and plants; and the resulting risks or hazards posed by such exposures. For each particular site, the appropriate models are chosen for implementation.

The key to the risk simulations is the MMSP, which consists of a set of computational modules and a Module Execution Manager. These computational modules include source, transport, foodweb and foodchain, and exposure/risk modules. The SUI allows the user to interact with the software system. The main input data for the system are from the site-based, regional, and national databases. The output data files for the system are the Risk Summary Output Files (RSOFs) and the Protective Summary Output Files (PSOFs).

1.3

The interrelationships between input/output data files, computational modules, the Module Execution Manager, and the SUI are schematically illustrated in Figure 1.2. As shown in the figure, the MMSP receives input from the Site Simulation Files (SSFs), as well as user input through the SUI. The SUI is the user interface of the entire system and allows the user to select databases, executables, and operation mode for the simulations. The MMSP Module Execution Manager manages data flow and the execution of the appropriate modules. The SSF contain all the site data needed to run a simulation. Following directions in this input, the MMSP Module Execution Manager provides the names and locations of the files, as specified by the user, needed to execute the appropriate computational modules. The MMSP Module Execution Manager ensures the computational modules execute in the appropriate sequence to assess risk for a particular simulation. Computational modules write results to the Global Results Files (GRFs). These results are used by the other computational modules and the ELPs to calculate potential waste concentrations by site and source type.

System User Interface

List of sites

List of chemicals

Error/Warning Files

Header and Directory

Error/Warning Files

Header and Directory

Error/Warning Files

Header and Directory

Error/Warning Files

Header and Directory

Error/Warning Files

Header and Directory

Site-Based Database

Chemical Properties Database

Chemical Properties Processor

Site Definition Processor

Site Definition Files

Computational Optimization Processor

Site Simulation Files

Multimedia Multipathway Simulation Processor

Global Results Files

Exit Level Processor I

Risk Summary Output File

Exit Level Processor II

Protective Summary Output File

Key: ◯ Processor   ▢ Database

▯ Data Files

Shading indicates components that are designed into the system yet will not be functional by Oct. 31, 1999.
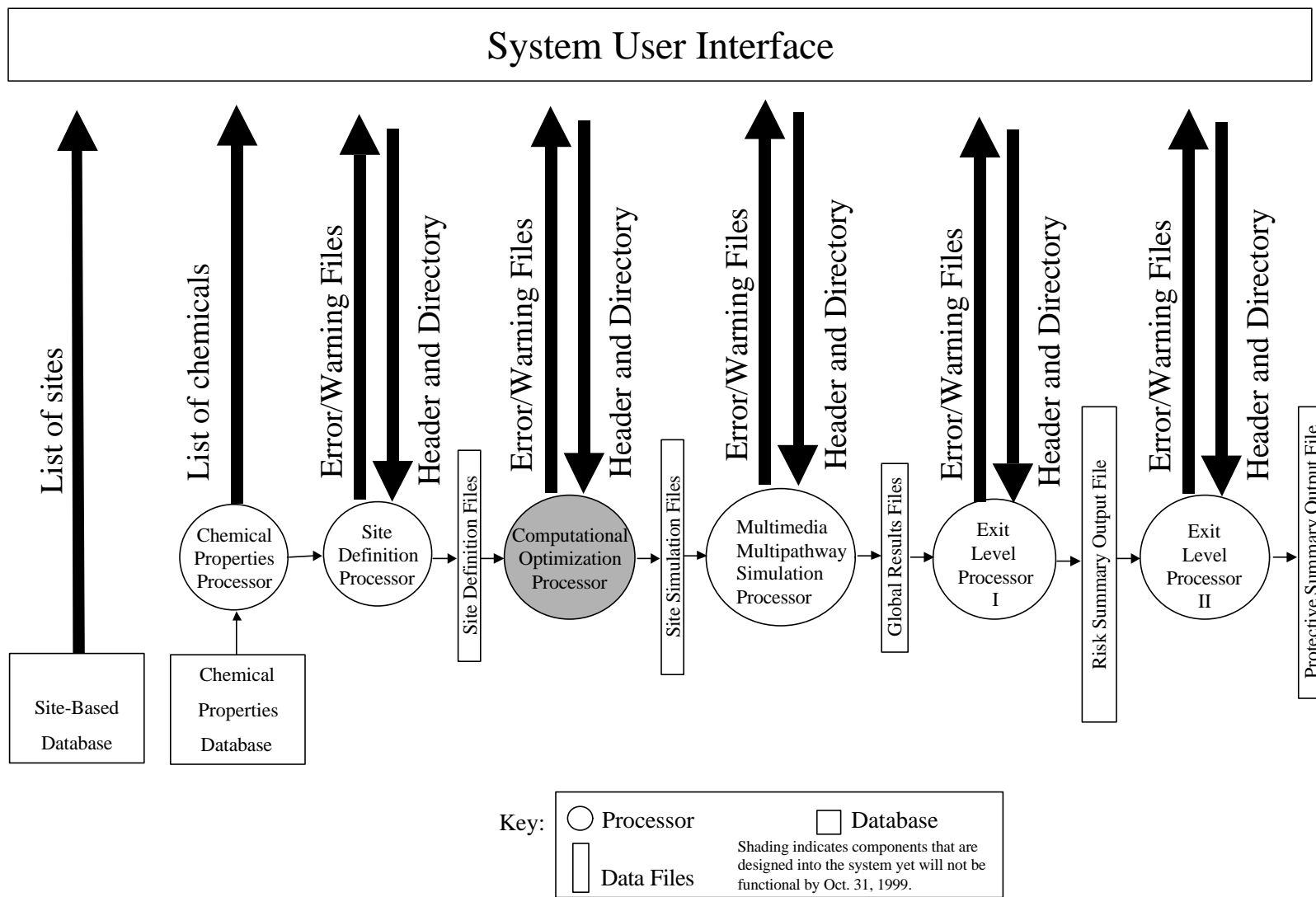
Figure 1.2 Detail of the System User Interface Interfaces with Other System Components

1.5

2.0 Requirements

This section of the document provides the hardware and software requirements for the FRAMES-HWIR Technology Software System. This document assumes the FRAMES-HWIR Technology Software System has been properly installed on the computer and is accessible. Requirements for the user to operate the software system are listed, along with the input and output files and data requirements.

2.1 System Requirements

The system-level requirements for the FRAMES-HWIR Technology Software System are listed as follows.

The FRAMES-HWIR Technology Software System will be implemented on one or multiple stand-alone IBM Pentium (586)-compatible personal computers (PC) using a Windows® 95 environment (32-bit). The PC should have, at a minimum, a 200 megahertz (MHz) processing speed, 64 megabytes of RAM, and a 6-gigabyte (or larger) hard drive. The preceding list of requirements describes the hardware requirements for the FRAMES-HWIR Software System; the following are the software-system design requirements of the FRAMES-HWIR software system. The system software is designed with performance criteria emphasizing run-time efficiencies, using an object-oriented system with each processor/module developed for a specific purpose and linked through data specifications. The FRAMES-HWIR Technology Software System accommodates existing environmental models in a variety of programming languages (such as, FORTRAN, C++, C). The SUI and processors are programmed in C++.

The FRAMES-HWIR Technology Software System accesses the regional and national environmental setting distribution statistics, model error statistics, site-based statistics, regional statistics, national statistics, site survey, MET (meteorological station data), and chemical properties databases. These databases are in Microsoft® Access file format and are populated by EPA. The system produces the Site Definition Files, SSF, GRF, RSOF, and PSOF. These system data files use a flat-ASCII file format (sequence-independent). The user interacts with the software system through the SUI.

2.2 User Requirements

The requirements for the user of the FRAMES-HWIR Technology Software System are:

1) User is familiar with PC and Windows® 95 operations.
2) User has read the system overview (Volume 1) of the FRAMES-HWIR Technology Software System documentation.
3) User is familiar with and has available all system processor and module documentation.
4) User is familiar with multimedia risk assessment.

Meeting these user requirements ensures the user can properly operate the FRAMES-HWIR Technology Software System. If the user is not familiar with the PC (for example, a Macintosh or Unix user) or with Windows® 95, a possibility exists for misuse of the system software or an error to occur. Also, if the user is not familiar with the FRAMES-HWIR Technology Software System, errors can occur in its application. The document *Overview of the FRAMES-HWIR Technology Software System (Documentation of the FRAMES-HWIR Technology System, Volume 1)* provides the user with a high-level description and purpose of the software system and its components. By reading the system overview document, the user will have the basic knowledge of the software and how it works. The user also needs to have some knowledge of the

processors and modules being executed in the software system. The user needs to know what and where all the databases and executables are and where to store the output files. If an error or warning message occurs, the user needs to know what to do to correct the problem. The user requirements are not to restrict the use of the FRAMES-HWIR Technology Software System, but to reduce the misuse or inappropriate application of the software.

2.2.1 About This Guide

Certain notational conventions are used throughout the rest of this volume. These conventions provide helpful information on the operation of the FRAMES-HWIR Technology Software System.

In this guide, all button names are **Boxed** like this and bolded, so you can easily identify them; file names and their extensions are in italics; the name of a screen or subscreen is presented in small caps sans serif (for example, SYSTEM MANAGEMENT SCEREEN). Menu item names are denoted using bold-faced text type. Mode names (such as Stop on Error) appear on the screen in a font type that looks like this: **Stop on Error**. Status indicators, such as OFF and ON, are shown in the text as all caps with a serif typeface. Notes and their text are in bolded, italicized text and are usually boxed, as well.

2.3 Input and Output Files and Data Requirements

All databases, processor and module executables, and other relevant files to operate the FRAMES-HWIR Technology Software System are assumed to be properly installed on the computer. The user needs to know where these files are so they can be specified to the software. The key databases that must be installed on the computer are the site-based, regional distribution, national distribution, static regional, static national, site survey, chemical properties, and MET databases. Refer to *Documentation for the FRAMES-HWIR Technology Software System, Volume 4: Site Definition Processor* and *Volume 6: Multimedia Multipathway Simulation Processor* (see Section 5.0) for descriptions of these databases. The databases are the responsibility of the EPA and are developed in conjunction with the software system but are not the responsibility of the system.

Several key directories contain or will store data files. These directories are for the SSFs, GRFs, RSOFs, PSOFs, chemical properties database, and intermediate output files from modules. These directories are identified by the user through the SUI before any simulation is conducted. The directories also allow the software system to locate and access the appropriate information or store the results of the simulation.

The different system processors must be specified and accessed by the user to operate the FRAMES-HWIR Technology Software System. The SUI is a processor that is activated by the system icon through Windows® 95. The other system processors are specified and activated by the SUI. The user must provide the location of the DSP, SDP, COP, MMSP, ELP I, and ELP II. After their location and simulation data are established, these processors operate independently of the user.

The locations of the following modules associated with the HWIR project must also be specified by the user:

- C   source (land application unit, waste pile, surface impoundment, aerated tank, and landfill)
- C   transport (vadose zone, aquifer, watershed, waterbody network, and air)
- C   foodweb and foodchain (aquatic foodweb, terrestrial foodweb, and farm foodchain)
- C   exposure/risk (ecological exposure, ecological risk, human exposure, and human risk).

The user must specify the locations of these different modules to allow the system software to access and execute them.

3.0 Operational Functions

This section describes the different functions and tasks the FRAMES-HWIR Technology Software System was built to perform. These operational functions are described in detail in the sequence that a user would generally conduct an assessment. The three main functions of the FRAMES-HWIR Technology Software System are system configuration, management, and status. The system configuration function defines the locations of database files and processor and module executables required to run a simulation. This function also specifies where the data files that are produced by the system are stored. The system management function defines which sites, chemicals, source types, and waste levels are included in the simulation, as well as the storage level of output, the number of iterations, and the run mode. The system status function allows the user to stop and resume the simulation. It also reports any errors or warnings that may have occurred during the simulations. These warnings and errors are shown to the user in the Messages area of the SYSTEM STATUS SCREEN.

3.1 System Configuration

The system configuration function is managed through the SYSTEM CONFIGURATION SCREEN of the software SUI that, in turn, has several functions. In general, this screen allows the user to select and define (i.e., the location) the system databases, data files, processors, and modules used for the simulation.

3.1.1 Databases

Six databases must be available to the system software to run a simulation: site-based, regional distribution, national distribution, static regional, static national, and site survey databases. The Database subscreen of the SYSTEM CONFIGURATION SCREEN allows users to specify where these databases are located on the computer. These six databases must be installed onto the computer before this function is implemented. The user can use the $\boxed{\bullet\ \bullet\ \bullet}$ button to **Open** the correct databases. The $\boxed{\bullet\ \bullet\ \bullet}$ button is used to browse file/directory locations. Figure 3.1 shows the database selection function of the SYSTEM CONFIGURATION SCREEN and the six databases that must be selected. The user must specify, using the SUI, the drive and directories where these databases are located.

3.1.2 Directories

The Directories subscreen of the SYSTEM CONFIGURATION SCREEN also allows the user to specify where the system files are stored and where the chemical properties and MET Data files are located. Figure 1.2 shows the relationship of these data files to the SUI and MMSP. Figure 3.2 shows the Directories subscreen of the system configuration screen. The user can use the $\boxed{\bullet\ \bullet\ \bullet}$ button to specify the directories where these outputs files should be stored or type in the appropriate drive and directory (for example, C:\HWIR\OUTPUT). The key system data files that need to be defined are illustrated in Figure 3.2 and are as follows:
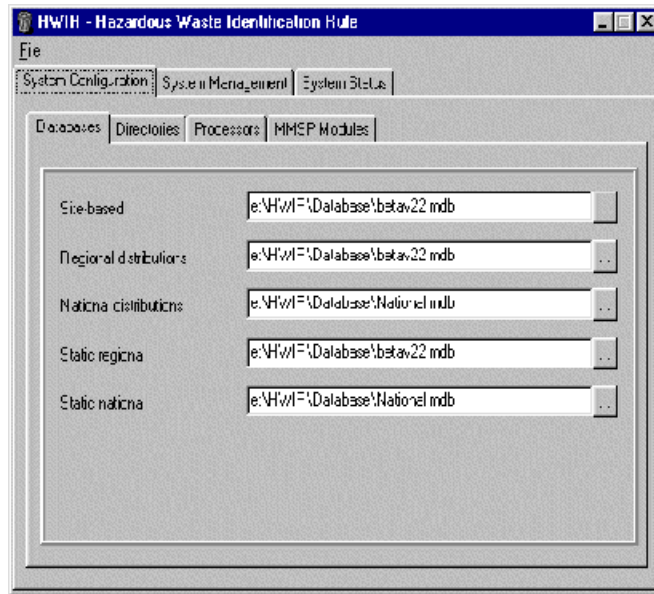
Figure 3.1 Database Selection Function of the System
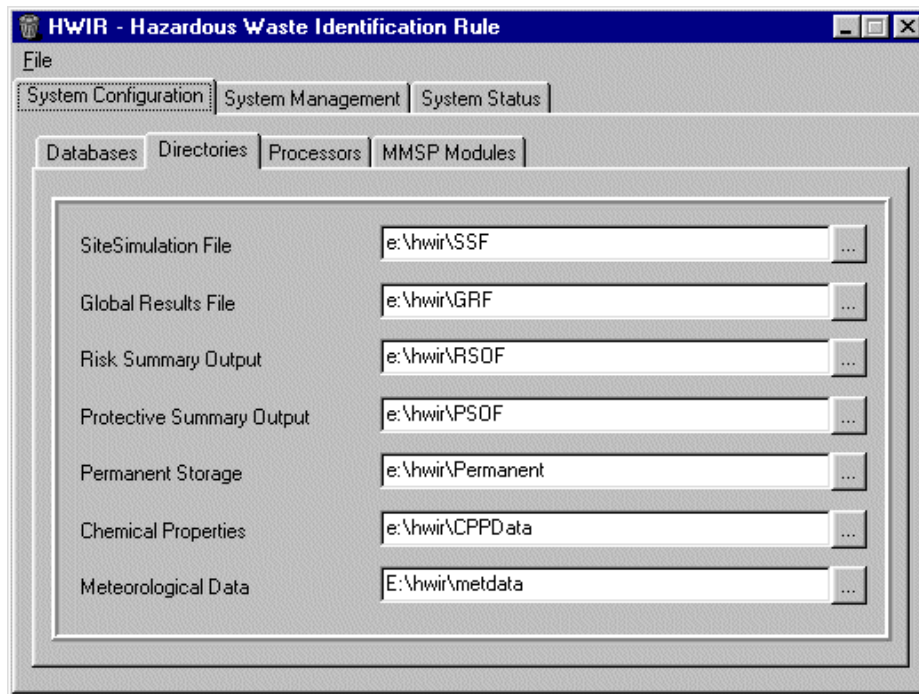Configuration Screen

Figure 3.2 System Data File Locations of the System Configuration Screen

3.2

- C   SSFs
- C   GRFs
- C   RSOFs
- C   PSOFs
- C   Permanent Storage
- C   chemical properties database
- C   MET database

The SSF, GRF, RSOF, and PSOF data files are produced by the system during a simulation. These data files are the standard data files of the system and are produced by the system processors. They contain all the site data required by all modules, except those supplied by the Chemical Properties and MET databases, and information describing the assessment scenario to be implemented. Source types, transport and exposure media, and receptor characteristic data are included. The GRF contain all the key output data from the MMSP modules that were executed during the simulation. The RSOF is the output file of the ELP I and contains key exposure and risk results from the simulations. The PSOF is produced by the ELP II and contains summary exposure and risk information. Permanent Storage allows the user to specify where the important files associated with the MMSP modules are stored. The level of importance attributed to the output files for storage purposes is defined by the SELECTIONS subscreen of the SYSTEM MANAGEMENT SCREEN that is described in the next section. The chemical properties database contains the data that governs the parameters for all chemical variables that vary by temperature or pH. The MET database contains five different meteorological data sets for the site: hourly, daily, monthly, annual, and long-term climatological data.

3.1.3 Processors

A total of six system processors must be specified by the user: DSP, SDP, COP, MMSP, ELP I, and ELP II. The user can click on the [• • •] button to **Open** the correct executables or type the appropriate drive, directory, and file name (for example, C:/HWIR/PROCESSOR/SDP.EXE). Each processor must be identified and opened before a simulation can be started. Figure 3.3 shows the processors subscreen of the system configuration screen.

3.1.4 MMSP Modules

The four types of modules specified by the user to run simulations are the source, transport, foodweb and foodchain, and exposure/risk modules. The user clicks on the MMSP modules subscreen to specify these module types. The following subsections describe how the user specifies these modules.

3.1.4.1 Source Modules

After the user has clicked on the MMSP Modules tab of the MMSP subscreen, the Source tab can be selected. This Source tab allows the user to specify and open the executables for the five different source modules. These source modules are land application unit, waste pile, surface impoundment, aerated tank, and landfill. The user can use the [• • •] button to **Open** the correct executables or type the appropriate drive, directory, and file name (for example, C:/HWIR/MODULE/SOURCE/LAU.EXE). Each processor must be identified and opened before a simulation can be started. Figure 3.4 shows the Source tab of the MMSP subscreen.
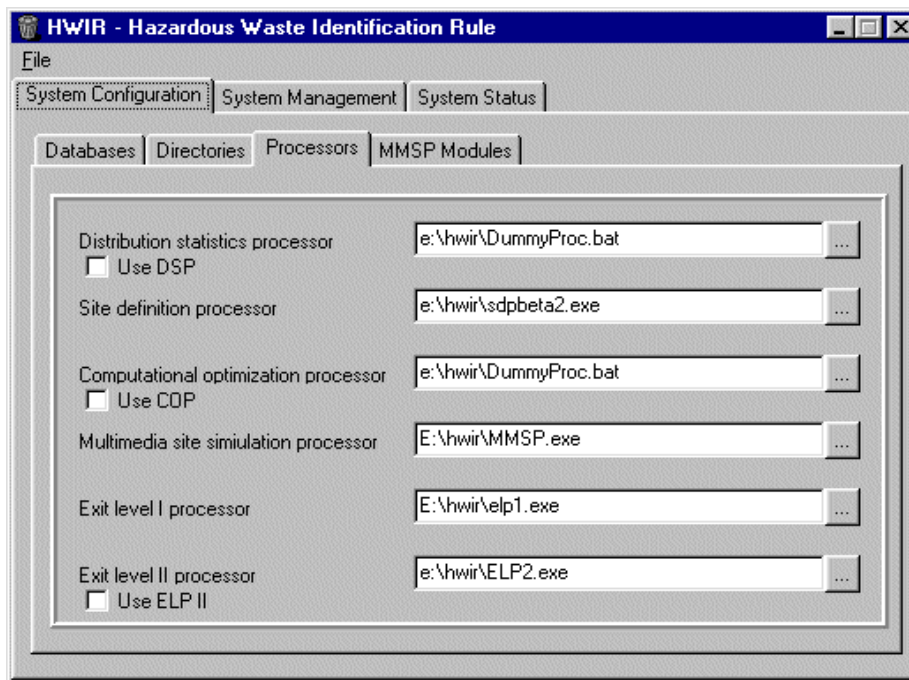
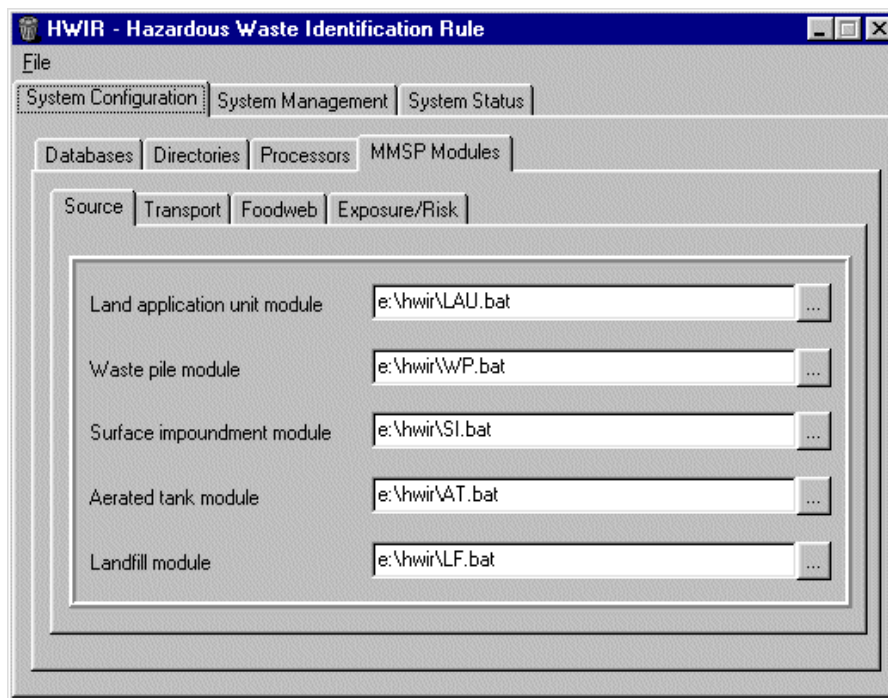**Figure 3.3** System Processor Locations of the System Configuration Screen

Figure 3.4 System Source Module Locations of the System Configuration Screen

3.1.4.2 Transport Modules

The user can specify the different transport modules by clicking on the Transport tab of the MMSP subscreen. This tab allows the user to specify and open the executables for the five different transport modules. The transport modules are the vadose zone, aquifer, watershed, waterbody (includes rivers, ponds, lakes, and wetlands), and air modules. The user can click on the ⌈• • •⌉ button to **Open** the correct executables or type the appropriate drive, directory, and file name (for example, C:/HWIR/MODULE/SOURCE/AIR.EXE). Each processor must be identified and opened before a simulation can be started. Figure 3.5 shows the Transport tab of the MMSP subscreen.
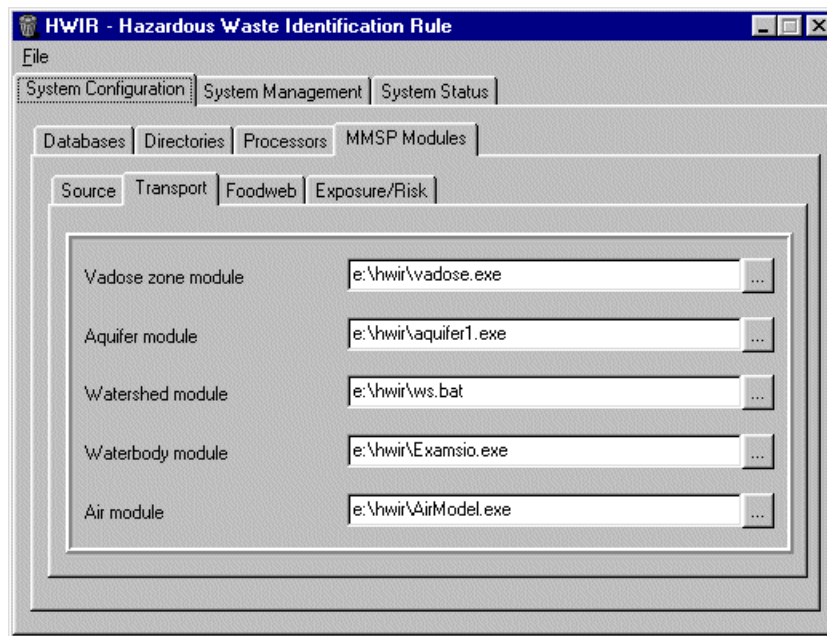

Figure 3.5 System Transport Module Locations of the System
Configuration Screen

3.1.4.3 Foodweb and Foodchain Modules

The user can specify different foodweb and foodchain modules by clicking on the Foodweb tab of the MMSP subscreen. This tab allows the user to specify and open the executables for the three different foodweb and foodchain modules. These foodweb and foodchain modules are aquatic foodweb, terrestrial foodweb, and farmchain. The user can click the ⌈• • •⌉ button to **Open** the correct executables or type the appropriate drive, directory, and file name (for example, C:/HWIR/MODULE/FOODCHAIN/FARM.EXE). Each processor must be identified and opened before a simulation can be started. Figure 3.6 shows the Foodweb tab of the MMSP subscreen.
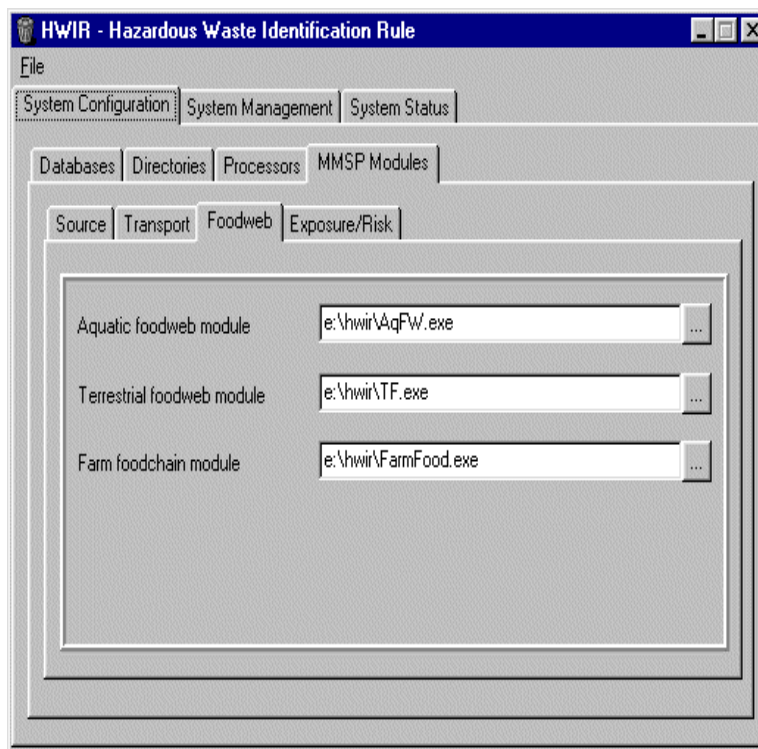
Figure 3.6 System Foodweb Module Locations of the
System Configuration Screen

3.1.4.4 Exposure/Risk Modules

The user can specify the different Exposure/Risk modules by clicking on the Exposure/Risk tab of the MMSP subscreen. This tab allows the user to specify and open the executables for the four different exposure and risk modules, ecological exposure, ecological risk, human exposure, and human risk. The user can click on the ⌐•••⌐ button to **Open** the correct executables or type the appropriate drive, directory, and file name (for example, C:/HWIR/MODULE/EXPOSURE/HR.EXE). Each processor must be identified and opened before a simulation can be started. Figure 3.7 shows the Exposure/Risk tab of the MMSP subscreen.

3.2 System Management

The functions of the system management screen allow the user to define the sites, chemicals, source types, and waste levels for simulation. It also allows the user to select the level of storage of data files from the MMSP modules, the mode of operation, the number of iterations, and seed value for the statistical analysis of the simulation. Each of these functions is accessed by the user through subscreens associated with the system management screen. These functions are described in the following subsections.
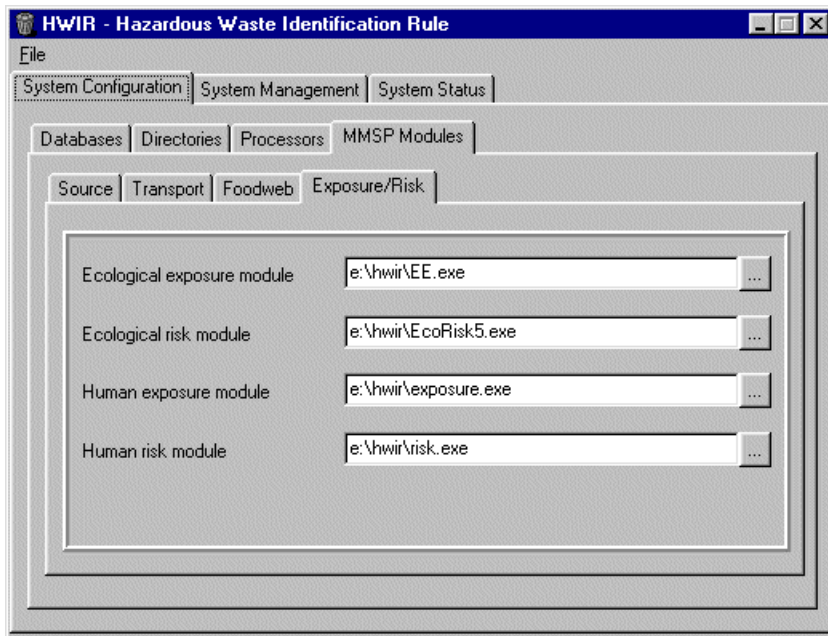
Figure 3.7 System Exposure/Risk Module Locations of the System
Configuration Screen

3.2.1 Selections

The selections subscreen (Figure 3.8) of the system management screen allows the user to select the sites, chemicals, source types, and waste levels used for the simulation. The user can select a single, subset, or all of the sites, chemicals, source types, and waste levels to be simulated. The sites appear on the subscreen as site identification names that come directly from the site-based database. The chemicals also appear on the subscreen as the actual names defined in the chemical properties database.

The five source types are land application unit, waste pile, surface impoundment, aerated tank, or landfill. The waste level categories define the waste concentration at the source on which the protection level is based.

3.2.2 Options

When the site, chemicals, source types, and waste levels are selected, the options subscreen (Figure 3.9) of the system management screen is used to select the data storage level, mode of operation, number of iterations, and seed value used as part of the probabilistic simulation. The storage level selections are currently *minimum* or *maximum*. The minimum storage level keeps only the GRF from the simulation while the maximum storage level stores the GRF and all intermediate files created during the simulation. The number of iterations (or realizations) for the simulation is defined by the user and represents the number of times each site selected will be simulated. The value has statistical significance and the user needs to understand the needs of the simulation to define this value appropriately.
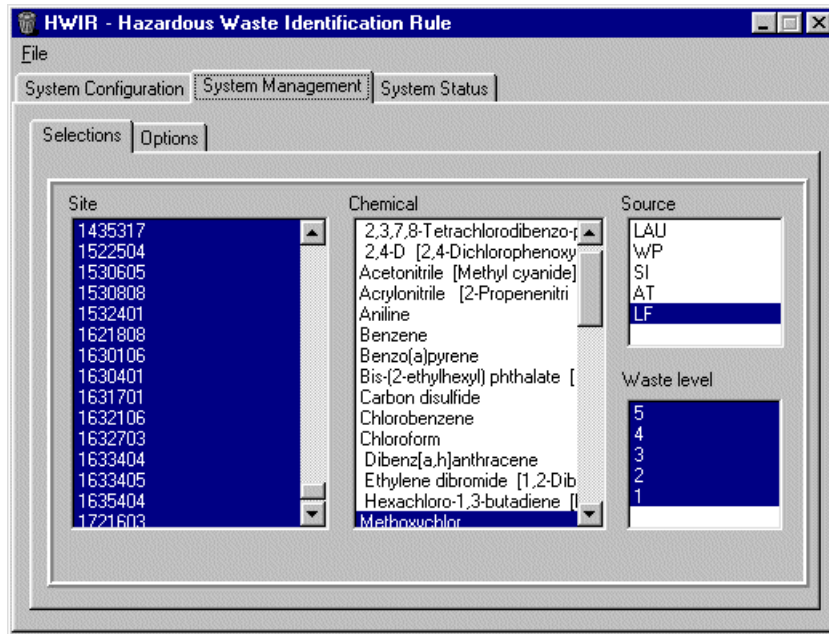
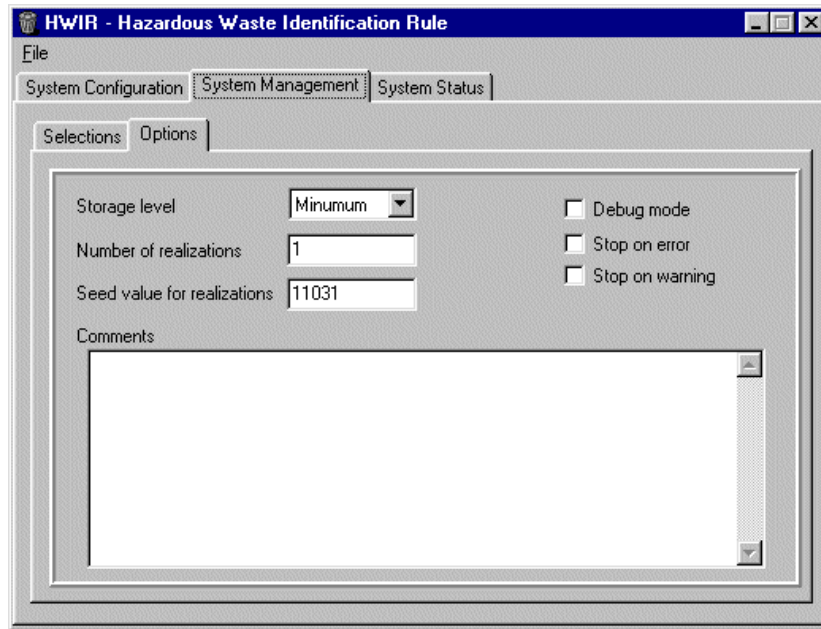**Figure 3.8** Simulation Selections of the System
Management Screen

Figure 3.9 Simulation Options of the System
Management Screen

The seed value is used by the statistical component of the simulation. This value defines the random sampling seed required for the simulation. If the user needs to duplicate a simulation, this value must be the same as the one used in the original simulation.

The user can select one of three different operation modes for the simulation. The **Debug** mode stops the simulation after every change in iteration, chemical, source type, and waste level. This mode is intended to test the system setup and operations before a production run. The **Stop on Error** mode stops the simulation only if an error occurs in a processor or module when production runs are being implemented. The **Stop on Warning** mode stops the simulation only if a warning appears in a processor or module. The **Debug**, **Stop on Error**, and **Stop on Warning** modes can be selected simultaneously by the user. The Comment box on this subscreen provides the user with description information about the current simulation; it is populated by the software system when a warning or error occurs.

3.3 System Status

The main function of the system status screen (Figure 3.10) is to allow the user to follow the progress of the simulation, as it steps through the iterations, sites, chemicals, source types, and waste levels. Depending on the mode of operation the user selected for the simulation (see the options subscreen of the System management screen, Section 3.2.2), this screen behaves differently. If the **Debug** mode is selected, the simulation stops after each step whether it is an iteration, site, chemical, source type, or waste level. The user can then select the Resume button to continue the simulation or evaluate the results of the simulation (switch out of the FRAMES-HWIR Technology Software System to some other software). If the **Stop on Error** or **Stop on Warning** mode is selected, the software continuously cycles through the simulation until it encounters an error or warning from a processor or module. If an error or warning occurs, the simulation is suspended. The user can evaluate the situation and decide whether to continue the simulation or stop it. If the simulation is not completed, all files created before the suspension of the simulation are stored in the specified locations and are available for future evaluation. If the simulation is suspended, the user can attempt to correct the problem, and then resume the simulation.

Any error or warning message generated by a processor or module is displayed in the message box provided at the bottom of the system status screen. These messages help the user determine the status of the simulation and whether to continue or suspend the simulation. Error and warning files created by the system processors or modules are processed by the SUI into the messages.all file. The user can utilize these files to determine the problem and continue the simulation, or stop it and correct the problem. If the user stops the simulation and corrects the problem, the simulation can be set up where it stopped and the simulation resumed using the Resume button.
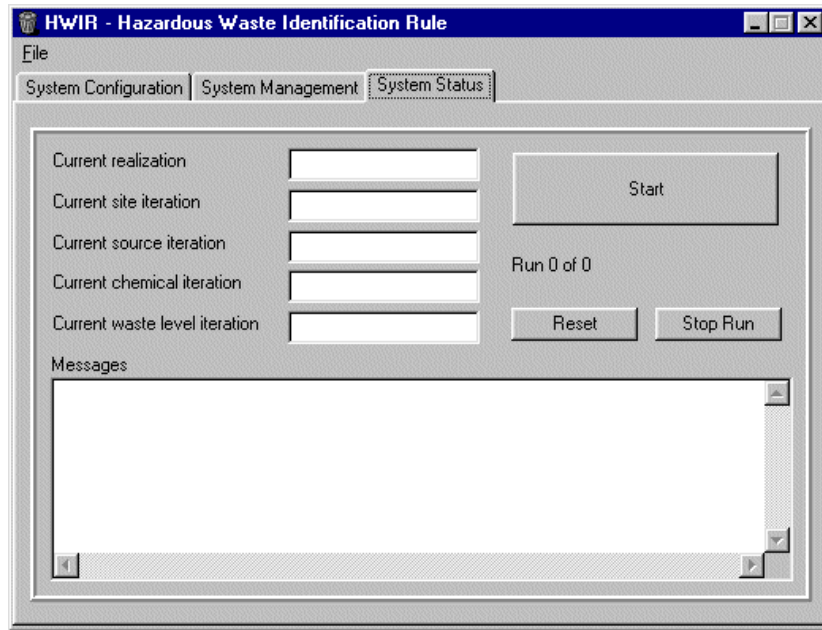
Figure 3.10 System Status Information of the System
Status Screen

4.0 Operating Procedures Using an Example Site

This chapter covers the different operating procedures associated with the operation of the FRAMES-HWIR Technology Software System, including both normal (planned) and abnormal (unplanned) conditions.

Under normal conditions and operations, the FRAMES-HWIR Technology Software System behaves the same as most Windows® 95 applications. The SUI is the link between the user and the system, and all user inputs and information are entered though the SUI. Refer to the document *Documentation of the FRAMES-HWIR Technology Software System, Volume 2: System User Interface* (see Section 5.0) for more information on the SUI. The normal operations of the FRAMES-HWIR Technology Software System are demonstrated by providing an example site simulation. The example is meant to provide an illustrative case for the user to follow. The data and information used in the example are real but are not meant to provide accurate results.

As stated previously, it is assumed the FRAMES-HWIR Technology Software System is successfully installed on an IBM-based computer, and all required databases and executables are installed. To start the FRAMES-HWIR Technology Software System, the user needs to identify the system icon on the computer. Windows® 95 does this in several ways; this example shows one way. From the Windows **Start** toggle at the bottom of the screen, click and scan up to Programs. Select HWIR. Figure 4.1 shows the selections to start up the software system.

Figure 4.2 illustrates the initial screen that appears when the system starts. This display is the system configuration screen of the SUI. The user can now begin to specify the databases upon which the simulation is based. The user can type in the correct location and name of the database or click the ⟦• • •⟧ button located to the right of the text box for each database and open the databases (for example, C:/HWIR/DATABASES/SITEBASE.MDB). Figure 4.3 shows the type of screen that appears if the ⟦• • •⟧ button is clicked. The user can browse the different drives and directories until the appropriate database file is located. The user then double-clicks the file name to open the file. This procedure is repeated for each database. These databases may be located in the same drive and directory or in different locations, depending on the type of simulation. The same procedure is used to locate and define the system output files, and the processors and module executables.

When the system configuration screens have been completed and all system files have been located, the user can move to the system management screen. To do this, the user clicks the System Management tab. After the system management screen appears, the user can use the selection subscreen to select the required sites, chemicals, source types, and waste levels for the simulation. Figure 4.4 illustrates the selection subscreen of the system management screen. Site 1233101, chemical lead, source type landfill, and all five waste levels have been selected in this example case. The user has now defined what site(s), chemical(s), source type(s), and waste level(s) to use in the simulation.
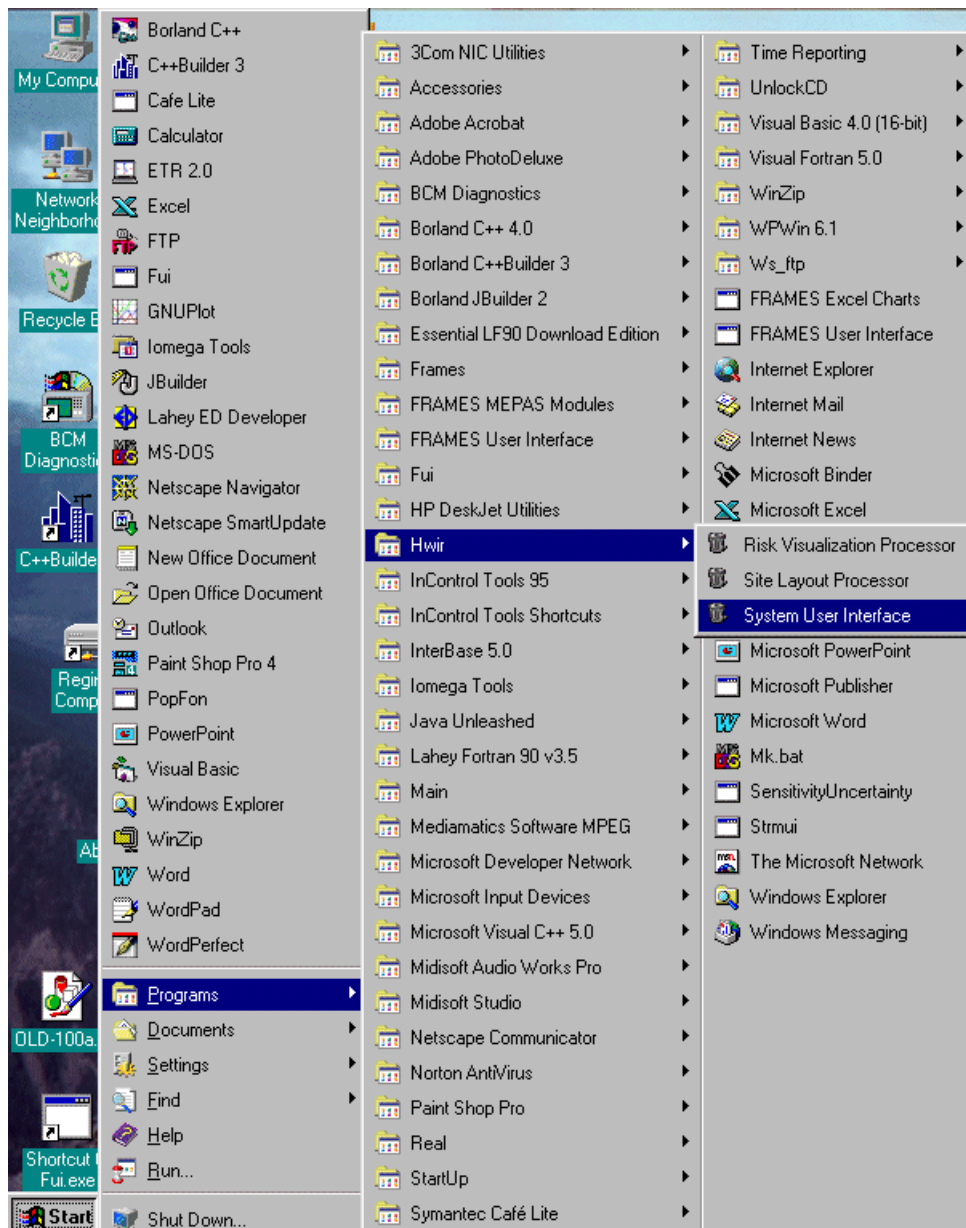
Figure 4.1 Start Up of FRAMES-HWIR Technology Software System

The user then clicks on the Options tab of the system management screen to define the mode of operation, level of data storage, number of iterations (realizations) for the simulations, and the seed value for defining the random sampling process. Figure 4.5 presents a completed options subscreen for this example case. The user has selected the modes of operation to be **Stop on Error** and **Stop on Warning**. This means the simulation will run unless an error or warning is encountered by the SUI. The error or warning could come from a system processor or MMSP module. The error or warning appears in the Messages box in the system status screen, so the user can identify the problem and where it occurred. The Comments box on the options subscreen provides the user with information from the system as it executes the simulation. This example screen shows the user has selected the minimum data storage level for the simulations.
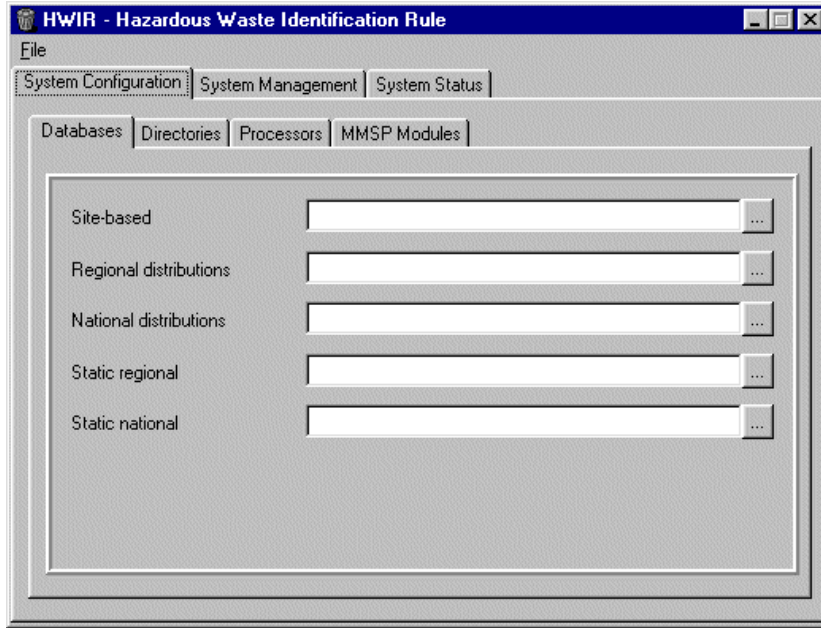
4.2

Figure 4.2 Initial Software Screen after Start Up of the Software
System

The system stores only the GRF from the simulation under this configuration. The simulation will run for one iteration, and the seed value for the random sampling process is "11031." This process includes the normal production options for the system. For the **Debug** mode, the user would use the maximum storage level and may include only 10 iterations to minimize the run times.
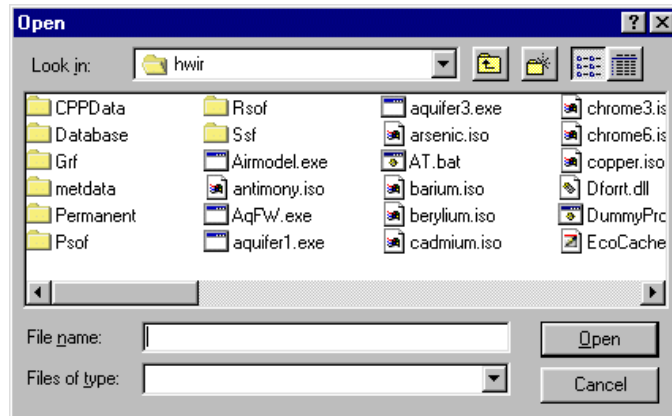

Figure 4.3 Browse Box for Selecting Database File

4.3

When the options subscreen has completed, the user clicks on the system status screen tab and then clicks the [Start] button. This action will initiate the simulation. The realization, site, chemical, source type, and waste level iteration for the simulation are displayed in real time. Figure 4.6 shows an example display of the system status screen during a simulation. The current realization is 126 of 280; only one site, chemical, and source is included; the third waste level is under evaluation. Note the example shows a message in the Messages box, indicating the storage space available on the computer may not be sufficient for the simulation. This statement is a warning because the storage space has not been completely filled, but the system detected this situation may occur. The user can continue the simulation or pause the process to see if more space can be made available on the drive.
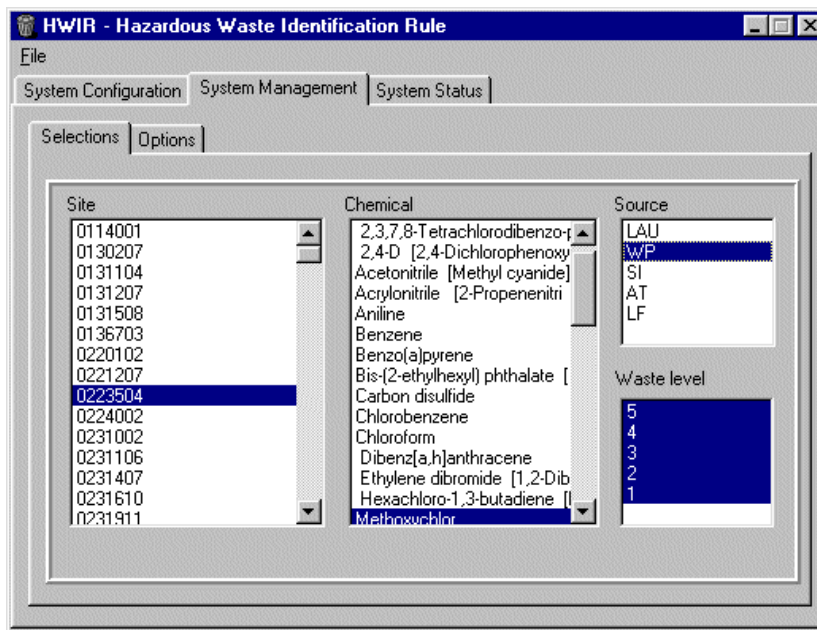

Figure 4.4 System Management Site, Chemical, Source and Waste Level Selection

When the simulation has paused, the [Start] button is replaced by a [Resume] button so the user can continue the simulation. If the simulation is stopped because of a warning, the entire realization is completed before stopping (that is, it has completed the current site, chemical, source, and waste level). In this example case, the 456th realization would be completed before the simulation is paused. If the simulation is stopped because of an error, it is stopped where the error occurred. When resumed, the system begins at the next step (the site, source, chemical, or waste level iteration). In this example case, if an error occurred during the COP on the chemical loop, the simulation would stop. If resumed, it would begin at realization 456, site "1233101", lead, and for waste level 4. If the user chooses, the [Reset] button could be used to start the entire simulation over from the beginning (that is, realization 1, site 1, chemical 1, source 1, and waste level 1).
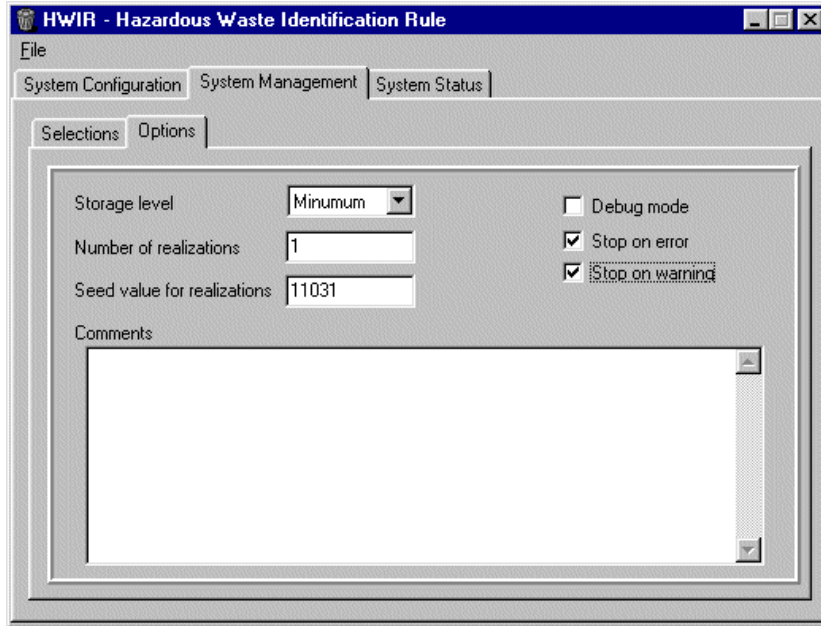
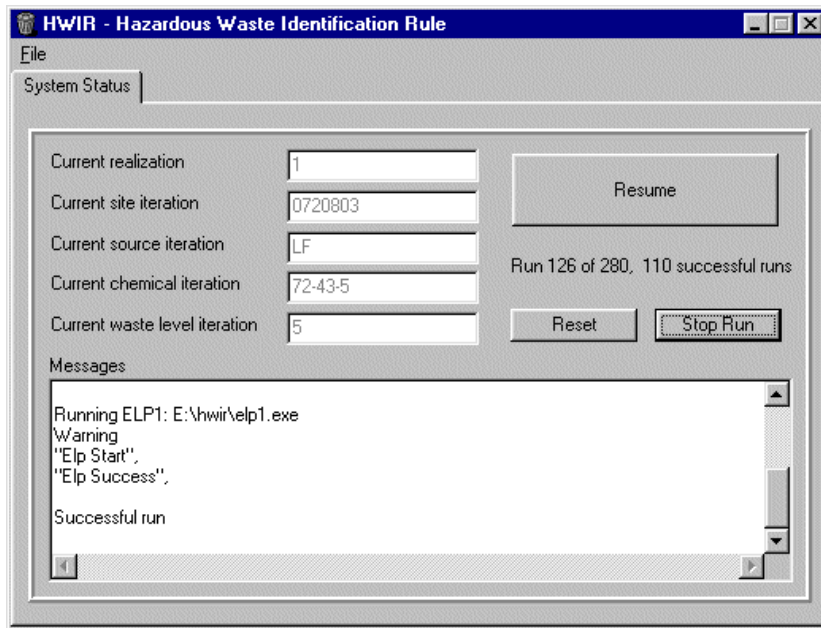**Figure 4.5** Example Options Subscreen of the System Management Screen

Figure 4.6 Example Case for System Status Screen

5.0 References

Volume 1: *Overview of the FRAMES-HWIR Technology Software System.* 1998. PNNL-11914, Vol. 1, Pacific Northwest National Laboratory, Richland, Washington.

Volume 2: *System User Interface Documentation.* 1998. PNNL-11914, Vol. 2, Pacific Northwest National Laboratory, Richland, Washington.

Volume 3: *Distribution Statistics Processor Documentation.* 1998. TetraTech, Lafayette, California.

Volume 4: *Site Definition Processor Documentation*. 1998. PNNL-11914, Vol. 4, Pacific Northwest National Laboratory, Richland, Washington.

Volume 5: *Computational Optimization Processor Documentation.* 1998. TetraTech, Lafayette, California.

Volume 6: *Multimedia Multipathway Simulation Processor Documentation.* 1998. PNNL-11914, Vol. 6, Pacific Northwest National Laboratory, Richland, Washington.

Volume 7: *Exit Level Processor Documentation.* 1998. PNNL-11914, Vol. 7, Pacific Northwest National Laboratory, Richland, Washington.

Volume 8: *Specifications.* 1998. PNNL-11914, Vol. 8, Pacific Northwest National Laboratory, Richland, Washington.

Volume 9: *Software Development and Testing Strategies.* 1998. PNNL-11914, Vol. 9, Pacific Northwest National Laboratory, Richland, Washington.

Volume 10: *Facilitating Dynamic Link Libraries.* 1998. PNNL-11914, Vol. 10, Pacific Northwest National Laboratory, Richland, Washington.

Volume 11: *User's Guidance.* 1998. PNNL-11914, Vol. 11, Pacific Northwest National Laboratory, Richland, Washington.

Volume 12: *Dictionary.* 1998. PNNL-11914, Vol. 12, Pacific Northwest National Laboratory, Richland, Washington.

Volume 13: *Chemical Properties Processor Documentation.* 1998. PNNL-11914, Vol. 13, Pacific Northwest National Laboratory, Richland, Washington.

Volume 14: *Site Layout Processor Documentation.* 1998. PNNL-11914, Vol. 14, Pacific Northwest National Laboratory, Richland, Washington.

Volume 15: *Risk Visualization Tool Documentation.* 1998. PNNL-11914, Vol. 15, Pacific Northwest National Laboratory, Richland, Washington.

Quality Assurance Program Document

Gelston, G. M., R. E. Lundgren, J. P. McDonald, and B. L. Hoopes. 1998. *An Approach to Ensuring Quality in Environmental Software.* PNNL-11880, Pacific Northwest National Laboratory, Richland, Washington.

Additional References

Office of Civilian Radioactive Waste Management (OCRWM). 1995. *Quality Assurance Requirements and Description, Software.* U.S. Department of Energy, Washington, D.C.

U.S. Environmental Protection Agency (EPA). 1997. *System Design and Development Guidance.* EPA Directive Number 2182, Washington, D.C.

Marin, C., and Z. Saleem. 1997. *A Preliminary Framework for Finite-Source Multimedia, Multipathway and Multireceptor Risk Assessment (3MRA).* Draft, October 1997, U.S. Environmental Protection Agency, Office of Solid Waste, Washington, D.C.