

CHARM User's Manual

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Chapter 1: Introducing CHARM Version 9

Radian's Complex Hazardous Air Release Model (CHARM®) is a modeling software program that calculates and predicts:

- the movement and concentration of airborne plumes from released chemicals;
- mechanical overpressures from pressurized vessels and explosion overpressures from ignition of vapor clouds;
- thermal radiation footprints associated with jet fires, pool fires, and boiling liquid expanding vapor explosions (BLEVE); and
- population impacts associated with any one of the footprints described above.

The CHARM program is useful for preparing for or responding to the occurrence of an accidental release, designing response plans, and implementing training programs. Whether you are developing an emergency response plan or responding to an actual event, the CHARM program provides a quick and accurate method for assessing the potential impacts of airborne chemical releases, overpressures, and thermal radiation.

Planning Mode

Planning for emergency response involves describing the potential release. You can define maps with the CHARM Editor for use in CHARM displays. In the planning mode, CHARM guides you through a list of input fields that describe a particular release and the present meteorological conditions. When you request a Plume display, CHARM requests a release time to use in the calculations which enable simulation of the release. The various graphic displays can be altered with a variety of options, and the release information can be stored in a scenario file for use with CHARM's emergency response mode.

Emergency Response Mode

In the emergency response mode, CHARM quickly accesses pre-stored input in one or more scenario files. To save time in an emergency situation, CHARM enables you to define and store a base map that will

be displayed automatically whenever the CHARM program is started. Ideally, the map display will have icons that can be selected to show release scenarios and other maps.

CHARM generates plume displays, radiation and overpressure footprint displays, plots, tables, and site information. Emergency response procedures for a particular chemical release, local sources of help, and important phone numbers stored in the CHARM Editor (CHARMED) can be retrieved quickly in the emergency response mode.

CHARM Input

The Main CHARM Input Window guides you through a list of characteristics that describe the release and the meteorological conditions. The selected species and release type determine which data fields are displayed for input. Although default data values are provided for the input fields, any data in the input window can be changed, including all of the default values (see “CHARM.INI File Description” in Chapter 3).

To assess the effects of an actual or potential accident, CHARM needs information about the toxicity of the released substance and how it disperses under different conditions. CHARM provides data on the physical, chemical, and toxic properties of over 180 chemical compounds. The chemical database can be expanded or modified through the CHARM editor (CHARMED). If you are unable to locate those chemical properties associated with a desired chemical which is not in CHARM's chemical database, Radian does provide services to gather necessary data to be used with CHARM.

A release can be described as a liquid or gas escaping from a container, or a liquid pool/lagoon. In either case, the conditions are defined right at or just prior to the release. CHARM also has the capability of defining release conditions right at or after the release has occurred, called “User-Specified After-Release Condition”. You can describe a release that is heavier or lighter than air, a ground-level or elevated release, and the type of surface on which a spill occurred. CHARM also allows you to describe liquid pool fires, Boiling Liquid Expanding Vapor Explosions (BLEVE), and jet fires. For a flammable vapor cloud, overpressures from the detonation or deflagration of the cloud can be estimated. In addition to explosion overpressures, CHARM can calculate mechanical overpressures from failures of pressurized vessels. Once an impacted area from any one of the available footprints has been identified, CHARM can estimate population impacts based on U.S. Census Bureau

Tiger/Line™ 1992 Data.

Meteorological data for input to CHARM can be obtained from instruments brought to the site, from a nearby meteorological station(s), or from estimates prepared by a remote weather center. CHARM can also be set up permanently as part of a facilities operation to automatically receive continuous data from a meteorological station, or from multiple data collection sites. For automatic meteorological data retrieval, CHARM requires an additional program called METINTER which is custom designed to integrate with the protocol sent by your met station hardware.

Map Displays

Maps cannot be created in CHARM or CHARMED. Drawings must be created with some type of third-party software and then defined in the Map Definition Editor in CHARMED before the map can be utilized in CHARM. The Map Definition Utility in CHARMED can import properly scaled, site-specific or area maps created with the Microsoft® Windows Paint Program or other more sophisticated Windows-compatible drawing programs. Detailed maps of areas may be found on and downloaded from the internet. Maps can be read from the clipboard or from files. Maps must be read and edited with the CHARM Editor before they can be used in CHARM. During a CHARM run, you can overlay displays of concentration, thermal radiation, and overpressure levels on a selected map to identify local impact areas. Icons representing release locations and other maps can also be defined on a map display.

Population Impacts

CHARM has the ability to calculate the number of people affected by footprints of desired concentrations, radiation fluxes, or overpressures. The number of people is determined from the population information available on U.S. Census Bureau Tiger/Line™ 1992 Data. To use population data with CHARM, the U.S. Census Bureau data files must be preprocessed with the CHARM TigerMap Utility. After preprocessing, the data files must be defined in the CHARM Editor. Once a footprint is displayed, CHARM uses one of three different methods to calculate population impacts. For more information defining and displaying population data, see "Population Data" in Chapter 4. To order Census Bureau data, contact:

U.S. Department of Commerce
BUREAU OF THE CENSUS
Data User Service Division

CHARM Calculations

When the required input has been entered, CHARM calculates the radiation footprint, overpressure footprint, or concentration of a chemical plume, and predicts the dispersion of the release. CHARM is a Gaussian puff model that considers any release to be a series of **puffs**. CHARM determines the number of puffs in a release and the initial characteristics of each puff.

CHARM creates a source term based on the user input then proceeds to generate the transport/dispersion, radiation, or overpressure calculations to describe an impact. The resulting displays simulate the release according to the specified input and the calculations. For information on CHARM algorithms, refer to the “CHARM Technical Reference Documentation.”

Graphic Displays

CHARM provides plume displays to show the locations, shapes, and up to three concentration isopleths of the chemical plume resulting from a release. Footprint displays show up to three values each for thermal radiation and overpressures. Any footprint display may overlay a map. Vertical cross-sections, tables, and two-dimensional plots are also provided.

The CHARM displays include:

- An instantaneous plume view showing the concentrations at the specified time since release;
- An integrated plume view showing a minute-by-minute (or second-by-second) time history of the impact area;
- A time-averaged plume based on a user-defined averaging interval and a user-defined grid size;
- A dose display showing the time history of concentration at any point;
- A vertical cross-section of the plume or footprint;
- Thermal radiation footprints from liquid pool and jet fires;

- Overpressure footprints resulting from mechanical failure of a pressurized vessel;
- Overpressure footprints resulting from ignition of a vapor cloud at a specified time;
- A table showing the location of maximum concentrations as a function of time;
- A plot and table showing the maximum downwind distance from the source of a specific concentration level as a function of time;
- A plot and table showing the concentrations through the centerline of the plume;
- A plot and table showing the maximum crosswind width of a user-specified concentration as a function of time;
- A plot and table showing the crosswind half-width down the centerline of the plume as a function of concentration;
- A 3-Dimensional view of a single user-specified concentration;
- Population impacts of a plume or footprint (requires 1992 Tiger/Line Census Bureau Data);
- Circular Population impacts associated with a radial distance from the source (requires 1992 Tiger/Line Census Bureau Data);
- A plot and table illustrating emission rates from both the container and the pool;
- A detailed report (Source/Puff Calculation) showing the output of the source term calculation performed by CHARM. The data consists mainly of the numbers used to describe the source term, emission out of the container, emission of each puff into the atmosphere during the release, etc.;
- Displays showing chemical data and emergency response action to be taken in association with the species being modeled; and
- User-definable site specific information.

The CHARM Environment

CHARM operates in the Microsoft Windows environment. The Windows program comes with thorough documentation for using the menus and dialog boxes with and without a mouse. CHARM menus and dialog boxes follow the same style. CHARM comes with a complete on-line help system. A help command is available for every CHARM window and dialog box. The on-line help screens provide additional information to describe the window or explain the type of data requested.

Within the Windows environment, a single CHARM run can display several scenarios of the same or a different chemical under different meteorological and/or time-release conditions simultaneously. In addition, both text and graphic displays can be sent to the clipboard for use with Windows-compatible word processors.

Hardware Requirements

The hardware requirement for the CHARM program depends on the type of processor (CPU) in the computer.

The minimum hardware requirements are a computer with a 80486 CPU and 8 megabytes (M) RAM.

In addition, the hardware requirements include:

- A 20M hard disk;
- A 1.44M, 3.5 inch diskette drive;
- Graphics card/monitor with a Microsoft Windows software driver; (Many drivers come with Windows. Some manufacturers supply drivers with their products. You may have to check with the manufacturer.)
- A math co-processor;
- A mouse is highly recommended, although not required. The mouse requires a Windows driver;

Software Requirements

CHARM 9 requires Microsoft Windows95 or WindowsNT as the operating system. CHARM does not include a run-time version of the Windows program; it must be purchased separately.

About This Manual

The CHARM User's Manual is divided into the following sections:

- | | |
|------------------|--|
| Chapter 1 | "Introducing CHARM" is an overview of the features of the CHARM program. It also includes the hardware and software requirements, and a description of the contents of this book. |
| Chapter 2 | "Installing CHARM" provides the steps for installing CHARM and information for updating a previous CHARM version. This chapter also explains how CHARM is protected from unauthorized use and how to solve insufficient memory problems. |
| Chapter 3 | "Getting Started" describes how to start and stop the CHARM program and provides general conventions for running the program. |
| Chapter 4 | "Using the CHARM Editor" explains how to use the editors to modify CHARM file location information; modify and update the chemical database; enter site-specific information; specify 1992 Tiger/Line Census Bureau data for determining population impacts; and set the parameters for communication with a meteorological tower(s). This chapter also describes how to edit the maps you want to use with CHARM. |
| Chapter 5 | "The Main CHARM Input Window" explains how to use CHARM in the planning mode and describes the input for creating a release scenario. |
| Chapter 6 | "Understanding CHARM Displays" describes the displays that CHARM generates for a release scenario. |
| Chapter 7 | "Using CHARM for Emergency Response" describes how to use CHARM in the emergency response mode. |
| Chapter 8 | "Using the TigerMap Utility" explains how to preprocess U.S. Census Bureau Tiger/Line™ 1992 Data for |

preparation for use with the CHARM Editor and CHARM in determining population impacts.

Chapter 9 "Menus and Commands Reference" is an alphabetical listing of the CHARM menus and their commands. This chapter functions as a reference for quickly accessing detailed information in the CHARM User's Manual.

This manual also provides a list of figures for each screen in the manual and an index for locating specific information quickly.

Manual Conventions

This manual uses the conventions for terminology and typography discussed in the following paragraphs.

Key Names

The names of keys on the computer keyboard appear capitalized and enclosed in angle brackets. For example, the Enter key is represented as <Enter> in this manual. The actual key names seen on your particular keyboard may be a little different.

Key Combinations

In some cases, two keys must be pressed at the same time to achieve the intended result. In these cases, the two key names are hyphenated. For example, <Ctrl-Del> means hold <Ctrl> while pressing .

Arrow Keys

The four arrow keys on the computer keypad refer to the directions in which you can move the selection, the pointer, or the insertion point on your screen. The arrow keys are also used to position icons on a map display. These keys are particularly useful if you are using the keyboard instead of the mouse.

Menu and Command Names

The names of menu commands and their commands are capitalized in this manual. They appear in text just as they appear on the screen.

What You Type

Whenever this manual presents something you should type verbatim, the characters are shown in **bold** typeface. If the letter case is significant, uppercase or lowercase information is specified in the directions.

Terms

Many of the computer terms used in this manual are equivalent to the terms used by Windows documentation. When a term is defined, it appears in **bold** typeface. *Italics* indicate emphasis.

Notes and Cautions

A note provides information that is specific to certain circumstances or is of special interest. A caution contains information about actions that can cause you to lose or damage your data. Notes and cautions are shown in *italics*.

Figures

CHARM windows are shown as numbered figures throughout this manual. A complete list of figures is provided immediately following the Table of Contents. The appropriate dialog box is shown for each CHARM data entry field. These graphics are not numbered, but the field names are listed in the Table of Contents. Window examples are generated from Windows95, and may differ if you are running another Windows Operating System

Chapter 2: Installing CHARM

The initial steps to use for installation depend on whether you are installing CHARM for the first time or updating a previous version of CHARM. After installation, you must install the parallel port key to indicate to CHARM that this license of CHARM is authorized for use. This chapter also contains suggestions for handling insufficient memory problems.

Updating a Previous CHARM Version

CHARM is backward compatible as far as reading scenario and meteorological files from a previous version of CHARM. However, you may have added chemical data to the chemical database, in which case you do not want to overwrite CHMDAT8 files. Be sure to backup CHMDAT8 files before installing CHARM version 9, or simply install CHARM version 9 in another directory. (see "Updating Chemical Database from a Previous Version" in Chapter 3).

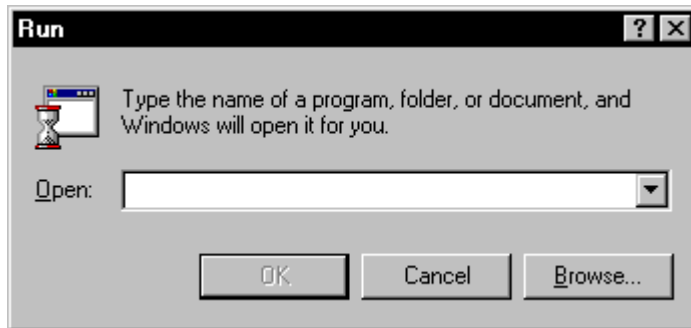
Installing CHARM for the First Time

Use the following steps to install CHARM for the first time:

1. Turn on or boot your computer.
2. If a Microsoft Windows operating system is not already installed on your PC, install Microsoft Windows version Windows95 or WindowsNT.
3. If Microsoft Windows is not already running, start MS Windows by typing the following command at the DOS prompt:

WIN

4. Select the 'Run' option from the appropriate Windows OS. The following window is displayed:



5. Place the CHARM diskette labeled "Disk 1" in the diskette drive, and enter the following command at the Command Line prompt of the 'Run' window:

A : \SETUP

If you are using a diskette drive other than A, use its name in place of the **A** shown in the command above. Alternatively, you may initiate the CHARM installation procedure by executing My Computer or Windows Explorer from the desktop, and executing SETUP.EXE from your floppy drive.

6. Once the Setup program is running, follow the instructions on the screen to continue or exit the installation.

Handling Insufficient Memory Problems

Several conditions may cause a "Not enough memory" message to be displayed. Some conditions to check for and their possible remedies are described here.

1. The Windows program must be started before the CHARM program is started. CHARM requires Microsoft Windows to run. This means that CHARM cannot be started from the DOS command prompt like other DOS programs. If you enter **CHARM** at the command prompt, an insufficient memory message is generated because the size of the CHARM program is greater than 640K.
2. Start Windows as described in the Windows documentation for your computer system. CHARM can then be started by selecting the CHARM icon from the CHARM group in the Program Manager.

3. Other programs may be running and taking up memory needed by CHARM. These programs are called Terminate but Stay Resident (TSR) programs, and they reduce the amount of memory available to CHARM. For example, the programs necessary for computer networking require memory. Another example is a utility program, such as Sidekick, that requires memory. A mouse driver need not be loaded, because Windows provides its own. TSRs and some drivers are normally loaded with the AUTOEXEC.BAT file. Most drivers are loaded with the CONFIG.SYS file.
4. The AUTOEXEC.BAT and the CONFIG.SYS files must always allow Windows and CHARM to operate. Some sample AUTOEXEC.BAT and CONFIG.SYS files that represent the simplest cases are provided below. It is possible that other directives have been added to these files to the extent that memory is no longer available for completing a CHARM run.

Example 1 shows the contents of one of the simplest AUTOEXEC.BAT files that can be used. The example creates a prompt of the default directory and identifies the PATH directive. The PATH directive tells the computer where to look for programs named in a command that are not in the default directory (the directory from which the command is issued).

Example 1:

```
ECHO OFF  
PROMPT $P$G  
PATH C:\WIN;C:\DOS;C:\BIN;C:\UTIL;C:\CHARM
```

Example 2 shows the minimum requirements for a CONFIG.SYS file to operate correctly with Windows.

Example 2:

```
FILES=30  
BUFFERS=10
```

Protecting CHARM from Unauthorized Use

The CHARM software is protected from unauthorized use by a hardware device called a **key**, which is supplied as a part of the purchase of CHARM. This key must be installed before CHARM is run or the program will not perform any calculations. If no key is present, a warning is displayed, and calculation is halted, and CHARM terminates.

The type of key CHARM uses is a parallel port (LPT) key. The standard key being sent with CHARM Version 9 software is the printer port key. This key connects in line with the parallel port and the printer cable.

Use the following steps to install the printer port key:

1. Disconnect any cable connected to the designated LPT output (printer) port of your computer.
2. Connect the parallel port key to the designated LPT output port.
3. Connect the printer cable to the other side of the key. The male end of the key attaches to the female end of the LPT port.

You are now ready to execute CHARM.

Chapter 3: Getting Started

This chapter provides information for starting and stopping the CHARM program and CHARM utilities, and understanding the general conventions used throughout the CHARM program.

Starting and Stopping the CHARM Program

After the CHARM program is installed as described in Chapter 2, use the following steps to start CHARM.

5. Turn on the computer, if necessary.
6. Start Microsoft Windows, if necessary.
7. Double click the CHARM icon in the CHARM Group of select CHARM from the Start menu.

To stop CHARM or a CHARM utility program, select the Exit command from the File menu. CHARM can also be stopped by double-clicking the icon at the upper left corner of the CHARM window, or by single-clicking the X icon at the upper right corner of the window.

General CHARM Conventions

The general conventions used by the CHARM program involve file names, on-line help, dialog boxes, and the search function. Familiarity with the Windows program is helpful in understanding these features.

CHARM uses a Windows application style that is common for large-scale software programs. This application style is called a Multiple Document Interface, or MDI. This particular style allows the application to display multiple windows in a single CHARM window. The user can view and move among multiple windows, but every window is bounded by the extents of the single larger CHARM window frame. A standard MDI window frame usually contains a menu bar, an optional toolbar, and microhelp in the lower left portion of the window. Using the MDI application style also dictates that only the single larger CHARM window frame contain the menu bar, the toolbar, and the microhelp; that is, the multitude of windows that may be generated in the MDI frame do NOT contain menus, as the menu bar and the toolbar on the MDI frame dynamically change when a child window is selected.

CHARM Menus and Commands

All CHARM commands are organized in menus on the menu bar on the CHARM MDI frame. A menu lists all the available commands for a selected window, but only those that are not grayed are executable at a particular time. Since CHARM operates in the Microsoft Windows environment, many of the conventions are similar. For example, CHARM provides drop-down menus, icons, and the choice of using the mouse, the keyboard, or both.

The File, Edit, and Window menus represented in the CHARM program are similar to the Windows menus of the same names. Refer to the Microsoft Windows User's Guide for a more detailed description of the standard Windows menus and commands. The CHARM program provides additional menus and commands.

CHARM provides menus for displaying and altering text and graphics. These menus include the File, MetFile, Options, and Displays menus. The commands on these menus change depending on the currently displayed window and user input. Refer to Chapter 8, "Menu and Command Reference" for a complete listing of all CHARM menus and commands.

The CHARM editor (CHARMED) has special menus and commands that are described in Chapter 4, "Using the CHARM Editor."

CHARM File Names

When you save a file in CHARM or CHARMED, you can assign the base file name and let CHARM assign the default extension, or you can assign the base name and the extension. CHARM uses the file name extension for identifying the names to display for selection lists.

CHARM uses several default file name extensions that are assigned according to the file type. Some file type extensions are user-definable (see "CHARM.INI File Description" in this chapter). The default extensions used by CHARM and a brief description of each file type follows:

.IND	A file containing subdirectory information that CHARM uses to locate .EMG files. Files with .IND extensions are created by the user with a text editor and are only used in accordance with the Scenario command under the File menu.
-------------	---

.EMG	A file containing release scenario data. When you save a release scenario without specifying a file name extension, CHARM assigns the .EMG default extension.
.MET	A file containing meteorological data. When you save met data without specifying a file name extension, CHARM assigns the .MET default extension.
.MAP	A file containing a map. When you save a map without specifying a file name extension, CHARM assigns the .MAP default extension.
.MFD	A file containing a map definition. CHARM automatically creates this file when you save a map. A file with the .MFD extension should not be deleted unless its corresponding .MAP file is also deleted. Likewise, if the .MAP file is moved to a different location (subdirectory) on the PC disk, the .MFD file should also be moved to the same location.
.TPY	A file containing population information to be used in determining population impacts for a plume or footprint. This file is initially generated from the TIGERMAP Utility program. The user then specifies in CHARMED under 'Edit/Select Population Files' which population files are to be used to calculate population impacts in CHARM.
.TGR	A map file initially generated from the TIGERMAP Utility program. The file is merely graphic information processed from 1992 Tiger Line Census Bureau data. The format is not readable from within CHARM or CHARMED, and is only displayed in the TIGER MAP Utility.
.PLM	An ascii text file that contains the Cartesian x, y, and z coordinates and other pertinent information that define the extents of a plume or footprint.

.SHP A file which describes a footprint of impact (concentration, thermal radiation, or overpressure) which can be transferred to ArcView for display. An ArcView shape file is actually three files: the main file, an index file, and a dBase file with attributes. These three files all have the same names and locations except for their extensions. The main file extension is .SHP. The index file extension is .SHX and the dBase file extension is .DBF.

Files with .EMG, .MET, .MAP, TPY, TGR, and PLM extensions are used in selection lists when no other extension is specified. Files with .IND and .MFD extensions have exclusive purposes in CHARM. Files with the .IND extension are user-created ascii files that identify the locations of certain .EMG files. Files with .MFD extensions are created by CHARM to accompany a .MAP file and provide the necessary map definition information specified with the map editor. These file name extensions should not be used for other purposes.

Creating .IND Files

Files with the .IND extension are index files that point to subdirectories containing .EMG files. You can create .IND files with a text editor. When the Scenarios command is selected from the File menu in the Main CHARM Input Window, CHARM initially searches the initial lookup directory for files that have the .EMG extension. This initial lookup directory is defined in CHARMED under the File Locations command of the Edit menu labeled 'Scenario Files'. If no .EMG files are found, CHARM searches for an .IND file for directions. Files with .EMG and .IND extensions should not exist in the same directory, because only the .EMG files will be accessed. Additionally, only the first .IND file CHARM encounters in a directory is used and any others are ignored. Therefore, only one .IND file should exist per directory.

An .IND file can have multiple pairs of subdirectory listings. Each subdirectory can have subdirectories. A subdirectory that has .EMG files can have multiple .EMG files associated with that subdirectory.

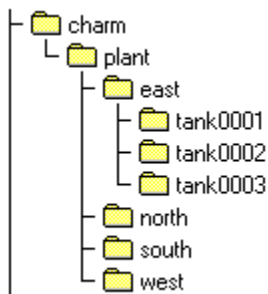
To create an .IND file, use a text editor to open a new file. Enter a pair of lines for each subdirectory. The first line of the pair can have up to 60 characters naming the subdirectory. Full path names are not required, because the named subdirectory is added to the full path name of the

previous directory searched. The second line of the pair provides CHARM with a detailed description of the subdirectory when the directory is listed to the user for selection.

Steps for creating IND Files:

1) The user must define the location of the initial .IND file under the File Locations command in the CHARM editor (CHARMED) in the field labeled 'Scenario Files'.

2) From Windows Explorer, create subdirectories which layout, for example, geographical aspects of possible release sites. Other alternatives for organizing your data may be by process or chemical inventory.



3) From Notepad (or some other text editor), create a file with the .IND extension and format the file as follows:

Format

<Subdirectory Name>
<Description associated with subdirectory name>
<Subdirectory Name>
<Description associated with subdirectory name>
<Subdirectory Name>
<Description associated with subdirectory name>

Example

The EXAMPLE.IND would read as follows and reside in the C:\CHARM\PLANT subdirectory:

```

EAST
Relase occurred in east side of plant
NORTH
Relase occurred in north side of plant
SOUTH
```

Relase occurred in south side of plant
WEST
Relase occurred in west side of plant

NOTE: The above file should reside in the initial Emergency Response file location defined by the CHARM editor (CHARMED). No prestored data files (.EMG) should reside in the same directory as .IND files. CHARM attempts to locate EMG files first. If EMG files are located and read, no attempt is made to locate IND files.

4) Repeat Step 3 for all directories.

Creating .EMG Files

CHARM creates files with the .EMG extension when you save the release input data. Initially, this file type extension is .EMG. However, refer to "CHARM.INI File Description" later in this chapter for information about redefining this default extension. You must specify a base name for the file. Unless you specify a different file name extension, CHARM automatically adds the default extension. Files with the default extension can be created with the Save and Save As commands on the File menu.

On-line Help

CHARM provides on-line help that explains each window and field in the program. On-line help is available in both CHARM and CHARMED. Press <F1> for a description of the contents of the current window or dialog box. When you select a field for data input, the dialog box contains a Help command button that displays field information and the data entry requirements. To select help on a menu or topic, select <Shift-F1>. The cursor will change to a pointer with a question mark. Simply point to the menu item or the editable text and click the left mouse button. CHARM will attempt to locate on-line help for the selected menu or topic. If CHARM cannot locate the menu or topic, it will display an index into on-line help.

Dialog Boxes

CHARM displays a dialog box whenever it needs additional information to carry out a command. Dialog boxes typically contain text, lists of available choices, command buttons, and option buttons. You may be required to make a selection or enter text or values. Normally, default values are provided. Any units of measure that are acceptable for the entry are available in drop-down lists. The OK, Cancel, and Help command buttons are also available in dialog boxes.

Many of the values solicited in a CHARM dialog box require you to make an entry. If you try to select the OK command button when the entry field is blank, CHARM displays a message saying an entry is required. However, in some cases, it may be OK to leave the field blank, whereby CHARM will accept the blank entry.

CHARM often accepts only those values that are within certain limits. For example, relative humidity must be less than or equal to 99. If you try to enter an unacceptable value, CHARM displays a message showing the acceptable range of values.

Default Input Values

On some occasions, you may need to estimate a release incident about which you have little data. In an emergency situation, you may not only have little data, but you need to enter the data quickly. To address this, CHARM provides default values for data fields that are essential to the calculations. Default values appear on the screen as already entered data. In some cases, these default values may be user-definable (see “CHARM.INI File Description” in this chapter). These values may represent the worst-case conditions or some typical situation. You can accept the default values or replace them with more accurate data.

CHARM.INI File Description

The file CHARM.INI is used to store information which CHARM reads and uses as defaults upon starting the program. The file is divided into two sections: [Directories] and [Default settings]. The [Directories] section associates types of files with physical subdirectory locations on your hard disk. Currently, CHARM differentiates between fifteen types of files. Initially, upon installation, all subdirectories default to the setup directory. Thirteen of these fifteen subdirectories may and should be modified from CHARM or CHARMED. The two file types (HelpDir and WinchDir) can only be changed by modifying the CHARM.INI file itself. In order to do this, use the following instructions:

- 1) Exit CHARM.
- 2) Open your CHARM.INI file using a text editor such as Notepad.
- 3) Find the [Directories] section of the file. It should be the first section.
4. Change the subdirectory associated with any one of the following:

(NOTE: Make sure the subdirectory truly exists.)

HelpDir - this subdirectory will contain CHARM help files (.HLP files).

For example, HelpDir=c:\charm\help\;

WinchDir - this subdirectory will contain your encrypted hidden password file for access to the CHARM Editor.

For example, WinchDir=c:\charm\winch\;

NOTE: Any other modifications to the following should be made from within CHARM or CHARMED.

DataDir - this subdirectory will contain CHMDAT*.* files (chemical database files).

For example, DataDir=c:\charm\data\;

SiteDir - This subdirectory will contain site specific information in the a file labeled USRMSG.

For example, SiteDir=c:\charm\site\;

CommDir - this subdirectory contains files (METINTER.EXE, METINTER.INI, and METDAT*.*) necessary to establish and maintain communication with a data logger (if available).

For example, CommDir=c:\charm\comm\;

ScenDir - this subdirectory contains a *.IND file or *.EMG files.

For example, ScenDir=c:\charm\scenario\;

MapDir - this subdirectory is the default for saving or displaying map files with the extensions associated with the keyword **MapExt** under the section labeled [Default settings] in CHARM.INI.

For example, MapDir=c:\charm\maps\;

EmgDir - this subdirectory is the default for saving or displaying pre-stored scenario data files with the extensions associated with the keyword **EmgExt** under the section labeled [Default Settings] in CHARM.INI.

For Example, EmgDir=c:\charm\emgs\;

MetDir - this subdirectory is the default for saving or displaying pre-stored met data files with the extensions associated with the keyword **MetExt** under the section labeled [Default settings] in CHARM.INI.

For Example, MetDir=c:\charm\mets\;

AsciiDir - this subdirectory is the default for storing data files containing real-world coordinates of plume, thermal radiation, or overpressure footprints generated by CHARM. The default extension for listing these data files is associated with the keyword **AsciiExt** under the section labeled [Default settings].

For Example, AsciiDir=c:\charm\ascii\;

ShapeFileDir - this subdirectory is the default for storing ArcView shape files containing plume, thermal radiation, or overpressure footprints generated by CHARM. The default extension for listing these data files is associated with the keyword **ShapeFileExt** under the section labeled [Default Settings]. A set of files for an ArcView shape file also consist of files containing the SHX and DBF extensions.

For Example, ShapeFileDir=c:\charm\shapes;

DIPPRDir - this subdirectory is the default where CHARMED looks to find the DIPPR database for importing chemical data into CHARM's chemical database.

For Example, DIPPRDir=c:\charm\dippr\;

PopFiles - this keyword contains a list of comma delimited files (including paths) of those population files that were processed from CHARM's TIGERMAP Utility for use with population impacts.

For Example,
PopFiles=c:\charm\popfiles\county1.tpy, county2.tpy;

RelDir - this subdirectory is the default from which CHARMED displays scenario data files when using the BROWSE button upon selecting files associated with a release icon. The default extension for listing these scenario files is associated with the keyword **RelExt** under the selection labeled [Default settings].

For Example, RelDir=c:\charm\emgs\;

PopDir - this subdirectory is the default where CHARMED displays population files when using the BROWSE button upon selecting files used for population impacts. The default extension for listing these

population files is associated with the keyword **PopExt** under the selection labeled [Default settings].

For Example, PopDir=c:\charm\popdata\;

5) Save your CHARM.INI file.

6) Restart CHARM.

The [Default settings] section contains default values for variables within CHARM itself. **DO NOT CHANGE ANY OF THESE VALUES AS THEY ALL MAY BE CHANGED FROM WITHIN CHARM. CHANGING A VALUE MAY CAUSE CHARM TO RUN IN AN INCORRECT MANNER OR POSSIBLY CRASH THE SYSTEM.** You may change some variables without having severe effects on CHARM: MapExt, EMGExt, MetExt, AsciiExt, ShapeFileExt, PopExt, and RelExt. MapExt contains the default extension for map files; EMGExt contains the default extension for prestored scenario files; MetExt contains the default extension for met data files; AsciiExt contains the default extension for text files that contain x,y, and z real world coordinates of a plume or footprint; ShapeFileExt contains the default extension for plume or footprint datafiles formatted to import into ArcView; PopExt contains the default extension to browse for when selecting population files in CHARMED; RelExt contains the default extension to browse for when associating emergency response files with release icons in Map Definition in CHARMED.

Search Function

When the chemical selection list is being displayed, you can perform a forward or backward search through the chemical database. First, select Set String and enter the character string for which you want to search. Then, select Up to search backward or Down to search forward through the database.

When you specify the character string, you can use the wild card characters, * (asterisk) and ? (question mark). The * represents zero or more characters. The ? represents a character location within the string rather than a special character.

Using the Mouse

The mouse can be used to move icons, expand and shrink windows, and select menus and commands. The mouse techniques used in CHARM include pointing, dragging, clicking, and double-clicking.

The CHARM program responds to left mouse button clicks and combining keys (e.g. Shift, Ctrl, and Alt) with left mouse button clicks. Menus and commands are selected in the same manner in CHARM as in the Windows program. Clicking the left mouse button highlights a field or selects a location pointed to by the cursor. Double-clicking the left mouse button on a field displays a dialog box for data input.

The CHARM dialog boxes display command buttons that can be selected with the mouse. You can select the OK command button to complete an action, or select the Cancel command button to ignore the attempted action. These are standard techniques for Windows applications.

Using the Keyboard

The keyboard can be used to achieve the same results as the mouse. The following keys are standard for the CHARM application:

<Alt>	Moves the inverse video bar to the menu bar. Use the arrow keys to position the inverse video bar.
<Esc>	Clears a menu from the screen.
Arrow keys	Move the inverse video bar (highlighted selection) up, down, right, or left. In CHARM and CHARMED, the arrow keys can also be used to move the crosshair cursor on graphic displays, define a zoom area, define a map scale, and reposition plumes, footprints, and icons.
<Enter>	Selects the highlighted item or map location represented by the cursor. On a map display, <Enter> can be used to select an icon or generate a dose display at a specific location. In a dialog box, <Enter> directs CHARM to accept the displayed values or cancel the operation, depending on which command button is highlighted.

Page Up	Scrolls a window display up. In CHARMED, after an option from the Define menu of the Map Definition window is selected, <Page Up> moves the cursor instead of the map display.
Page Down	Scrolls a window display down. In CHARMED, after an option from the Define menu of the Map Definition windows is selected, <Page Down> moves the cursor instead of the map display.
<Ctrl-Arrow key>	Changes the position of the plume, overpressure, or radiation footprint within the viewport by virtually moving the solid circle on the CHARM display.
<Shift-Enter>	In CHARM, when the cursor is on a map location icon on a snapshot footprint view, <Shift-Enter> displays the enlarged map represented by the icon. When the cursor is on a release icon, <Shift-Enter> displays a selection list of release scenarios for the location. In CHARMED, <Shift-Enter> selects an icon to be repositioned.
<Shift-Arrow key>	In CHARMED, <Shift-Arrow key> moves an icon that has been selected with <Shift-Enter>.

Chapter 4: Using the CHARM Editor

Use the CHARM editor (CHARMED) to identify the locations of the files that CHARM uses; add, modify, or delete data from the chemical database; update chemical data from a previous version of a CHARM database; enter site-specific information; set up communication with a meteorological tower(s); select population data files to determine population impacts; and define maps for display with the CHARM program.

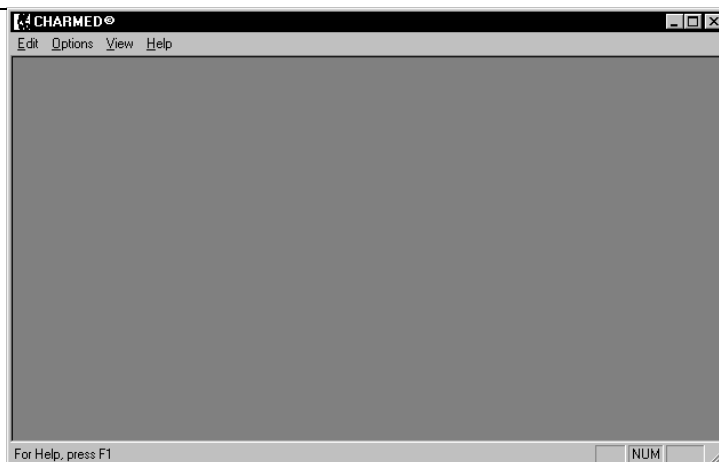
Use the following steps to run the CHARM editor:

1. Double click the CHARMED icon in the CHARM Group in Program Manager, or

Select CHARMED.EXE from the CHARM installation directory using the Windows Explorer or My Computer from the desktop. The CHARMED window is displayed.

The CHARMED window shown in Figure 4.1 is displayed.

Figure 4.1
Main CHARM
Editor
Window



The CHARMED Window

The main CHARM editor window has several menus, the most significant one where the user will spend most of the time is the Edit menu. The Edit menu provides a command for each of the following CHARM editors:

Chemical Database	Add, modify, or delete data in the chemical database.
--------------------------	---

Import Previous Database

Displays a dialog box requesting the path to the previous version of the CHARM database. Once the path is entered, CHARM will attempt to update the current database from those records in the previous database. The user will be prompted to add or modify any data that exists in the previous database and not in the most recent database.

Update Plot Concentrations

Displays a dialog box requesting the path to the previous version of the CHARM database. Once the path is entered, CHARM will attempt to update the default plot concentrations in the current database from those records in the previous database. The user will be prompted for verification.

Pack Chemical Database

Physically removes logically deleted records from the chemical database. Records are logically deleted from within the Chemical Database editor using the Delete button.

Local Met Comm Parameters

Sets the parameters for communications with a meteorological tower. Another Radian software program (METINTER.EXE) is required for the implementation of communication with a tower.

Network Met Server Location	Sets the logical name of the server to where a network version of the Meteorological Interface (METINTER.EXE) will reside for LAN/WAN access.
File Location	Specifies where CHARM can find necessary files.
Site Information	Specifies site-specific information for a release in a file labeled USRMSG.
Map Definition	Reads maps and provides commands to edit them for use with CHARM.
Select Population Files	Select population files to be used in determining population impacts for a plume or footprint. These files are initially generated from the TIGERMAP Utility program.
Change Password	Defines CHARM/System password to regulate CHARMED entry. This menu item may be grayed and optional to the user. Contact Radian to allow password access.
Exit	Exits CHARMED.

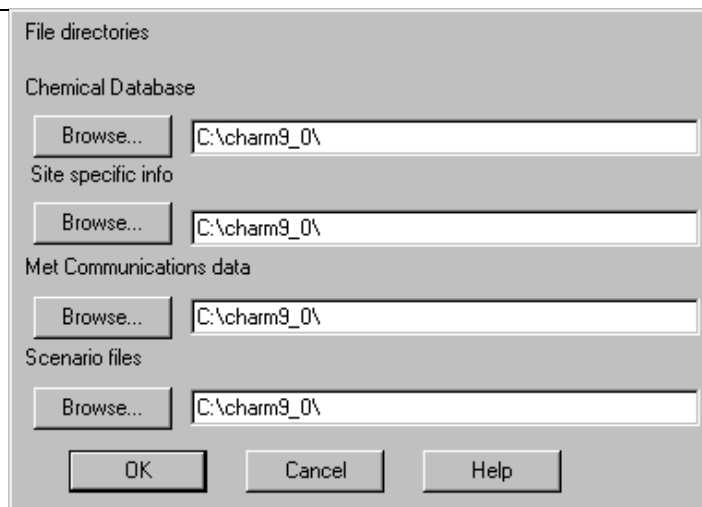
Only one editor can be used at a time. When you exit from an editor, you are returned to the CHARMED window.

Editing File Locations for CHARM

Use the File Location command on the Edit menu of the CHARMED window to identify the directory locations for the chemical database, site specific information, meteorological communication parameters, as well as the location of the emergency response files. Emergency response files have default .EMG extensions, unless you specify a

different extension (see Chapter 3: CHARM.INI File Description). CHARM uses this directory information to locate necessary files. Figure 4.2 shows the CHARMED File Location Editor.

Figure 4.2
File Location
Editor



To identify directory locations:

1. Run the CHARM editor by selecting the CHARMED.EXE file. The CHARMED window is displayed.
2. Select the File Locations command on the Edit menu of the CHARMED window.
3. Enter the full path names for the directories containing the Chemical Database, Site Specific Information, Meteorological Communication Parameters, and Scenario files. Alternatively, use the Browse button associated with each file directory to input full path names.
4. Select OK or press <Enter>.

Maintaining the Chemical Database

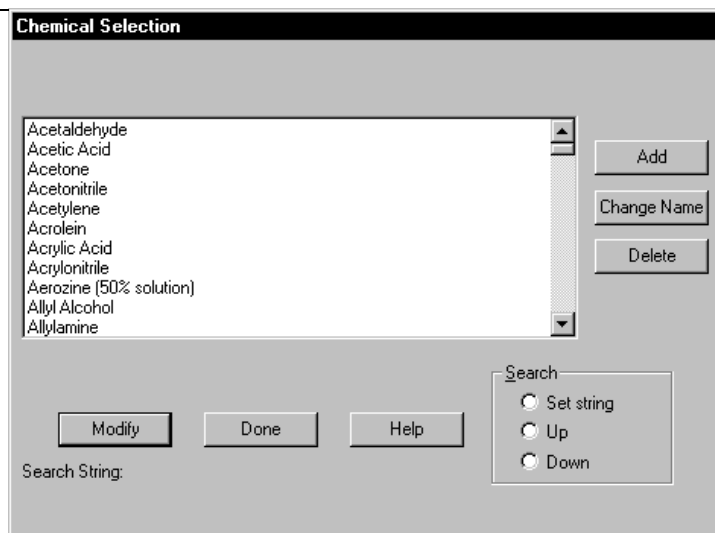
The chemical database provides over 180 chemical species and their characteristics for use with the CHARM program. Information from the chemical database is displayed in the Chemical Selection and Chemical Editor windows of the CHARM editor.

The Chemical Selection Window

After you select the Chemical Database command from the Edit menu, the Chemical Selection window shown in Figure 4.3 is displayed. This window contains a list of all the chemicals in the database. The

Change Name, Delete, and Modify commands require you to select the chemical name first. To select a chemical, simply highlight the desired compound by left mouse clicking on the chemical name. You can use the search or scroll functions to look for a particular chemical species.

Figure 4.3
Chemical
Selection
Window



Using the Search Function

Use the Search function to look for a particular chemical in the chemical database. This function can be used to find entire chemical names quickly or to find a chemical whose name is only partially known. The Search function is also available in CHARM when the chemical species is selected for input. The following dialog box is displayed when you select the Set Search String command button from the Chemical Selection window.



To perform a search on the list of chemical names:

1. Run the CHARM editor by selecting the CHARMED icon from the CHARM group or by executing the CHARMED.EXE file from the Windows Explorer or My Computer on the desktop. The CHARMED window is displayed.
2. Select the Chemical Database command on the Edit menu. The

Chemical Selection window is displayed.

3. Select the Set string radio button from within the Search group box.
4. Type a character string for the search and include one of the wild card characters, * (asterisk) or ? (question mark).

The * represents zero or more characters. The ? represents the position of a character in the string, rather than a particular character.

A search allows for multiple order-dependent strings to be used. For example, a search for the character string "di*meth*e?e" retrieves all strings with the substrings "di," followed by "meth," and then followed by "e?e." The ? represents any character with an "e" on either side.

5. Select OK or press <Enter>.
6. Specify whether to search backward or forward from the currently highlighted species by selecting the Up or Down button. Either the highlight bar moves to the first name that matches the search string, or a message displays saying no matches were found.

Chemical Species

The chemicals available with CHARM are listed below. *(NOTE: Your copy of CHARM may actually contain more than the names listed below, since new chemicals are periodically added to this list).*

Acetaldehyde
Acetic Acid
Acetone
Acetonitrile
Acetylene
Acrolein
Acrylic Acid
Acrylonitrile
Aerozine (50% solution)
Allyl Alcohol
Allylamine
Allyl Chloride (3-Chloropropene)
Ammonia
Ammonia 25%
Ammonia (15% solution)
Ammonia (20% solution)
Ammonia (29% solution)
Ammonia (3.6% solution)
Ammonia (49.9% solution)
Ammonia (5% solution)
Aniline

Arsine
Benzene
Benzyl Chloride (Tolyl Chloride)
Benzyl Cyanide
Boron Trichloride
Boron Trifluoride
Bromine
2-Bromopropionic Acid
1,3-Butadiene
Butane
1-Butene(a-Butylene)
2-Butene-cis
2-Butene-trans
Carbon Dioxide
Carbon Disulfide
Carbon Monoxide
Carbon Tetrachloride
Chlorine
2-Chloroethanol
Chloroform
Chloromethyl Ether
Chloromethyl Methyl Ether
2-Chloropropylene
Crotonaldehyde, (E)
Cyanogen Bromide
Cyanogen Chloride
Cyclohexylamine
Cyclopropane
Diallylamine
Diborane
Dibutyl Phthalate
2,3 Dichloropropene
Dichlorosilane
Diethylene Triamine
Difluoroethane
Diisopropylaminoethanol
Diisopropylcarbonate
Dimethylamine
Dimethyldichlorosilane
Dimethyl Disulfide
2,2-Dimethylpropane
Dimethyl Sulfate
Di-tert-butylethyldiamine
Epichlorohydrin
Ethane
Ethanol
Ethyl Acetylene
Ethyl Acrylate
Ethylamine
Ethyl Chloride
Ethylene
Ethylenediamine
Ethylene Dibromide(1,2-Dibromoethane)
Ethylene Dichloride(1,2-Dichloroethane)

Ethylene Glycol
Ethyleneimine
Ethylene Oxide
Ethyl Ether
2-Ethyl-1-Hexanol
Ethyl Mercaptan
Fluorine
Formaldehyde
Formaldehyde (37% solution)
Formaldehyde (56% solution)
Formic Acid
Freon 12 (Dichlorodifluoromethane)
Freon 14 (Carbon Tetrafluoride)
Freon 16 (Hexafluoroethane)
Furan
Furfural
Hexamethylenediamine
37% Hydrochloric Acid
Hydrazine
Hydrazine Monohydrate (35% Solution)
Hydrazine (54% Solution)
Hydrochloric Acid (30% Solution)
Hydrogen
Hydrogen Bromide
Hydrogen Chloride
Hydrogen Cyanide
Hydrogen Fluoride
Hydrogen Fluoride (30% Solution)
Hydrogen Selenide
Hydrogen Sulfide
IRFNA (Inhibited Red Fuming Nitric Acid)
Isoamylene (2-Methyl-2-Butene)
Isobutane
Isobutyronitrile
Isopentane
Isoprene
Isopropanol
Isopropylamine
Isopropyl Benzene (Cumene)
Isopropyl Chloride
Isopropyl Ether
Mesityl Oxide
Methacrylonitrile
Methane
Methanol
2-Methyl-1-Butene
3-Methyl-1-Butene
Methyl Chloride
Methyl Diisocyanate
Methylene Chloride (Dichloromethane)
Methyl Ether
Methyl Ethyl Ketone
Methyl Formate
Methyl Hydrazine

Methyl Isobutyl Ketone
Methyl Isocyanate
Methyl Mercaptan
Methyl Methacrylate
Methyl Phosphonic Dichloride
Methyl Phosphonic Difluoride
2-Methylpropene
Methyltrichlorosilane
Morpholine
Mustard Gas
m-Xylene
n-Butane
n-Butyl Acetate
n-Butyl Acrylate
n-Butyl Alcohol (1-Butanol)
n-Decane
n-Hexane
Nitric Acid (70% Solution)
Nitric Acid (98Solution)
Nitric Oxide
Nitrogen Dioxide
Nitrogen Dioxide/ Dinitrogen Tetroxide
Nitrogen Tetroxide
Nitrogen Trifluoride
N,N-DimethylFormamide
o-Cresol
o-Dichlorobenzene
Oleum (35%)
Oxygen
Parathion
Pentane
1-Pentene
2-Pentene,(E)
2-Pentene,(Z)
Phenol
Phosgene
Phosphine
Phosphorous Oxychloride
Phosphorous Trichloride
Pinacolyl Alcohol
Piperidine
Propadiene
Propane
Propionic Acid (Methylacetic Acid)
Propionitrile
Propylene
Propyleneimine
Propylene Oxide
Sarin
Silane
Soman
Styrene
Sulfur Dioxide
Sulfuric Acid (98% solution)

Sulfur Trioxide
tert-Butyl Alcohol (2-Methyl-2-Propanol)
tert-Butylamine
Tetrachloroethylene (Perchloroethylene)
Tetraethyl Lead
Tetrafluoroethylene
Tetrahydrofuran
Tetramethylsilane
Tetranitromethane
Thionyl Chloride
Thiophenol (Benzenethiol)
Toluene
Toluene Diisocyanate
Toluene 2,4-Diisocyanate
1,1,1-Trichloroethane (Methyl Chloroform)
Trichloroethylene
Trichlorosilane
Trifluorochloroethylene
Trimethylamine
TriMethylChloroSilane
Unsymmetrical Dimethyl Hydrazine
Vinyl Acetate
Vinyl Chloride
Vinyl Ethyl Ether
Vinyl Fluoride
Vinylidene Chloride
Vinylidene Fluoride
Vinyl Methyl Ether
VX

The Chemical Editor Window

The Chemical Editor Window contains the thermodynamic data that define the chemical in the database. The window shown in Figures 4.4, 4.5, and 4.6 is displayed when you select the Add or Modify command buttons in the Chemical Selection window.

Figure 4.4
Chemical
Editor
Window (top)

CHARMED® - [Chlorine]	
File Edit View Window Help	
Chlorine	
Molecular weight (kg/kmole)	70.91
Normal boiling point (K)	239.12
Melting Point (K)	172.12
Triple Point Temperature (K)	172.12
Triple Point Pressure (atmospheres)	0.0135
Critical temperature (K)	417.15
Critical pressure (atmospheres)	76.09
Critical volume (m³/kmole)	0.124
Heat of vaporization at normal boiling point (J/kg)	2.88e+005
Surface tension of liquid phase at normal boiling point (N/m)	0.0268
Viscosity of liquid phase at normal boiling point (kg/m s)	0.00048863
Gamma (Cp/Cv)	1.32
Energy of molecular interaction (K)	274.99
Effective diameter of molecule (Å)	5.25
For Help, press F1	
NUM	

Figure 4.5
Chemical
Editor
Window
(Temperature
Dependent
Equations)

CHARMED® - [Chlorine]	
File Edit View Window Help	
Liquid Heat Capacity Equation (J/kmol K)	
$C_p = A + B \cdot T + C \cdot T^2 + D \cdot T^3 + E \cdot (T^2)^2$	
Liquid Heat Capacity Coeffs (J/kmol K)	
A	63936.000
B	46.35000
C	-0.1623000
D	0
E	0
Liquid Density Equation (kg/m³)	
$d = A/B \cdot (1 + (1-T/C)^D)$	
Liquid Density Coeffs	
A	158.119
B	0.27645
C	417.1499939
D	0.2926
E	0
Vapor Heat Capacity Equation (J/kmol K)	
$C_p = A + B \cdot [C/T/\sinh(C/T)]^2 + D \cdot [E/T/\cosh(E/T)]^2$	
Vapor Heat Capacity Coeffs	
A	29142.000
B	9176.00000
C	949.0000000
D	10030
E	425
For Help, press F1	
NUM	

Figure 4.6
Chemical
Editor
Window
(Bottom)

CHARMED® - [Chlorine]	
File Edit View Window Help	
Default concentrations for plotting (ppm)	
(1)	0.500
(2)	5.000
(3)	50.000
Reported Fraction (0 -> 1)	
Parameter A for concentration probit equation	-8.290
Parameter B for concentration probit equation	0.920
Parameter N for concentration probit equation	2.000
Net heat of combustion (J/g)	0.00
Flash point temperature (K)	0.00
Upper flammability limit (%)	0.00
Lower flammability limit (%)	0.00
Auto-ignition temperature (K)	0.00
Free energy of formation at 25 C (kcal/mole)	0.00
Flame speed (Mach)	0.000
Explosion efficiency (fraction)	0.10
Flame temperature (K)	0.00
Number of carbon atoms	0
Number of hydrogen atoms	0
Number of oxygen atoms	0
Number of halogen atoms	2
Halogen atoms are assumed to be chlorine	
For Help, press F1	
NUM	

To edit chemical data, move the highlight bar over the field and double-click the left mouse button or press <Enter>. A dialog box is displayed in which you can change the value. When you edit chemical data, the database is updated only if you select Close or Save from the File menu. If you select Close after making changes to the data, CHARMED will prompt the user to save changes to the chemical database.

When you are running the CHARM program, you can display chemical data for the selected species by selecting the Chemical Data command on the Displays menu of the Main CHARM Input Window and the Displays menu of plan view windows. You can also display the Emergency response text from the database by selecting the Emergency Response command on the Displays menu.

File Menu

The File menu in the Chemical Editor closes the chemical data window, saves any changes to the database, edits emergency response text, prints the text in a window, previews the data before printing, configures the printer, or exits the CHARM Editor.

Edit Menu

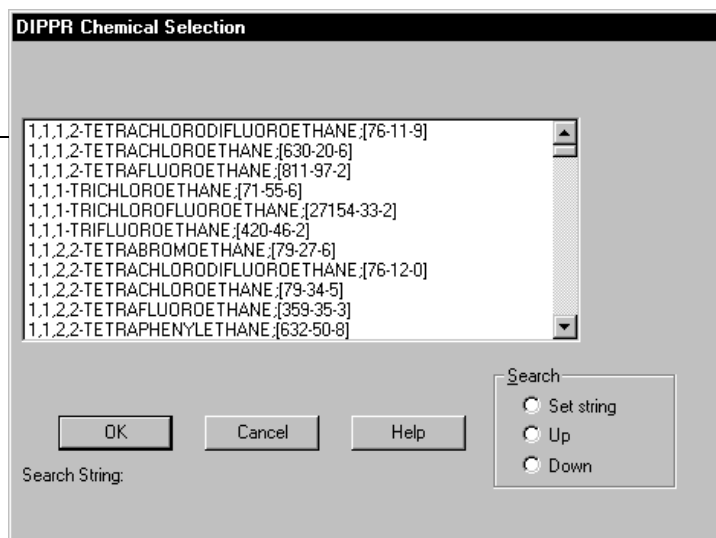
The Edit menu in the Chemical Editor window allows the user to export the chemical data currently displayed in the window. To accomplish this, select the Copy Data command from the Edit Menu. The chemical data are copied to Window's Clipboard in an ordered, comma delimited format. Likewise, chemical data may be imported in the same manner. Once comma delimited data exists in the Clipboard, select the Paste Data command from the Edit menu, and the data is copied from the Clipboard into the Chemical Database window into the appropriate data fields.

Another method of importing data involves CHARM's interface to the DIPPR database. For this option, select Import From DIPPR under the Edit menu. CHARMED displays a selection list of all the species in the DIPPR chemical database (see Figure 4.7). The display window is much like the CHARM Chemical Species selection window. The user may build a search string containing wild card characters * (asterisk) or ? (question mark). The * wild card character represents zero or more character, and the ? wild card character represents the position of a single character (see Using the Search Function in this chapter).

The user may search by name or by CAS number. After selecting a chemical, the DIPPR database is read and the data in the original data display window is replaced. To exit the Chemical Selection window without choosing a chemical, select the Cancel command button. CHARMED will inform the user if any values required by CHARM were not located in the DIPPR database. The missing data values will be reported as zeros (0.00) in the CHARMED Chemical Data sheet.

The Copy menu item simply copies the contents of the Chemical Database window, including field description text, into the clipboard.

Figure 4.7
DIPPR
Selection
Window



Chemical Data

The chemical database includes the following thermodynamic data for each chemical:

Molecular Weight

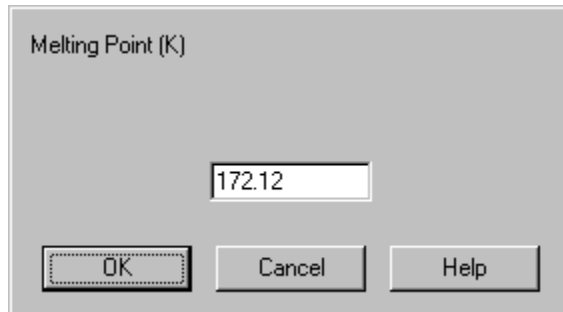
The molecular weight (grams per mole) of the species.

Normal Boiling Point (NBP)

The temperature (Kelvin) at which the vapor pressure of the liquid is equal to one atmosphere.

Melting Point

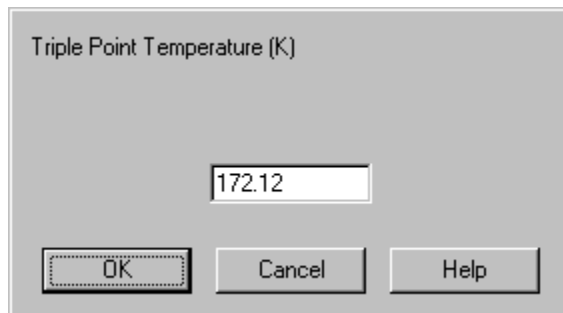
This is the temperature (Kelvin) at 1 atmosphere of pressure at which the solid phase of the species changes to liquid.



A dialog box titled "Melting Point (K)". It contains a text input field with the value "172.12". Below the input field are three buttons: "OK", "Cancel", and "Help". The "OK" button is highlighted with a dashed border.

Triple Point Temperature

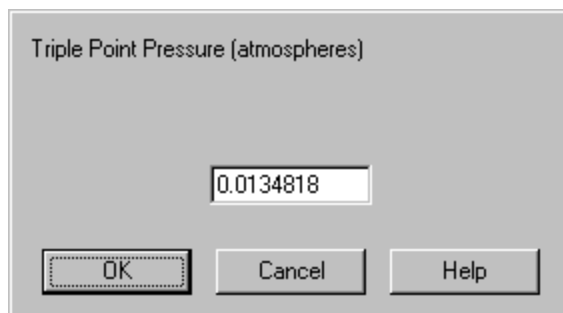
This is the temperature (Kelvin) at the triple point pressure which all three phases (solid, liquid, and vapor) of the species exist.



A dialog box titled "Triple Point Temperature (K)". It contains a text input field with the value "172.12". Below the input field are three buttons: "OK", "Cancel", and "Help". The "OK" button is highlighted with a dashed border.

Triple Point Pressure

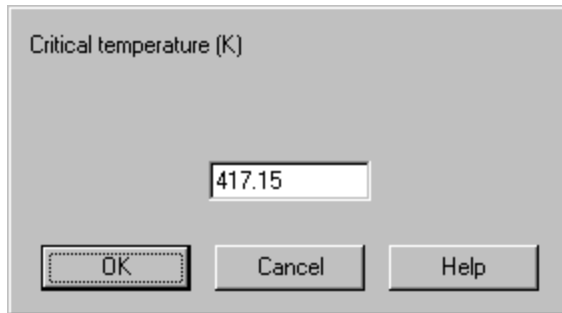
This is the pressure (atmospheres) at the triple point temperature which all three phases (solid, liquid, and vapor) of the species exist.



A dialog box titled "Triple Point Pressure (atmospheres)". It contains a text input field with the value "0.0134818". Below the input field are three buttons: "OK", "Cancel", and "Help". The "OK" button is highlighted with a dashed border.

Critical Temperature

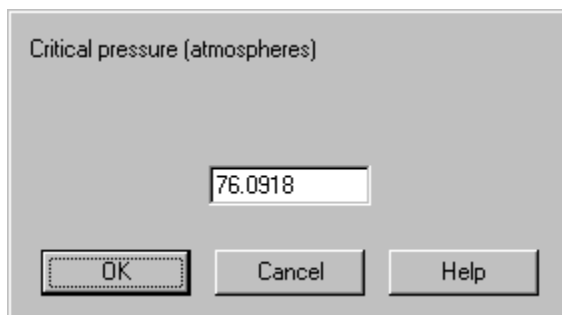
The temperature (Kelvin) above which a gas cannot be liquefied, regardless of pressure.



A dialog box titled "Critical temperature (K)". It features a text input field containing the value "417.15". Below the input field are three buttons: "OK", "Cancel", and "Help". The "OK" button is highlighted with a dashed border.

Critical Pressure

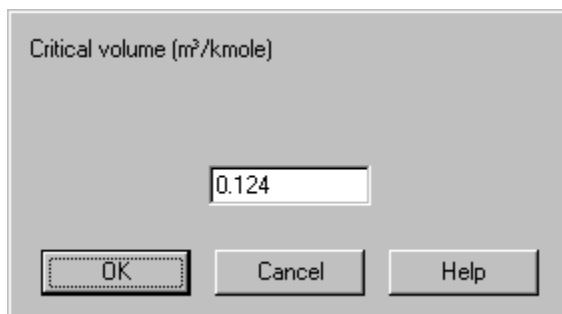
The lowest pressure (atmospheres) required to liquefy the gas at the critical temperature.



A dialog box titled "Critical pressure (atmospheres)". It features a text input field containing the value "76.0918". Below the input field are three buttons: "OK", "Cancel", and "Help". The "OK" button is highlighted with a dashed border.

Critical Volume

The molar volume (cubic centimeters) at the critical point. The critical point is the temperature and pressure at which the liquid and vapor states of a material have the same density.



A dialog box titled "Critical volume (m³/kmole)". It features a text input field containing the value "0.124". Below the input field are three buttons: "OK", "Cancel", and "Help". The "OK" button is highlighted with a dashed border.

Heat of Vaporization at Normal Boiling Point

The heat of vaporization (Joules per kilogram) at normal boiling point (NBP). This value is used to determine the heat required (ambient air to be entrained) to evaporate any droplets of the released species.

Heat of vaporization at NBP (J/kg)

287844

OK Cancel Help

A dialog box with a title bar. The text 'Heat of vaporization at NBP (J/kg)' is at the top. Below it is a text input field containing the number '287844'. At the bottom are three buttons: 'OK', 'Cancel', and 'Help'.

Surface Tension of Liquid Phase at NBP

A measure (Newtons per meter) of the lateral elasticity of a liquid surface. This is a measure of the resistance of a fluid to flow.

Surface tension at NBP (N/m)

0.0268199

OK Cancel Help

A dialog box with a title bar. The text 'Surface tension at NBP (N/m)' is at the top. Below it is a text input field containing the number '0.0268199'. At the bottom are three buttons: 'OK', 'Cancel', and 'Help'.

Viscosity of Liquid Phase at NBP

A measure (kilograms per meter seconds) of the resistance of a fluid to flow.

Viscosity at NBP (kg/m s)

0.000488629

OK Cancel Help

A dialog box with a title bar. The text 'Viscosity at NBP (kg/m s)' is at the top. Below it is a text input field containing the number '0.000488629'. At the bottom are three buttons: 'OK', 'Cancel', and 'Help'.

Gamma (Cp/Cv)

The ratio of the vapor state heat capacity at constant pressure to the vapor state heat capacity at constant volume. This is a dimensionless value.

Gamma (Cp/Cv)

1.3238

OK Cancel Help

Energy of Molecular Interaction

Energy divided by the Boltzman constant (hence Kelvin units). The value can be estimated with the following equation:

$$E/k = 1.15 T_B$$

where T_B is the normal boiling point. The energy of molecular interaction is used in calculating the rate at which molecules of an evaporating liquid leave the surface.

Energy of molecular interaction (K)

274.988

OK Cancel Help

Effective Diameter of Molecule

The diameter (Angstroms) of an average molecule. This diameter is determined from the volume of an average molecule, which is the molar volume divided by Avogadro's number, and then solved for the diameter. Normally, the liquid molar volume used is at normal boiling point. The diameter can be computed from the liquid molar volume (V) at the normal boiling point using the following equation:

$$D = 1.18 (V / N)^{1/3}$$

where N is Avogadro's number.

Effective diameter of molecule (Å)

5.24509

OK Cancel Help

Liquid Heat Capacity Equation

This is the form of the equation used to calculate the liquid phase heat capacity (J/kmole K). Two forms are allowed. After selecting the form, the parameters in the equation must be entered. The two forms of the equation are:

$$C_p = A + B \cdot T + C \cdot T^2 + D \cdot T^3 + E \cdot (T^2)^2$$

$$C_p = A^2/T + B - 2 \cdot A \cdot C \cdot T - A \cdot D \cdot T^2 - C^2 \cdot T^3 / 3 - C \cdot D \cdot (T^2)^2 / 2 - D^2 \cdot T^2 \cdot T^3 / 5$$

where

T = temperature (K)

A, B, C, D, and possibly E = parameters to be input.

Liquid Heat Capacity Equation (J/kmol K)

$C_p = A^2/T + B - 2 \cdot A \cdot C \cdot T - A \cdot D \cdot T^2 - C^2 \cdot T^3 / 3 - C \cdot D \cdot (T^2)^2 / 2 - D^2 \cdot T^2 \cdot T^3 / 5$

OK Cancel Help

Liquid Heat Capacity Coefficient A

This is the A term of the equation used to calculate the liquid phase heat capacity (J/kmole K). The equation takes one of the two forms described in the section above labeled 'Liquid Heat Capacity Equation'. Depending on the form of the Liquid Heat Capacity Equation, the coefficients A, B, C, D, and possibly E are required to be input.

Liquid Heat Capacity (J/kmol K) Coeff. A

63936

OK Cancel Help

Liquid Heat Capacity Coefficient B

This is the B term of the equation used to calculate the liquid phase heat capacity (J/kmole K). The equation takes one of the two forms described in the section above labeled 'Liquid Heat Capacity Equation'. Depending on the form of the Liquid Heat Capacity Equation, the coefficients A, B, C, D, and possibly E are required to be input.

Liquid Heat Capacity (J/kmol K) Coeff. B

46.35

OK Cancel Help

Liquid Heat Capacity Coefficient C

This is the C term of the equation used to calculate the liquid phase heat capacity (J/kmole K). The equation takes one of the two forms described in the section above labeled 'Liquid Heat Capacity Equation'. Depending on the form of the Liquid Heat Capacity Equation, the coefficients A, B, C, D, and possibly E are required to be input.

Liquid Heat Capacity (J/kmol K) Coeff. C

-0.1623

OK Cancel Help

Liquid Heat Capacity Coefficient D

This is the D term of the equation used to calculate the liquid phase heat capacity (J/kmole K). The equation takes one of the two forms described in the section above labeled 'Liquid Heat Capacity Equation'.

Depending on the form of the Liquid Heat Capacity Equation, the coefficients A, B, C, D, and possibly E are required to be input.

Liquid Heat Capacity Coefficient E

This is the E term of the equation used to calculate the liquid phase heat capacity (J/kmole K). This coefficient is only required if the form of the Liquid Heat Capacity Equation described in the section above labeled 'Liquid Heat Capacity Equation' is of the form

$$C_p = A + B \cdot T + C \cdot T^2 + D \cdot T^3 + E \cdot (T^2)^2$$

The coefficients A, B, C, and D are required to be input.

Liquid Density Equation

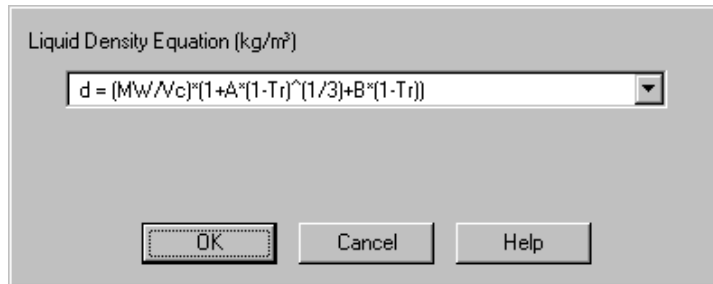
This is the form of the equation used for calculation of liquid density (d). Three forms are allowed. After selecting the form, the parameters in the equation must be entered. The three forms of the equation are:

$$\begin{aligned} d &= (MW/V_c) \cdot (1 + A \cdot (1 - T_r)^{1/3} + B \cdot (1 - T_r)) \\ d &= A / B^{(1 + (1 - T/C)^D)} \\ d &= A + B \cdot T + C \cdot T^2 + D \cdot T^3 + E \cdot (T^2)^2 \end{aligned}$$

where

MW = molecular weight (kg/kmole)
V_c = critical volume (m³/kmole)
T = temperature (K)
T_r = T / T_c
T_c = critical temperature (K)

A, B, and possibly C, D, and E = parameters to be input, depending on the form of the equation chosen.



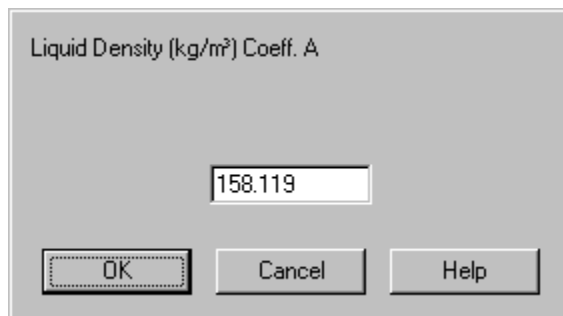
Liquid Density Equation (kg/m³)

$d = (MW/Vc) * (1 + A * (1 - T_r)^{1/3} + B * (1 - T_r))$

OK Cancel Help

Liquid Density Equation Coefficient A

This is the A term (units depend on the equation form) of the equation used to calculate the liquid density (d). The equation takes one of the three forms described in the section above labeled 'Liquid Density Equation'. In any form of the Liquid Density Equation, the coefficient A is required.



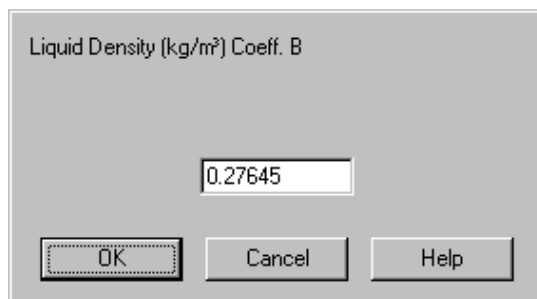
Liquid Density (kg/m³) Coeff. A

158.119

OK Cancel Help

Liquid Density Equation Coefficient B

This is the B term (units depend on the equation form) of the equation used to calculate the liquid density (d). The equation takes one of the three forms described in the section above labeled 'Liquid Density Equation'. In any form of the Liquid Density Equation, the coefficient B is required.



Liquid Density (kg/m³) Coeff. B

0.27645

OK Cancel Help

Liquid Density Equation Coefficient C

This is the C term (units depend on the equation form) of the equation

used to calculate the liquid density (d). The equation takes one of the three forms described in the section above labeled 'Liquid Density Equation'. If the Liquid Density Equation is of the form

$$d = A/B^{(1 + (1-T/C)^D)}, \text{ or}$$

$$d = A + B*T + C*T^2 + D*T^3 + E*(T^2)^2,$$

the coefficient C is required. Otherwise, set C=0.

Liquid Density (kg/m³) Coeff. C

417.15

OK Cancel Help

Liquid Density Equation Coefficient D

This is the D term of the equation used to calculate the liquid density (d). The equation may only take one of three forms described in the section above labeled 'Liquid Density Equation'. If the Liquid Density Equation is of the form

$$d = A + B*T + C*T^2 + D*T^3 + E*(T^2)^2,$$

the coefficient D is required. Otherwise, set D=0.

Liquid Density (kg/m³) Coeff. C

417.15

OK Cancel Help

Liquid Density Equation Coefficient E

This is the E term of the equation used to calculate the liquid density (d). The equation may only take one of three forms described in the section above labeled 'Liquid Density Equation'. If the Liquid Density Equation is of the form

$$d = A + B*T + C*T^2 + D*T^3 + E*(T^2)^2,$$

the coefficient E is required. Otherwise, set E=0.

Liquid Density (kg/m³) Coeff. C

417.15

OK Cancel Help

Vapor Phase Heat Capacity Equation

This is the form of the equation used for calculation of vapor phase heat capacity (C_p). Three forms are allowed. After selecting the form, the parameters in the equation must be entered. The three forms of the equation are:

$$C_p = A + B \cdot \exp[-C/T^E]$$

$$C_p = A + B \cdot [C/T \cdot \sinh(C/T)]^2 + D \cdot [E/T \cdot \cosh(E/T)]^2$$

$$C_p = A + B \cdot T + C \cdot T^2 + D \cdot T^3 + E \cdot (T^2)^2$$

where

T = temperature (K)

A, B, C, D, and possibly E = parameters to be input, depending on the form of the equation chosen.

Vapor Heat Capacity Equation (J/kmol K)

$C_p = A + B \cdot [C/T \cdot \sinh(C/T)]^2 + D \cdot [E/T \cdot \cosh(E/T)]^2$

OK Cancel Help

Vapor Phase Heat Capacity Equation Coefficient A

This is the A term of the equation used to calculate the vapor phase heat capacity (J/kmole K). The equation takes one of the three forms described in the section above labeled 'Vapor Phase Heat Capacity Equation'. In any form of the Liquid Density Equation, the coefficient A is required.

Vapor Heat Capacity (J/kmol K) Coeff. A

29142

OK Cancel Help

Vapor Phase Heat Capacity Equation Coefficient B

This is the B term of the equation used to calculate the vapor phase heat capacity (J/kmole K). The equation takes one of the three forms described in the section above labeled 'Vapor Phase Heat Capacity Equation'. In any form of the Liquid Density Equation, the coefficient B is required.

Vapor Heat Capacity (J/kmol K) Coeff. B

9176

OK Cancel Help

Vapor Phase Heat Capacity Equation Coefficient C

This is the C term of the equation used to calculate the vapor phase heat capacity (J/kmole K). The equation takes one of the three forms described in the section above labeled 'Vapor Phase Heat Capacity Equation'. In any form of the Liquid Density Equation, the coefficient C is required.

Vapor Heat Capacity (J/kmol K) Coeff. C

949

OK Cancel Help

Vapor Phase Heat Capacity Equation Coefficient D

This is the D term of the equation used to calculate the vapor phase heat capacity (J/kmole K). The equation takes one of the three forms described in the section above labeled 'Vapor Phase Heat Capacity

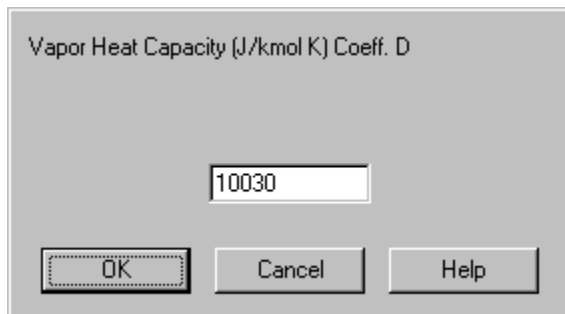
Equation'. If the Vapor Phase Heat Capacity Equation is of the form

$$C_p = A + B*[C/T*\sinh(C/T)]^2 + D*[E/T*\cosh(E/T)]^2$$

or

$$C_p = A + B*T + C*T^2 + D*T^3 + E*(T^2)^2,$$

the coefficient D is required. Otherwise, set D=0.



Vapor Phase Heat Capacity Equation Coefficient E

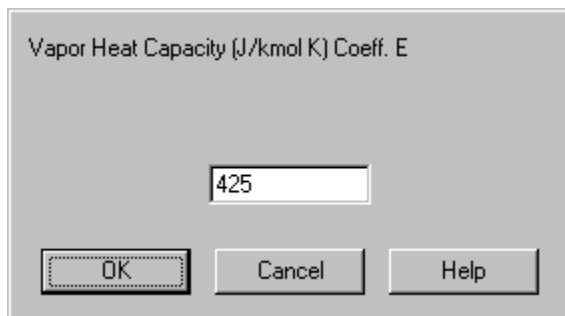
This is the E term of the equation used to calculate the vapor phase heat capacity (J/kmole K). The equation may takes two of the three forms described in the section above labeled 'Vapor Phase Heat Capacity Equation'. If the Vapor Phase Heat Capacity Equation is of the form

$$C_p = A + B*[C/T*\sinh(C/T)]^2 + D*[E/T*\cosh(E/T)]^2$$

or

$$C_p = A + B*T + C*T^2 + D*T^3 + E*(T^2)^2,$$

the coefficient E is required. Otherwise, set E=0.



First Default Concentration for plotting

The first of three isopleth concentrations (parts per million) to be used as defaults for plotting the plume. The defaults can be changed while you are running or storing a scenario.

First default concentration for plotting (ppm)

0.5

OK Cancel Help

A dialog box with a title bar. The title is "First default concentration for plotting (ppm)". Below the title is a text input field containing the value "0.5". At the bottom of the dialog are three buttons: "OK", "Cancel", and "Help". The "OK" button is highlighted with a dashed border.

Second Default Concentration for plotting

The second of three isopleth concentrations (parts per million) to be used as defaults for plotting the plume. The defaults can be changed while you are running or storing a scenario.

Second default concentration for plotting (ppm)

5

OK Cancel Help

A dialog box with a title bar. The title is "Second default concentration for plotting (ppm)". Below the title is a text input field containing the value "5". At the bottom of the dialog are three buttons: "OK", "Cancel", and "Help". The "OK" button is highlighted with a dashed border.

Third Default Concentration for plotting

The third of three isopleth concentrations (parts per million) to be used as defaults for plotting the plume. The defaults can be changed while you are running or storing a scenario.

Third default concentration for plotting (ppm)

50

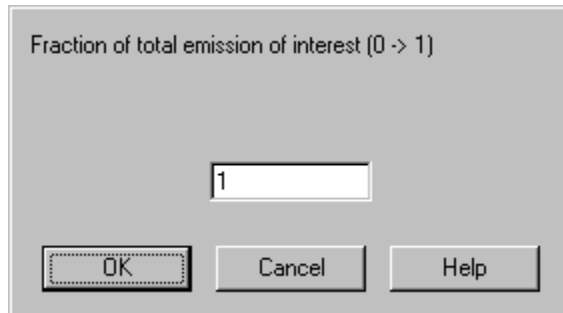
OK Cancel Help

A dialog box with a title bar. The title is "Third default concentration for plotting (ppm)". Below the title is a text input field containing the value "50". At the bottom of the dialog are three buttons: "OK", "Cancel", and "Help". The "OK" button is highlighted with a dashed border.

Reported Fraction

If the emission entering the atmosphere as a gas is actually a mixture this parameter allows you to allocate only part of the concentration to a single species. If 20% of the emission were species A and 40% species B, two chemicals could be added to the database. All the parameters would be the same for the two species except the name and this parameter. For species A to be reported correctly, this parameter should be 0.20. For species B it should be 0.40. Most species will have this parameter as

1.0. If it is set to zero, it is assumed to be 1.0.



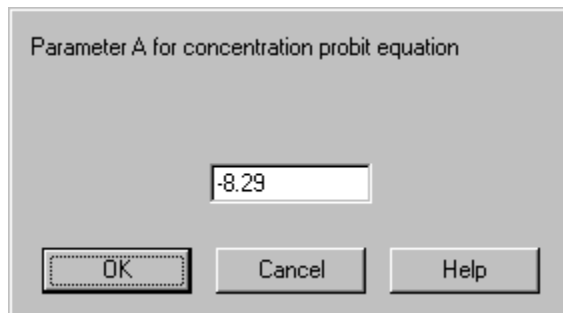
A dialog box titled "Fraction of total emission of interest (0 -> 1)". It contains a text input field with the value "1". Below the input field are three buttons: "OK", "Cancel", and "Help".

Parameter A for Concentration Probit Equation

The **A** term in the probit equation, which has the following form:

$$P = A + B \log N(TC^N)$$

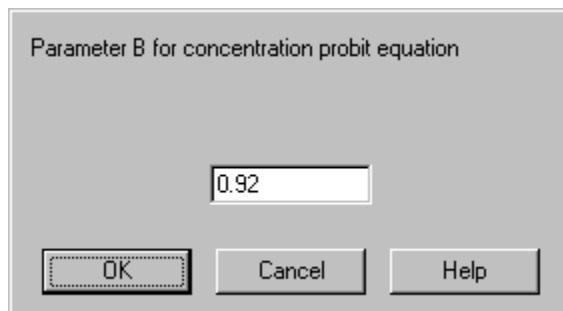
where **C** is the concentration (parts per million) and **T** is the exposure time (minutes). The probit is used to determine the probability of fatality.



A dialog box titled "Parameter A for concentration probit equation". It contains a text input field with the value "-8.29". Below the input field are three buttons: "OK", "Cancel", and "Help".

Parameter B for Concentration Probit Equation

The **B** term in the probit equation shown previously for Parameter A for Concentration Probit Equation.



A dialog box titled "Parameter B for concentration probit equation". It contains a text input field with the value "0.92". Below the input field are three buttons: "OK", "Cancel", and "Help".

Parameter N for Concentration Probit Equation

The **N** term in the probit equation shown previously for Parameter A for Concentration Probit Equation.

Parameter N for concentration probit equation

2

OK Cancel Help

Net Heat of Combustion

The amount of energy released (Joules per gram) when the material is burned.

Net heat of combustion (J/g)

22998.9

OK Cancel Help

Flash Point Temperature

The lowest temperature (degrees Kelvin) at which the vapor in air can be made to ignite momentarily.

Flash point temperature (K)

241.15

OK Cancel Help

Upper Flammability Limit

The highest concentration (percent) at which the vapor will burn.

Upper flammability limit (%)

11.1

OK Cancel Help

Lower Flammability Limit

The lowest concentration (percent) at which the vapor will burn.

Lower flammability limit (%)

2.9

OK Cancel Help

Auto-Ignition Temperature

The lowest temperature (Kelvin) at which the vapor in air can be made to ignite and burn.

Auto-ignition temperature (K)

758.15

OK Cancel Help

Free Energy of Formation at 25 °C

The amount of energy (kilocalories per mole) required to bring together the individual atoms in the molecule.

Free energy of formation at 25°C (kcal/mole)

10.4132

OK Cancel Help

Flame Speed

The speed (Mach) at which the flame will spread if a vapor cloud of the material is ignited. If the speed is greater than Mach 1, it is assumed to be a detonation. If the speed is less than Mach 1, it is assumed to be a deflagration.

Flame speed (Mach)

0

OK Cancel Help

Below is a table of flame speeds from Quentin A. Baker, Ming Jun Tang, Ephraim Scheier, and Gustavo J. Silva, Vapor Cloud Explosion Analysis, Process Safety Progress, Vol. 15, No. 2, Summer 1996.

Type of Flame <u>Expansion</u>	Mixture <u>Reactivity</u>	<u>Obstacle Density</u>		
1-D	High	High	Medium	Low
	High	5.2	5.2	5.2
	Medium	2.265	1.765	1.029
	Low	2.265	1.029	0.294
2-D	High	1.765	1.029	0.588
	Medium	1.235	0.662	0.118
	Low	0.662	0.471	0.079

3-D

High	0.588	0.153	0.071
Medium	0.206	0.100	0.037
Low	0.147	0.100	0.037

Table Explanation

Type of Flame Expansion refers to the geometry associated with the propagating (expanding) flame front. Propagation of the flame front in a long pipe corresponds to 1-D.

Propagation of the flame front between two flat plates corresponds to 2-D. Propagation of the flame front in three dimensions corresponds to 3-D. Note: Multi-deck, open framework structures should be treated as 2-D.

Reactivity is classified as low, average (medium), or high according to the recommendations of TNO (Methods for the Calculation of Physical Effects Resulting from Releases of Hazardous Materials (Liquids and Gases), CPR 14E, Second Edition 1992.) Ammonia, carbon monoxide, methane, and natural gas are the only materials regarded as having low reactivity. Hydrogen, acetylene, ethylene, ethylene oxide, and propylene oxide are considered highly reactive. All other fuels (ethane, propane, propylene, butane, isobutane, etc.) are classified as average (medium) reactivity.

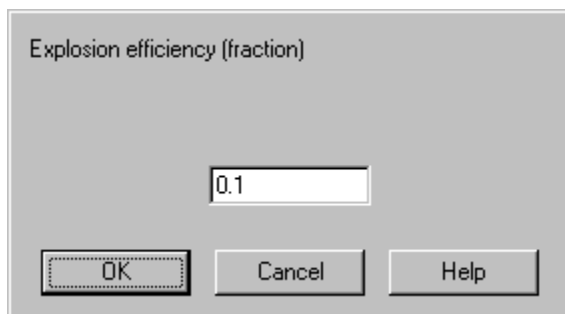
Obstacle Density refers to the presence of obstacles that may enhance flame propagation. Low obstacle density is applicable when there are few obstacles in the flames path, or the obstacles are widely spaced (blockage ratio [see below] < 10 %) and only 1 or 2 layers of obstacles are present. High obstacle density is applicable when there are 3 or more fairly closely-spaced layers of obstacles with a blockage ratio of > 40 % per layer (e.g., closely-spaced structural members, pipes, valves, and pipe racks). Medium obstacle density is that which falls between the low and high categories.

This table assumes that the vapor cloud explosion is initiated from soft ignition sources. Soft ignition sources include open flames, spark, or hot surfaces (i.e., sources that do not significantly affect the flame speed). The above table would not apply to ignition of highly turbulent jets or to high energy ignition sources (i.e., high explosives); the maximum flame speed (Mach number 5.2) should be assumed for these situations.

Blockage ratio is defined as the ratio of the are blocked by obstacles to the total cross-sectional area.

Explosion Efficiency

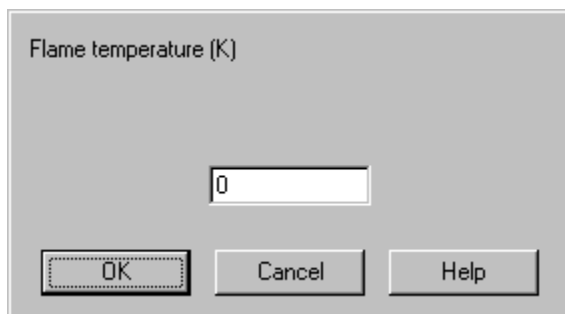
The fraction of material actually consumed if a vapor cloud is ignited. The explosion efficiency is normally about 0.10.



A dialog box titled "Explosion efficiency (fraction)". It contains a text input field with the value "0.1". Below the input field are three buttons: "OK", "Cancel", and "Help". The "OK" button is highlighted with a dashed border.

Flame Temperature

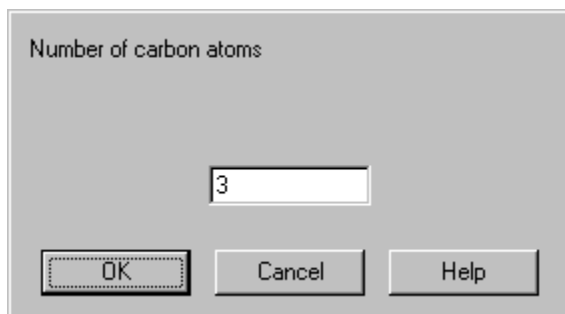
The temperature (Kelvin) at which the flame will burn when a vapor cloud is ignited. Typical values are 2000°K to 2500°K.



A dialog box titled "Flame temperature (K)". It contains a text input field with the value "0". Below the input field are three buttons: "OK", "Cancel", and "Help". The "OK" button is highlighted with a dashed border.

Number of Carbon Atoms

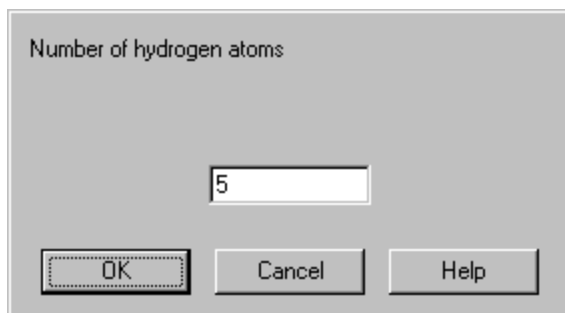
This is the number of carbon atoms in a single molecule of the species. If -1 is entered, CHARM ignores this material as being flammable for liquid pool fires.



A dialog box titled "Number of carbon atoms". It contains a text input field with the value "3". Below the input field are three buttons: "OK", "Cancel", and "Help". The "OK" button is highlighted with a dashed border.

Number of Hydrogen Atoms

The number of hydrogen atoms in a single molecule of the species.



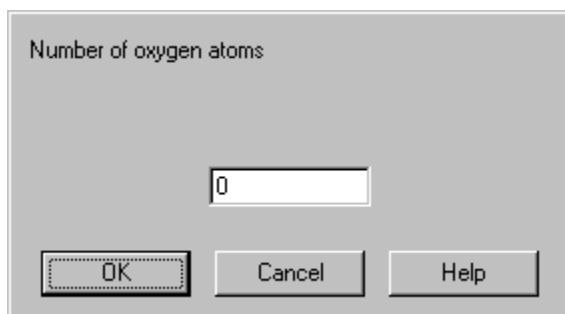
Number of hydrogen atoms

5

OK Cancel Help

Number of Oxygen Atoms

The number of oxygen atoms in a single molecule of the species.



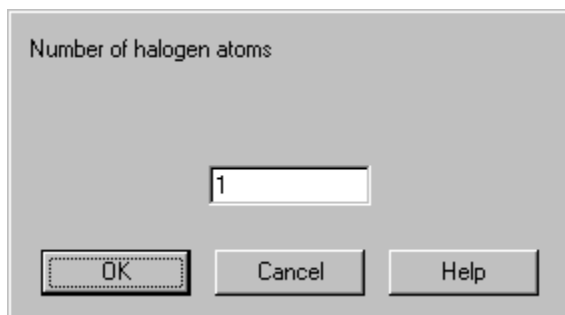
Number of oxygen atoms

0

OK Cancel Help

Number of Halogen Atoms

The number of halogen atoms in a single molecule of the species.



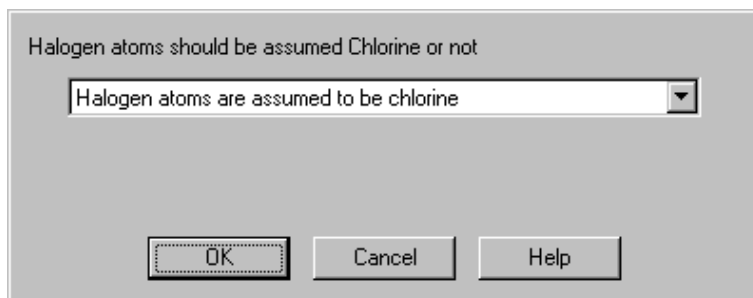
Number of halogen atoms

1

OK Cancel Help

Halogen Atoms Being Chlorine

This field indicates whether the halogen atoms are chlorine. If the halogen atoms are chlorine, an emission rate of phosgene gas will be calculated for the burn. The phosgene emission rate and concentration are reported in the Source/Puff Calculation display. These values can be used in a separate run.



Editing the Chemical Database

Use the Chemical Database command on the Edit menu of the CHARMED window to edit the chemical database. You can add a chemical and its data, change a chemical name, modify the chemical data, or logically/physically delete a chemical. You can also edit the Emergency Response Text for the selected chemical. On-line help is available for each CHARMED window and input field to guide you through entering the appropriate information.

Adding a Chemical to the Database

Use the Add command button in the Chemical Selection window to add new chemicals to the database.

To add a chemical species:

1. Run the CHARM editor by selecting the CHARMED icon from the CHARM group or by executing the CHARMED.EXE file from the Windows Explorer or My Computer on the desktop. The CHARMED window is displayed.
2. Select the Chemical Database command on the Edit menu. The Chemical Selection window is displayed.
3. Select the Add command button. A dialog box requesting the name of the chemical is displayed.



4. Type the name of the chemical to add and select OK or press <Enter>. The Chemical Editor window is displayed.

5. Enter the requested data for the chemical.

To do this, place the highlight bar over the desired field, and double-click the mouse or press <Enter>. Then type the appropriate value in the dialog box, and select OK or press <Enter> to close the dialog box.

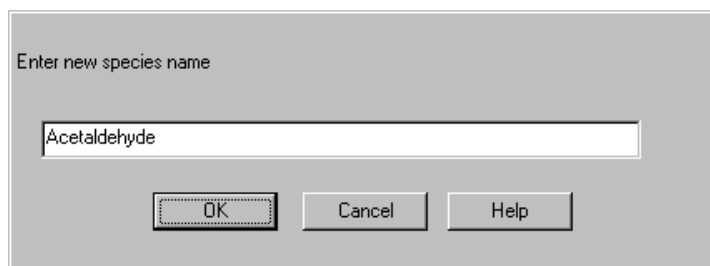
6. Select Save and then Close from the File menu to save the addition. The Chemical Selection window is again displayed.

Changing a Chemical Name

Use the Change Name command button in the Chemical Selection window to change the name of a chemical species in the database. The dialog box for changing a chemical name is the same as the dialog box for adding a new chemical.

To change the name of a chemical:

1. Run the CHARM editor by selecting the CHARMED icon from the CHARM group or by executing the CHARMED.EXE file from the Windows Explorer or My Computer on the desktop. The CHARMED window is displayed.
2. Select the Chemical Database command on the Edit menu. The Chemical Selection window is displayed.
3. Place the highlight bar over the name of the chemical in the list to change. You can use the scroll or search function to locate the chemical name.
4. Select the Change Name command button. A dialog box requesting the new name is displayed.



5. Type the new chemical name, and select OK or press <Enter>. The Chemical Selection window is again displayed.

Modifying Chemical Data

Use the Modify command button in the Chemical Selection window to modify chemical data and emergency response text stored in the

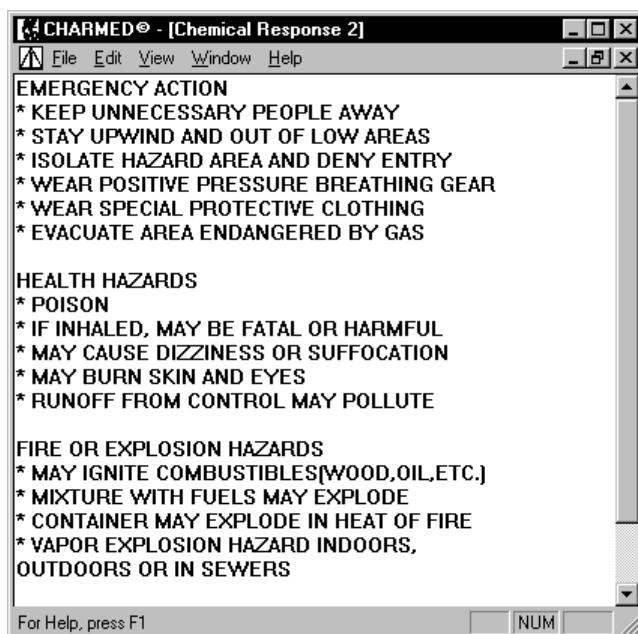
database. The chemical data window is shown in Figures 4.4, 4.5, and 4.6 earlier in this chapter.

To modify the data for a chemical:

1. Run the CHARM editor by selecting the CHARMED icon from the CHARM group or by executing the CHARMED.EXE file from the Windows Explorer or My Computer on the desktop. The CHARMED window is displayed.
2. Select the Chemical Database command on the Edit menu. The Chemical Selection window is displayed.
3. Place the highlight bar over the name of the chemical in the list. You can use the scroll or search function to locate the chemical name.
4. Double-click the left mouse button or select the Modify command button. The Chemical Editor window is displayed with data for the selected chemical.
5. Move the highlight bar over the field you want to modify and select it. A dialog box showing the current value is displayed.
6. Change the value in the dialog box.
7. Select OK or press <Enter> to close the dialog box.
8. If you want to edit the emergency response information for a chemical, select the Emergency Response Text command from the File menu while the chemical data are displayed. The text editor window is displayed and you can change the text. Select Save and Close from the File menu to return to the Chemical Editor window.
9. Select Save and Close from the File menu of the Chemical Editor window to save the changes. The Chemical Selection window is displayed.

Modifying Emergency Response Text

Use the Emergency Response Text command on the File menu of the Chemical Editor window to display the text editor window. Emergency response text is provided for each chemical species in the database. You can add, delete, or modify this information using the text editor.



The text editor is similar to the Windows Notepad. Use the Print command from the File menu to print all the text in a window. To return to the Chemical Editor window, select the Save and Close commands from the File Menu. Use the Edit menu to undo the most recent action, cut and paste text, clear selected text, and select all text in the file. Unlike other windows in the application, the File menu has no New, Open, or Save commands, because the file being edited is known and specific to CHARM.

The Emergency Response Text command and the Site Information command use the same text editor. However, the methods for saving emergency response text and site information text are different. If you use the Save command on the File menu of the Emergency Response Text window, the text changes are flagged. The changes are not saved until you select the Exit command on the File menu of the Chemical Editor window.

To edit the Emergency Response Text:

1. Run the CHARM editor by selecting the CHARMED.EXE file. The CHARMED window is displayed.
2. Select the Chemical Database command on the Edit menu of the CHARMED window.
3. Place the highlight bar over the name of the chemical whose information you want to change. You can use the scroll or search

function to locate the chemical name.

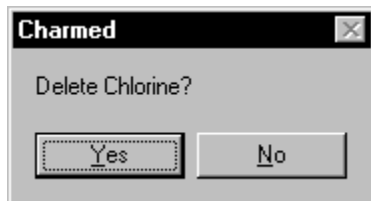
4. Select the Modify command button. The Chemical Editor window is displayed.
5. Select Emergency Response Text from the File menu. The text editor window is displayed.
6. Modify the Emergency Response Text as needed. You can enter a maximum of 32,000 characters of information.
7. Select Save and Close from the File menu of the text editor window.
8. Select Save and Close from the File menu of the Chemical Editor to save the changes. The Chemical Selection window is displayed.

Deleting a Chemical

Use the Delete command button on the Chemical Selection window to logically delete a chemical. Deleting a chemical does not actually remove the data from the database; it simply flags the data in the database and does not display the chemical name in CHARM selection lists. To physically remove the data from the database, delete the chemical and then run the Pack Database command.

To delete a chemical:

1. Run the CHARM editor by selecting the CHARMED.EXE file. The CHARMED window is displayed.
2. Select the Chemical Database command on the Edit menu of the CHARMED window. The Chemical Selection window is displayed.
3. Place the highlight bar over the chemical name in the list and select the name. You can use the scroll or search function to locate the chemical name.
4. Select the Delete button. CHARM will prompt the user to verify deletion of the desired chemical.



If you inadvertently delete a chemical from the database with the Delete command button, you can retrieve the data by adding the

chemical. Use the Add command button in the Chemical Selection window and enter the chemical name. CHARMED displays the chemical data for that chemical as they appeared before the delete operation. In fact, any chemical that was logically deleted using the Delete button from the Chemical Selection window can be retrieved simply by adding chemicals back into the database. The rule that CHARM follows is simply this: The last chemical that was logically deleted from the Chemical Selection window is the data which is used as the default data when a chemical is added.

Packing the Chemical Database

Packing the chemical database actually removes from the database all records that have been previously deleted. Figure 4.6 shows the confirmation window for packing the chemical database.

To pack the database:

1. Run the CHARM editor by selecting the CHARMED icon from the CHARM group or by executing the CHARMED.EXE file from the Windows Explorer or My Computer on the desktop. The CHARMED window is displayed.
2. Select the Pack Chemical Database command on the Edit menu of the CHARMED window. CHARMED displays a dialog box that asks you to confirm the deletion.



3. To confirm the deletion, select the Yes command button or press <Enter>. All deleted records are removed from the database and the CHARMED window is displayed.

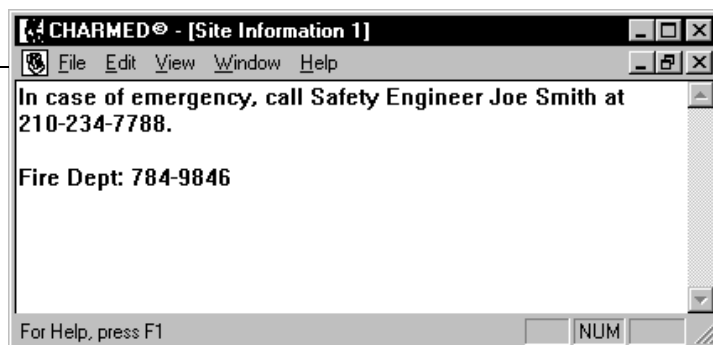
To cancel the deletion, select the No command button. No changes are made to the database and the CHARMED window is displayed.

Entering Site Information

Use the Site Information command on the Edit menu of the CHARMED window to enter and edit site-specific information such as names and telephone numbers. This information can be displayed while you are running CHARM. Figure 4.8 shows an example of a site information

text editor window.

Figure 4.8
Site
Information
Editor



The Site Information command and the Emergency Response Text command use the same text editor. However, the method by which the information is saved is different. Site information is saved when you select Save and Close from the File menu of the text editor window. If you select Exit from the File menu after making changes to the text, CHARMED will prompt you to save the changes, and then proceed to exit the CHARM Editor. Conversely, emergency response text is not saved until you select Save and Close from the Chemical Editor Window (See 'Modifying Emergency Response Text' previously mentioned in this Chapter).

The text editor is similar to the Windows Notepad. Use the File menu to print all the text in a window, save changes to the text, or close the window. Use the Edit menu to Undo the most recent action, or Copy, Cut and Paste text in the file. Unlike Windows, the File menu has no New, Open, or Save commands, because the file being edited is known and specific to CHARM.

When you are running the CHARM program, you can display site information for the current release by selecting the Site Information command on the Displays menu of the Main CHARM Input Window, or any subsequent footprint display.

To enter site information:

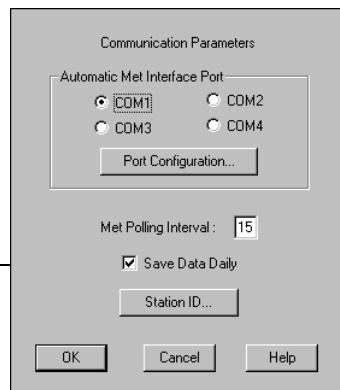
1. Run the CHARM editor by selecting the CHARMED icon from the CHARM group or by executing the CHARMED.EXE file from the Windows Explorer or My Computer on the desktop. The CHARMED window is displayed.
2. Select the Site Information command on the Edit menu of the CHARMED window. The text editor window is displayed.

3. Enter up to 32,000 characters of site-specific information.
4. Select Save and Close from the File menu in the text editor to save the site information. The CHARMED window is displayed.

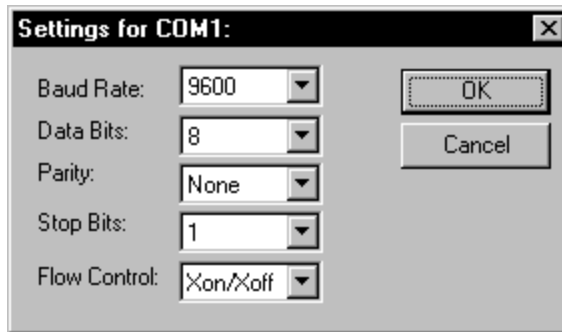
Setting the Communication Parameters

Use the Communications Parameters command on the Edit menu of the CHARMED window to define the communications port, the polling interval, and other configuration items for communication with a meteorological tower. This editor is only useful if the CHARM meteorological interface program (supplied by Radian) is on the computer. The meteorological interface program (METINTER.EXE) provides the tower-specific interface to CHARM. Figure 4.9 shows the Communications Parameters Editor window.

Figure 4.9
Communica-
tions
Parameters
Editor



The communications parameters consist of defining and configuring the Automatic Met Interface Port, specifying the Met Polling Interval, saving Data Daily, and defining station connectivity. The choices for communication ports are COM1, COM2, COM3, and COM4. One of these specifies connection with the meteorological tower. Accurate port specification is required for proper information exchange. Select the Port Configuration button to specify additional information, including the baud rate, data bits, parity, stop bits, and flow control type for the selected communication port.



The Met Polling Interval defines the frequency with which meteorological tower communications take place. The time interval should be the same as the averaging time interval for the data.

To set the parameters for communication with a meteorological tower:

1. Run the CHARM editor by selecting the CHARMED icon from the CHARM group or by executing the CHARMED.EXE file from the Windows Explorer or My Computer on the desktop. The CHARMED window is displayed.
2. Select the Local Met Comm Parameters command on the Edit menu of the CHARMED window. The text editor window is displayed.
3. Specify the communications port (COM1, COM2, COM3, or COM4) to use.
4. Select the Port Configuration button to specify additional port configuration information. Select OK or press <Enter>.
5. Enter the interval for polling the met tower in minutes.
6. Check the Save Data Daily checkbox if you want CHARM to archive meteorological data from your data logger on a daily basis into a file which timestamped with a Julian date. *[NOTE: This feature is strictly for archival purposes. CHARM cannot read these files back into the model as a source for meteorological data input. This feature is simply an add-on feature as some data loggers are not capable of archiving data.]*
7. Select OK or press <Enter>. The CHARMED window is displayed.

Defining Station ID's

Select the Station ID button to define multiple station names and means of communication (i.e. direct connection with the PC or remote connection via modem). Input up to 30 characters describing a

meteorological station to be used by CHARM to acquire real-time met data. Also, type in a phone number that will be used to access the met tower remotely if communications between the PC and the datalogger are to be connected via dial-up modems. The phone number is optional. If no phone number is specified, CHARM will assume direct connection between the PC and the data logger.

The screenshot shows a window titled 'Station ID' with a table of station information. The table has two columns: 'Station ID' and 'Phone Number'. The first row is 'Station Name 002' with phone number '210-987-6543'. The second row is 'Station Name 000' with phone number '210-345-6789' and is highlighted. The third row is 'Station Name 001' with phone number '210-987-6543'. The fourth row is 'Station Name 002' with phone number '210-987-6543'. Below the table are buttons: 'Add', 'Delete', 'Change', 'Save Change', and 'Delete All'. Below these buttons is a 'Site ID...' button. At the bottom are 'OK', 'Cancel', and 'Help' buttons.

Station ID	Phone Number
Station Name 002	210-987-6543
Station Name 000	210-345-6789
Station Name 001	210-987-6543
Station Name 002	210-987-6543

Buttons: Add, Delete, Change, Save Change, Delete All, Site ID..., OK, Cancel, Help

Adding a Station ID

Upon entering the Station ID and Phone Number (optional), press the Add button to enter the Station ID/Phone Number input into the list of possible stations. Currently, the user may define up to 100 stations.

Deleting a Station ID

Select the Delete button to delete the highlighted Station ID from the list of possible stations. All associated sites and their information will also be deleted. Select the Delete All button to delete all Station IDs and associated Phone Numbers in the list of possible stations. Again, all associated sites and their information will also be deleted.

Modifying a Station ID

Select the Change button to change the highlighted Station ID character name or associated phone number. The highlighted information will be placed in the Station ID and Phone Number input boxes. Make the appropriate changes and then select the Save Change button. The changes will be reflected in the list of stations.

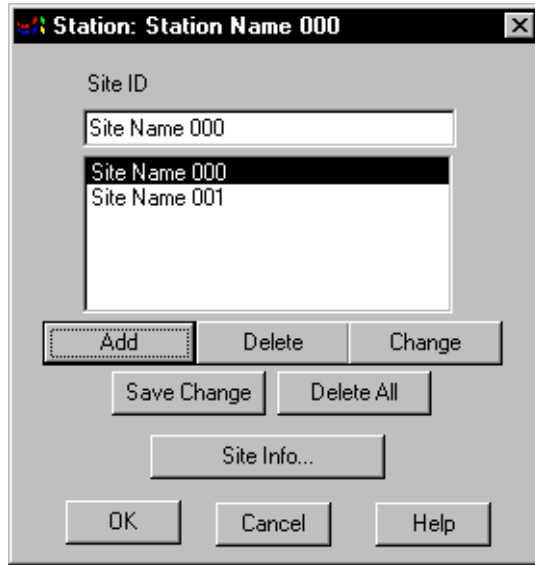
Site ID

Select the Site ID button to define multiple site names associated with the highlighted station.

Defining Site ID's

Input up to 30 characters describing a site associated with the

specified station.



Adding a Site ID

Upon entering the Site ID, select Add to enter the Site ID input into the list of possible sites. Currently, the user may define up to 100 sites.

Deleting a Site ID

Select the Delete button to delete the highlighted Site ID from the list of possible sites. All associated site information will also be deleted. Select the Delete All button to delete all Site IDs and associated site information from the list of possible sites.

Modifying a Site ID

Select the Change button to change the highlighted Site ID character name. The highlighted information will be placed in the Site ID input boxes. Make the appropriate changes and then select Save Change. The changes will be reflected in the list of possible sites.

Specifying Site Information

Select the Site Information button to display the Cartesian coordinates (x,y,z) and some default parameters associated with the highlighted site.

Defining Site Information

Define default parameters specific to a site.

Site: Site Name 000

Site Coordinates

X: 30.5 feet

Y: -17.0 meters

Z: 976.5 feet

Relative Humidity (0-100): 85

Ambient Pressure: 1.000000 atmos

Surface Roughness: 1 centimeters

OK Cancel Help

Defining Site Coordinates

Input the site location in Cartesian coordinates (x,y,z) and the associated units. Accurate site location relative to the source will ensure proper met conditions will be utilized correctly in CHARM.

Defining Relative Humidity

Enter the default ambient relative humidity in percent. Acceptable values are greater than 0 and less than 99. If relative humidity is not available to CHARM real-time, CHARM will use this value as the default.

Defining Ambient Pressure

Enter the default ambient atmospheric pressure at ground level. The pressure can be entered in atmospheres, pounds/square inch, inches of Mercury, millimeters of Mercury, or millibars. If pressure is not available to CHARM real-time, CHARM will use this value as the default.

Normal atmospheric pressure at sea level has the following equivalents:

- 1 atmosphere (atm)
- 14.7 pounds/square inch (psi)
- 1013.25 millibars (mb)
- 29.92 inches of Mercury (in Hg)
- 760 millimeters of Mercury (mm Hg)

Defining Surface Roughness

Surface roughness is a measure of the interaction between the wind and surface. It affects wind speed with altitude and thus the amount of mixing that can occur. The units are inches, feet, centimeters, or meters. If the field is left blank, no surface roughness is assumed and

the wind is assumed constant with height. See “Surface Roughness” in Chapter 5 “The Main CHARM Input Window” for some examples of surface roughness.

Defining Maps for Use With CHARM

Use the Map Definition command on the Edit menu of the CHARMED window to read a map from the clipboard or a file. After the map is displayed, you must define a scale and location with respect to some point of origin. You can also define release locations and map locations. You can define an area to zoom or unzoom, and name a larger-scaled map that will replace the current map in CHARM. You can also associate textual information to, perhaps, indicate when the map was created, evacuation routes, etc.

All maps used in CHARM are assumed to be created outside of CHARMED but accessible by CHARMED. The map definition editor can read maps from the clipboard, from Windows metafiles, Tagged Information File Format (TIFF) files, device independent bitmap (DIB) files, or from previously edited and stored files.

Improved internet browsing and downloading allows you to examine and extract map files directly from the internet. In many cases, you can simply download a file into a form that CHARM can read directly. In other instances, however, you may have to read the file into third-party software, copy the map to the clipboard, and then paste the image into the Map Definition Editor.

Reading Maps From the Clipboard

The Map Definition command can be used with other Windows programs that create metafiles, picture files, or bitmaps and place them on the clipboard. For example, MicroGrafx Draw Plus, MicroGrafx Designer, and Microsoft Windows Paint programs can generate maps for use with CHARM. AutoCAD's DXF (drawing interchange) file formats can be read into a program such as Designer® or Hijaak®, copied to the clipboard, and then read into the CHARM map editor. Refer to the Microsoft Windows user's guide for details on sending a drawing to the clipboard.

When a map has been created and placed on the clipboard, it can be accessed and displayed by the Map Definition Editor. Simply use the Paste command from the Edit menu and the map will be displayed.

Reading Maps From Files

The Map Definition command can also read previously stored files. For example, the map editor can read files stored in the Micrografx Draw Plus or PageMaker format directly instead of reading them through the

clipboard. These files must have the Windows metafile, TIFF, or windows bitmap format. Maps that have been edited and saved in CHARMED can also be read again.

To read a file into the Map Definition Editor, use the Open command on the File menu and select the name of the file to display. The Open command works the same in CHARM as in other Windows applications.

Caution: When you edit a metafile or TIFF file, be sure to rename the edited version when saving the map or the original file will be overwritten. Map information, such as scaling and map location, requires CHARM to use a different file format.

The Map Definition Command

Use the Map Definition command to edit maps for use in CHARM. After a map has been displayed in the Map Definition Editor either by opening a file or pasting an image in from the clipboard, you must perform a minimum of two operations before the map can be used from within CHARM proper. Select the Define Point command or the Define Scale command from the Define menu. It is irrelevant which operation is performed first, but a point of reference and scale must be defined to ensure that a footprint is overlayed properly on the map when displayed in CHARM proper. Other options include defining detailed map and release location icons, associating textual information with the map, and associating an expanded map to use with the Auto Map Change and Larger Scale Map options in CHARM. The map must be saved for recall when running CHARM.

While a map is displayed, you can move the cursor with the mouse or the keyboard. To scroll the map, use the mouse and the scroll bars or use <Page Up>, <Page Down>, and the arrow keys. The keys are used to move the map until an option from the Define menu is selected. After a define option is selected, the keys move the cursor.

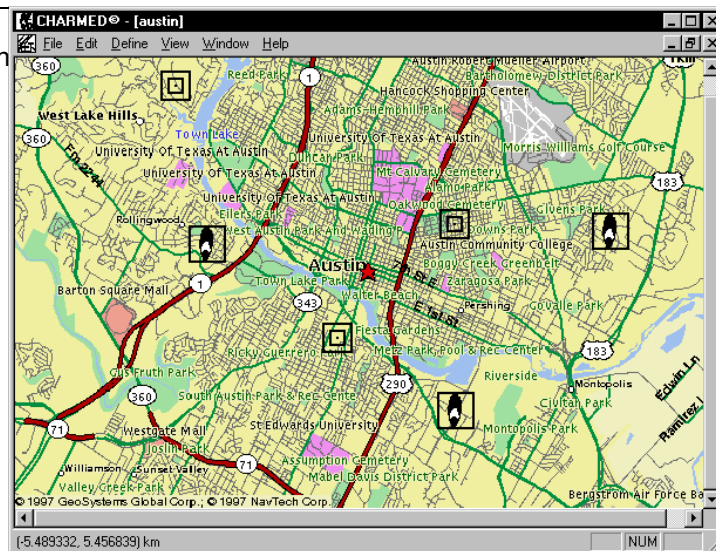
Figure 4.8 shows a sample map display. The sample shows three map location icons,



which can be selected to display a smaller scaled, or more detailed, version of the map area. Likewise, the sample illustrates three possible release sites with release locations icons



Figure 4.8
Map Definition
Editor



The Define Menu

Use the Define menu in the Map Definition window to define a point and scale. After the Map Definition Editor displays a map from the clipboard or a file, you must define a point location and a map scale. The point and scale together identify the point of origin. The origin should be the same for all maps that you intend to use with the Zoom or Automap functions. You can also use the Define menu to define zoom area, detailed map location, release location, map description, default size, and/or an expanded map name.

Using the Zoom Command

Use the Zoom command on the Define menu to define an area (zoom box) on the displayed map for enlargement. Notice that the cursor is transformed to a magnifying glass. The size of the zoom box determines the degree of zoom. The upper left corner of the box is used to determine the region that will be displayed. There may not be a one-to-one correspondence between the box and the displayed zoom area since the x,y aspect is maintained. To return a zoomed map to its original size when the window was opened, use the Unzoom command on the Define menu.

After you decide on the area to zoom in on, follow these steps:

1. Run the CHARM editor by selecting the CHARMED icon from the CHARM group or by executing the CHARMED.EXE file from the Windows Explorer or My Computer on the desktop. The

CHARMED window is displayed.

2. Select the Map Definition command on the Edit menu of the CHARMED window. The map editor window is displayed.

Use the Open command on the File menu or use the Paste command on the Edit menu to select and display a map.

3. While the map is displayed, select the Zoom command on the Define menu.
4. Move the cursor to the location of one corner of the area to be zoomed. This location represents one corner of the zoom box.
5. Define the zoom box by creating a rubberband box around the intended area to zoom. This can be done by using the mouse, or by using keyboard strokes.

If you are using a mouse, hold the left mouse button down, drag the cursor to the opposite corner of the box, and release the button.

If you are not using a mouse, press <Enter> to define the first corner of the zoom box. Next, use the arrow keys to draw the zoom box, and press <Enter> again to complete the drawing.

To return the map to its initial size when the window was opened, select the Unzoom command on the Define menu.

Defining a Point

Use the Define Point command on the Define menu to define a point of reference for a map. Notice that the cursor is transformed to an axial representation of a 3D coordinate system. You must define a point and scale for each map you use. To ensure proper placement of the plume on the map, the origin should be the same for all related maps. You can redefine the point location by repeating the steps for defining a point.

Defining a point involves identifying the location for the point on the displayed map and specifying the X and Y coordinates for the point.

Use the following steps to define a point:

1. Run the CHARM editor by selecting the CHARMED icon from the CHARM group or by executing the CHARMED.EXE file from the Windows Explorer or My Computer on the desktop. The CHARMED window is displayed.
2. Select the Map Definition command on the Edit menu of the

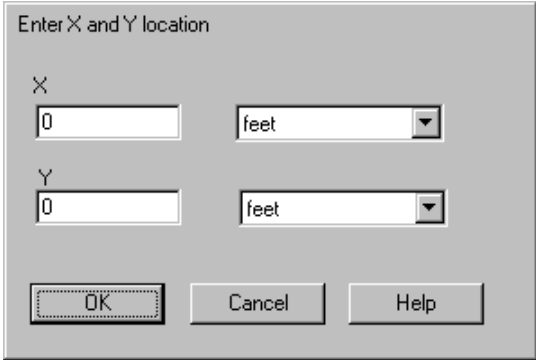
CHARMED window. The Map Definition window is displayed.

Use the Open command on the File menu or use the Paste command on the Edit menu to select and display a map.

3. While a map is displayed, select the Define Point command on the Define menu.
4. Move the cursor to the location for the point on the map.

If you are using a mouse, click the left button to identify the point location.

If you are not using a mouse, press <Enter> to identify the point location. CHARMED prompts the user for the point of reference.



5. Enter the X and Y coordinates for the point in the dialog box. The units are feet, miles, kilometers, or meters. A positive (+) X number is East of the origin and a negative (-) X number is West. A positive Y number is North of the origin and a negative Y number is South.
6. Select the OK command button or press <Enter>.

Defining a Scale

Use the Define Scale command on the Define menu to define a map scale. Notice that the cursor is transformed into a scale pointer. CHARM uses this scale to automatically expand or contract the map when a plume is displayed. You must define a point and scale for each map you use. You should use the measurement between two known points, which are preferably as far apart as possible.

A scale definition involves drawing a line on the displayed map and specifying the length of the line. After the line is drawn, CHARMED prompts the user to specify the line length.

Use the following steps to define a scale:

1. Run the CHARM editor by selecting the CHARMED icon from the CHARM group or by executing the CHARMED.EXE file from the Windows Explorer or My Computer on the desktop. The CHARMED window is displayed.
2. Select the Map Definition command on the Edit menu of the CHARMED window. The Map Definition window is displayed.

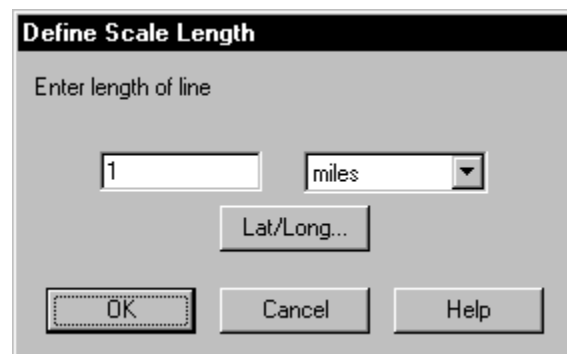
Use the Open command on the File menu or use the Paste command on the Edit menu to select and display a map.

3. While a map is displayed, select the Define Scale command on the Define menu.
4. Draw a line between two points on the map.

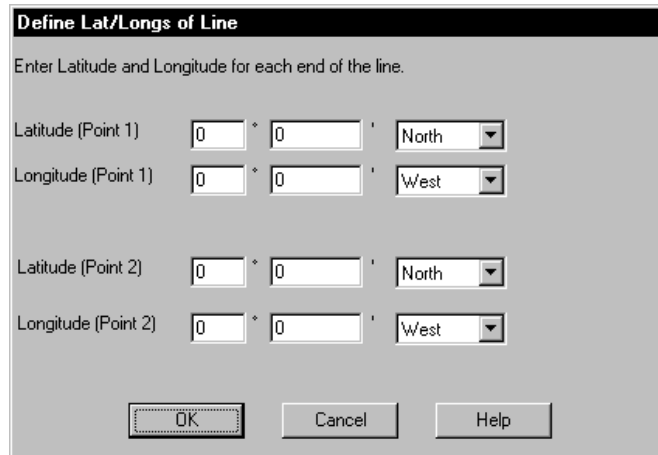
To draw the line with a mouse, move the cursor to the beginning point for the line. Press and hold the left mouse button, drag the cursor to the end point of the line, and then release the button.

To draw the line with the keyboard, move the cursor to the beginning point for the line. Press <Enter> to mark the beginning point of the line, extend the line with the arrow keys, and press <Enter> again to mark the end point of the line. CHARMED prompts the user for the length of the line.

NOTE: Bitmaps only allow a horizontal line to be drawn. Vector maps allows the user to draw the line at any angle.



5. Enter the length of the line in the dialog box. The units are feet, miles, kilometers, or meters. Alternatively, if latitude/longitude coordinates are known at the line endpoints, you may enter those coordinates by selecting the Lat/Long button.



Define Lat/Longs of Line

Enter Latitude and Longitude for each end of the line.

Latitude (Point 1) 0 * 0 ' North

Longitude (Point 1) 0 * 0 ' West

Latitude (Point 2) 0 * 0 ' North

Longitude (Point 2) 0 * 0 ' West

OK Cancel Help

6. Select the OK command button or press <Enter>. CHARMED returns to the Scale Length dialog box. Select the OK command button or press <Enter>. CHARMED returns to the Map Definition window.

Defining a Map Location

Use the Define a Map Location command to define and edit the location of an icon that represents another map. The icon looks like boxes within boxes on the map.



Notice that the cursor is transformed to a representation of this icon. The map is a smaller-scaled map to be used with the zoom feature in CHARM. Defining a map location involves positioning the icon on the map and specifying the name of the map to be displayed when the icon is selected in CHARM.

Use the following steps to define a map location:

1. Run the CHARM editor by selecting the CHARMED icon from the CHARM group or by executing the CHARMED.EXE file from the Windows Explorer or My Computer on the desktop. The CHARMED window is displayed.
2. Select the Map Definition command on the Edit menu of the CHARMED window. The Map Definition window is displayed.

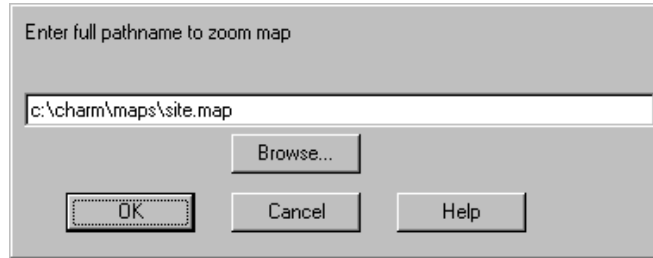
Paste an image from Windows clipboard, or use the Open command on the File menu to select and display a map.

3. While a map is displayed, select the Define Map Location

command on the Define menu.

4. Move the cursor to the point at which you want to place the icon on the displayed map.

If you are using a mouse, press the left or right mouse button to locate the icon. If you are not using a mouse, press <Enter> to locate the icon. CHARMED prompts the user for complete path and file name of the associated map file.



5. In the dialog box, enter the file name for the map that is represented by the icon. Include the full path name, including the drive, so that the file can be located anywhere in the system. Alternative, use the Browse button to scan and select the desired map file.
6. Select the OK command button or press <Enter>. CHARMED returns to the Map Definition window.

Defining a Release Location

Use the Define Release Location command on the Define menu define and edit the location of an icon that represents the location of one or more release scenarios. The icon looks like a plume within a box.



The release scenarios must be created and stored in CHARM using the Main CHARM Input Window. Defining a release location involves positioning the icon and specifying the scenarios whose titles will be displayed when the icon is selected in CHARM.

To define a release location, use the following steps:

1. Run the CHARM editor by selecting the CHARMED icon from the CHARM group or by executing the CHARMED.EXE file from the Windows Explorer or My Computer on the desktop. The CHARMED window is displayed.

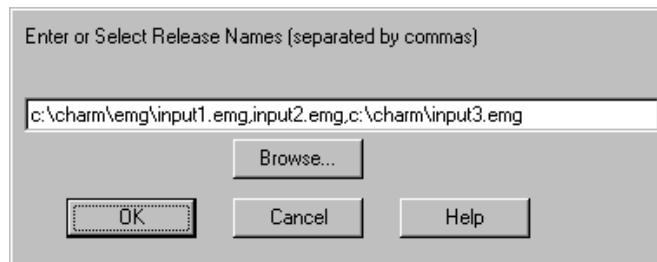
2. Select the Map Definition command on the Edit menu of the CHARMED window. The Map Definition window is displayed.

Paste an image from Windows clipboard, or use the Open command on the File menu to select and display a map.

3. While a map is displayed, select the Define Map Location command on the Define menu.
4. Move the cursor to the point at which you want to place the icon.

If you are using a mouse, press the left or right mouse button to locate the icon.

If you are not using a mouse, press <Enter> to locate the icon.



5. In the dialog box, enter the file name(s) for the release represented by the icon. Include the full path name, so that the file can be located anywhere in the system. If you want to specify more than one release, separate the file names by commas. The Browse button may be used to examine and select files currently stored on your system. DOS wildcards can be used in file names.
6. Select the OK command button or press <Enter>.

Once a map or release location is defined, you can edit the file information for an icon, reposition an icon, or delete an icon.

Map Description

Use the Map Description command on the Define menu and CHARMED displays a text window from which the user may describe pertinent information associated with a map. For example, the user may identify the sensitive receptors that exist beyond the fenceline. The description may be viewed from CHARM when the map is displayed.

The Map Description command, Emergency Response Text command, and Site Information command all use the same text editor. However, the method by which the information is saved is different. Site information and Map Definition information is saved when you select

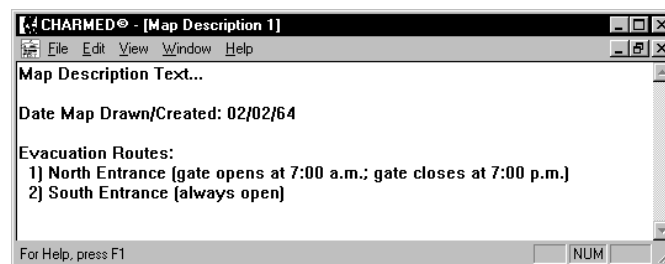
Save and Close from the File menu of the text editor window. If you select Exit from the File menu after making changes to the text, CHARMED will prompt you to save the changes, and then proceed to exit the CHARM Editor. Conversely, even though you may have saved Map Description text, the Map Description text is not really saved until you select Save and Close from the Map Definition Window.

To use the Map Description command, use the following steps:

1. Run the CHARM editor by selecting the CHARMED icon from the CHARM group or by executing the CHARMED.EXE file from the Windows Explorer or My Computer on the desktop. The CHARMED window is displayed.
2. Select the Map Definition command on the Edit menu of the CHARMED window. The Map Definition window is displayed.

Paste an image from Windows clipboard, or use the Open command on the File menu to select and display a map.

3. While a map is displayed, select the Map Description command on the Define menu. The following window is displayed.



4. In the Map Description text window, input or modify text that is pertinent to information associated with the map. Use selections from the Edit menu to copy, cut, or paste information from other Window's applications.
5. Select Save and Close from the File menu of the text editor window to save the information. Selecting Exit from the file menu closes CHARMED.

Editing Icon File Information

The file information for an existing map or release icon can be edited. If you are using a mouse, move the cursor over the icon and double-click the left mouse button. If you are using the keyboard, select the Define Map Location or Define Release Location command to allow the cursor to move the desired icon. Then, position the cursor over the icon and

press <Enter> (or click the left mouse button). A dialog box containing the current file information is displayed. Make the necessary changes and select OK or press <Enter>.

Use the following steps to edit the file information for a map or release location icon:

1. Run the CHARM editor by selecting the CHARMED icon from the CHARM group or by executing the CHARMED.EXE file from the Windows Explorer or My Computer on the desktop. The CHARMED window is displayed.
2. Select the Map Definition command on the Edit menu of the CHARMED window. The map editor window is displayed.

Use the Open command on the File menu to select and display a map.

3. Using the mouse, you can move the cursor over the icon and double-click the left mouse button; or, select the desired type of icon to edit from the Define menu, move the cursor over the desired icon and click the left mouse button.

If you are using the keyboard, you must select the Define Map Location or Define Release Location command on the Define menu *before* you can move the cursor over the icon. When the cursor is over the icon, press <Enter> to select it.

A dialog box containing the file information is displayed.

4. Edit the file information and select OK or press <Enter>.

Repositioning an Icon

You can relocate an existing map or release icon. If you are using a mouse, move the cursor over the icon, hold the left mouse button down, drag the mouse to reposition the icon, and release the left mouse button. If you are using only the keyboard, you cannot simply move the icon. You must delete the icon and then redefine the icon using the Define Map Location or Define Release Location commands.

Use the following steps to relocate a map or release location icon:

1. Run the CHARM editor by selecting the CHARMED icon from the CHARM group or by executing the CHARMED.EXE file from the Windows Explorer or My Computer on the desktop. The CHARMED window is displayed.

2. Select the Map Definition command on the Edit menu of the CHARMED window. The map editor window is displayed.

Use the Open command on the File menu to select and display a map.

3. To move the icon with the mouse, position the cursor over the desired icon, press the left mouse button and reposition the icon by dragging it. Then, release the mouse button.

Deleting an Icon

To delete an icon, move the cursor over the icon and press the Delete key. Select Yes in the dialog box to confirm the deletion.

Use the following steps to delete a map or release location icon:

1. While the map containing the icon is displayed, move the cursor over the icon and press <Delete>. CHARMED will verify the deletion.



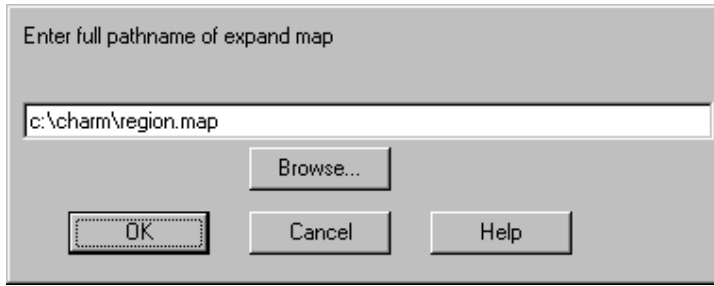
2. Select Yes in the dialog box or press <Enter> to confirm the deletion.

Naming an Expand Map

Use the Expand Map Name command on the Define menu to specify the name of a larger-scaled map than the one being defined. Figure 4.9 shows the window in which to enter the map name. The specified map is displayed automatically by CHARM if the Auto Map Scale option is checked and the currently displayed map covers a percentage of the footprint display area which is less than the percentage defined by the Auto Map Fraction. The rectangular area used for comparison is the area in which the viewport circle is inscribed. If the current map covers less than the Auto Map Fraction of the rectangular area, CHARM will attempt to display a larger scaled map, if one has been defined. The value must be between 0.05 and 0.95. The default is 0.25.

The Auto Map Scale and Auto Map Fraction options are on the Options menu of a Plan Display window in CHARM proper.

Figure 4.9
Expand Map
Window



To name an expanded map:

1. Run the CHARM editor by selecting the CHARMED icon from the CHARM group or by executing the CHARMED.EXE file from the Windows Explorer or My Computer on the desktop. The CHARMED window is displayed.
2. Select the Map Definition command on the Edit menu of the CHARMED window. The Map Definition window is displayed.

Paste an image from Windows clipboard, or use the Open command on the File menu to select and display a map.

3. Select the Define Expand Map Name on the Define menu.
4. Enter the full path name for the expanded map, or use the Browse button to display files on your disk for selection.
5. Select OK or press <Enter>. The map editor window is displayed.

Saving a Map Definition

Once you edit a map with the map definition editor, you must store it as a file for later retrieval. To save a map definition, use the Save or Save As commands on the File menu. The Save and Save As commands work the same in CHARM as in other Windows applications.

You can enter a base name and allow CHARMED to assign the default extension. CHARM uses specific extensions to identify files for selection list displays. If you do not assign an extension to the file name, CHARMED automatically assigns the default .MAP extension to the base name. When you save a map definition, another file is created with the same base name but with the .MFD extension. This file contains the map definition information.

Caution: Since files with the .MFD extension contain the map definition information, this extension should not be used for other CHARM file names. Also, a file with the .MFD extension must not be deleted, unless

its corresponding map is also deleted.

If you want a base map to display automatically when the CHARM program is started, assign the file name BASEMAP.MAP (and the associated BASEMAP.MFD file) to one of the maps you define. This feature is especially useful for running CHARM in the emergency response mode. When CHARM is started, if no file named BASEMAP.MAP is found, the main input window displays.

For maps from the clipboard, you must assign a base name to the edited map. For maps from files, you should assign a new and unique base name to the edited map. If you use the same base name, the original file will be overwritten, thereby destroying the original metafile, TIFF, or bitmap file.

Defining Population Files for Use With CHARM

Use the Select Population Files command on the Edit menu of the CHARMED window to identify one or more population files which will be used to determine the approximate number of people impacted by a footprint. The population file is created from Radian's TIGERMAP Utility in the CHARM group.



The program reads U.S. Census Bureau Tiger/Line[™] 1992 data and creates maps and/or population files. An icon for starting TIGERMAP is in the CHARM group box. Tiger/Line[™] 1992 data (available on CD-ROM) is required before the population files can be created. Contact the U.S. Census Bureau directly for ordering the data files needed. Their number is (301) 457-4100.

Multiple files can be entered. If a full path name is given to a file, the subsequent files are assumed to be in the same subdirectory until the next full path name is given. Wild cards may be used. If no extension is given (including no '.' at the end of the file name) on a file, then the default extension (normally .TPY) will be used. If you want to select pre-existing files press the Browse button. A window allowing the multiple selection of files will appear. Any files selected will be appended to the existing list.

To define population files use the following steps:

1. Run the CHARM editor by selecting the CHARMED icon from the CHARM group or by executing the CHARMED.EXE file from the Windows Explorer or My Computer on the desktop. The CHARMED window is displayed.
2. Select the Select Population Files command on the Edit menu of the CHARMED window.
3. In the dialog box, enter the file name(s) for those desired population files.

Include the full path name, so that the file can be located anywhere in the system. If you want to specify more than one release, separate the file names by commas. The Browse button may be used to examine and select files currently stored on your system. DOS wildcards can be used in the file names.

4. Select the OK command button or press <Enter>.

Inputting Data for Mixtures into the Chemical Database

CHARM is capable of modeling only a single substance at a time, independent of whether the substance is pure or suspended in a mixture. If a substance is a constituent within a mixture, there are three ways to model this from within CHARM.

1) The best approach for handling a mixture is to add a new chemical to the CHARM Chemical Database which contains the bulk properties of the liquid and the bulk gas properties of the mixture. The boiling point of the mixture is defined when the sum of all of the partial pressures of the constituents of the mixture equals one atmosphere. For CHARM to report the concentration of the constituent of interest, set the Reported Fraction field to the molar fraction of the constituent in the mixture. For example, if 20% of the emission were species A and 40% species B, two chemicals could be added to the database. All the parameters would be the same for the two species except the name and the Reported Fraction parameter. For species A to be reported correctly this parameter should be 0.20. For species B it should be 0.40. Most species will define the Reported Fraction as 1.0. If it is set to zero it is assumed to be 1.0.

2) The next best approach is to add a new chemical to the CHARM Chemical Database that contains the bulk properties of the liquid and the gas properties of the species in equilibrium with the liquid mixture. The critical values, triple point values, and the boiling point

should be representative of the vapor pressure curve of the constituent of interest in equilibrium with the liquid mixture. The Reported Fraction field should be set to 1.0.

3) The last method for handling mixtures in a liquid release is to use the data for the pure species and the CHARM model. Simply enter a "pseudo" pool diameter in the Pool/Lagoon release type by making the size of the pool proportionate to the percentage of constituent within the mixture. Use the emission rate from that CHARM calculation (see Source/Puff Calculation Display in CHARM) as input in the User Specified After-Release type. The puff diameter should be set to the actual pool size, not the pseudo pool size. The molar fraction of the constituent of interest in the gas state in equilibrium with the pool mixture should be subtracted from 1.0 and the result entered in the molar air fraction field (i.e. all other constituents will be assumed to be air). This method allows you to specify the initial concentration as well as the emission rate.

Chapter 5: The Main CHARM Input Window

The Main CHARM Input Window provides the data that CHARM needs to simulate a chemical release. When you initially run the CHARM.EXE program, the Main CHARM Input Window is displayed, unless there is a stored map file with the name BASEMAP.MAP. In the planning mode, CHARM uses the input window to solicit release and meteorological data.

If a map file has been defined using the CHARM Editor and stored with the BASEMAP.MAP name, the map is displayed when CHARM is started. The Main CHARM Input Window will still be present, but behind the Map Window. It can be made active by selecting the Input Window from the Window menu.

Note: The purpose of the BASEMAP.MAP file is to save time when using CHARM in the emergency response mode as described in Chapter 7, "Using CHARM for Emergency Response."

CHARM input consists of the **release description** in the top portion of the window and the **meteorological data** in the lower portion. Figures 5.1 and 5.2 show the release description portion of the window and Figure 5.3 shows the meteorological data portion.

Figure 5.1
Main CHARM
Input Window
(top)

Version 9.0
Title: Standard CHARM Run - Chlorine
Species: Chlorine
Release type: Container/Surface Description
Emergency response output: Plume
X location: 0 ft Y location: 0 ft
Isoleth Concentrations (ppm): 0.5, 5, 50
Building Height: 0 ft Width: 0 ft
Source to Building Distance: 0 ft Direction: 0°
Horizontal Tank or Pipeline
Tank Length: 10 ft
Tank Diameter: 10 ft
Liquid Depth in Container: 10 ft
Liquid Amount in Container (Calculated): 5875 gallons
Tank will not vent during pool fire
Storage Temperature assumed to be ambient
Storage Pressure (Calculated, gauge): 7.028 atms
Droplet fraction of mass same as Flash fraction
BLEVE burn efficiency (Calculated): 0.2527
Hole Height Above Ground: 0 ft
No Container Mitigation Time
Hole Diameter: 1 in
Hole facing opposite of wind direction
Vertical Angle of Hole: 0°
Height of Hole from Container Bottom: 0 ft
Liquid Pool Surface Height Above Ground: 0 ft
Maximum Pool Diameter: 25 ft
No Pool Mitigation Time
For Help, press F1

Figure 5.2
Main CHARM
Input Window
(middle)

Connecting Pipe
Length: 0 ft
Diameter: 0.5 ft
Relative Roughness Factor (e/D, 0->1): 0
Number of Globe Valves (100% open): 0
Number of Gate Valves (100% open): 0
Number of Gate Valves (75% open): 0
Number of Gate Valves (50% open): 0
Number of Gate Valves (25% open): 0
Number of 90° Elbows: 0
Number of 45° Elbows: 0
Number of Tee Elbows-Entering Stem: 0
Number of Tee Elbows-Entering Side: 0
Number of Tee Straight Throughs: 0
Number of Flush Pipe-Vessel Connections: 0
Number of Borda Pipe-Vessel Connections: 0
Number of Round Pipe-Vessel Connections: 0
Water Fraction of Spill Surface (0 -> 1): 0.15
Surface is assumed to be dirt
Surface Specific Heat: 800 joules/kg K
Surface Thermal Conductivity: 0.32 w/m K
Surface Density: 1640 kg/m²
Relative Pore Volume of Surface (0 ->1): 0.34
Darcy Constant of Surface: 2.8e-007 m
For Help, press F1

Figure 5.3
Main CHARM
Input Window
(bottom)

Met Data
Relative Humidity: 50 %
Ambient Temperature: 78 °F
Ambient Pressure: 1 atms
Cloud Cover (tenths): 10
Stability Class: D (User supplied)
Solar Radiation: 0 kW/m²
No inversion present
Surface roughness: 1 cm
Wind measurement altitude: 10 m
Winds Time Direction Speed
00:00 180° 10 mph
Add another wind
For Help, press F1

The Main CHARM Input Window guides you through the data fields that describe the toxicity of the release and the conditions under which the chemical species will disperse. Many of the input fields require an entry in order for CHARM to simulate the release. CHARM provides default values for the input fields that you can accept or change. If you leave a required field blank and try to close the dialog box, CHARM displays a message saying the field requires an entry.

The release description fields that appear in the input window vary according to the selected species and release type. Some of the fields in the input window contain default values. CHARM uses the data entered in the input window to calculate and predict 1) the dispersion, concentration, and movement of the plume; 2) thermal radiation from a jet fire, liquid pool fire, or boiling liquid expanding vapor explosion (BLEVE); and/or 3) mechanical/explosion overpressures.

Each release that is described in the input window and simulated in a CHARM run is called a **scenario**. To create a scenario, CHARM determines the number of puffs in a release and the initial characteristics of each puff. CHARM creates a variety of displays, such as the Snapshot Plan Plume View, based on the information entered in the input window. Whether you are using CHARM for emergency planning or emergency response, each scenario can be saved for later retrieval.

Scrolling the Input Window

To view the contents of the entire window, the CHARM input screen can be scrolled with a mouse or the keyboard. To scroll with a mouse, use the vertical scroll bar to scroll up or down, and the horizontal scroll bar to scroll right or left. With a mouse, you can scroll one line at a time, one window full of information, or to a relative location. Refer to the Windows User's Guide for more details on scrolling with a mouse. To scroll with the keyboard, move the inverse video bar to the next item off the screen, press an arrow key until the screen moves, or use <Page Up> and <Page Down>.

Selecting an Input Field

To select a field with the mouse, move the cursor over the field and double-click the left or right mouse button. To select a field with the keyboard, use the arrow keys to move the inverse video bar to the field and press the Enter key.

When you select a field, CHARM displays a dialog box in which you enter the requested information. On-line help is available from within the dialog box for each field.

Modifying CHARM Input

To change the values for any of the data fields in the Main CHARM Input Window, use the following steps:

1. Move the inverse video bar to the desired field.

To move the bar with the mouse, position the cursor over the field and click the left mouse button.

To move the bar with the keyboard, use the arrow keys to position the bar over the field.

2. Select the field.

To select the field with the mouse, double-click the left mouse button while the bar is over the field.

To select the field with the keyboard, press <Enter> while the bar is over the field.

3. Make the necessary changes to the value(s) in the dialog box.

To display the on-line help that provides additional information for the requested data, select the Help command button in the dialog box.

4. Select OK to return to the Main CHARM Input Window.

Alternatively, the user has the option of viewing the input data in a folder format. For more information on inputting the release scenario and meteorological data in this form, see the Option Menu description under Main CHARM Input Window Menus later in this Chapter.

Main CHARM Input Window Menus

The File, Edit, View, Window, and Help menus on the Main CHARM Input Window include the standard Windows commands plus some additional commands. The Options, MetFile, and Displays menus are exclusive to the CHARM program. Only those menu commands that are appropriate for the current release description are available for selection.

View Menu

Use the Status Bar command to display and hide the Status Bar, which describes the action to be executed by the selected menu item, and keyboard latch state. A check mark appears next to the menu item when the Status Bar is displayed.

Window Menu

The Window menu offers the following commands, which enable you to arrange multiple views of multiple windows in the application window:

<u>COMMAND</u>	<u>SUMMARY</u>
Cascade	Arranges windows in an overlapped fashion.
Tile	Arranges windows in non-overlapped tiles.
Arrange Icons	Arranges icons of closed windows.
Window 1, 2, ...	Goes to specified window.

Help Menu

The Help menu offers the following commands, which provide you assistance with this application:

<u>COMMAND</u>	<u>SUMMARY</u>
Help	Offers you help on the current task or command.
Index	Provides general instructions on using help.

Using Help	Offers you an index to topics on which you can get help.
Search for Help on	Displays a list of keywords used in CHARM from which a list of related topics may be.
About	Displays the version number and copyright notice for CHARM.

File Menu

The File menu on the Main CHARM Input Window provides the standard Windows file commands for creating, opening, saving, renaming, printing, and exiting CHARM. The CHARM File menu also provides a command for selecting a previously stored scenario.

The File menu of the Main CHARM Input Window has the following commands:

<u>COMMAND</u>	<u>SUMMARY</u>
New	Restores all the fields on the Main CHARM Input Window to their initial values when the CHARM program began. These default values may be changed via the CHARM.INI file (see CHAPTER 3: CHARM.INI File Description) or by selecting Save As Default under the File menu (see Save As Default command description below).
Open	Displays a dialog box requesting the name of an input file to open. The dialog box contains a selection list of the drives and any file names that match the file specification. The default extension is .EMG, which may be changed via the CHARM.INI file (see Chapter 3: CHARM.INI File Description).

Scenarios	Displays a selection list of release scenario titles stored previously in CHARM with the .EMG default file name extension or other file name that matches the currently specified extension. To create the list, CHARM first searches the directory specified for emergency response files in the File Location Editor of CHARMED. CHARM displays the selected scenario. For more information on this menu item, see the “Scenarios Command” topic below.
Save	Saves the input data from the Main CHARM Input Window. If no file name has been assigned, a dialog box is displayed in which you enter a file name.
Save As	Displays a dialog box in which you can enter the name of the file being saved.
Save As Default	Automatically saves the current scenario described in the CHARM Input Window as the default scenario stored in a file labeled CHRMDFLT.EMG; that is, upon first entering CHARM or selecting New from the File menu, the parameters stored in CHRMDFLT file are displayed.
Print	Print the entire contents of a window
Print Preview	Display the window contents on the screen as it would appear printed.
Printer	Allows the user to change the current printer configuration and connection.

Exit Exit the CHARM MDI. All windows are closed and exit the CHARM program.

New Command

The New command on the File menu restores all the fields on the Main Input Window to their initial values when the CHARM program began. If any modifications were made to the current scenario and the current scenario has not yet been saved, CHARM will prompt the user to save changes before resetting the release input parameters back to the default values. These default values may be changed via changing the CHARM initialization file CHARM.INI (see CHAPTER 3: CHARM.INI File Description) or by simply selecting the Save As Default command from the file menu.

Open File Command

The Open command on the File menu displays a dialog box requesting the name of an input file to open.

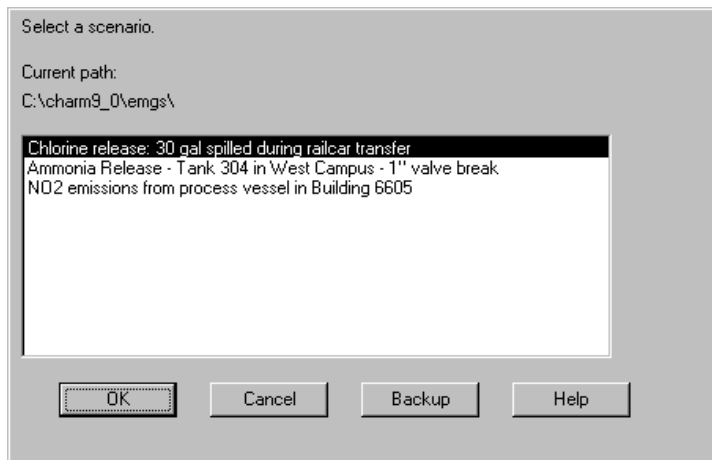


The dialog box contains a selection list of the drives and any file names that match the file specification. The default extension is .EMG, which may be changed via the CHARM.INI file (see Chapter 3: CHARM.INI File Description). Alternatively, the default extension may be changed by simply specifying a new extension in the Open or Save dialog boxes.

Scenarios Command

The Scenarios command on the File menu displays a selection list of the run titles for release scenarios that have been previously stored. Unless you specify a different extension, release scenario files are assigned the

default .EMG file name extension by CHARM. The default may be changed via the CHARM.INI file (see Chapter 3: CHARM.INI File Description).



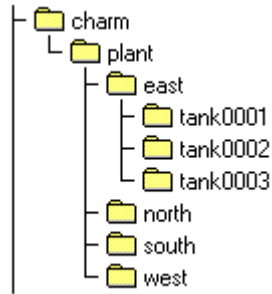
When you select a title, CHARM displays the input window containing the data for that scenario. Multiple selections, one after the other, may be required to completely select the desired scenario. The number of selections depends on the setup and location of the .IND and .EMG files. The first subdirectory in which CHARM searches for .EMG and .IND files is the directory specified for the emergency response files in the File Location editor of CHARMED. CHARM displays lists until you make the last level of selections. Then, CHARM displays the input window for the scenario described in the selected .EMG file. You can move back and forth through the scenarios as desired.

IND File

A file containing subdirectory information that CHARM uses to locate .EMG files in the emergency response mode. Files with .IND extensions are created by the user with a text editor. Using the combination of .IND file and .EMG files allows the user to organize prestored data files by geography, chemical species, etc. IND files are strictly used with the Scenarios command under the file menu in CHARM proper.

Steps for using IND Files:

- 1) The user must define the location of the initial .IND file under File Locations in the CHARM editor (CHARMED).
- 2) From File Manager or Windows Explorer, create subdirectories which layout, for example, geographical aspects of possible release sites.



3) From Notepad or some other text editor, create a file with the .IND extension and format the file as follows:

<u>LINE</u>	<u>TEXT</u>
-------------	-------------

1	Subdirectory Name.
2	Description of information associated with subdirectory name.
3	Subdirectory Name.
4	Description of information associated with subdirectory name.
5	Subdirectory Name.
6	Description of information associated with subdirectory name.
	etc...

Example IND File

The EXAMPLE.IND would read as follows and reside in the C:\CHARM\PLANT subdirectory:

```

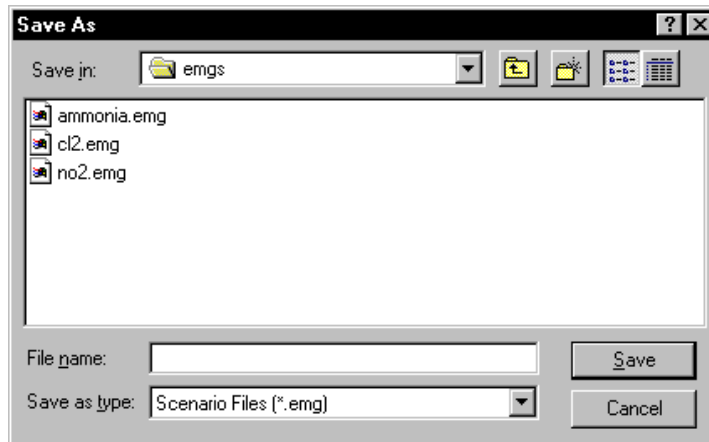
EAST
Release occurred in east side of plant
NORTH
Release occurred in north side of plant
SOUTH
Release occurred in south side of plant
WEST
Release occurred in west side of plant
  
```

NOTE: The above file should reside in the initial Emergency Response file location defined by the CHARM editor (CHARMED). NO prestored data files (.EMG) should reside in the same directory as .IND files. CHARM attempts to locate EMG files first. If EMG files are located and read, no attempt is made to locate IND files.

4) Repeat Step 3 for all directories.

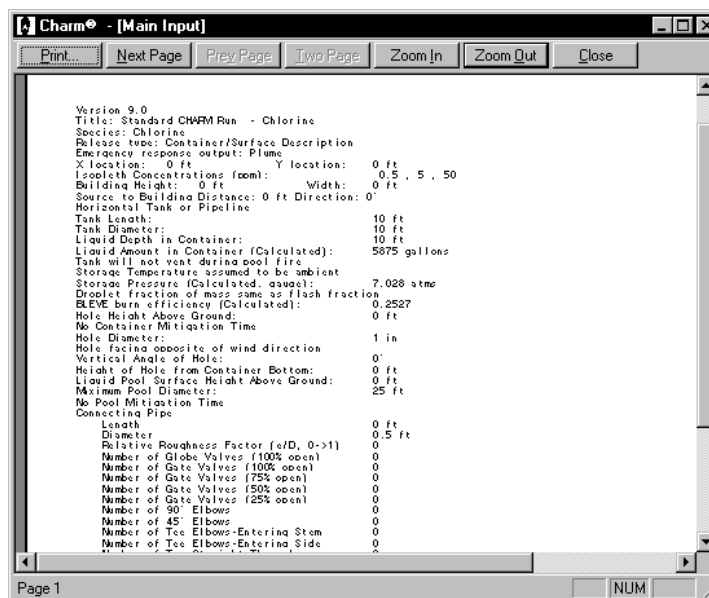
Save/Save As Commands

The Save command will save the current release description information into the currently opened file. If no current file is defined, then invoking the Save command will invoke the Save As command and display a dialog box requesting the name of an input file to save the currently defined release scenario.



Print Preview Command

The Print Preview command on the File menu displays a dialog box illustrating how the information displayed from the Main Input Window will be printed. The user has options to zoom in or out, display the next page of information, print the existing data, or close the preview and return to the CHARM Main Input Window.



Print Setup Command

The Print Setup command on the File menu displays a dialog box requesting printer configuration information. The user has options to specify the desired printer, portrait or landscape orientation, and paper size and source. Other options may also be available.



Edit Menu

The Edit menu of the Main CHARM Input Window has only one command. Use the Copy command to send text from the input window to the Windows clipboard where it can be retrieved by other programs. All text in the window, visible or not, is sent to the clipboard.

MetFile Menu

Use the Metfile menu of the Main CHARM Input Window to create, open, save, and rename files containing meteorological data. These commands are similar to the standard Windows functions. If you are set up to receive automatic information from a meteorological tower, the Metfile menu also provides the Automatic Poll command.

The Metfile menu includes the following commands:

COMMAND

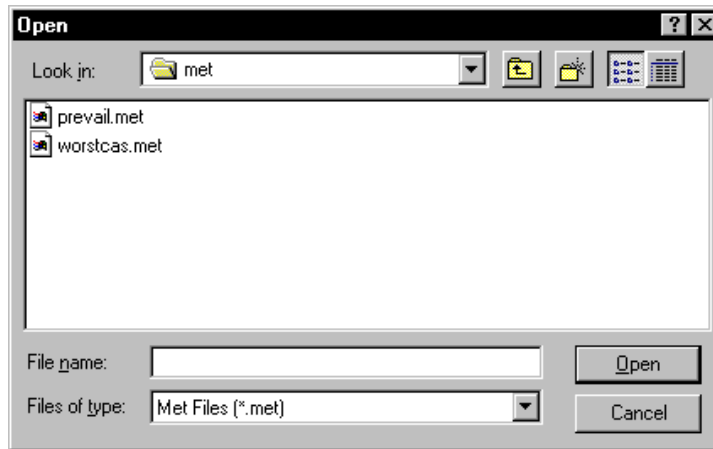
SUMMARY

New	Restores all met data to the values that existed when the program began. These default values may be changed via the CHARM.INI file (see Chapter 3: CHARM.INI File Description) or by selecting the Save As Default command under the MetFile menu.
Open	Displays a dialog box requesting the name of a met file to open. The dialog box contains a selection list of the drives and any file names matching the file specification. The default extension is .MET, which may be changed via the CHARM.INI file (see Chapter 3: CHARM .INI File Description).
Save	Saves the met data. If no file name has been assigned, a dialog box is displayed in which you enter the file name. You can enter a base extension name for the file and allow CHARM to assign the extension, or you can assign the entire name.
Save As	Displays a dialog box in which you enter the new file name and saves the met data in that file.
Save As Default	Automatically saves the current met data described in the CHARM Input Window as the default met data stored in a file labeled CHRMDFLT.MET; that is, upon first entering CHARM or selecting New from the File menu, the parameters stored in CHRMDFLT file are displayed.
Solar Radiation Worksheet	A worksheet provided to aid the user in the estimation of solar radiation.

Automatic Poll	Initiates conversation between CHARM and the meteorological interface (METINTER.EXE) to automatically read stored met data. This menu item may be grayed (unavailable) if you do not have real-time met capabilities.
Stop Poll	Signals CHARM to stop real-time data acquisition. This option is only available after Automatic Polling has been invoked. This menu item may be grayed (unavailable) if you do not have real-time met capabilities.
Use Inverse Square	Available only if more than one met site is available to CHARM for real-time data acquisition. Selecting this method allows CHARM to determine meteorological conditions at a given site, using an algorithm that weights each met parameter as a function of the met parameter at every other site and their relative distances.
Calculate Solar Radiation	Calculate the solar radiation as real-time met data is acquired. A check beside this option indicates that CHARM will calculate the solar radiation based on user input into the Solar Radiation Worksheet. This option is only available if CHARM is configured to do real-time met data acquisition.

Open MetFile Command

The Open command on the File menu displays a dialog box requesting the name of an input file to open containing meteorological data previously stored in CHARM.



Save/Save As MetFile Commands

The Save command will save the current meteorological data into the currently opened file. If no current file is defined, then invoking the Save command will invoke the Save As command and display a dialog box requesting the name of an input file to save the currently defined meteorological data.



Automatic Poll Command

Use the Automatic Poll command on the Metfile menu of the Main CHARM Input Window to read met data automatically for up to 24 hours from the specified time of release. To use this option, your system must be set up with the appropriate software program (METINTER.EXE) and communication parameters for receiving automatic data from a meteorological tower. The communications parameters can be set using the CHARM editor.

Solar Radiation Worksheet Command

Use the Solar Radiation worksheet to estimate the amount of solar radiation as a function of the time of day, the day of the year, and location. Solar radiation is a function of latitude/longitude, cloud

cover, time of day, and the day of the year. The user must specify the +/- offset from local time to Greenwich Mean Time (GMT). CHARM will use the calculated solar radiation value to aid in the determination of the stability class if so desired. Likewise, if the user elects to let CHARM calculate the solar radiation value, it will be displayed in the meteorology conditions at the bottom of the Main CHARM Input Window. An example of the worksheet is illustrated below.

Options Menu

The Options menu offers the following commands:

COMMAND

SUMMARY

Prompt at Exit

Toggle switch to prompt or not to prompt the user before exiting CHARM. A check by this menu item indicates that the user will be prompted before exiting; otherwise, no check indicates the user will not be prompted by the exit dialog box.

Time is Minutes-Seconds

Toggle switch to run CHARM in Minutes-Seconds mode or Hours-Minutes mode. A check by this menu item indicates that CHARM will run in Minutes-Seconds mode; otherwise, no check indicates that CHARM will run in Hours-Minutes mode.

Default Metric Units	Toggle switch to default CHARM to report units in metric terms or English units. A check by this menu item indicates that CHARM will use metric units; otherwise, no check indicates that CHARM will report units in English terms.
Description Dialog Input	Provides a means of viewing the release input data in a tabbed folder format.
Met Dialog Input	Provides a means of viewing the meteorological input data in a tabbed folder format.

Prompt At Exit Command

Use this command to turn on/off the prompt to exit CHARM. A check by this menu item indicates that the user will be prompted before exiting CHARM; otherwise, no check mark indicates that the user will not be prompted by the exit dialog box.

Time is Minutes-Seconds Command

Use this command to toggle between CHARM's two time modes. A check by this menu item indicates CHARM is running in Minutes-Seconds mode; i.e. CHARM will model a maximum of 24 minutes of dispersion. Likewise, all output will be in terms of minutes and seconds.

On the other hand, no check indicates that CHARM is running in Hours-Minutes mode; i.e. CHARM will model a maximum of 24 hours of dispersion. All output will be in terms of hours and minutes.

On output displays, this is differentiated by the following:

Hours-Minutes mode uses a colon (:) to delimit hour and minutes;

Minutes-Seconds mode uses equals (=) to delimit Minutes-Seconds.

For example, when CHARM is in the seconds mode all times will be displayed with the separator “=” instead of “:” or whatever the local time indicator is. So fifteen seconds into the release will appear as 00=15 rather than 00:15, which indicates fifteen minutes into the release. All time labels and columns will appropriately indicate seconds rather than minutes.

Default Metric Units Command

Use this command to default CHARM to report units in metric terms or English units. A check by this menu item indicates that CHARM will use metric units; otherwise, no check indicates that CHARM will report units in English terms.

Description Dialog Input Command

Use this command as an alternative means to view release input data rather than displaying the information from the single Main Input Window. Depending on the release type chosen from the basic information tab, the data is categorized appropriately. The basic, location, and building information tabs are always requested for any one of the three release types.

Basic Tab

On the Basic tab of the folder, CHARM requests the following:

- title of the scenario;
- the release type (Container/Surface Description, Pool/Lagoon Description, or User-Specified After-Release Conditions);
- the species being modeled;
- the desired isopleth concentrations for dispersion; and
- the type of output to be displayed when/if the stored scenario is used in CHARM's emergency response mode of operation. The type of output available depends on the scenario definition.

CHARM

Basic | Location | Building | Emission Rate | Puff | Velocity | Makeup

Title: Standard CHARM Run - Chlorine

Release Type: User Specified After-Release Conditions

Select Species...
Chlorine

Isopleth Concentrations:
0.5
5
50
ppm

Emergency Response Output
Plume

OK Cancel Apply Help

Location Tab

On the Location tab of the folder, CHARM simply requests the x,y Cartesian coordinates associated with the source location. This is only required if the footprint generated by CHARM is to be overlaid on a map, or population impact calculations are to be performed. However, this location may be changed once the footprint has been calculated by CHARM.

CHARM

Basic | Location | Building | Emission Rate | Puff | Velocity | Makeup

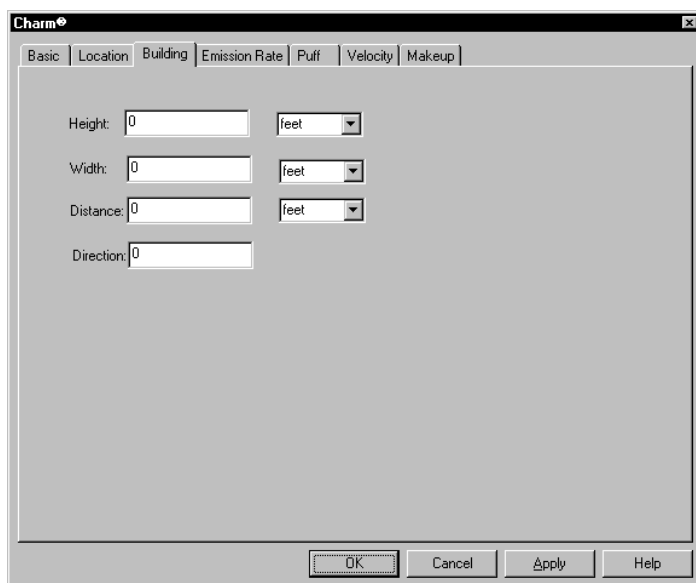
X: 0 feet

Y: 0 feet

OK Cancel Apply Help

Building Tab

On the Building tab of the folder, CHARM requests the dimensions of the building (height and width) and the distance and direction to the source. Enter the direction you would be facing if you were at the release site looking at the building. If the release site is not downwind of the building, the building is ignored. The direction can be entered in degrees or points of the compass. Degrees refer to the 360-degree directional compass, where North is 0 or 360, East is 90, South is 180, and West is 270. Points of the compass refer to North (N), East (E), South (S), West (W), and the points between, such as Northeast (NE) and South Southeast (SSE). Also, Enter the distance from the release site to the center of the building. The units are feet or meters. If the release site is more than ten times the minimum dimension of the building (height or width), the building is ignored.



For a Container/Surface Description or Pool/Lagoon Description release types, the folder is additionally categorized by pool and surface information.

Pool Tab

On the Pool tab of the folder, CHARM requests the following:

- Enter the height above ground of the liquid-air interface. The units are feet or meters. Normally a released liquid falls to the ground.

- Enter the total area or equivalent circular diameter of the pool size. The units are inches, feet, centimeters, or meters. The diameter is used to calculate the surface area from which the liquid will evaporate. Larger areas tend to evaporate more rapidly than smaller areas. CHARM will calculate the pool diameter/area if given the amount released and pool depth.
- Enter the time from the beginning of the release when the pool is assumed to be covered or drained. The evaporation from the pool will stop at the Pool Mitigation Time. The time can be in units of hours, minutes, or seconds. If no mitigation time is desired the entry can be left blank or enter zero.

Surface Tab

On the Surface tab of the folder, CHARM requests the following:

- Enter the fraction (by volume) of the spill surface that is water. This is the amount of water in the surface soil of the area that immediately surrounds the release site. The water fraction is used to determine whether freezing ground water may alter the heat flow into the spill.
- A value less than 0.1 is dry. A value of 0.6 indicates mud. A value of 1.0 is water. The suggested average value is 0.15. An entry is required.

- Select the type of surface on which the spill occurred. If you select User-defined surface type, you must enter values for the specific heat, thermal conductivity, density, relative pore volume, and Darcy's constant. If you select dirt, asphalt, concrete, or steel, CHARM assigns default values for the surface parameters. You can accept or change the default values. Otherwise, making a change to any of the surface parameters automatically changes the Surface Type to User-Defined.

The screenshot shows the CHARM software window with the 'Surface' tab selected. The 'Water Fraction' is set to 0.15. The 'Type' is set to 'Dirt'. The 'Parameters' section contains the following values:

Parameter	Value	Unit
Specific Heat	800	J/kg K
Thermal Conductivity	0.32	W/m K
Density	1640	kg/m³
Relative Pore Volume	0.34	
Darcy Constant	2.8e-007	meters

For a Container/Surface Description release type, the folder is additionally categorized by container, storage, hole, pipe, and fire/droplets information.

Container Tab

On the Container tab of the folder, CHARM requests the following:

- the container type (horizontal tank or pipeline, vertical tank, or spherical tank);
- the appropriate dimensions based on the selected container type;
- a mitigation time indicating that the release has been mitigated by some circumstance in which the release has been halted;
- the amount of liquid in the container either by volume, weight, or depth.

Charm

Basic | Location | Building | Container | **Storage** | Hole | Pool | Surface | Pipe | Fire/Droplets

Type: Horizontal tank or pipeline

Height: 10 feet

Length: 10 feet

Diameter: 10 feet

Mitigation Time: 0 Minutes

Quantity of Liquid

☒ Depth: 10 feet

☐ Amount: 5875.19 gallons

OK Cancel Apply Help

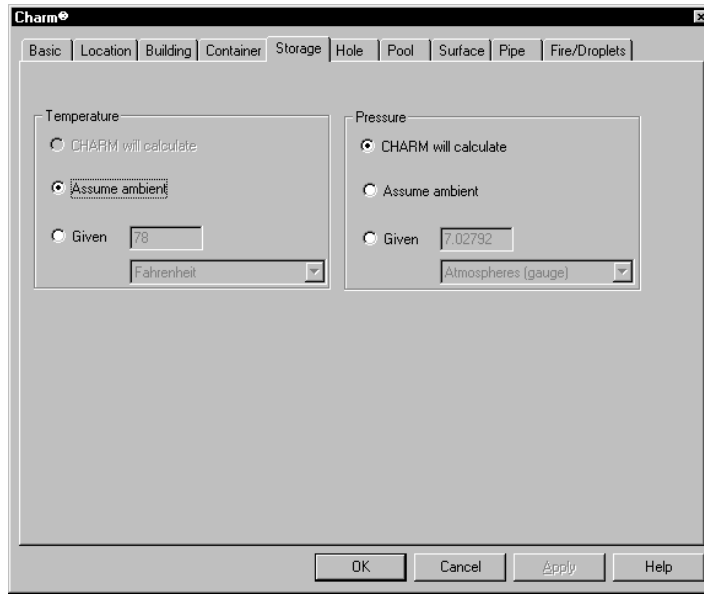
Storage Tab

On the Storage tab of the folder, CHARM requests storage temperature and pressure conditions just prior to release.

The storage temperature can be specified in Fahrenheit, Celsius, Rankine, or Kelvin units. Use a storage temperature that is greater than the melting point of the chemical released. The user can specify a value for the temperature, use the ambient condition specified in the meteorological conditions, or let CHARM calculate the temperature if the storage pressure is NOT calculated.

The storage pressure can be either gauge or absolute. The units are atmospheres, pounds/square inch, inches of Mercury, or millimeters of Mercury. An absolute pressure of less than one atmosphere is treated as one atmosphere in the release rate calculation. The user can specify a value for the pressure, use the ambient condition specified in the meteorological conditions, or let CHARM calculate the pressure if the storage temperature is NOT calculated.

CHARM will inform the user if the given temperature and pressure define a solid phase or if no liquid should exist but a liquid depth is specified. However, this is only a warning, and the user may proceed with the erroneous input.



Hole Tab

On the Hole tab of the folder, CHARM requests the following:

- Enter the hole height above the ground of the release from the container. The units are feet or meters. For a gas release, enter the height where the gas enters the atmosphere. For most heavier-than-air gas releases, where the release height is less than 50 feet (15 meters), the release can be set to zero without loss of accuracy.
- Enter the height of the hole from the bottom of the container. The units are inches, feet, centimeters, or meters. The hole height is used to determine when the liquid release may stop and the pressurized gas release begin. It is also used to determine the amount of liquid that can be left in the tank for boil-off at a later time. An entry is required.

- Enter the equivalent area or circular diameter of the hole, or the desired release time whereby CHARM will calculate the hole size required to dump the entire liquid contents of the container. When specifying the hole size directly, the units are inches, feet, centimeters, or meters. When determining the hole size indirectly by specifying the release time, the units are hours, minutes, or seconds. An entry with a value greater than zero is required. Alternatively, CHARM will calculate the hole size if the user specifies a release duration for the material in the container.
- Enter the horizontal direction you would be facing if you were inside of the tank looking out of the hole. The direction can be entered in degrees or in points of the compass. Degrees refer to the 360-degree directional compass, where North is 0 or 360, East is 90, South is 180, and West is 270. Points of the compass refer to North (N), East (E), South (S), West (W), and the points between, such as Northeast (NE) and South Southeast (SSE). An entry is required.

For a gas release, the hole direction determines the initial direction the plume takes. It is possible for the plume to travel upwind for some period of time.

CHARM can be told to assume that the hole is facing the same direction that the wind is blowing toward. Note that wind direction is specified as the direction the wind is blowing from. This reduces the turbulence that may occur as the release enters the atmosphere. Reduced turbulence generally leads to higher concentrations reaching further downwind.

- Enter the vertical angle of the hole. This is the angle that your line of sight would make with the horizon if you were inside the tank looking out through the hole. For example, if you are looking straight up, the value is 90 degrees. If you are looking straight down, the value is -90 degrees. A hole that is parallel to the horizon has a value of 0 degrees. The vertical angle of the hole can effect the plume rise of a gas release.

Pipe Tab

On the Pipe tab of the folder, CHARM requests the following:

- the pipe dimensions (length and diameter) as well as relative roughness factor. The Relative Roughness Factor (e/D) is a measure of the resistance to flow by friction from the interior surface of the cylindrical pipe where the Roughness Factor e is a function of the piping material, and D is the diameter of the pipe. Some examples of the Roughness Factor e are given below.

<u>Material</u>	<u>Roughness Factor e (mm)</u>
Drawn Tubing	0.0015
Commercial Steel or Wrought Iron	0.045
Asphalted Cast Iron	0.12
Galvanized Iron	0.15
Cast Iron	0.26
Wood Stave	0.3
Concrete	0.9
Riveted Steel	3

NOTE: Remember, the above Roughness Factors (e) must be divided by the diameter of the pipe to determine the Relative Roughness Factor.

- the number of pipe/vessel connections for each pipe type (Flush, Borda, Round);
- the number of valves;
- the number of elbows/tees.

Fire/Droplets Tab

On the Fire/Droplets tab of the folder, CHARM requests the following:

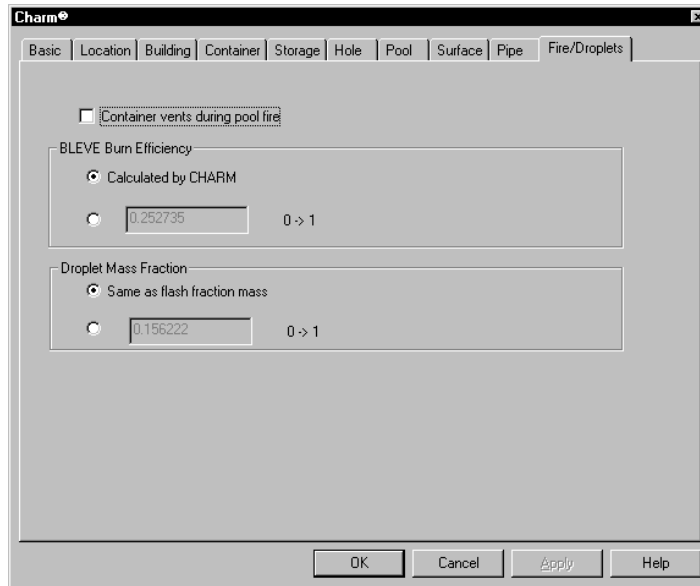
- Specify whether the tank vents during a pool fire.

Specifying that the tank will vent during pool fire signals CHARM to use 50% of the wetted tank surface area to calculate heat transfer to the stored liquid that may be released due to an increase in tank pressure and venting. The Liquid Pool Fires release type provides the information for heat calculation.

Specifying that the tank will NOT vent merely signals CHARM that no additional mass will be added to the primary source.

- Enter the efficiency (or fraction of material burned) in the BLEVE. CHARM can calculate an efficiency based on the vapor pressure of the material.

- Enter the fraction (0.0-1.0) of the total mass released that is assumed to be suspended as droplets. The default in CHARM is to assume that the same amount of mass that flashes also forms as droplets.



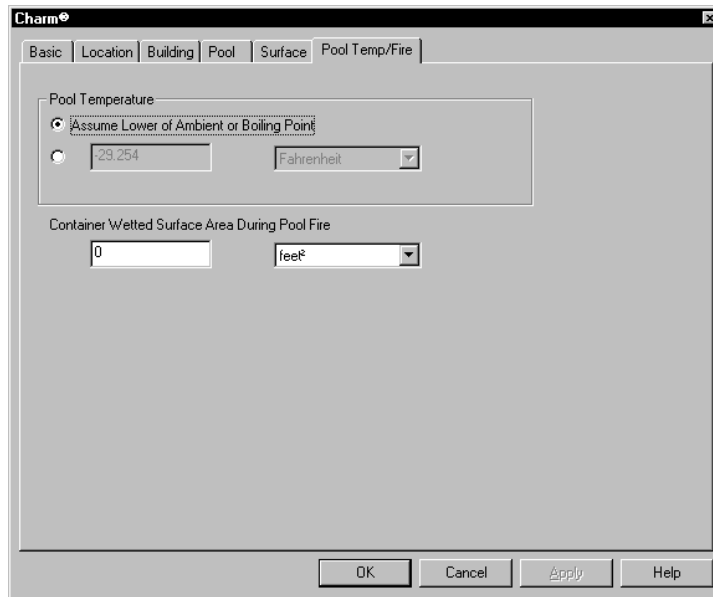
For a Pool/Lagoon Description release type, the folder is additionally categorized by pool temp/fire information.

Pool Temp/Fire Tab

On the Pool Temp/Fire tab of the folder, CHARM requests the following:

- Enter the temperature of the pool or lagoon of liquid. The temperature can be specified in Fahrenheit, Celsius, Rankine, or Kelvin units. If selected, CHARM will assume a value for the temperature, using the ambient condition specified in the meteorological conditions, or using the boiling point of the species, whichever temperature value is lower.
- Specifying a number greater than 0 indicates that a nearby tank will vent during a pool fire. CHARM uses the user-specified tank surface area which is wetted by the chemical of interest to calculate heat transfer to the stored liquid that may be released due to an increase in tank pressure and venting. The Liquid Pool Fires release type provides the information for heat calculation.

Specifying 0 indicates that no venting will occur and signals CHARM that no additional mass will be added to the primary source.



Finally, for User-Specified mode, the additional categories are emission rate, puff, velocity, and makeup.

Emission Rate Tab

On the Emission Rate tab of the folder, CHARM requests the following:

- Click on the checkbox (if available) labeled “CHARM will calculate (vertical velocity and molar air fraction given)” if you desire CHARM to calculate the emission rate, so long as the vertical velocity under the Velocity tab and the molar air fraction under the Makeup tab are user-defined.
- If CHARM is not to calculate the emission rate, the user must specify an instantaneous release rate, or a continuous release rate (of which may be defined as constant release rate, linearly decaying release rate, or exponentially decaying release rate), or a user-defined schedule of release rates at different times since release.
- Finally, the user must specify a duration time for CHARM to use as a cut-off time for material to get into the air.

CHARM

Basic | Location | Building | Emission Rate | **Puff** | Velocity | Makeup

☐ CHARM will calculate (vertical velocity and molar air fraction given)

☐ Instantaneous Release 10000 pounds

☒ Continuous Release Continuous release (constant) Initial Rate: 20 lbs/hr

☐ User Specified

Time	Rate
Hours	lbs/hr

Duration: 1 Hours

OK Cancel Apply Help

Puff Tab

On the Puff tab of the folder, CHARM requests the following:

- Enter the height above the ground of the release from the container. The units are feet or meters. For a gas release, enter the height where the gas enters the atmosphere. For most heavier-than-air gas releases, where the release height is less than 50 feet (15 meters), the release height can be set to zero without loss of accuracy.
- Enter the equivalent circular diameter or the area of the puff or stack. The units are inches, feet, centimeters, or meters. The puff size is required for a user-specified release type.

For an evaporating liquid, enter the surface area of the liquid pool.
For a gas release, enter the diameter of the hole or stack.

- Enter the temperature of the initial puff in Fahrenheit, Celsius, Rankine, or Kelvin units. The puff temperature is required for a user-specified release type. If selected, CHARM assumes the ambient temperature or the boiling point of the species, whichever is lower.

For an evaporating liquid release, the puff temperature is the temperature just above the liquid pool. For a gas release, it is the temperature upon leaving the container or stack.

- It is recommended that you allow CHARM to calculate a depth that ensures mass conservation. If you enter a value, the prediction may be physically unrealistic.

The screenshot shows the CHARM software window with the 'Puff' tab selected. The 'Basic' tab is also visible. The 'Puff' tab contains the following fields and options:

- Height above ground of release:** A text box with '0' and a dropdown menu set to 'feet'.
- Puff (Source) Diameter or Area:** A text box with '25' and a dropdown menu set to 'feet'.
- Puff (Exit) Temperature:** A group box containing two radio buttons. The first is 'Assume Lower of Ambient or Boiling Point' (selected). The second is a text box with '23.254' and a dropdown menu set to 'Fahrenheit'.
- Puff Depth:** A group box containing two radio buttons. The first is 'CHARM will calculate' (selected). The second is a text box and a dropdown menu set to 'inches'.

At the bottom of the window are buttons for 'OK', 'Cancel', 'Apply', and 'Help'.

Velocity Tab

On the Velocity tab of the folder, CHARM requests the following:

- Enter the direction of horizontal (not vertical) movement of the initial puff. The direction is determined by release conditions, not by meteorological conditions such as wind. The puff direction is required for a user-specified release type.

The direction can be entered specifically in degrees or generally in points of the compass. Degrees refer to the 360-degree directional compass, where North is 0 or 360, East is 90, South is 180, and West is 270. Points of the compass refer to North (N), East (E), South (S), West (W), and the points between, such as Northeast (NE) and South Southeast (SSE).

For an evaporating liquid pool, the direction of horizontal movement has little meaning, since there should be no inherent horizontal movement. For a gas release, the direction should be the same as the direction that the hole or stack is facing. If the hole faces directly upward or downward, any value entered for the horizontal direction is ignored by CHARM.

This entry can be left blank. If selected CHARM will assume the puff is moving in the same direction that the wind is blowing toward. Note that wind direction is specified as the direction the wind is blowing from. This reduces the turbulence that may occur as the release enters the atmosphere. Reduced turbulence generally leads to higher concentrations reaching further downwind.

- Enter the horizontal puff speed in miles/hour, knots, meters/second, or kilometers/hour. An entry is required.

For an evaporating liquid pool, the horizontal speed is zero. For a gas release, it represents the horizontal component of the exit velocity from the hole or stack. If the hole faces directly upward or downward, enter 0 (zero) for the horizontal speed.

Use the following procedure to obtain the value for the Horizontal Puff Speed field:

1. Complete the entries for the Main CHARM Input Window. Let the Vertical Puff Speed be calculated and enter values for the Molar Air Fraction and Emission Rate fields.
2. Press the Apply button.
3. Find the value for the vertical speed (VERT SPD) on the Puff Description output, and enter this value in the Horizontal Puff Speed field.
4. Enter 0 (zero) for the Vertical Puff Speed in the same window.

- Enter the vertical speed and direction of the puff. The number indicates the speed. A positive (+) number indicates an upward direction. A negative (-) number indicates a downward direction. If selected and values for the Molar Air Fraction and Emission Rate have been entered, CHARM may calculate the Vertical Puff Speed. However, the user must specify whether the material exists as a liquid or a vapor.

For an evaporating liquid, the vertical speed is zero. For a gas release, the vertical speed represents the vertical component of the exit velocity from the hole or stack. For a puff that is directed horizontally, the vertical speed is zero.

Makeup Tab

On the Makeup tab of the folder, CHARM requests the following:

- Enter the fraction of the total mass released that is assumed to be suspended as droplets. This number is the mass fraction of droplets for each puff during the emission. An entry is required.
- Enter the molar fraction of water vapor in the emission. It should not be higher than approximately 0.04, unless you are describing an extremely hot, saturated emission. An entry is required.

- Enter the molar fraction of air in the emission. This number allows the initial concentration of the gas to be specified. If you select “CHARM will calculate (emission rate and vertical velocity give)” and enter values for the vertical puff speed on the Velocity tab and the emission rate on the Emission Rate tab, then CHARM calculates the Molar Air Fraction.

CHARM

Basic | Location | Building | Emission Rate | Puff | Velocity | Makeup

Droplet Mass Fraction (0 -> 1)
0

Molar Water Vapor Fraction (0 -> 1)
0

Molar Air Fraction (0 -> 1)
☒ CHARM will calculate (emission rate and vertical velocity given)
☐ 0

OK Cancel Apply Help

Met Dialog Input Command

Use this command as an alternative means to view/modify meteorological input data rather than displaying the information from the single Main Input Window. The required data is categorized by main information, stability class, solar radiation, and wind data.

Main Tab

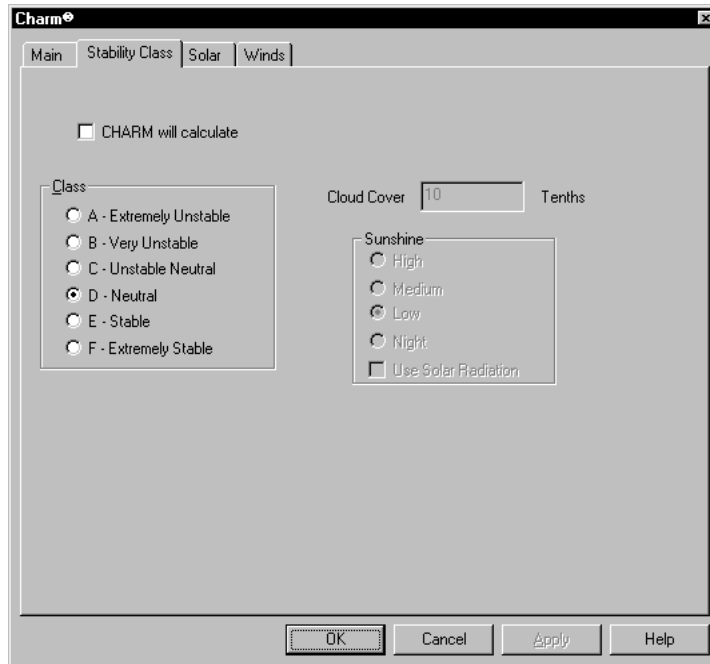
On the Main tab of the folder, CHARM requests the following:

- % Relative Humidity;
- Ambient Temperature;
- Ambient Pressure;
- Surface Roughness if it exists;
- Wind measurement height if a surface roughness is specified;
- An inversion layer height.

Stability Class Tab

On the Stability Class tab of the folder, CHARM requests the following:

- Select an atmospheric stability classification (A through F), or enter the amount sunshine. If you specify the stability class, you can not make entries for the sunshine, cloud cover, or solar radiation unless you allow CHARM to calculate the stability class for. If you want CHARM to calculate the stability class, select the appropriate checkbox and then specify the sunshine, the cloud cover, and solar radiation checkbox. If the 'Use Solar Radiation' checkbox is selected, CHARM determines the amount of sunshine based on a Solar Radiation Worksheet located under the Solar tab.



Solar Tab

Solar radiation is used as a source for heat transfer when calculating the evaporation of a liquid pool. The user may simply specify a value or use the worksheet provided on the Solar tab which will aid in CHARM's estimation of solar radiation.

Solar radiation is a function of latitude/longitude, cloud cover, time of day, and the day of the year. You must also specify the +/- offset from your local time to Greenwich Mean Time (GMT). CHARM will use the calculated solar radiation value to aid in the determination of the stability class if so desired. Likewise, if the user elects to let CHARM calculate the solar radiation value, it will be displayed in the meteorology conditions at the bottom of the Main CHARM Input Window.

Charm

Main Stability Class Solar Winds

☐ kW/m²

☒ CHARM will calculate

Latitude: ° ' North

Longitude: ° ' West

Offset to add to computer time for GMT: Hours

Date (mmdyy): Time (hhmm):

Cloud Cover: Tenths

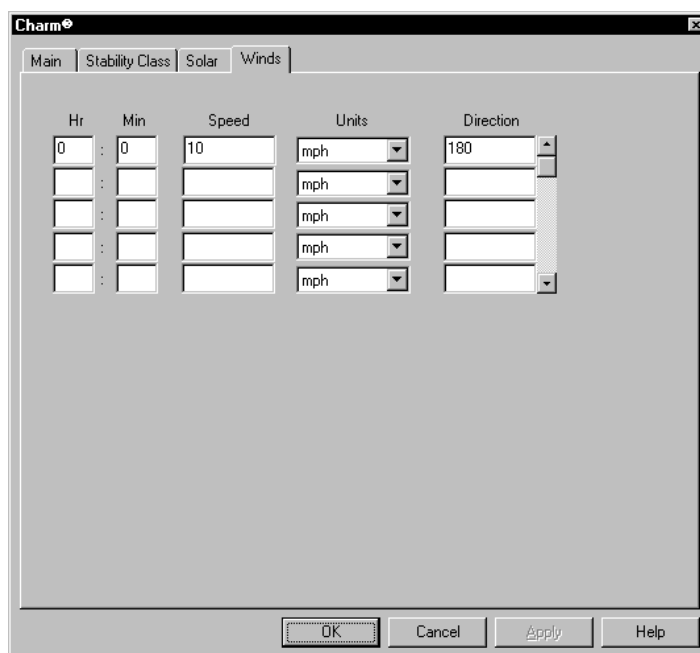
OK Cancel Apply Help

Winds Tab

Enter sets of wind times, speeds, and directions. Each set represents the conditions at a specific time. At least one wind is required. If you leave one of the wind values blank, that wind is deleted. The maximum number of wind entries is only restricted by memory.

The time is the time since release in hours and minutes, up to 24 hours. The wind speed units are miles/hour, meters/second, knots, or kilometers/hour. Wind direction is the direction from which the wind is coming. The direction can be entered in degrees or in points of the compass. Degrees refer to the 360-degree directional compass, where North is 0 or 360, East is 90, South is 180, and West is 270. Points of the compass refer to North (N), East (E), South (S), West (W), and the points between, such as Northeast (NE) and South Southeast (SSE).

CHARM performs a linear interpolation between wind times to determine a wind speed and direction. Therefore, there are no instantaneous wind shifts. To model a quick wind shift, you can enter two winds that are one minute apart.



Displays Menu

The available commands on the Displays menu vary according to the input window. Refer to Chapter 6, “Understanding CHARM Displays,” for display samples and more information. The Displays menu of the Main CHARM Input Window provides the following displays.

COMMAND

**Site
Information**

Chemical Data

**Chemical
Response**

SUMMARY

Displays a text file window containing site-specific information. The text is created using the CHARM editor.

Displays thermodynamic data and default plot concentrations from the chemical database for the selected species. The chemical database can be edited using the CHARM editor.

Displays a text window containing the emergency response information for the selected chemical species. The text can be edited using the CHARM editor.

The following displays start calculations for the numerical portion of CHARM.

Source/Puff Description	Display numerical results of different aspects of a release associated with the current input and met data.
Emission Rate	Displays a plot of the emission rate as a function of time for the variables in the Main CHARM Input Window throughout the release.

The following displays are available for the appropriate species and release types.

BLEVE	Displays a footprint of thermal radiation resulting from a fireball/BLEVE.
Pool Fire (Radiation)	Display thermal radiation of a Liquid Pool Fire associated with the current input scenario.
Pool Fire (Plume)	Display the plume of a Liquid Pool Fire associated with the current input scenario
Jet Fire Radiation	Display thermal radiation of a Jet Fire associated with the current input scenario.
Mechanical Overpressures	Display mechanical overpressures of a pressurized vessel associated with the current input scenario.
Plume	Displays a snapshot view of the plume at the specified time after release. You can also generate a concentration history plot at selected points, change the position of the plume, and zoom any map location icons that are shown.

Release Description Input

The upper portion of the Main CHARM Input Window contains input fields that describe the release. Figure 5.1 shows these fields. The release description requires the name of the chemical species, a

release type, and other pertinent information describing the release. For most release types, you can specify the proximity to a building downwind of the release, and CHARM will calculate a building wake.

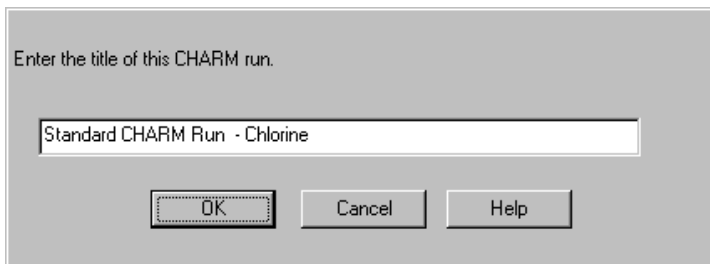
The selected chemical species and release type determine which release description fields are displayed. On-line help is available for each input field on the Main CHARM Input Window.

Version

The version number is displayed on the most hardcopy output and is not an editable field.

Title

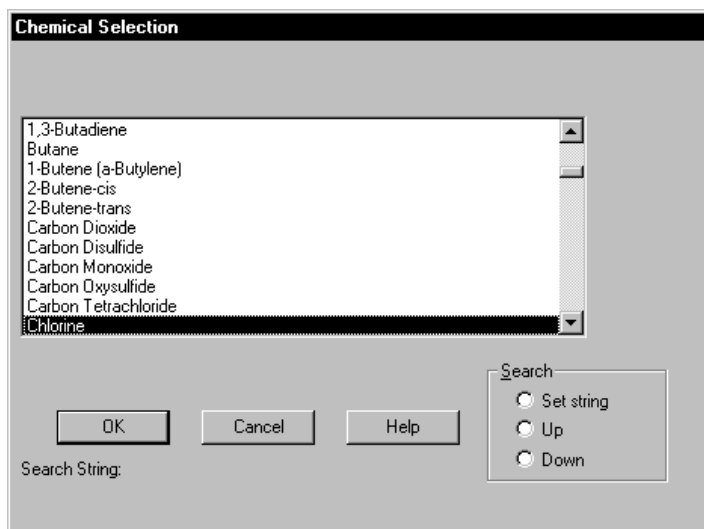
The run title displays on CHARM output and in the selection list for the Scenarios command. Enter the title of the current run.



A screenshot of a Windows-style dialog box titled "Enter the title of this CHARM run." The dialog box has a light gray background. Inside, there is a text input field containing the text "Standard CHARM Run - Chlorine". Below the input field are three buttons: "OK", "Cancel", and "Help". The "OK" button is highlighted with a dashed border.

Species

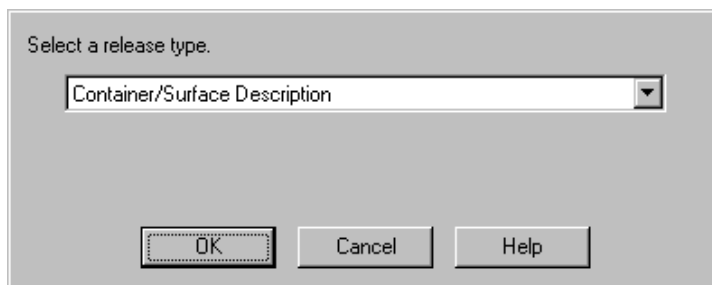
This field requires the name of the chemical whose effects you are assessing. When you select this field, CHARM displays the Chemical Selection window. You can select a species from the chemical database, which contains data for over 100 chemical compounds. The chemical database can be expanded or modified with the Chemical Database command in the CHARM editor (CHARMED.EXE). See Chapter 4, "Using the CHARM Editor," for a list of all the chemicals in the CHARM database and information on modifying the chemical database.



The search and scroll functions are available in the selection window. To perform a search through the chemical database, select Set String in the Chemical Selection window, enter the character string for which you want to search, and select OK or press <Enter>. Then, specify whether the search is Up (backward) or Down (forward). You can use the wild cards, * (asterisk) and ? (question mark) in the search string. The * wild card represents zero or more characters. The ? wild card represents a character position, rather than a special character.

Release Type

The release type describes the conditions of the initial chemical release. A release type must be selected for each CHARM run.



The release types provided by CHARM are defined according to the conditions right at and before release, or conditions right at and after release.

The release types available in CHARM are:

Container/Surface Description

A Container/Surface description requires that the user specify conditions at and before the release. The Main CHARM Input Window will change to reflect only that input which is required. Usually for a liquid release, the species escapes from a container and the generated pool is regulated by dikes or terrain. For this reason, the user must specify a maximum pool size, whereby CHARM will allow the pool to expand up to this maximum size, and then assume that the pool only becomes deeper. The remaining material of the species enters the air either as vapor or liquid droplets.

Pool/Lagoon Description

A Pool/Lagoon Description requires that the user specify conditions associated with a pool or lagoon of liquid. The Main CHARM Input Window will change to reflect only that input which is required. The release rate that the species enters the air is controlled by the rate at which the liquid materials evaporates from the pool. Depending on the chemical data, the pool may be lit on fire.

User-Specified After Release Conditions

A User-Specified After Release Conditions type requires you to specify a detailed description of the conditions following a release. You must supply the emission rate as well as the temperature, dimensions, direction, speed, and makeup of the initial puff. CHARM will calculate one of three of the following inputs: initial emission rate, exit velocity, or molar air fraction. Before you run a user-specified release, it is recommended that you perform a standard CHARM run using a release type that closely resembles the release you want to define. The standard run will provide some of the necessary data to facilitate running the user-specified release. This release type is useful when assessing stack emissions.

The figures on the following pages show the different input fields for various sample releases.

Figure 5.3
Container/
Surface
Description
(top)

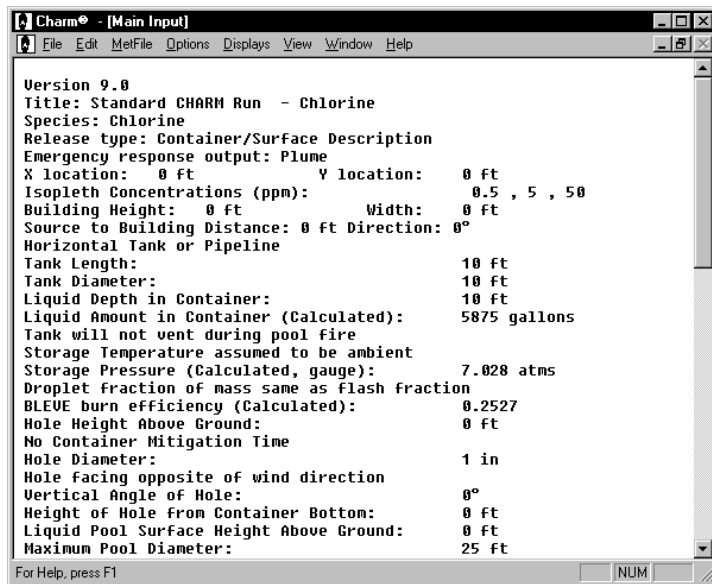


Figure 5.4
Container/
Surface
Description
(Bottom)

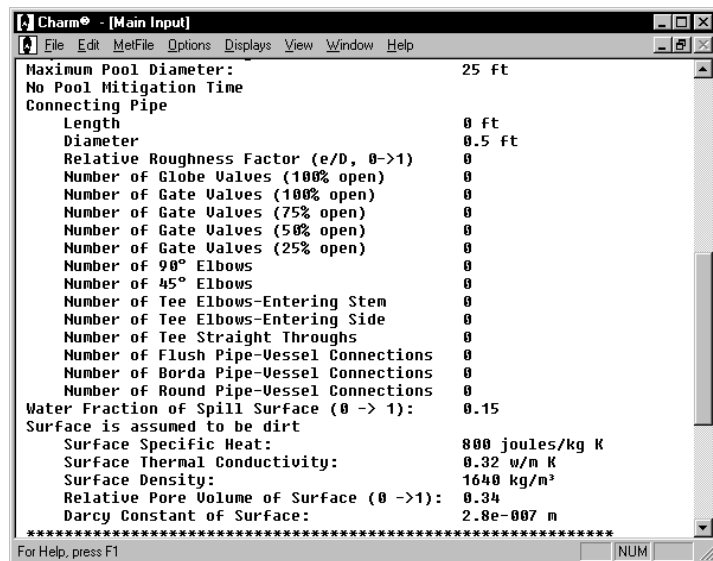


Figure 5.5
Pool/Lagoon
Description

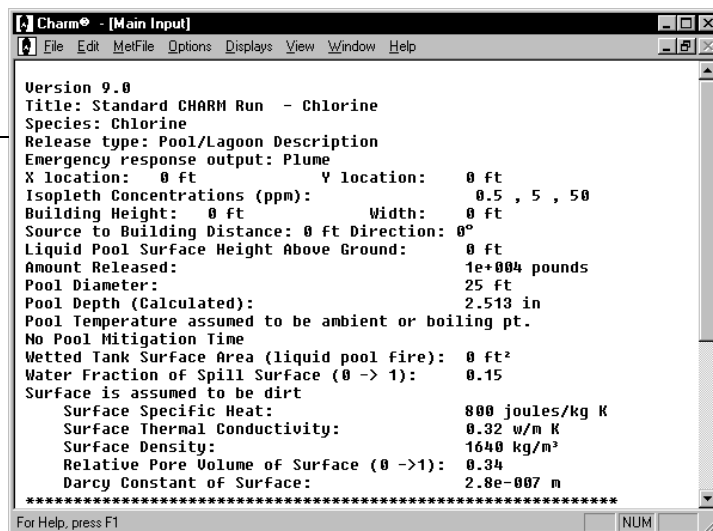
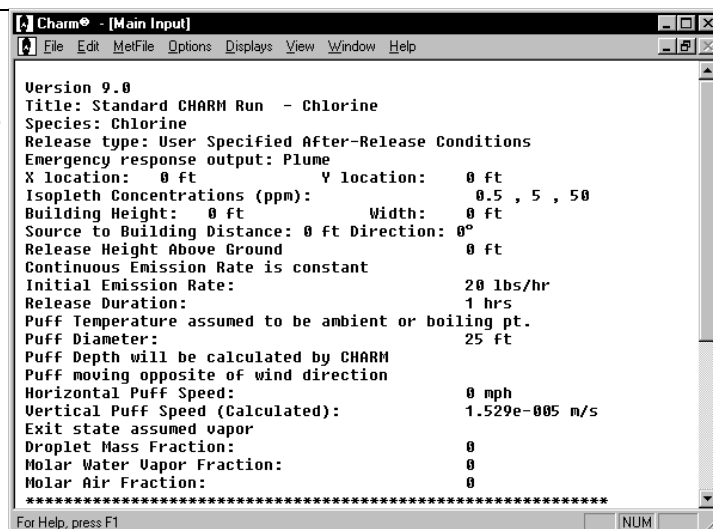


Figure 5.6
User-
Specified
After Release
Conditions



Emergency Response Output

Select from the type of output available from the drop-down list. The list is dynamic and changes depending on other scenario input. This field indicates to CHARM the type of output to generate when running from emergency response mode.

The six following choices may be available to the user:

- Plume** Shows concentration footprints of the released chemical.
- Pool Fire Plume** Shows the unburned portion of species emanating from a pool fire.

Pool Fire Radiation	Shows thermal radiation footprints from a liquid pool fire.
Mechanical Overpressures	Shows the overpressure or shockwave footprints from a pressurized vessel failure.
Jet Fire Radiation	Shows thermal radiation footprints from a jet fire release.
BLEVE	Shows thermal radiation footprints from a fireball/BLEVE.

X and Y Locations

The X and Y Locations are the East/West and North/South coordinates of the source location. To ensure proper placement, the point of origin should be the same as that of each map or population polygon you intend to use. Positive (+) X numbers are to the east (right) of the origin, and negative(-) X numbers are to the west (left). Positive Y numbers are to the north of the origin, and negative Y numbers are to the south.

Enter X and Y locations.

X

Y

Isopleth Concentrations

Isopleths are the species concentrations that are plotted on the output display screens and on hard-copy graphs. CHARM uses isopleth concentrations for creating a plume plot. You can enter up to three isopleth concentrations. At least one concentration is required. The units of concentration are parts per million (ppm) or micrograms per cubic meter (ug/m3). The default values are specified in the chemical database for the selected chemical. The default isopleth

values for a species can be changed using the Chemical Database command of the CHARM editor.

Enter concentrations for plume plot

Concentration 1 Units

Concentration 2

Concentration 3

Building Wake Input

The following information is required for CHARM to calculate a building wake.

Building Height and Width

Enter the height and width of a building that is upwind of the release site. The units are feet or meters. CHARM uses these dimensions to calculate building wake. If either the height or width field is 0 (zero), no building is assumed to be present.

Enter the building height and width.

Height

Width

Source to Building Direction and Distance

Enter the direction you would be facing if you were at the release site looking at the building. The direction can be entered in degrees or points of the compass. Degrees refer to the 360° directional compass, where North is 0 or 360, East is 90, South is 180, and West is 270. Points of the compass refer to North (N), East (E), South (S), West (W), and the points between, such as Northeast (NE) and South Southeast (SSE).

Enter the direction and distance from source to building.

Distance

Direction

The direction is required for the Huber-Snyder building wake effect calculations. If the release site is not downwind of the building, the building is ignored.

The distance from the release site to the building should be calculated from the release site to the center of the building. The units are feet or meters. CHARM uses the distance and direction to calculate a building wake.

If the distance to the release site is more than ten times the minimum dimension of the building (height or width), the Huber-Snyder building wake is not used in the dispersion calculation.

Release Height Above Ground

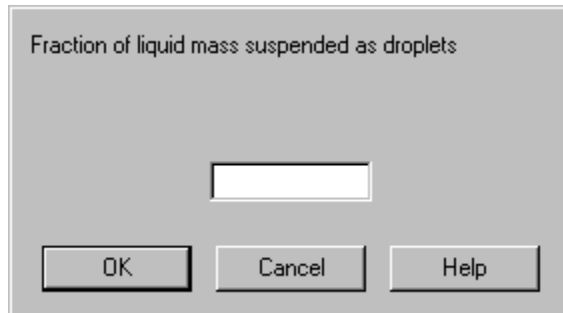
Use this field to enter the height of the release above ground. The units are feet or meters. This field can be used to describe elevated tanks.

Enter the release height above ground.

For a liquid release, enter the height of the liquid-air interface. Normally a released liquid falls to the ground. For a gas release, enter the height where the gas enters the atmosphere. For most heavier-than-air releases, where the release height is less than 50 feet, the release height can be set to 0 (zero) without loss of accuracy. For a container release both hole height and pool height will be requested.

Fraction of Liquid mass Suspended as Droplets

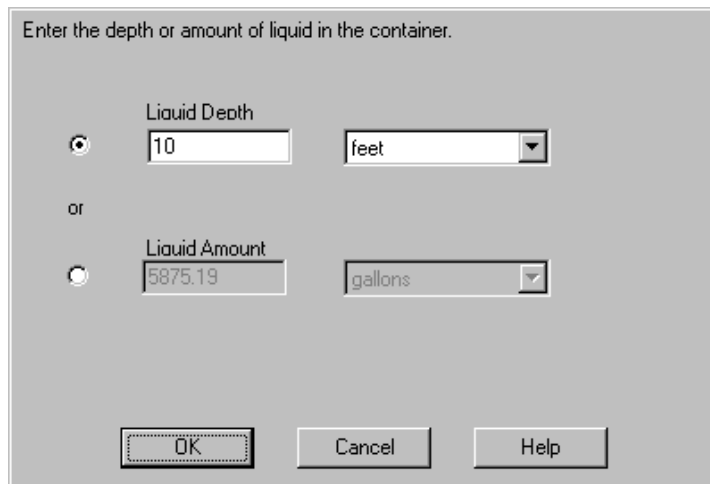
This field specifies the fraction of the total released mass that is assumed to be suspended as droplets. For a liquid release from a container, the mechanism for droplet creation is assumed to be turbulence and splashing during the release. This number is the mass fraction of droplets for each puff during the emission. For container/surface release, if this field is left blank, CHARM assumes that the droplet fraction of mass is the same as the flash fraction.



A dialog box titled "Fraction of liquid mass suspended as droplets". It contains a single text input field in the center. At the bottom, there are three buttons: "OK", "Cancel", and "Help".

Amount Released

The amount released can be either the volume of the container or the total amount of the species released. If you enter the volume, CHARM calculates the mass amount released. The units are cubic feet, cubic meters, pounds, kilograms, gallons, or liters. For a Pool/Lagoon release, CHARM will calculate the amount released if given the pool diameter/area and pool depth.

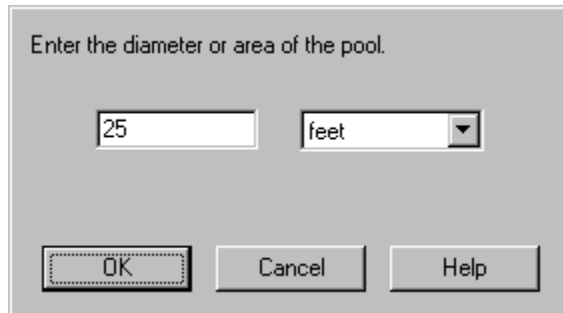


A dialog box titled "Enter the depth or amount of liquid in the container." It has two sections separated by "or". The first section, "Liquid Depth", has a radio button selected, a text field with "10", and a dropdown menu with "feet" selected. The second section, "Liquid Amount", has an unselected radio button, a text field with "5875.19", and a dropdown menu with "gallons" selected. At the bottom are "OK", "Cancel", and "Help" buttons.

For a liquid release from a container, some fraction of the total amount may be released as droplets.

Maximum Pool Diameter (Pool/Lagoon Description)

The size of the pool can be either the total area or equivalent circular diameter of the pool. The units are inches, feet, centimeters, or meters. If you enter the diameter, CHARM calculates the surface area from which the liquid will evaporate. Larger areas tend to evaporate more rapidly than smaller areas. For a Pool/Lagoon release, CHARM will calculate the pool diameter/area if given the amount released and the pool depth.



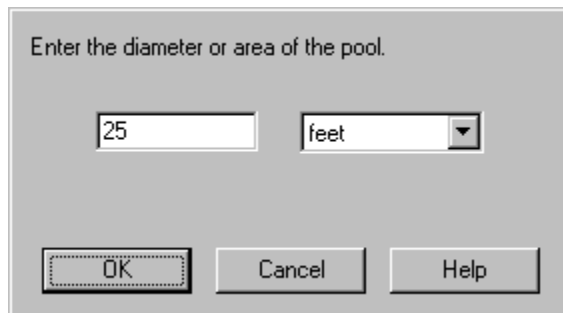
Enter the diameter or area of the pool.

25 feet

OK Cancel Help

Maximum Pool Diameter (Container/Surface Description)

Usually for a liquid release from a container, the species escapes from a container and the size of the generated pool is regulated by dikes or terrain, whereby the user must specify a maximum pool size. CHARM will allow the pool to expand up to this maximum size, and then assume that the pool only becomes deeper.



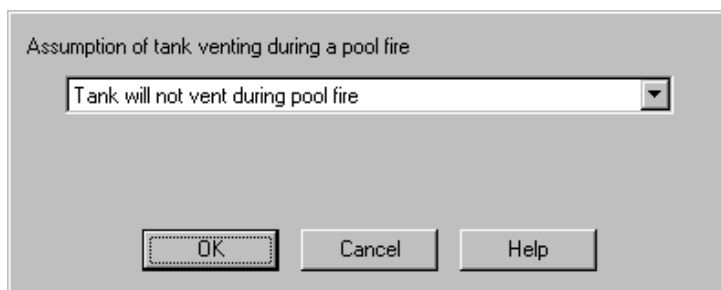
Enter the diameter or area of the pool.

25 feet

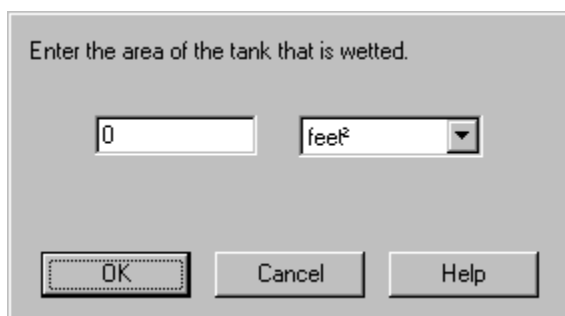
OK Cancel Help

Wetted Tank Surface Area

CHARM allows venting for two of the three release types: Container/Surface and Pool/Lagoon releases. When the scenario involves a container and a liquid pool fire, CHARM will inquire as to whether or not venting from the tank will occur. Specifying that the tank will vent during pool fire signals CHARM to use 50% of the wetted tank surface area to calculate heat transfer to the stored liquid that may be released due to an increase in tank pressure and venting. The Liquid Pool Fire release type provides the information for heat calculation. Specifying that the tank will NOT vent merely signals CHARM that no additional mass will be added to the primary source.



Likewise, if the scenario involves a liquid pool fire and a pool/lagoon of liquid, CHARM will inquire as to the area of a nearby tank that is wetted by the species. The units are square feet or square meters. CHARM uses this area to calculate heat transfer to the stored liquid that may be released because of an increase in tank pressure and venting. The heat is calculated from the value entered for liquid pool fires and the tank is assumed to be surrounded by fire.

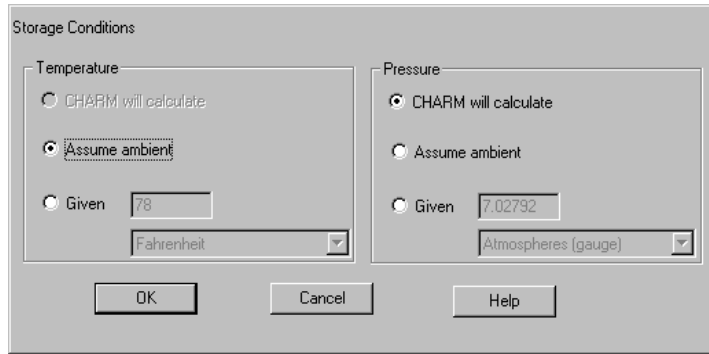


Storage Temperature

The storage temperature is the temperature of the container just prior to the release. The temperature can be specified in Fahrenheit, Celsius, Rankine, or Kelvin units. The storage temperature should be greater than the melting point of the chemical released. The user can specify a value for the temperature, use the ambient condition specified in the meteorological conditions, or let CHARM calculate the temperature if the storage pressure is NOT calculated.

Storage Pressure

The storage pressure is the pressure of the container just prior to release. This pressure can be either gauge or absolute. An absolute pressure of less than one atmosphere is treated as one atmosphere for the release calculation. The user can specify a value for the pressure, use the ambient condition specified in the meteorological conditions, or let CHARM calculate the pressure if the storage temperature is NOT calculated.

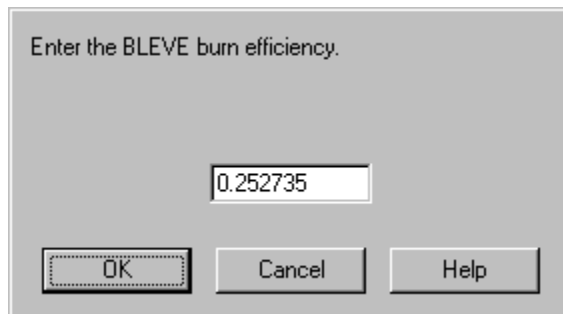


The 'Storage Conditions' dialog box is divided into two main sections: 'Temperature' and 'Pressure'. Each section contains three radio button options: 'CHARM will calculate' (selected in both), 'Assume ambient', and 'Given'. Below the 'Given' options, there are text input fields and unit dropdown menus. For Temperature, the input is '78' and the unit is 'Fahrenheit'. For Pressure, the input is '7.02792' and the unit is 'Atmospheres (gauge)'. At the bottom of the dialog are three buttons: 'OK', 'Cancel', and 'Help'.

CHARM will inform the user if the temperature and pressure indicate that the phase is solid or if no liquid should be present but a liquid depth is specified. However, this is only a warning, and the user may proceed with the non-equilibrium input.

BLEVE Burn Efficiency

Enter the efficiency or fraction of material burned in the Boiling Liquid Expanding Vapor Explosion (BLEVE). If the field is left blank, CHARM calculates an efficiency based on the vapor pressure of the material. Calculating a BLEVE burn efficiency is only available when describing a container/surface release.



The 'BLEVE Burn Efficiency' dialog box has a single text input field with the value '0.252735'. Below the input field are three buttons: 'OK', 'Cancel', and 'Help'.

Water Fraction of Spill Surface

This field specifies the fraction (by volume) of the spill surface that is water, or the amount of water in the surface soil of the area that immediately surrounds the release site. A value less than 0.1 is dry. A value of 0.6 indicates mud. A value of 1.0 is water. The suggested average value is 0.15. The water fraction is used to determine whether freezing ground water may alter the heat flow into the spill. An entry is required.

Enter the fraction of the spill surface that is water.

0.15

OK Cancel Help

Surface Description Input

The following information is required to describe the surface on which the spill occurred.

Surface Type

Enter the type of surface on which the spill occurred. If you select dirt, asphalt, or concrete, CHARM assigns default values for the surface characteristics. You can accept or change the default values.

Select the surface type.

Dirt

OK Cancel Help

If you select the user-defined surface type, you must enter the surface characteristics for specific heat, thermal conductivity, density, relative pore volume, and the Darcy constant.

Surface Specific Heat

Enter the specific heat of the surface on which the spill occurred. The units are Joules/kilogram, BTU/pound °F, or calories/gram. CHARM uses the surface specific heat for heat transfer calculations.

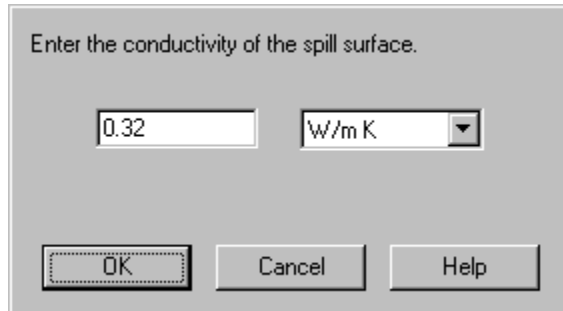
Enter the specific heat of the spill surface.

800 J/kg K

OK Cancel Help

Surface Thermal Conductivity

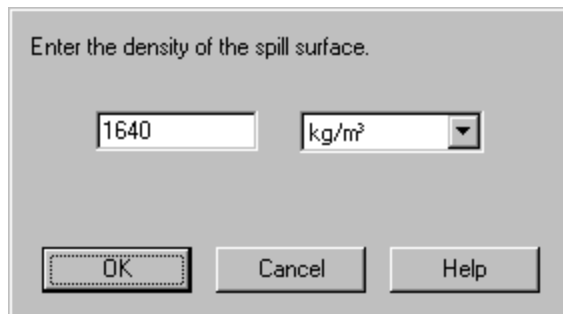
Enter the conductivity of the surface on which the spill occurred. The units are watts/meter per degree Celsius, calories/second/centimeter per degree Celsius, or BTU/hour/foot °F per degree Fahrenheit. CHARM uses the surface thermal conductivity for heat transfer calculations.



A dialog box titled "Enter the conductivity of the spill surface." with a text input field containing "0.32" and a dropdown menu showing "W/m K". At the bottom are three buttons: "OK", "Cancel", and "Help".

Surface Density

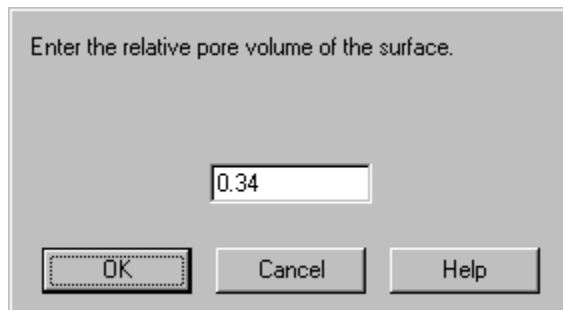
Enter the density of the surface on which the spill occurred. The units are kilograms/cubic meter, grams/cubic centimeter, pounds/cubic foot, or pounds/cubic inch. CHARM uses the surface density for heat transfer calculations. An entry is required.



A dialog box titled "Enter the density of the spill surface." with a text input field containing "1640" and a dropdown menu showing "kg/m³". At the bottom are three buttons: "OK", "Cancel", and "Help".

Relative Pore Volume of Surface

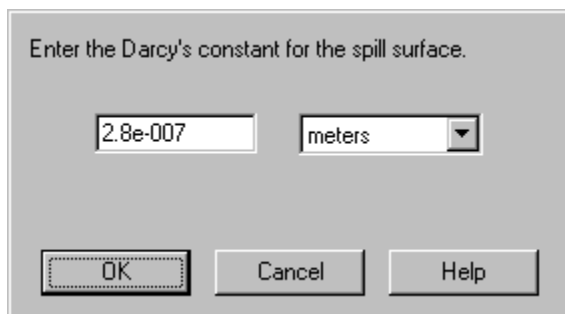
Enter the porosity or relative pore volume of the surface on which the spill occurred. The unit is a fraction. CHARM uses the relative pore volume to calculate the amount of liquid that can be percolated through the spill surface.



A dialog box titled "Enter the relative pore volume of the surface." with a text input field containing "0.34". At the bottom are three buttons: "OK", "Cancel", and "Help".

Darcy Constant of Surface

Enter the Darcy constant to use for calculating the amount of liquid that can be absorbed into the spill surface. The units are feet or meters.



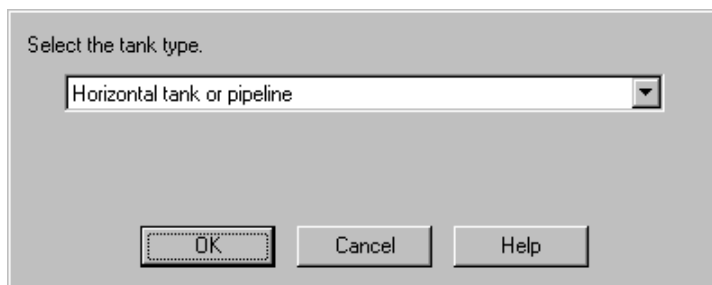
A dialog box titled "Enter the Darcy's constant for the spill surface." It contains a text input field with the value "2.8e-007" and a dropdown menu currently set to "meters". At the bottom are three buttons: "OK", "Cancel", and "Help".

Tank Description Input

The tank description fields that appear in the window are determined by the tank type. The following fields describe the tank from which the chemical was released.

Tank Type

Select the type of container from which the species was released. The three choices are a vertical cylinder tank, horizontal cylinder tank or pipeline, and a spherical tank.



A dialog box titled "Select the tank type." It features a dropdown menu with "Horizontal tank or pipeline" selected. At the bottom are three buttons: "OK", "Cancel", and "Help".

The tank dimensions are used to determine the amount of species released. A vertical cylinder has horizontal bases and requires an entry for the tank height and diameter. A horizontal cylinder requires an entry for the tank length and diameter. A railroad tank car is an example of a horizontal cylinder. A spherical tank requires an entry only for tank diameter.

Tank Height

Enter the height of a vertical tank. The units are inches, feet, centimeters, or meters. The tank height is used to determine the amount of species released.

Enter the height of the container.

10 feet

OK Cancel Help

This is a standard Windows-style dialog box with a light gray background. At the top, it contains the text 'Enter the height of the container.' Below this text is a text input field containing the number '10' and a unit selection dropdown menu currently set to 'feet'. At the bottom of the dialog, there are three buttons: 'OK', 'Cancel', and 'Help'. The 'OK' button is highlighted with a dashed border.

Tank height refers to the physical dimension of the tank, rather than tank elevation. The calculations for elevated tanks are handled by the entry in the field named **Release Height**.

Tank Diameter

Enter the diameter of the spherical container, or the cylindrical portion of a vertical tank or horizontal pipeline. The units are inches, feet, centimeters, or meters.

Enter the diameter of the container.

10 feet

OK Cancel Help

This is a standard Windows-style dialog box with a light gray background. At the top, it contains the text 'Enter the diameter of the container.' Below this text is a text input field containing the number '10' and a unit selection dropdown menu currently set to 'feet'. At the bottom of the dialog, there are three buttons: 'OK', 'Cancel', and 'Help'. The 'OK' button is highlighted with a dashed border.

Tank Length

Enter the length of a horizontal tank or the distance between closed valves of a pipeline. The units are inches, feet, miles, centimeters, meters, or kilometers.

Enter the length of the tank or pipeline.

10 feet

OK Cancel Help

This is a standard Windows-style dialog box with a light gray background. At the top, it contains the text 'Enter the length of the tank or pipeline.' Below this text is a text input field containing the number '10' and a unit selection dropdown menu currently set to 'feet'. At the bottom of the dialog, there are three buttons: 'OK', 'Cancel', and 'Help'. The 'OK' button is highlighted with a dashed border.

Liquid Depth in Container

If there is liquid inside the storage container, this field requires a value

for the depth of the liquid. The units are inches, feet, centimeters, or meters. The liquid depth is used to determine the amount and rate of liquid released.

Enter the depth or amount of liquid in the container.

☒ Liquid Depth

or

☐ Liquid Amount

For a vertical tank, the liquid depth must be less than the tank height. For a horizontal tank or pipeline, the liquid depth must be less than the tank diameter. For spherical tanks, the liquid depth must be less than the tank diameter. If you change the liquid depth to a value that is inconsistent with the values for the tank height or diameter, CHARM adjusts the tank height or diameter to accommodate the liquid depth value.

If liquid exists in the container, some may escape through the hole or some may be left in the container. Liquid left in the container may boil off after any pressurized gas escapes from the container.

Hole Diameter

Enter the equivalent area or circular diameter of the hole. The units are inches, feet, centimeters, or meters. An entry with a value greater than zero is required.

Select the parameter to use

☒ Hole Size

or

☐ Release Time

Hole is Facing

Enter the direction you would be facing if you were inside the tank looking out of the hole. The direction can be entered specifically in degrees or generally in points of the compass.

Enter the direction the hole faces.

Degrees refer to the 360° directional compass, where North is 0 or 360, East is 90, South is 180, and West is 270. Points of the compass refer to North (N), East (E), South (S), West (W), and the points between, such as Northeast (NE) and South Southeast (SSE).

For a gas release, the hole direction determines the initial direction that the plume takes. It is possible for the plume to travel upwind for some period of time.

Vertical Angle of Hole

Enter the vertical angle (in degrees) that your line of sight would make with the horizon if you were inside the tank looking out through the hole. A hole that is parallel to the horizon has a value of 0 (zero).

Enter the vertical angle of the hole in degrees.

0

OK Cancel Help

For example, if you are looking straight up, the value is 90. If you are looking straight down, the value is -90. The vertical angle of the hole can effect the plume rise of a gas release. An entry is required.

Height of Hole From Container Bottom

Enter the height of the hole from the bottom of the container. The units are inches, feet, centimeters, or meters. The hole height is used to determine when the liquid release may stop and the pressurized gas release begin. It is also used to determine the amount of liquid that can be left in the tank for boil-off at a later time.

Enter the height of the hole from the container bottom.

0 feet

OK Cancel Help

Liquid Pool Surface Height Above Ground

Enter the height above ground of the liquid-air interface. The units are feet or meters. Normally a released liquid falls to the ground.

Liquid pool height above ground

0 feet

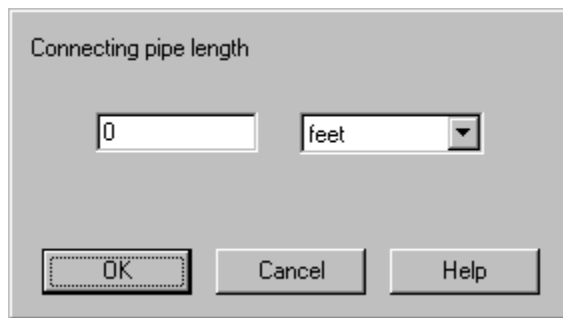
OK Cancel Help

Connecting Pipe

If the release occurs within piping connected to a vessel, CHARM will account for the piping and any piping system components in the release calculation. Entries for the pipe length, diameter, relative roughness factor, and components will affect the flow rate due to pressure loss characteristics of the pipe, and therefore affect the release rate calculated by CHARM.

Connecting Pipe Length

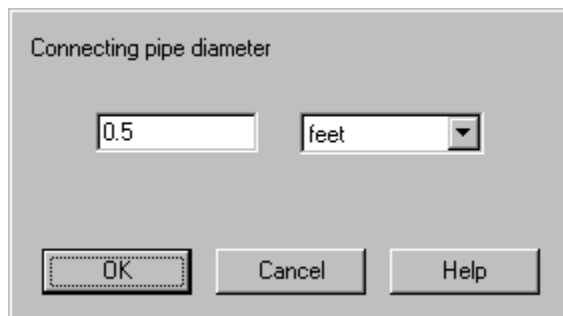
When specifying the pipe length, include all piping and piping components that describe the connecting pipe from the source vessel to the release point.



A dialog box titled "Connecting pipe length". It contains a text input field with the value "0" and a dropdown menu showing "feet". At the bottom are three buttons: "OK", "Cancel", and "Help".

Connecting Pipe Diameter

When specifying the pipe diameter, CHARM will assume the diameter is uniform throughout the length of the pipe; that is, multiple piping components with varying diameters is not considered.



A dialog box titled "Connecting pipe diameter". It contains a text input field with the value "0.5" and a dropdown menu showing "feet". At the bottom are three buttons: "OK", "Cancel", and "Help".

Relative Roughness Factor (e/D) (0-1)

Relative Roughness Factor (e/D) (0-1)

The Relative Roughness Factor (e/D) is a measure of the resistance to flow by friction from the interior surface of the cylindrical pipe where the Roughness Factor e is a function of the piping material, and D is the diameter of the pipe. Some examples of the Roughness Factor e are given below.

<u>Material</u>	<u>Roughness Factor e(mm)</u>
Drawn Tubing	0.0015
Commercial Steel or Wrought Iron	0.045
Asphalted Cast Iron	0.12
Galvanized Iron	0.15
Cast Iron	0.26
Wood Stave	0.3
Concrete	0.9
Riveted Steel	3

NOTE: Remember, the above Roughness Factors (e) must be divided by the diameter of the pipe to determine the Relative Roughness Factor.

Connecting pipe relative roughness factor (e/D, 0->1)

0

OK Cancel Help

Piping System Components

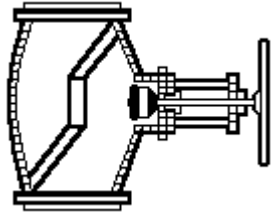
CHARM allows the user to specify any number of typical components within the piping system between the source vessel and the release point. These entries will affect flow rate due to pressure loss characteristics of the pipe, and therefore affect the release rate calculated by CHARM.

Example diagrams of each component type identified by CHARM are shown below:

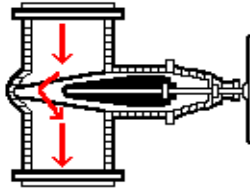
Piping System Components

CHARM allows the user to specify any number of typical components within the piping system between the source vessel and the release point. This entry will affect flow rate due to pressure loss characteristics of the pipe, and therefore affect the release rate calculated by CHARM.

Example diagrams of each component type identified by CHARM are shown below.



Globe Valve (100% Open)



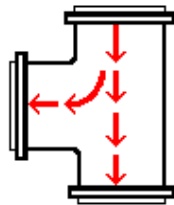
Gate Valve (50% Open)



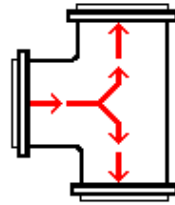
90° Elbow



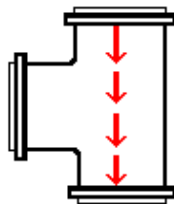
45° Elbow



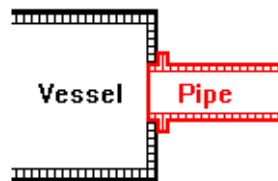
Tee Elbow-entering stem



Tee Elbow-entering side



Tee Straight Through



Flush Pipe-Vessel Connection



Borda Pipe-Vessel Connection

Round Pipe-Vessel Connection

User-Specified Release Description Input

If User-Specified After-Release Conditions is selected as the release type, CHARM requires additional release information. The following information is required for a user-specified release type.

User-Specified Release Type

An instantaneous release requires you to specify the total amount of material emitted. A continuous release requires you to specify an initial emission rate and whether the rate is constant or decreasing. A decreasing continuous release rate can be exponential or linear.

Selecting User-Specified Rate allows the user to define an emission rate schedule. Enter the time schedule for the emission rate from a source. CHARM will use this schedule for the emission for the duration of the release. If release duration is longer than the schedule the last emission rate is extended unless it is zero. Schedule entries can only be added if valid numbers are in the entry boxes. Two times can not both be the same. To delete an entry select it and press “Delete.” To change an entry select it and press “Change.”

When done changing press “Save Change.” “Clear” deletes all entries.

Emission Rate Schedule

Time units:
☒ hrs
☐ min
☐ sec

Emission rate units:
☒ lbs/hr ☐ scfm ☐ cfm
☐ g/s ☐ scms ☐ cms

	Time	Emission rate
Add	15	125
Delete	0	100
	10	200
	15	125

Change
Save Change

OK Cancel Help

Emission Rate

Enter the mass rate of emission of the species alone or the volume emission rate, which includes the species, air, and water vapor being emitted. The units are pounds per hour, grams per second, standard cubic feet per minute, standard cubic meters per second, cubic feet per minute, or cubic meters per second.

Enter the emission rate.

20 lbs/hr

OK Cancel Help

If you leave the **Emission Rate** field blank, and enter values for the **Vertical Puff Speed** and the **Molar Air Fraction** fields, CHARM will calculate the emission rate.

Release Time

For a constant or linearly decreasing release, the release time is the amount of time that lapsed during the release. For an exponentially decreasing release, the release time represents the amount of time before the emission rate equals one percent (.01) of the initial emission rate. The units are hours, minutes, and seconds.

Enter the release duration.

However, for linearly and exponentially decreasing releases, you should enter actual times.

Puff Temperature

The puff temperature is the temperature of the initial puff in Fahrenheit, Celsius, Rankine, or Kelvin units. If this field is left blank, CHARM assumes the ambient temperature or the boiling point of the selected species, whichever is lower.

Enter the temperature of the initial puff.

For an evaporating liquid release, this is the temperature just above the liquid pool. For a gas release, this is the temperature upon leaving the container or stack.

Puff Diameter

Enter the equivalent circular diameter or area of the puff or stack. The units are inches, feet, centimeters, or meters. For an evaporating liquid, enter the surface area of the liquid pool. For a gas release, enter the diameter of the hole or stack.

Enter the diameter or area of the puff.

Puff Depth

The Puff Depth field can be left blank, and CHARM will calculate a depth to ensure mass conservation. You can enter a value, but the prediction may be physically unrealistic.

Enter the depth of the puff.

Puff Is Moving Toward

Enter the direction of horizontal movement of the initial puff. The direction is determined by release conditions, not by meteorological conditions such as wind.

Enter the direction toward which the puff is moving.

The direction can be entered in degrees or points of the compass. Degrees refer to the 360° directional compass, where North is 0 or 360, East is 90, South is 180, and West is 270. Points of the compass refer to North (N), East (E), South (S), West (W), and the points between, such as Northeast (NE) and South Southeast (SSE).

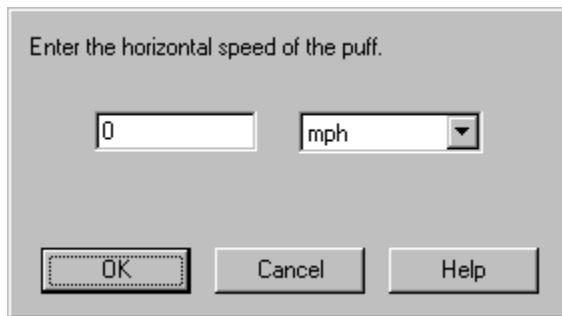
If the hole faces directly upward or downward, any value entered for the horizontal direction is ignored by CHARM. For an evaporating

liquid pool, the direction of horizontal movement has little meaning, because there should be no inherent horizontal movement. For a gas release, the direction should be the same as the direction that the hole or stack is facing.

This entry can be left blank. If it is left blank CHARM will assume the puff is moving in the same direction that the wind is blowing toward. Note that wind direction is specified as the direction the wind is blowing from. This reduces the turbulence that may occur as the release enters the atmosphere. Reduced turbulence generally leads to higher concentrations reaching further downwind.

Horizontal Puff Speed

This field requires a value for the horizontal puff speed in miles per hour, knots, meters per second, or kilometers per hour.



For an evaporating liquid pool, the horizontal speed is 0 (zero). For a gas release, it represents the horizontal component of the exit velocity from the hole or stack. If the hole faces directly upward or downward, enter 0 (zero) for the horizontal speed. See the following section for instructions on obtaining the horizontal speed.

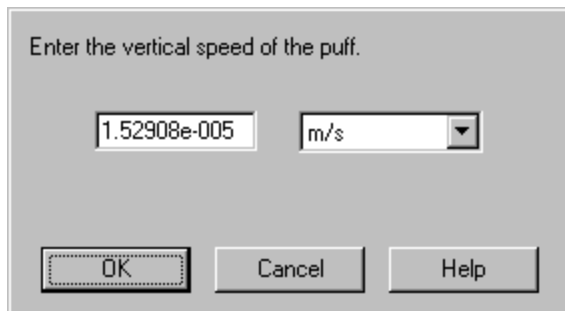
Obtaining the Horizontal Speed

To obtain the horizontal speed, use the following procedure:

1. Complete the entries for the Main CHARM Input Window. Leave the **Vertical Puff Speed** field blank and enter values for the **Molar Air Fraction** and **Emission Rate** fields. CHARM will calculate the vertical puff speed.
2. Find the calculated vertical speed (VERT SPD) in the Main CHARM Input Window, and enter this value in the **Horizontal Puff Speed** field in the Main CHARM Input Window.
3. Enter 0 (zero) for the **Vertical Puff Speed** field in the same window.

Vertical Puff Speed

Enter the speed and direction of the puff. The number indicates the speed. A positive (+) number indicates an upward direction. A negative (-) number indicates a downward direction.



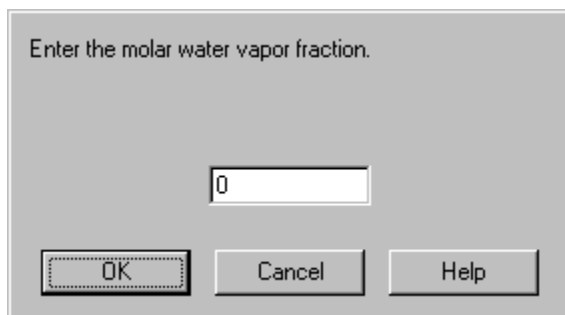
A dialog box titled "Enter the vertical speed of the puff." with a text input field containing "1.52908e-005" and a dropdown menu showing "m/s". At the bottom are three buttons: "OK", "Cancel", and "Help".

For an evaporating liquid, the vertical speed is 0 (zero). For a gas release, the vertical speed represents the vertical component of the exit velocity from the hole or stack. For a puff that is directed horizontally, the vertical speed is 0 (zero).

If you leave this field blank and enter values for the **Molar Air Fraction** and **Emission Rate** fields, CHARM will calculate the **Vertical Puff Speed**. Also, the user must specify the physical state (liquid or vapor) in the CHARM Main Input Window. the state is required to determine whether the liquid or vapor density should be used in the calculation.

Molar Water Vapor Fraction

Enter the molar fraction of water vapor in the emission. It should not be higher than approximately 0.04, unless you are describing an extremely hot, saturated emission.



A dialog box titled "Enter the molar water vapor fraction." with a text input field containing "0". At the bottom are three buttons: "OK", "Cancel", and "Help".

Molar Air Fraction

Enter the molar fraction of air in the emission. This value allows the initial concentration of the gas to be calculated. If you leave this field blank and enter values for the **Vertical Puff Speed** and the **Emission Rate**, CHARM calculates the **Molar Air Fraction**.

Enter the molar water vapor fraction.

0

OK Cancel Help

Meteorological Data Input

The lower portion of the Main CHARM Input Window contains the meteorological data fields for the current scenario. Figure 5.2 shows the Met Data input fields.

Relative Humidity

This field requires the ambient relative humidity in percent. Acceptable values are greater than 0 and less than 99.

Enter the percent relative humidity.

50

OK Cancel Help

Ambient Temperature

The ambient temperature is the air temperature at the release site. The temperature can be specified in Fahrenheit, Celsius, Rankine, or Kelvin units. If the ambient temperature is higher than the boiling point of the material released, the impact may become much greater.

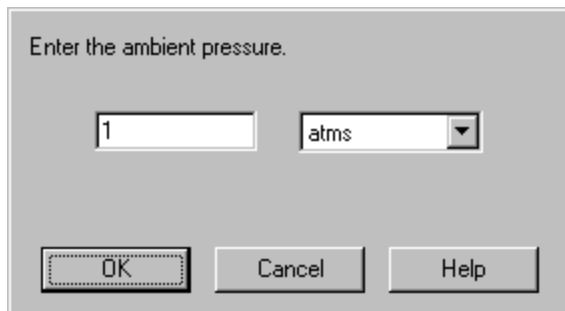
Enter the ambient temperature at the release site.

78 Fahrenheit

OK Cancel Help

Ambient Pressure

The ambient pressure is the atmospheric pressure at ground level at the release site. The pressure can be entered in atmospheres (atm), pounds per square inch, inches of Mercury, millimeters of Mercury, or millibars.



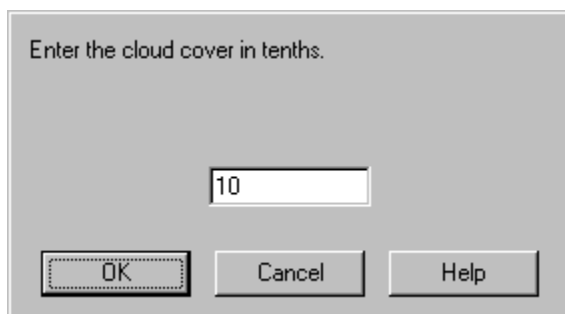
A dialog box titled "Enter the ambient pressure." with a text input field containing the value "1" and a dropdown menu set to "atms". At the bottom are three buttons: "OK", "Cancel", and "Help".

Normal atmospheric pressure at sea level has the following equivalents:

- 1 atmosphere (atm);
- 14.7 pounds per square inch (psi);
- 1013.25 millibars (mb);
- 29.92 inches of Mercury (in Hg); and
- 760 millimeters of Mercury (mm Hg).

Cloud Cover

Specify the amount of cloud cover in tenths of sky coverage. CHARM will use the amount of cloud cover if the user wants CHARM to determine the stability class and/or solar radiation.



A dialog box titled "Enter the cloud cover in tenths." with a text input field containing the value "10". At the bottom are three buttons: "OK", "Cancel", and "Help".

Stability Class

Select an atmospheric stability classification (A through F), or enter the amount of sunshine. If you want CHARM to calculate the stability class, select the appropriate checkbox and then specify the sunshine. CHARM can also determine the amount of sunshine based on a Solar Radiation Worksheet located under the MetFile menu.

Select a stability class or have CHARM calculate.

<p>Class</p> <p><input type="radio"/> A - Extremely Unstable</p> <p><input type="radio"/> B - Very Unstable</p> <p><input type="radio"/> C - Unstable Neutral</p> <p><input checked="" type="radio"/> D - Neutral</p> <p><input type="radio"/> E - Stable</p> <p><input type="radio"/> F - Extremely Stable</p>	<p>Cloud Cover 10</p> <p>in tenths</p> <p><input type="checkbox"/> CHARM will calculate</p> <p>Sunshine</p> <p><input type="radio"/> High</p> <p><input type="radio"/> Medium</p> <p><input checked="" type="radio"/> Low</p> <p><input type="radio"/> Night</p>
---	---

OK Cancel Help

CHARM calculates the stability classification from the wind speed, cloud cover, and amount of sunshine. Sunshine is strong if the skies are clear and the sun is at least 60 degrees above the horizon. A 75% middle-level cloud cover reduces strong sunshine to moderate. Sunshine is slight, if the sun is less than 35 degrees above the horizon or a 75% low cloud cover exists.

The atmospheric stability class indicates how much mixing occurs in the air. An unstable condition (such as class **A**, **B**, or **C**) tends to mix the plume quickly with the ambient air, thereby reducing concentrations quickly. Conditions are unstable if there is a layer of warm air near the ground with cooler air above it. An unstable condition is promoted by bright sun with no cloud cover and low wind. Unstable conditions rarely exist at night.

Conditions are neutral if there is little or no temperature gradient between the lower atmosphere and the upper atmosphere. A neutral condition (such as class **D**) exists when the sky is overcast.

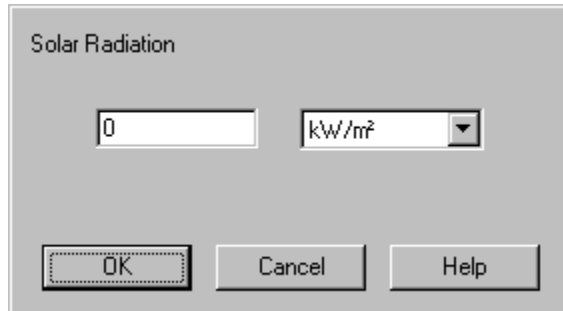
A stable condition mixes the plume more slowly and allows higher concentrations to reach farther downwind. Conditions are stable if there is a layer of cool air near the ground with warmer air above it. A stable condition (such as class **E** or **F**) can exist on a clear night with low wind speed.

For ground releases, an extremely stable condition (such as class **F**) generates the greatest ground-level impacts. For elevated releases, it is not as clear which stability will create the greatest ground-level impacts. A stable condition tends to maintain an elevated emission aloft, unless it is heavier than air. However, more unstable conditions allow mixing downward to the ground.

If an automatic meteorological interface is available and the standard deviation of the horizontal wind direction (also known as sigma theta) is one of the available data values, it will be used to determine stability class.

Solar Radiation

Solar radiation is used as a source for heat transfer when calculating the evaporation of off a liquid pool. A worksheet provided in the MetFile menu will aid in the estimation of solar radiation.

A dialog box titled "Solar Radiation" with a text input field containing "0" and a dropdown menu showing "kW/m²". At the bottom are "OK", "Cancel", and "Help" buttons.

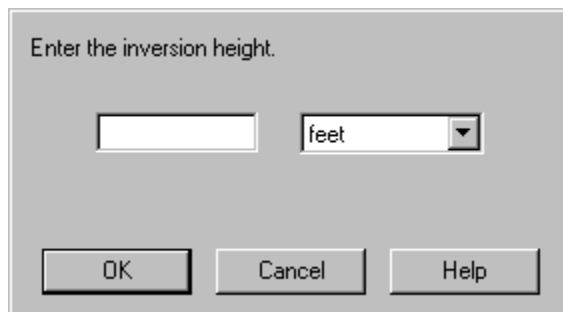
Solar Radiation

0 kW/m²

OK Cancel Help

Inversion Height

The Inversion Height is the altitude above ground at which a temperature inversion makes it difficult or impossible for a plume to traverse vertically. The units are feet, miles, meters, or kilometers. The inversion height is difficult to estimate without some form of measurement above the surface.

A dialog box titled "Enter the inversion height." with a text input field and a dropdown menu showing "feet". At the bottom are "OK", "Cancel", and "Help" buttons.

Enter the inversion height.

feet

OK Cancel Help

If a height is specified, a plume is not allowed to pass through it (except for a jet). If the release height is above the inversion, the plume will remain above. If the release height is below the inversion, the plume will remain below. If this field is left blank, no inversion will be assumed.

Surface Roughness

Surface roughness is a measure of the interaction between the wind and the surface. It affects wind speed with altitude and thus the amount of

mixing that can occur. The units are inches, feet, centimeters, or meters. If the field is left blank, no surface roughness is assumed and the wind is assumed to be constant with height.

Enter the surface roughness.

1 centimeters

OK Cancel Help

The following table shows some examples of surface roughnesses:

Surface type	Roughness (cm)
Smooth mud flats; ice	0.001
Smooth snow	0.005
Smooth sea	0.02
Level desert	0.03
Snow surface; lawn to 1 cm high	0.1
Lawn, grass to 60 cm high	4-9
Fully grown root crops	14
Parkland, bushes	50
Large obstacles (suburb, forest)	50-100

Wind Measurement Height

The wind Measurement Height is the height above ground at which the wind speed and direction were measured. It is used along with surface roughness to calculate the wind profile with altitude. The units are feet or meters. A value is required if a surface roughness has been entered.

Enter the wind measurement height.

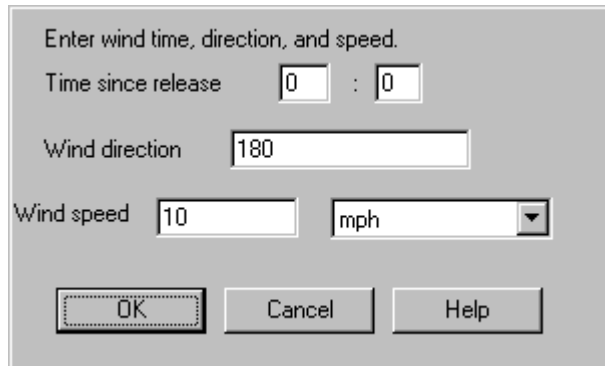
10 meters

OK Cancel Help

Winds

Use this field to describe wind speeds and directions that represent the conditions at specific times. At least one wind pair is required. If

you leave a wind time, direction, or speed blank, that wind will be deleted.



Enter wind time, direction, and speed.

Time since release 0 : 0

Wind direction 180

Wind speed 10 mph

OK Cancel Help

Time The time since release in hours and minutes, up to 24 hours.

Direction The direction from which the wind is coming. The direction can be entered specifically in degrees or generally in points of the compass. Degrees refer to the 360° directional compass, where North is 0 or 360, East is 90, South is 180, and West is 270. Points of the compass refer to North (N), East (E), South (S), West (W), and the points between, such as Northeast (NE) and South Southeast (SSE).

Speed The wind speed in knots (kts), miles per hour (mph), meters per second (m/s), or kilometers per hour (kph).

Add Winds

Use this field to describe additional winds. You can enter wind speeds and their directions representing the conditions at a specific time. The description is the same as described in the previous section. CHARM performs a linear interpolation between wind times to determine a wind speed and direction. Thus there are no instantaneous wind shifts. If you want to model a quick wind shift, you can enter two winds that are one minute apart.

Chapter 6: Understanding CHARM Displays

CHARM provides various text and graphic displays to simulate a release from data entered in the Main CHARM Input Window. All CHARM displays are accessible through the Displays menus of the Main CHARM Input Window or footprint displays. The displays available for selection depend on the species and release type specified in the current input window. The Options menu provides various options for altering the CHARM displays.

Map displays are available for maps that have been read, defined, and stored with the Map Definition command of the CHARM Editor. CHARM superimposes plume, thermal radiation and overpressure displays (graphics) on a map display. If the map display has map or release location icons, you can select an icon to display the map or the release scenario list. The cursor is represented with cross hairs instead of an arrow on graphic displays.

Main CHARM Input Window Displays

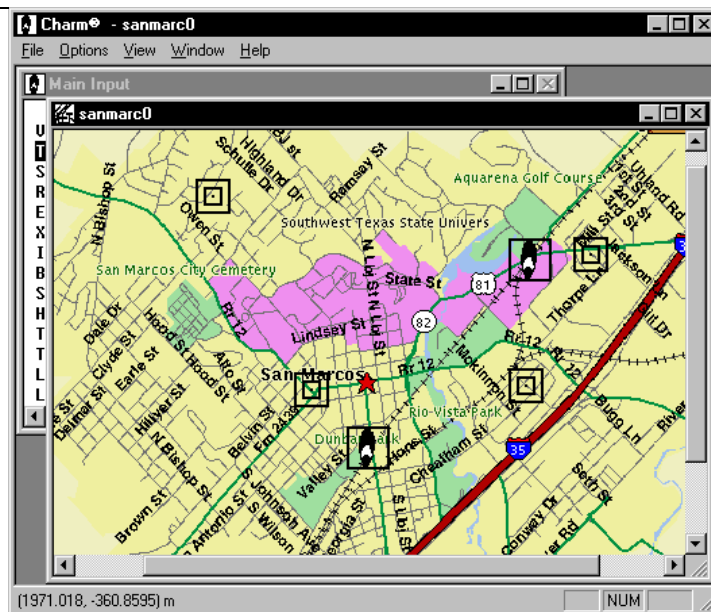
The Displays menu of the Main CHARM Input Window permits access to a variety of text and graphic displays, some of which require CHARM calculations. The Basemap command displays maps that have been predefined using the CHARM Editor (CHARMED). These maps may contain release icons that are associated with prestored data file information, whereby CHARM may be used in an emergency response mode of operation. The Site Information, Chemical Data, Chemical Response, and Source/Puff Calculation commands invoke text displays. The Emission Rate command generates a plot. The BLEVE Radiation, Pool Fire Radiation and Plume, and Mechanical Overpressures commands invoke graphic displays. When selecting the Displays menu from the Main CHARM Input Window, the cursor changes momentarily to an hourglass while CHARM performs source term calculations. During these calculations and before the menu is displayed, CHARM decides which types of output are valid for the current input scenario. For example, if the chemical being modeled, say Chlorine, does not have any flammable characteristics associated with it in the Chemical Database, then those options involving thermal radiation output (BLEVE, Pool Fire, and Jet Fire) are grayed and cannot be modeled.

Basemap Display

Use the Basemap command on the Displays menu when the Main CHARM Input Window is activated to display a new map for use in emergency response mode. All maps used with CHARM must first be defined with the Map Definition command of the CHARM editor. Refer to Chapter 4, “Using the CHARM Editor,” for details on defining maps. When you select the Basemap command, CHARM displays a selection list of map files having the default map file name extension. Initially, this default extension is .MAP. For more information about changing this default map extension, refer to Chapter 3, “CHARM.INI File Description”. When a map is selected, CHARM displays the map and a point of reference associated with the cross hair location in the status bar at the bottom of the CHARM MDI window.

When a map is displayed, the menu bar on the CHARM MDI frame changes to reflect only those menus that are to be used with the active window; in this case, the Basemap Window. These menu items include a file menu to open and close other map files, an options menu to zoom and unzoom an area, or display a larger-scaled map, and other standard windows menus. Figure 6.0 shows a sample map from a Basemap display.

Figure 6.0
Basemap
Display

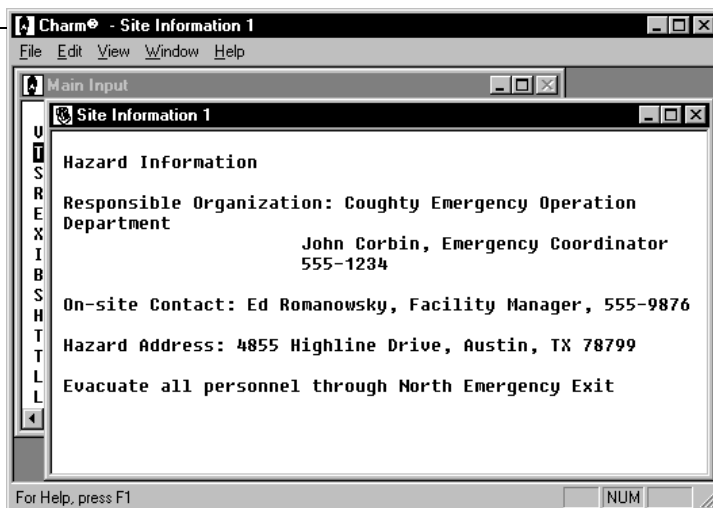


Site Information Display

The Site Information command on the Displays menu shows a text file window created with the CHARM Editor. The text file contains information that is specific to the release site. It may contain useful information such as general response procedures, telephone numbers, and evacuation exits. Site information text can be printed

or copied to the clipboard using the File and Edit menu commands respectively. Figure 6.1 shows sample text for a Site Information display.

Figure 6.1
Site Information Display



Chemical Data Display

The Chemical Data command on the Displays menu shows a text window containing the thermodynamic data and default isopleth concentrations stored in the chemical database for the selected species. Figures 6.2, 6.3, and 6.4 show the chemical data display for Chlorine. Chemical data can be printed or copied to the clipboard using the File and Edit menu commands respectively. It can be modified using the CHARM Editor.

Figure 6.2
Chemical Data Display (top)

The screenshot shows a window titled "Charm - Chemical Data 1" with a menu bar (File, Edit, View, Window, Help). Below the menu bar is a "Main Input" section. The main display area shows the following data for Chlorine:

Chlorine	
Molecular weight (kg/kmole)	70.9
Normal boiling point (K)	239.1
Melting Point (K)	172.1
Triple Point Temperature (K)	172.1
Triple Point Pressure (atmospheres)	0.013
Critical temperature (K)	417.1
Critical pressure (atmospheres)	76.0
Critical volume (m ³ /kmole)	0.12
Heat of vaporization at normal boiling point (J/kg)	2.88e+00
Surface tension of liquid phase at normal boiling point (N/m)	0.026
Viscosity of liquid phase at normal boiling point (kg/m s)	0.0004886
Gamma (Cp/Cv)	1.3
Energy of molecular interaction (K)	274.9
Effective diameter of molecule (Å)	5.2

At the bottom of the window, it says "For Help, press F1" and there is a "NUM" button.

Figure 6.3
Chemical Data Display (Temperature Dependent Equations)

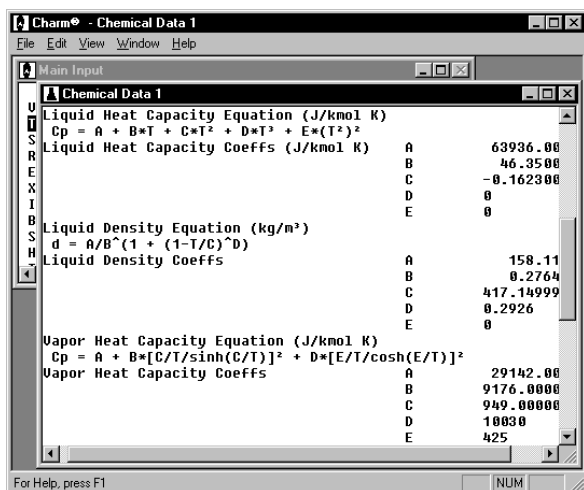
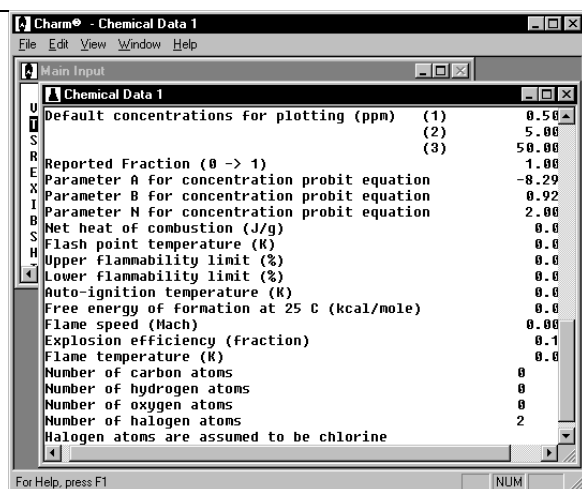


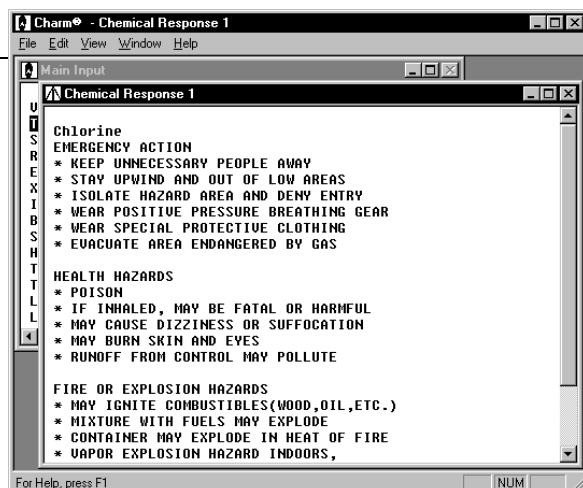
Figure 6.4
Chemical
Data Display
(bottom)



Chemical Response Display

The Chemical Response command on the Displays menu shows the emergency response information stored in the chemical database for the selected species. Figure 6.5 shows a sample Chemical Response display. Chemical response text can be printed or copied to the clipboard using the File and Edit menu commands respectively. It can be modified using the CHARM Editor.

Figure 6.5
Chemical
Response
Display



Source/Puff Calculation Display

The Source/Puff Calculation command on the Displays menu shows the output of the source term calculation for a CHARM run. The Source/Puff Calculation display can be printed or copied using the File and Edit menu commands respectively. This output contains a detailed description of each portion of a release. The data consists mainly of the numbers used to describe the source term, emission out of the container, emission of each puff into the atmosphere during the release, etc.

During calculations, the release is divided into a number of puffs. The display contains, near the end of the display, the data used to describe each puff during the release. You can display the puff descriptions for several CHARM runs at the same time. Figures 6.6 through 6.9 show a sample Source/Puff Calculation display.

Figure 6.6
Source/Puff
Description
Display
(Liquid
Release from
Tank)

The screenshot shows the 'ChARM - Source Calculation 1' window. The main display area shows the following information:

Standard CHARM Run - Chlorine
Species: Chlorine

Liquid Release From Tank

Duration(min)	Amount(lb)	Amount(kg)
35.2	2.13e+004	9.67e+003

Time(sec)	Press(Atm)	Temp(°F)	Cont. Rate(lb/h)	Flas
0	8.03	78.00	1.16e+005	
205.2	8.03	78.00	1.16e+005	
410.4	8.03	78.00	1.16e+005	
615.6	8.03	78.00	1.16e+005	
820.8	8.03	78.00	1.16e+005	
1026	8.03	78.00	1.16e+005	
1231	8.03	78.00	1.16e+005	
1436	8.03	78.00	1.16e+005	
1642	8.03	78.00	1.16e+005	
1847	8.03	78.00	1.16e+005	
2052	8.03	78.00	1.16e+005	

The window includes a menu bar (File, Edit, View, Window, Help) and a status bar at the bottom with the text 'For Help, press F1' and a 'NUM' button.

Figure 6.7
Source/Puff
Description
Display
(Vapor
Release From
Tank)

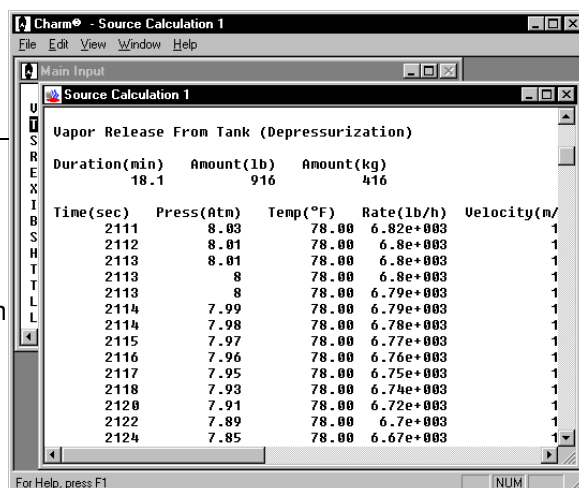


Figure 6.8
Source/Puff
Description
Display (Pool
Evaporation)

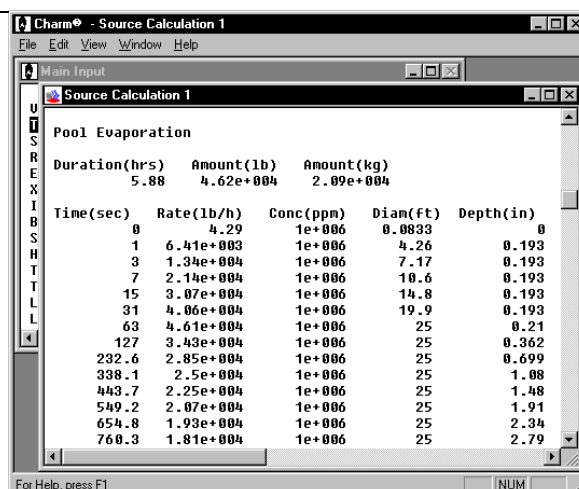
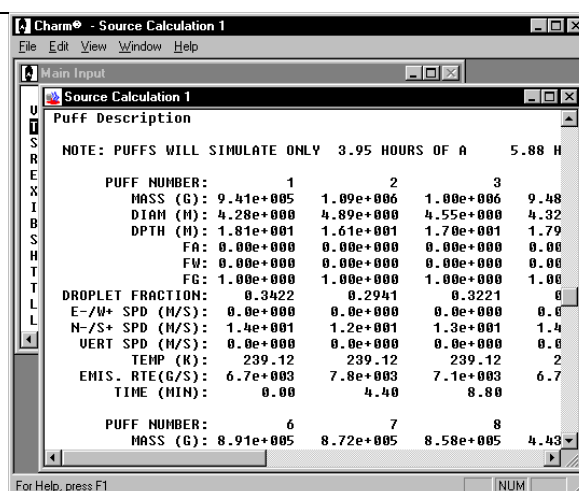


Figure 6.9
Source/Puff
Description
Display (Puff
Description)



Using the Source/Puff Calculation for Input

Information from the Source/Puff Calculation display can be used as input for a user-specified after release scenario, which requires a complete puff description. First, using a release type similar to the

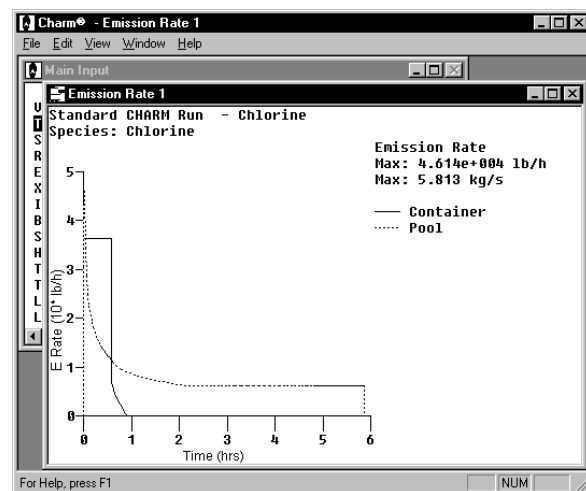
one you want to define, enter the required data in the input window. Next, display or print the Source/Puff Calculation. Then, using the User-Specified After-Release Conditions release type, perform another CHARM run using the data from the Source/Puff Calculation output as input. The data cannot be automatically inserted by the program; they must be manually entered into the Main CHARM Input Window.

Emission Rate Display

The Emission Rate command on the Displays menu shows a plot of the emission rate as a function of time throughout the release. The Emission Rate display can be printed or copied using the File and Edit menu commands respectively.

The Emission Rate is calculated by using values from the input window. The maximum emission rate for the release is also specified. Figure 6.10 shows a sample Emission Rate display. If the emission is out of a container, CHARM displays only the emission rate of the species into the air. During a liquid release some of the liquid may fall to the ground to form a pool. If a pool is present during the release, its evaporation rate will be shown separately from the container emission rate.

Figure 6.10
Emission
Rate Display



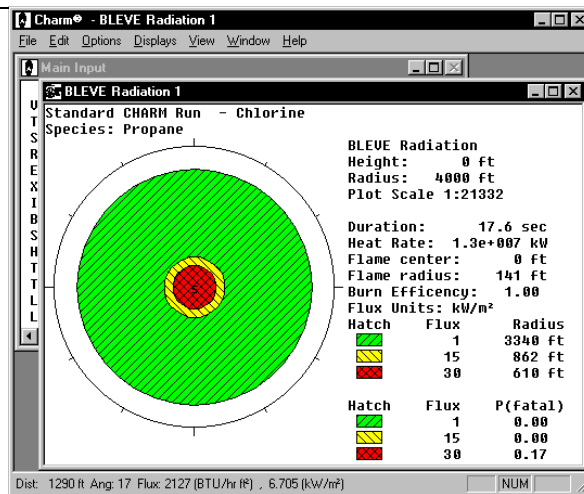
Thermal Radiation Displays

BLEVE Radiation, Pool Fire Radiation, and Jet Fire Radiation commands on the Displays menu presents three ways to generate thermal radiation displays. A BLEVE Radiation display generates a Single Point Energy Flux window as shown in Figure 6.11. This display shows the footprint of thermal radiation due to a fireball/BLEVE. The thermal radiation footprint can be repositioned within the display.

Since the display is a point source, it can be altered using the

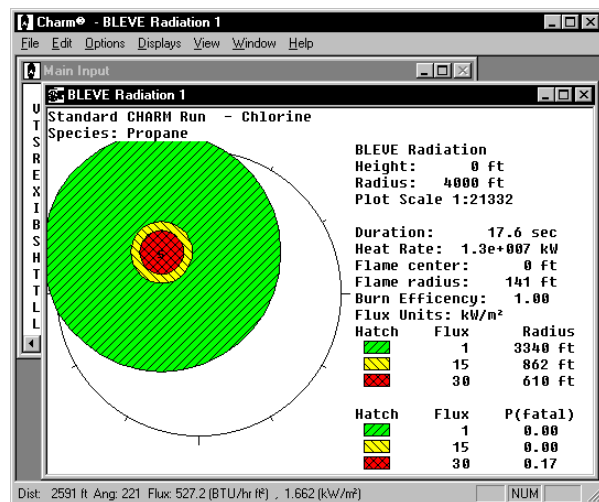
Options commands to change the energy flux values and/or the distances from the source. Use the File menu to print the graphics in the window or copy visible graphics to the clipboard.

Figure 6.11
Thermal
Radiation
Display



Repositioning the Radiation Footprint

To change the position of the thermal radiation footprint in the view port, press and hold <Ctrl> while you press the appropriate arrow key one or more times. Each time you press an arrow key, the footprint moves one-sixteenth of the dimension of the display area. The view port is actually the object being moved. Therefore, if you want to move the footprint down, use the <Ctrl-Up arrow> to move the view port up with respect to the footprint.



Setting the Energy Flux Values

To change the energy flux values for the thermal radiation display, select

the Energy Fluxes command on the Options menu. You can enter up to three energy flux values in BTU/hour/square foot or kilowatts/square meter.

Enter the energy flux values.

Flux 1	<input type="text" value="1"/>	Units
Flux 2	<input type="text" value="15"/>	<input type="text" value="kW/m²"/>
Flux 3	<input type="text" value="30"/>	

OK Cancel Help

Setting the Radiation Distances

To change the thermal radiation distances from the source on the display, select the Distances command from the Options menu. You can enter up to three distance values in feet, miles, meters, or kilometers.

Enter the distances from the source.

Distance 1	<input type="text" value="2268.84"/>	Units
Distance 2	<input type="text" value="585.811"/>	<input type="text" value="feet"/>
Distance 3	<input type="text" value="414.231"/>	

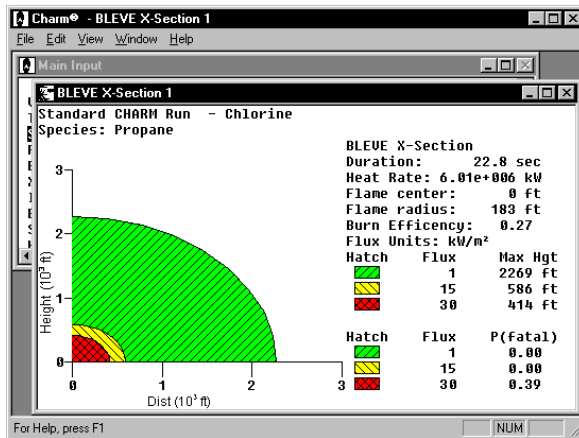
OK Cancel Help

Displaying a Radiation Footprint Vertical Cross-Section

The Vertical X-section command on the Displays menu shows a vertical cross-section of the thermal radiation footprint (See Figure 6.12). The maximum vertical extent may differ from the maximum horizontal extent if the source is not at ground level.

Figure 6.12

Thermal
Radiation
Vertical X-
Section
Display

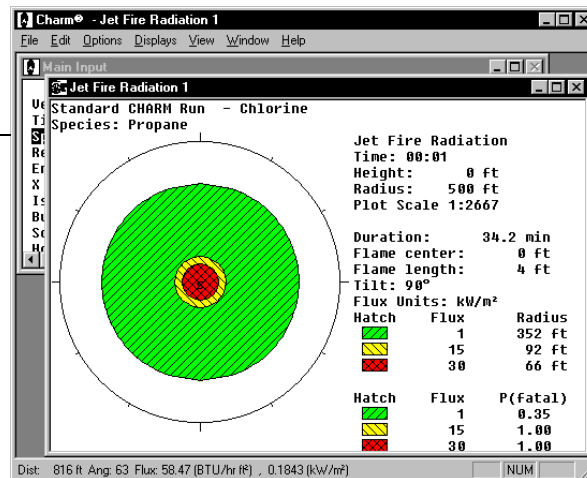


Pool Fire and Jet Fire Displays

The Pool Fire and Jet Fire commands on the Displays menu presents a Pool or Jet Fire Energy Flux window as shown in Figure 6.13. This display is the footprint of thermal radiation due to a pool or jet fire. The jet fire footprint can be repositioned within the display.

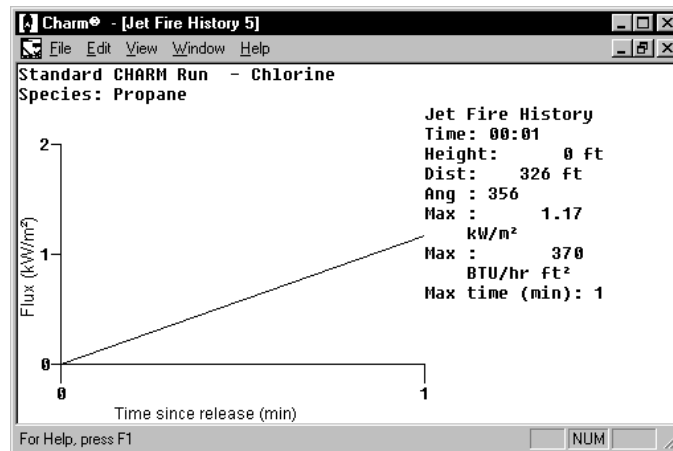
Use the File menu to print the graphics in the window or copy visible graphics to the clipboard.

Figure 6.13
Jet Fire
Display



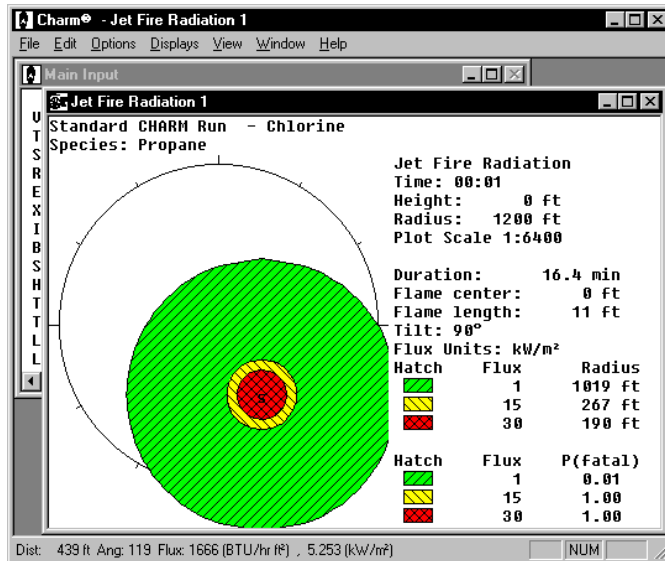
Plotting Thermal Radiation Versus Time

To generate a plot of thermal radiation as a function of time at a selected point, move the cursor to the desired location. Then double-click the left mouse button or press <Enter>. The plot shows a time history of the thermal radiation at the specified location. The radiation values are determined only once a minute (or once a second if CHARM is operating in Minutes-Seconds Mode).



Repositioning a Thermal Radiation Footprint

To change the position of the thermal radiation footprint in the view port, press and hold <Ctrl> while you press the appropriate arrow key one or more times. The footprint is repositioned. Each time you press an arrow key, the footprint moves one-sixteenth of the dimension of the display area. The view port is actually the object being moved. Therefore, if you want to move the footprint down, use <Ctrl-Up arrow> to move the view port up with respect to the footprint.



Setting the Energy Flux Values

To set the energy flux values for the pool or jet fire radiation display, select the Energy Fluxes command from the Options menu. You can enter up to three energy flux values in BTU/hour/square foot or kilowatts/square meter.

Enter the energy flux values.

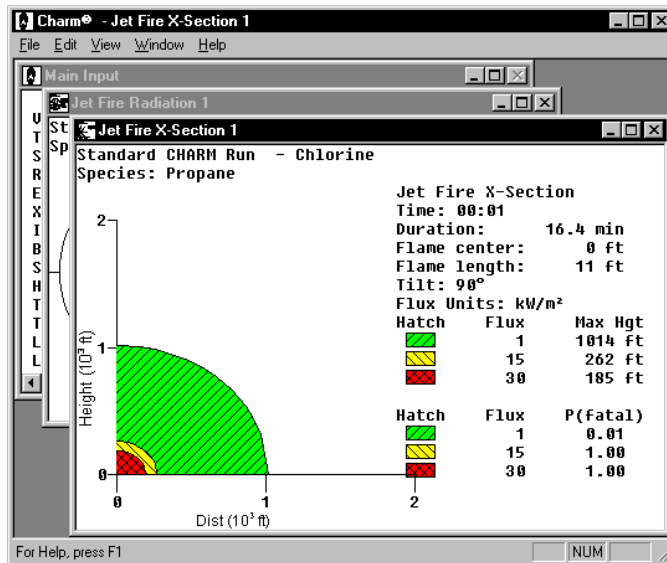
Flux 1 Units

Flux 2

Flux 3

Displaying a Thermal Radiation Footprint Cross-Section

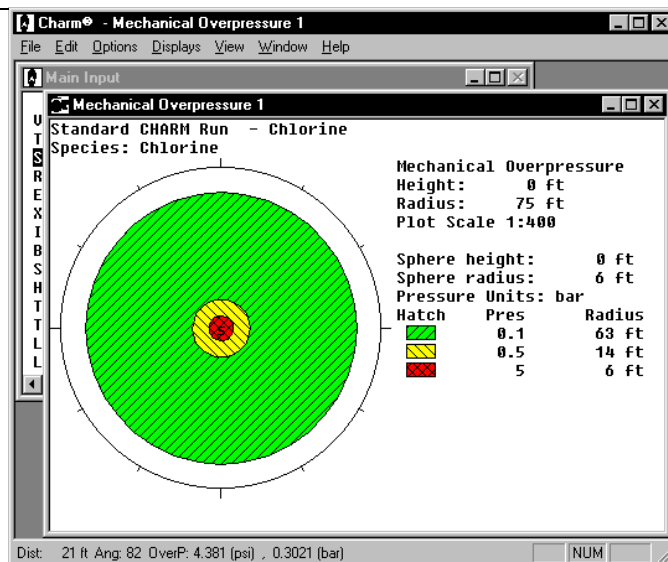
The Vertical X-section command on the Displays menu shows a plot representing the vertical cross-section of the thermal radiation footprint. The view is along the centerline of the flame as it exits the container.



Mechanical Overpressures Display

The Mechanical Overpressures command on the Displays menu presents the Sphere Burst Overpressure window shown in Figure 6.14. This display is a footprint of the overpressures expected from a pressurized bursting sphere. The overpressures footprint can be repositioned within the display.

Figure 6.14
Mechanical Over-
pressures
Display



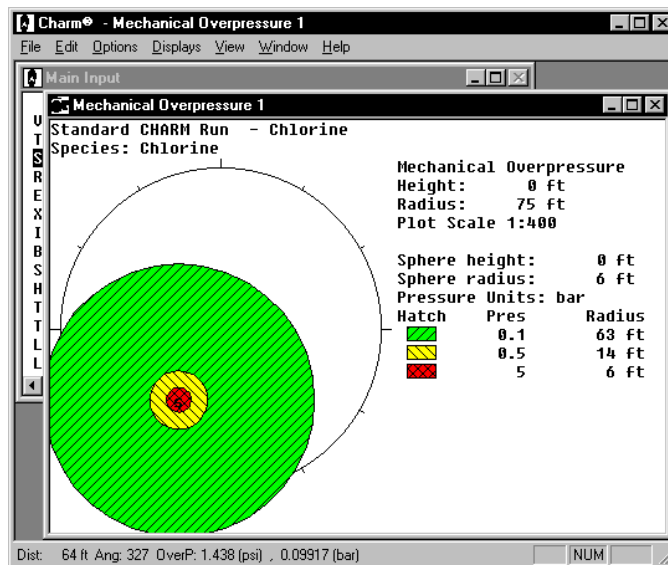
Since the display is a point source, it can be altered using the Options commands to change the overpressure values and/or the distances from the source. Use the File menu commands to save the release description

input or met data in separate files, and to print the window. Use the Copy command on the Edit menu to copy the footprint to the clipboard.

Since the sphere burst is instantaneous, no time plot can be generated. However, overpressures due to vapor cloud explosion can be plotted as a function of time.

Repositioning the Overpressures Footprint

To change the position of the footprint in the view port, press and hold <Ctrl> while you press the appropriate arrow key one or more times. The footprint is repositioned. Each time you press an arrow key, the footprint moves one-sixteenth of the dimension of the display area. The view port is actually the object being moved. Therefore, if you want to move the footprint down, use <Ctrl> and the up arrow key to move the view port up with respect to the footprint.



Setting the Overpressure Values

To change the overpressure values for the display, select the Overpressures command from the Options menu. You can enter up to three overpressures in pounds per square inch or bars.

The screenshot shows the 'Enter the overpressures' dialog box. It contains three input fields for 'Pressure 1', 'Pressure 2', and 'Pressure 3'. The values entered are 0.1, 0.5, and 5, respectively. To the right of these fields is a 'Units' dropdown menu currently set to 'bar'. At the bottom of the dialog are three buttons: 'OK', 'Cancel', and 'Help'.

Setting the Overpressure Distances

You can set the overpressure distances from the source for sphere burst overpressures display. To set the distances, select the Distances command from the Options menu. You can enter up to three distance values in feet, miles, meters, or kilometers.

Enter the distances from the source.

Distance 1: 106.306

Distance 2: 22.8277

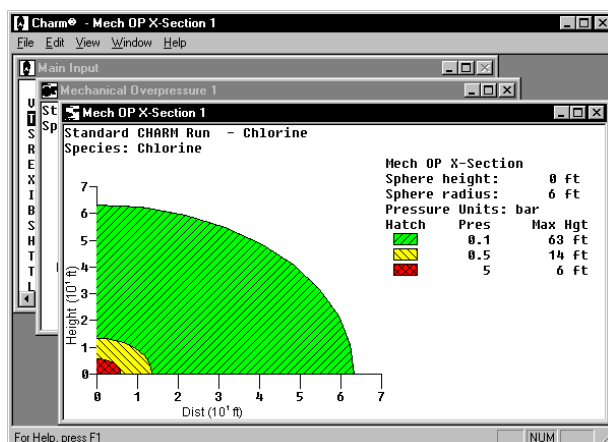
Distance 3: 5.72367

Units: feet

OK Cancel Help

Displaying an Overpressures Footprint Vertical Cross-Section

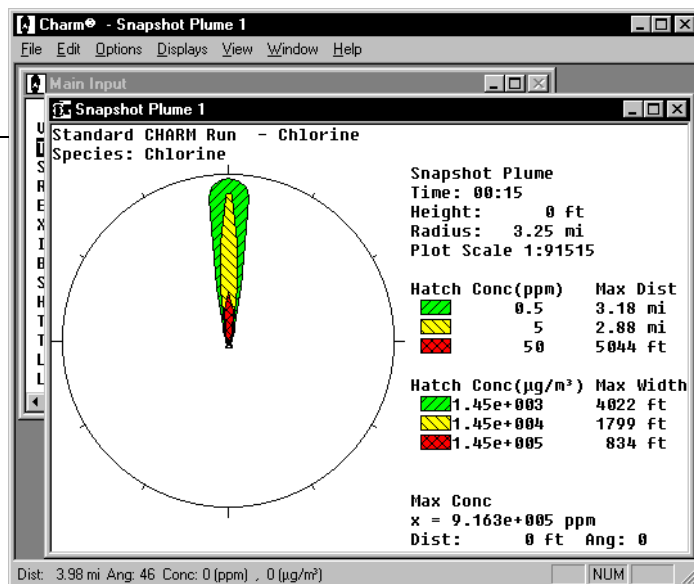
The Vertical X-section command on the Displays menu presents the Vertical Sphere Burst Overpressure window, which is a vertical cross-section of the overpressures footprint. The maximum vertical extent may differ from the maximum horizontal extent if the sphere is not at ground level.



Plume Display

The Plume command on the Displays menu of the Main CHARM Input Window presents a Snapshot Plan Plume View display, which is shown in Figure 6.15. This display is an instantaneous view of the plume at a specified time. In Figure 6.15, the display represents a snapshot of the plume 15 minutes after the release began.

Figure 6.15
Plume
Display



Generating a Plume Display

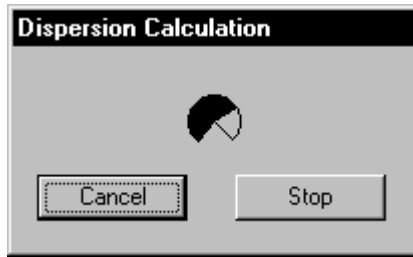
To generate a plume display, select the Plume or Pool Fire (Plume) command from the Displays menu of the main CHARM Input Window. CHARM prompts the user to enter the desired time of the Snapshot Plan Plume View in hours and minutes since the release. This time is used as the maximum time plotted for displays such as the Dose Display, Integrated Plume View, and Maximum Distance.

Enter time of plot.

Time since release 0 : 15

OK Cancel Help

After the plot time is entered, a message box appears momentarily while CHARM performs the necessary calculations for creating the plume. Select the Cancel button to abort the dispersion calculations and return to the Main CHARM Input Window. Select the Stop button to stop the dispersion calculation at the next calculated time interval. For example, if the user requested 15 minutes of dispersion calculation, and the user opted to press the Stop button before the calculation was complete, CHARM would only display dispersion calculations up to, perhaps, minute 11.



If calculations have been run with the current input for a previous display, they are not run again. Once the calculations have been completed or stopped, a plume display is generated similar to the display in Figure 6.15.

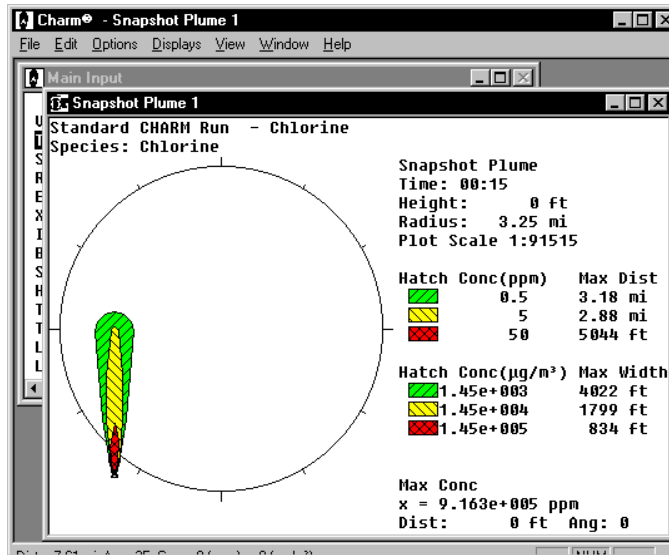
As the cross hair cursor is moved across the plume display, the concentration, distance, and angle from the source are reported at each point in the status bar at the bottom of the display. The plan plume view window does not scroll. If the legend at the right or bottom of the window is not visible, the window can be maximized. CHARM can show more than one plume display at a time.

Use the File menu commands to save the release description input or the met data in separate files, or plot the display to a printer or plotter. Since the Options and Displays menus of the Snapshot Plan Plume View and the Integrated Plan Plume View are very similar, these menus are discussed in detail in the following section titled "Plan Plume View Displays."

Repositioning the Source

To reposition the source within the viewport of a plume display, press <Ctrl> and the appropriate arrow key. Each press of an arrow key moves the plume one sixteenth of the distance across the area in which the plume is displayed. When you release the arrow key, the screen is updated.

The direction of the selected arrow key is the direction in which the view port (solid circle) is moved. For example, <Ctrl-Up arrow> moves the view port up, thereby moving the plume and map display (if any) down. When the source is not at the center of the view port, automatic scaling is turned off.



To reset the position of the source to the center of the view port, use the Reset Source command on the Options menu.

Generating a Dose Display Plot

The Dose Display shows a plot of the concentration versus time at a selected location. Figure 6.16 shows a sample Dose Display. The plot is initially one of instantaneous concentrations calculated at each minute versus time.

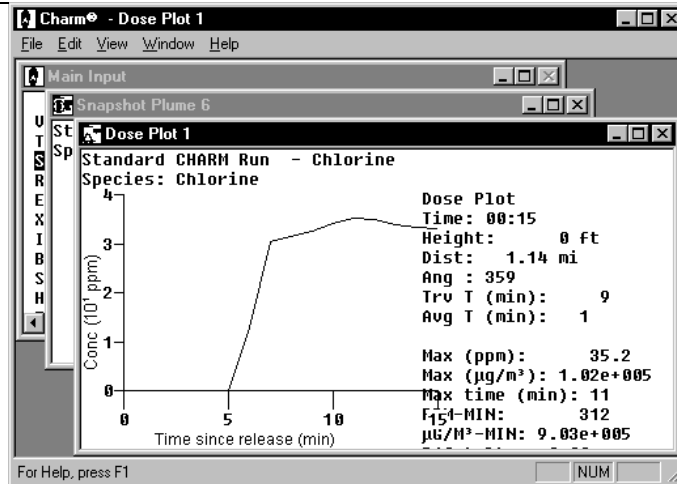
To generate a Dose Display plot, move the cursor to a desired location, and double-click the left mouse button or press <Enter>. You can generate dose plots for multiple locations by repeating this procedure.

The default averaging time is one minute, but the time can be changed using the Averaging option on the File menu from the Dose Display plot. Use the File and Edit menu commands to print and copy the Dose Display respectively. You can also display the dose information in tabular form using the Table command on the File menu.

Since the concentration at a location is calculated only once a minute, short duration releases (single puffs) may not be represented correctly. For a point near the source, the maximum concentration of a puff may move over the point not on the minute, but perhaps on a half minute. The maximum is then lost. As a puff moves further downwind, it spreads out and the problem is reduced. A single spike display is often an indication that this problem occurred. With single puffs or short duration releases, it may be better to use the Maximum Concentration command on the Displays menu and interpolate the actual maximum

concentration at the selected location, or use the Minutes-Seconds mode from the Options menu of the Main CHARM Input Window.

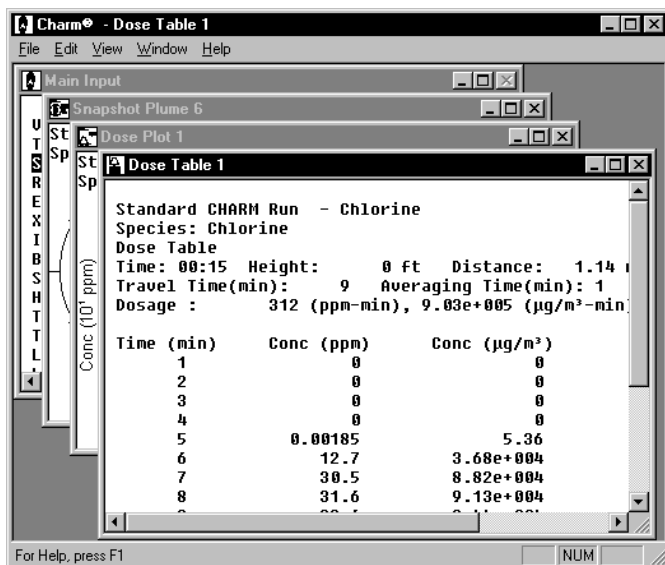
Figure 6.16
Dose Display



Generating a Dose Display Table

To generate a Dose Display table, first generate a Dose Display plot and then select the Table command on the File menu. The Dose Display table shown in Figure 6.17 is a tabular time history of the concentration at the selected location. The averaging time for the dose display is the number of minutes that are averaged to determine the display. Since the concentrations are calculated at the specified location only once a minute, the default is one minute. To change the averaging time, use the Averaging option from the File menu.

Figure 6.17
Dose Display
Table



Setting the Averaging Time for a Dose Display

To reset the averaging time, select the Averaging menu from the File menu of the Dose Display window, and enter the averaging time in minutes from 1 to the present plot time. The default time is 1 minute. The average taken is the running average. The concentrations at a specific point are averaged over time to determine a time-weighted average. For example, if the averaging time is 5 minutes the concentration given at time 0 minutes is the average for minutes 0, 1, 2, 3, and 4. For minute 1, the average is for minutes 1 through 5. For minute 2 the average is for minutes 2 through 6. The averages result from summing instantaneous minute predictions, not averages over each minute.

Enter the averaging time in minutes.

1

OK Cancel Help

Plan Plume View Displays

The plan plume view displays are the Snapshot Plan Plume View (Figure 6.15), the Integrated Plan Plume View (Figure 6.30), the Grid Averaged Plume View (Figure 6.31), Mechanical/Explosion Overpressure Views (Figure 6.35), and the Population Visual Verify (Figure 6.32). A Snapshot Plan Plume View display is an instantaneous view of the plume at a specified time. The Plume command on the Displays menu of the Main CHARM Input Window generates the snapshot view. An Integrated Area Plan Plume View is a minute by minute calculation of the plume display that shows all areas affected by the plume. The Integrated Area command on the Displays menu of the Snapshot Plan Plume View window generates the integrated plume. Selecting the Time-Averaged Plume command from the Displays menu of the Snapshot Plume generates a time-averaged plume based on a user-defined averaging interval and a user-defined grid size. The Mechanical Overpressures option shows a footprint of the overpressures expected from a pressurized bursting sphere. It is only available if the release type is Container/Surface Description. On the other hand, if flammability characteristics are right and concentration levels are sufficient, a plume may be ignited from the Explosion Overpressures command on the Displays menu from a Snapshot Plume View. Finally, the user may visually verify how a footprint (plume, overpressures, or thermal radiation) impact population tracts. This option is only available after the population impacts have been calculated from the Displays menu of any type of footprint.

Use the Options menu on the plan plume views to alter the appearance of a display. The Options menu and the Displays menu of the integrated view are similar to those of the snapshot view. The selections for both menus are discussed in the following sections.

Plume View Options Menu

The Options menu of the Snapshot Plan Plume View provides selections for altering the appearance of the plume display, showing a new map, setting and resetting the source location, and specifying a new release time. The Options menus for the Snapshot Plan Plume View and the Integrated Plume View have many of the same selections.

Isopleths Option (Plume Footprint Display)

Use the Isopleths command on the Options menu to change the species concentrations that are plotted on plume displays and graphs. Enter the isopleths in parts per million or microgram per cubic meter. At least one concentration is required.

Enter concentrations for plume plot

Concentration 1	<input type="text" value="0.5"/>	Units <input type="text" value="ppm"/>
Concentration 2	<input type="text" value="5"/>	
Concentration 3	<input type="text" value="50"/>	

OK Cancel Help

Overpressures Option (Mechanical/Explosion Overpressures Display)

Use the Overpressures command on the Options menu to change the desired overpressures that are plotted on the displays and graphs. Enter the overpressures in psi or bar. At least one overpressure is required.

Enter the overpressures.

Pressure 1	<input type="text" value="0.1"/>	Units <input type="text" value="bar"/>
Pressure 2	<input type="text" value="0.5"/>	
Pressure 3	<input type="text" value="5"/>	

OK Cancel Help

Distances Option (Explosion Overpressures Display)

Enter up to three distances from the source. The units are feet, meters, miles, or kilometers. CHARM displays the default values. You can accept or change the default values. A value is required for at least one distance. CHARM uses the distances to calculate overpressures to create the footprint display.

Enter the distances from the source.

Distance 1	<input type="text" value="63.24"/>	Units <input type="text" value="feet"/>
Distance 2	<input type="text" value="13.5006"/>	
Distance 3	<input type="text" value="5.72367"/>	

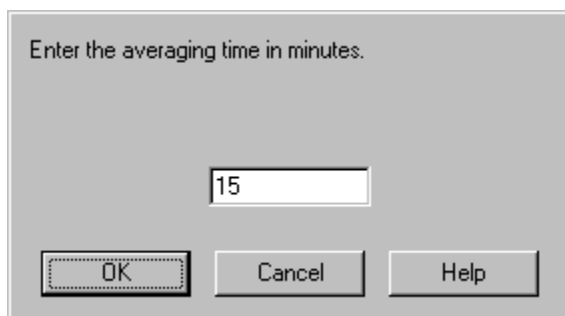
OK Cancel Help

Averaging Time Option (Time-Averaged Footprint Display)

You may change the averaging time associated with a Time-Averaged Footprint. Enter the averaging time in minutes from 1 to the present plot time. The average taken is the running average. The

concentrations at a specific point are averaged over time to determine a time-weighted average.

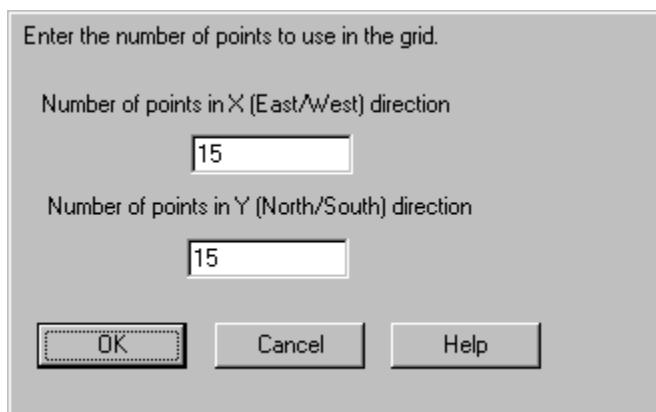
For example, if the averaging time is 5 minutes, the concentration given at time 0 minutes is the average for minutes 0, 1, 2, 3, and 4. For minute 1, the average is for minutes 1 through 5. For minute 2 the average is for minutes 2 through 6. The averages result from summing instantaneous minute predictions, not averages over each minute.



A dialog box with a gray background. At the top, it says "Enter the averaging time in minutes." Below this is a text input field containing the number "15". At the bottom, there are three buttons: "OK", "Cancel", and "Help". The "OK" button is highlighted with a dashed border.

Grid Size Option (Time-Averaged Footprint Display)

You may change the grid size associated with a Time-Averaged Footprint. Enter the number of points to be used in the grid when generating a Time-Averaged Plume. The grid is 2-dimensional and, therefore, the user must enter the number of points in the X direction (East/West) and the Y direction (North/South).



A dialog box with a gray background. At the top, it says "Enter the number of points to use in the grid." Below this are two text input fields. The first is labeled "Number of points in X (East/West) direction" and contains the number "15". The second is labeled "Number of points in Y (North/South) direction" and also contains the number "15". At the bottom, there are three buttons: "OK", "Cancel", and "Help". The "OK" button is highlighted with a dashed border.

Show Grid Option (Time-Averaged Footprint Display)

This option simply turns on or off the currently defined grid for a Time-Averaged Footprint. A check mark by the option indicates the grid is shown, while no check mark indicates that the grid is not shown.

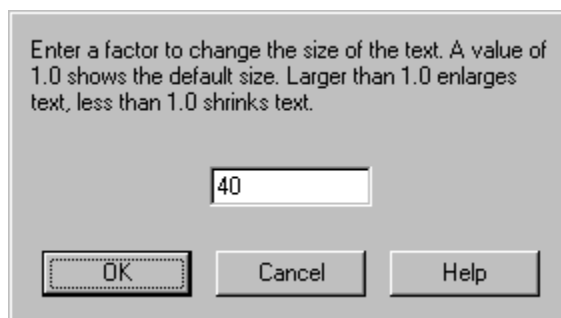
Grid Display Option (Time-Averaged Footprint Display)

If the Show Grid option is on, this option displays the user-defined grid for the Time-Averaged Plume as a series of points or a wire mesh, whichever submenu item is selected. A check by the menu

item indicates this option is turned on, whereas no check by the menu item indicates the option is not active and the grid points are not visible.

Text Size Option (Population Impact Visual Verify Display)

From the Population View, the user may adjust the size of the text describing the population number for each tract. Increasing the number enlarges the current size of the text, and decreasing the number reduces the current size of the text. Each population tract is described by two numbers, one on top of the other. The top number is usually lower if any type of impact was encountered in the tract. This number indicates the number of people impacted in the tract. The lower number is the total number of people located in that particular tract.



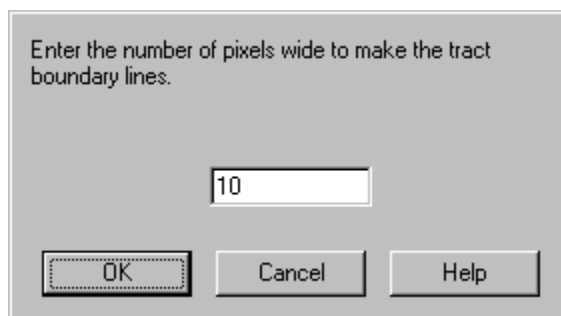
Enter a factor to change the size of the text. A value of 1.0 shows the default size. Larger than 1.0 enlarges text, less than 1.0 shrinks text.

40

OK Cancel Help

Line Width Option (Population Impact Visual Verify Display)

From the Population View, the user may adjust the line width describing the population tracts. This is helpful when differentiating the population tracts from lines drawn by overlaying maps. Increasing the number enlarges the current line width, and decreasing the number reduces the current size of the line width.



Enter the number of pixels wide to make the tract boundary lines.

10

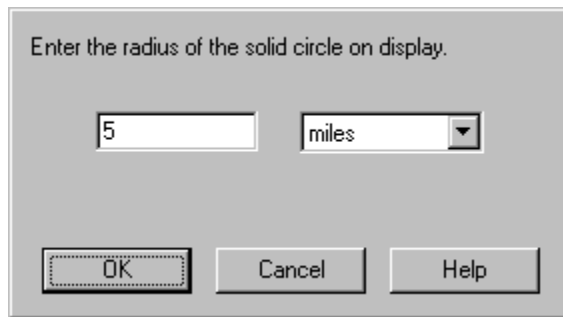
OK Cancel Help

Monochrome Option (3D Plume Display)

Use this option in the 3D Plume Display to remove the color from the concentration being viewed. This menu item is switched either on or off. A check mark beside the menu item indicates that no color is used with the plume and no check mark indicates the plume is filled with color.

Scale Radius Option (Any Footprint Display)

Use the Scale Radius command on the Options menu to change the radius of the view port (solid circle) on the plume display. A scale change alters the overall display area. Enter the radius of the view port in feet, miles, kilometers, or meters. A value greater than 0 (zero) must be entered. If you want CHARM to determine the radius of the view port, you can specify the scale ratio using the Scale Ratio command on the Options menu.



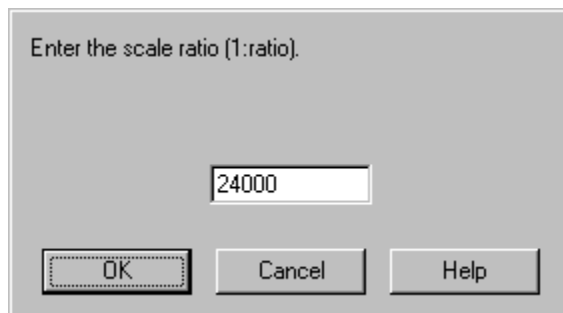
Enter the radius of the solid circle on display.

5 miles

OK Cancel Help

Scale Ratio Option (Any Footprint Display)

Use the Scale Ratio command on the Options menu to enter a ratio for which CHARM will determine the view port radius on the plume display. When you set the scale ratio, the plume display will approximate the plot that will be sent to the printer/plotter. The display itself will not be set to scale, but the output of a plot sent to the printer/plotter will be scaled. Enter the scale ratio of the current plume display. Assume a 1:scale relationship. The center of the plot will be at the center of the view port. The total area plotted is determined by the scale specified, not necessarily by what is visible on the screen.



Enter the scale ratio (1:ratio).

24000

OK Cancel Help

Distance Circles (Any Footprint Display)

To supplement the displays of the plan view, additional circles can be drawn within the large circle with tick marks. Enter the radius increment to use.

Enter radius of supplemental circles.

Receptor Height Option (Any Footprint Display)

Use the Receptor Height command on the Options menu to change the height of the display above the ground. The plan plume view represents a horizontal slice through the atmosphere. Enter the height above ground in feet or meters. This value is used for all calculations and displays that require a receptor height.

Enter the receptor height.

Transparency Option (Any Footprint Display)

The Transparency command on the Options menu is a toggle that changes the display between a colored, opaque plume and a "ghost" plume that is denoted only by concentration hatch marks. When a map and plume are displayed, this feature allows the map areas beneath the plume to be seen. The transparency option was used to create the plume figures shown in this chapter.

No Hatch Option (Any Footprint Display)

Use the No Hatch command to remove the hatch marks from the legend and the footprint so that only color may be seen. The command is merely a switch. A checkmark next to the command indicates that No Hatch is active. Alternatively, no checkmark by the command indicates the No Hatch is inactive.

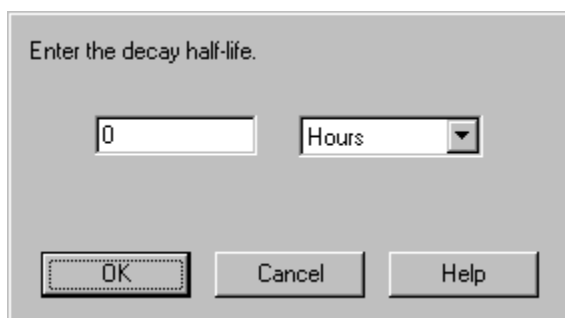
NOTE: The No Hatch command does not work in accordance with the Transparency command selected.

Use Auto Scale Option (Any Footprint Display)

Use Auto Scale command works in accordance with selecting an option (e.g. New Time, Receptor Height, etc.) for generating a new display. If the Use Auto Scale command is checked and active, then CHARM will automatically rescale the current display so that the resulting footprint is completely described in the viewport (i.e. large circle). On the other hand, if the Use Auto Scale command is unchecked and inactive, then the resulting display will remain at the current scale just before the user requests a option for display.

Decay Option (Plume Footprint Display)

Use the Decay command on the Options menu to specify the time (half-life) required for half of the emitted material to decay into neutral products. This option simulates the decay of the material in the air. Enter the decay time in hours, minutes, or seconds. Any previous windows produced for the current scenario are not updated with the effects of the half-life data, but all subsequent windows are.



Enter the decay half-life.

0 Hours

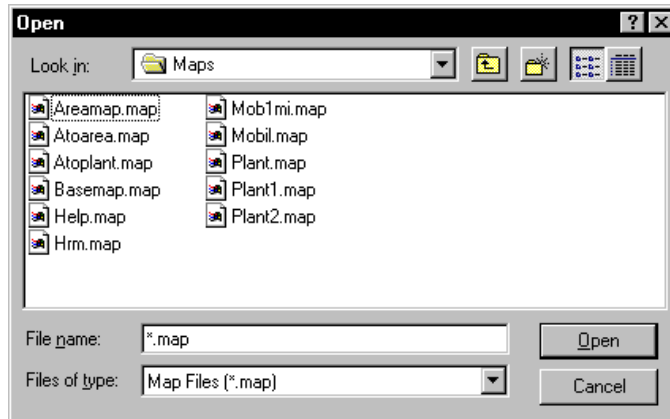
OK Cancel Help

If you enter a decay time, the downwind concentrations will be decreased.

NOTE: Use this option with caution, because the predicted concentrations will be lower than they would be with no decay.

Map Option (Any Footprint Display)

The Map command on the Options menu opens a dialog box in which you can select a map for display. Any maps that have been edited with the CHARM Editor and stored with the default .MAP file name extension are displayed. The default map name is BASEMAP.MAP. Select the name of the map to display. For more information on map displays, see the section of this chapter titled "Map Displays."

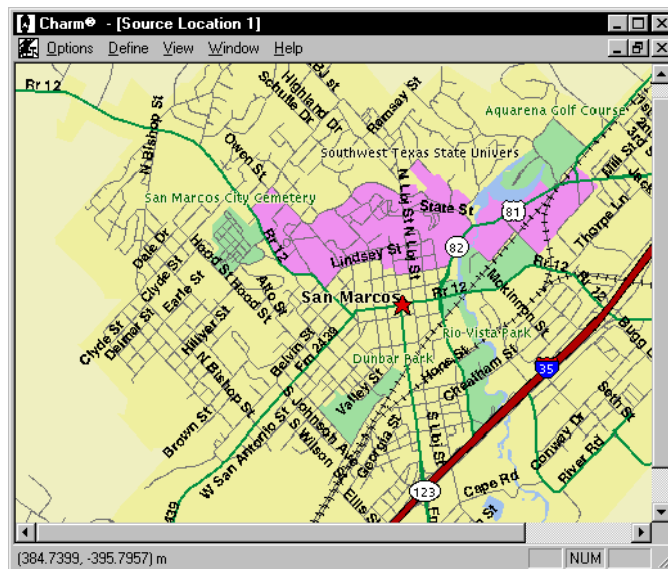


No Map Option (Any Footprint Display)

The No Map command on the Options menu quickly and easily removes the current map from the display when selected.

Location Option (Any Footprint Display)

Use the Location command on the Options menu to relocate the source of the release on the current map. This option displays the map on a separate screen where the source location can be changed.



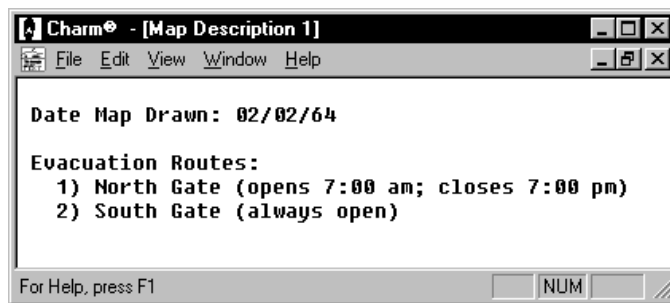
To change the source location, first select the new location on the map display. If you are using a mouse, move the cursor to the new location and double-click the left mouse button. With a mouse, you can achieve the same result by selecting the Define Point option in the Define menu, moving the cursor to the new location, and then clicking the left mouse button. If you are using the keyboard, select the Define Point option in

the Define menu of the map display, move the cursor to the new location by holding down <Shift> while pressing the arrow keys, and then press <Enter>.

To scroll the map display with a mouse, use the scroll bars. To scroll the map with the keyboard, use <Page Up> or <Page Down>.

Map Description (Any Footprint Display)

Selecting this option allows the user to view pertinent information describing the currently displayed map. This text is defined in the Map Definition Editor within CHARMED. For more information, refer to “Map Description” in Chapter 3.



Reset Source Option (Any Footprint Display)

If the plume has been repositioned within the view port, the Reset Source command on the Options menu resets the position of the source to the center of the view port.

Auto Map Change Option (Any Footprint Display)

Use the Auto Map Change command on the Options menu to enable CHARM to automatically display a larger-scaled map when the scale of the current map display is not large enough to cover a significant portion of the plot area (defined by the Auto Map Fraction command). In order for CHARM to identify and automatically display a larger-scaled map, the map must be edited with the CHARM Editor and assigned an Expand Map Name. The Auto Map Change command is a toggle.

Auto Map Fraction Option (Any Footprint Display)

Use the Auto Map Fraction command to define the fraction of the footprint display area which must be covered by a map to preclude CHARM from trying to go to a larger scale map. The rectangular area used for comparison is the area in which the viewport circle is inscribed. If the current map covers less than the Auto Map Fraction of the rectangular area, CHARM will try to go to the larger scale map defined for the map. The value must be between 0.05 and 0.95. The default is 0.25.

Enter the Auto Map Fraction

0.25

OK Cancel Help

Larger Scale Map Option (Any Footprint Display)

Use the Larger Scale Map command on the Options menu to display a larger-scaled map when the scale of the current map display does not cover a significant portion of the plot area. The larger-scaled map must be edited with the CHARM Editor.

New Time Option

Use the New Time command on the Options menu to change the time since release for the Plan Plume View. If the requested time has already been calculated, the display is immediately updated. This dialog box is also requested when first generating the plume or footprint from the Plume command of the Main CHARM Input Window.

Enter time of plot.

Time since release 0 : 30

OK Cancel Help

Time Circles Option (Any Concentration Footprint Display)

The Time Circles command on the Options menu draws dashed circles around the source, the radii of which are determined by the time specified in the dialog box. Time circles indicate the locations to which the current wind speed can move a parcel of air from the source in the number of minutes specified.

Enter a time (minutes) for spacing dashed circles on display.

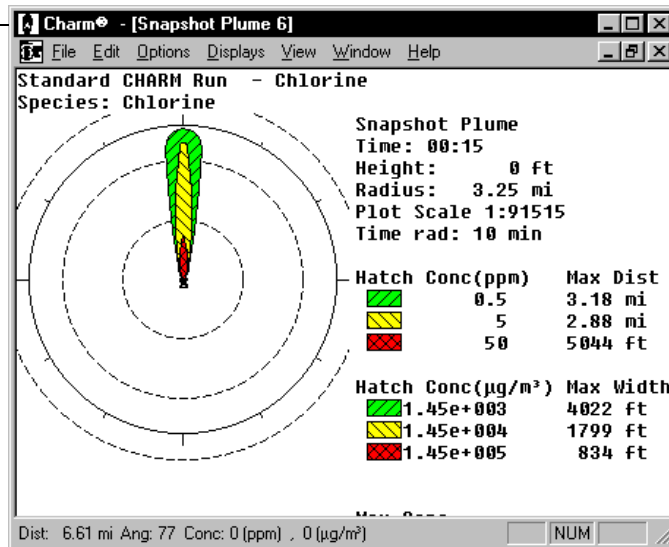
10

OK Cancel Help

Enter the time in minutes. A time greater than 0 (zero) is required to display time circles. If you enter 0 or leave the field blank, CHARM

does not display time circles. Figure 6.18 shows a sample Time Circles display.

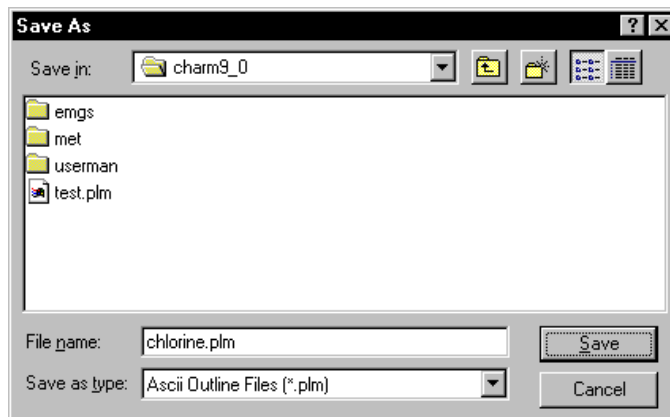
Figure 6.18
Time Circles
Display



The wind speed at the release site, current height, and the time of the Snapshot Plan Plume View are used to determine the radii of the circles. Spatial and temporal variations of the wind speed are not used. As the wind speed changes, the radii change. Wind speed changes with time also affect the radii of time circles.

Create ASCII File Option (Any Footprint Display)

Create ASCII File command on the Options menu enables the user to generate a file to hold a description of a footprint that can be transferred to other programs. CHARM requests the name of the file through a standard windows Save As dialog box. Select the drive, the directory, and the file name to store the text file. The default ASCII file extension (.PLM) is defined by the AsciiExt variable in CHARM.INI.



This option was designed to be used with the other programs, such as Computer Aided Design software (CAD), which should have options to import the data.

ASCII File Format

The ASCII file contains the real world coordinated (in meters from source) of the currently displayed footprint. The file contains what is envisioned as the minimum required for the general case. The points given describing the location of an isopleth are not necessarily close enough to give a smooth display of an isopleth.

<u>RECORD</u>	<u>VARIABLES</u>	<u>MEANING</u>	<u>FORTTRAN FORMAT</u>
1	HRO MINSO SECO	Time of release: hours minutes seconds	315
2	HRP MINP SECP	Time of plot: hours minutes seconds	
3	HEIGHT	Height above ground of plot (meters)	E15.4
4	NCON IUNITS	Number of isopleth values following; Units of isopleths; Type of calculation	315
5	ITYPE CONV (1 TO NCON)	Isopleth values	3E15.4

In the above if IUNITS is 0 or mission the isopleth values are in ppm. If IUNITS is 1, the isopleths are in kilowatts per square meter (thermal radiation). If IUNITS is 2 the isopleths are in pounds per square inch (overpressures).

The type of calculation indicated how the isopleths were generated:

<u>ITYPE</u>	<u>Source</u>
1	Snapshot Plume concentration.
2	Pool fire or BLEVE radiation.
3	Thermal Radiation.
4	Overpressures from a failure of a pressurized vessel.
5	Overpressures from a vapor cloud explosion.
6	Integrated Plume concentration.
7	Time-Averaged Plume

These first five records will be followed by NCON groups of records. Each group will consist of: first, a record containing the number of isopleths for one of the CONV values (NISO, format I5), followed by up to three subgroups of records. Each subgroup will have the following format:

SUB- GROUP <u>RECORD</u>	<u>VARIABLES</u>	<u>MEANING</u>	FORTTRAN <u>FORMAT</u>
1	NPTS	Number of X/Y pairs following	15
2 - NPTS+1	X,Y,R	Points describing an isopleth; R is always 0. R is never used and is only present for backward compatibility.	

An example of records 6 and onward may help. Assume NCON is three and that the three isopleths following are 1, 10, and 100 ppm. Further assume there are two distinct and separate isopleths for the 100 ppm concentration. This can happen if the emission rate has varied over time. The other concentrations will be assumed to only have a single isopleth each.

<u>Record</u>	<u>Value</u>
7	1 (only one isopleth for 1 ppm conc.)
8	NPTS1
9 to 8 + NPTS1	NPTS1 pairs of X/Y points describing 1 ppm isopleth
9 + NPTS1	1 (one isopleth for 10 ppm conc).
10 + NPTS1	NPTS10
11 + NPTS1 to	NPTS10 points pairs describing
10 + NPTS1 +	10 ppm
NPTS10	isopleth
11 + NPTS1	2(two isopleths for 100 ppm
+NPTS10	conc.)
12 + NPTS1 +	NPTS100A
NPTS10	

```

...           NPTS100A point pairs for first
               100 ppm isopleth
...           NPTS100B
...           NPTS100B point pairs for
               second 100 ppm isopleth

```

Minimum and maximum numbers that can be expected for each of the variables which may dictate the use of arrays are:

- NCON (1 to 3)
- NISO (0 to 3)
- NPTS (unlimited)

Transferring Footprints via DDE to other Windows Programs

A (Dynamic Data Exchange) DDE interface is available to send a footprint of impact (concentration, thermal radiation, or overpressure) data in a real-time manner to other Windows programs while CHARM is running. To set up the DDE a client program must initialize a conversation with the server, CHARM. The following values are needed to set up the communication.

Server Name: CHARM

Topic: EISI

Item: PLUME_CHARM

CHARM only performs Advise services (use XTYP_ADVSTART). After a conversation has been established, whenever a plan view is created or changed it will be sent out to all clients. Changing receptor heights, isopleth values, time, etc. change the plume. The block of data sent out is identical to creating an ASCIIFile except that a line is added to the beginning of the block. This first line is to be used as a scenario indicator. The first line is to be used as a scenario indicator. The first line will look like:

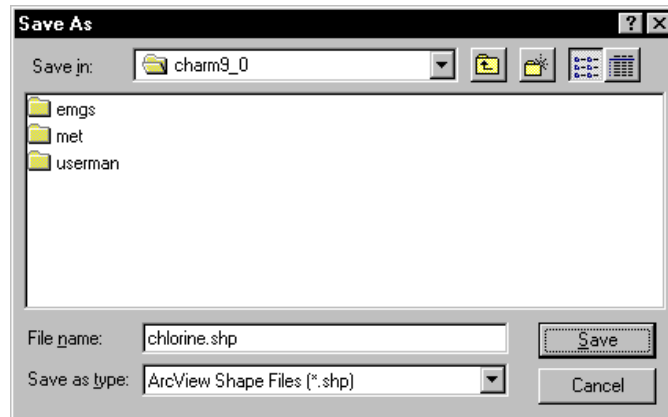
CHXXXXXX

where XXXXXX is a six digit number from 0 on up (leading 0s are used). Every data block sent with the same first line where created from the same input. This is actually only true if CHARM is not stopped and the re-started. Whenever CHARM begins the value of XXXXXX starts at 0. If the value of CHXXXXXX is identical to that in a previous data block and ITYPEs are the same the new data block is an update to the previous footprint (possibly at a new time, height, etc.).

Create Shape File Option (Any Footprint Display)

This command enables the user to generate a file that describes a footprint of impact (concentration, thermal radiation, or overpressure) which can be transferred to ArcView for display. Whenever a plan view of an impact is displayed, this option becomes available on the Options menu. The default shape file extension (.SHP) is defined by the

ShapeFileExt variable in CHARM.INI. It is set to SHP and should not be changed since ArcView expects that extension.



An ArcView shape file is actually three files: the main file, an index file, and a dBase file with attributes. These three files all have the same names and locations except for their extensions. The main file extension is .SHP. The index file extension is .SHX. The dBase file extension is .DBF.

The main file contains the real world coordinates (in meters from source) of the currently displayed footprint. The file contains what is envisioned as the minimum required for the general case. The points given describing the location of an isopleth are not necessarily close enough to give a smooth display of an isopleth. The index file has pointers to the footprints in the main file so that ArcView can find the data properly. The dBase file has the following attributes for each isopleth of the footprint: REL_TIME, PLOT_TIME, X_SRC, Y_SRC, HEIGHT, CONT_VALUE, UNITS, and SOURCE.

REL_TIME is the time of release. Usually 00:00 except for emergency response. Then it is clocktime of release.

PLOT_TIME is the display time which is given as time since release.

X_SRC, Y_SRC define the location of the source in meters. The footprint vertices are given in meters from the source.

HEIGHT is the height above ground of the footprint.

CONT_VALUE is the numeric value defining the isopleth.

UNITS is a flag for the units of CONT_VALUE

If UNITS is 0 the isopleth values are in ppm. If UNITS is 1, the isopleths are in kilowatts per square meter (thermal radiation). If UNITS is 2 the isopleths are in pounds per square inch (overpressures).

The type of calculation used to generate the isopleths is indicated by the SOURCE attribute:

<u>SOURCE</u>	<u>Source</u>
1	Snapshot Plume concentration.
2	Pool fire or BLEVE radiation.
3	Jet fire radiation.
4	Overpressures from a failure of a pressurized vessel.
5	Overpressures from a vapor cloud explosion.
6	Integrated Plume concentration.
7	Time-Averaged Plume

Plume View Displays Menu

The Displays menu of the Snapshot Plan Plume View window provides selections for plotting maximum distances, vertical cross-sections, centerline concentrations, explosion overpressures, population impacts, Time-Averaged plumes, and integrated area plumes. CHARM also creates table displays for maximum distances and concentrations. Met data, release data, puff description, and emission rate displays are also available from the plan plume view.

The Displays menu of the other Plan Displays have selections that are similar to the snapshot plume displays menu. The Displays menu for an integrated plume does not provide a vertical cross-section, centerline concentration, or meteorological data. The integrated plume has additional menu selections for recalculating a plume or continuing the current calculation.

Maximum Distance Display

The Maximum Distance command on the Displays menu plots the maximum distance downwind of the specified concentration as a function of time.

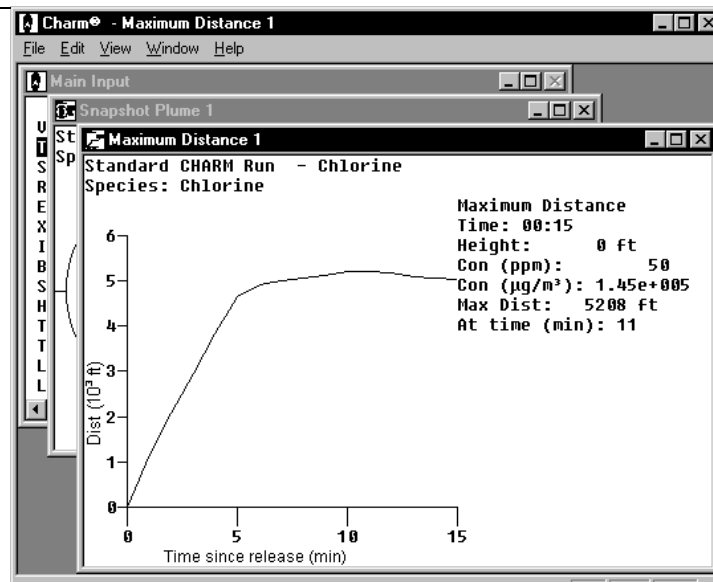
Enter a concentration for plotting maximum distance.

50 ppm

OK Cancel Help

Enter the concentration in parts per million or micrograms per cubic meter. The time interval for the plot depends on the time specified for the current Snapshot Plan View Plume view display. Figure 6.19 shows a sample Maximum Distance Plot.

Figure 6.19
Maximum
Distance Plot

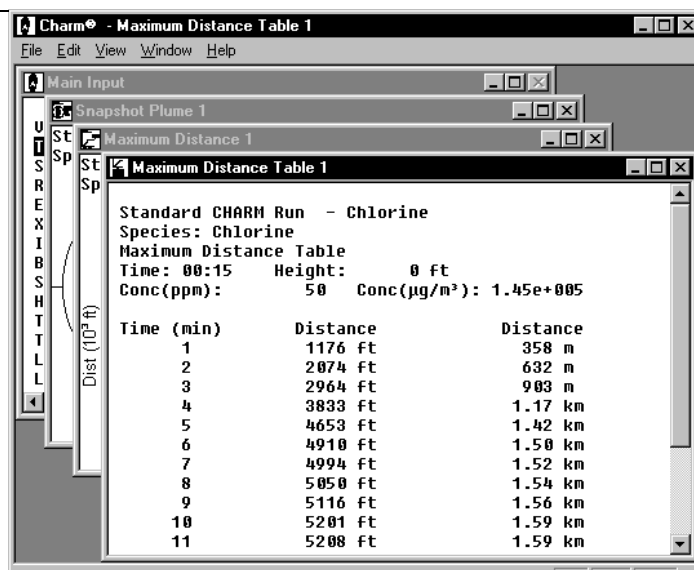


Use the Copy command from the Edit menu to copy the contents of the window to the clipboard. Use the File menu commands to print the Maximum Distance plot, or display the maximum distance information in the form of a table.

Maximum Distance Table

To display the maximum distance information in tabular form, first display the Maximum Distance plot and then select the Table command from the File menu. The table shows the distance downwind that a concentration has reached as a function of time. The distance is reported in feet, miles, meters, and kilometers for each minute since the release time specified for the plume. Figure 6.20 shows a sample Maximum Distance table.

Figure 6.20
Maximum
Distance
Table



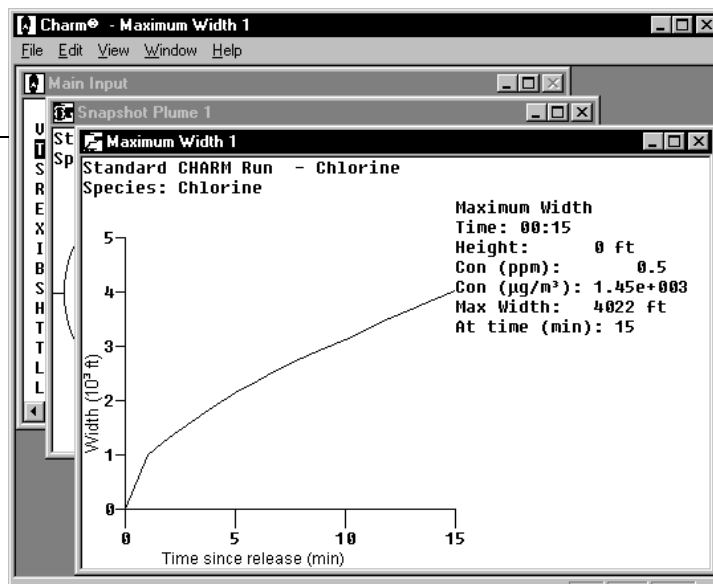
Maximum Width Display

The Maximum Width command on the Displays menu plots maximum crosswind width of a user-specified concentration as a function of time.

Enter a concentration for plotting maximum width.

Enter the concentration in parts per million or micrograms per cubic meter. The time interval for the plot depends on the time specified for the current Snapshot Plan View Plume view display. Figure 6.21 shows a sample Maximum Width Plot.

Figure 6.21
Maximum
Distance
Table

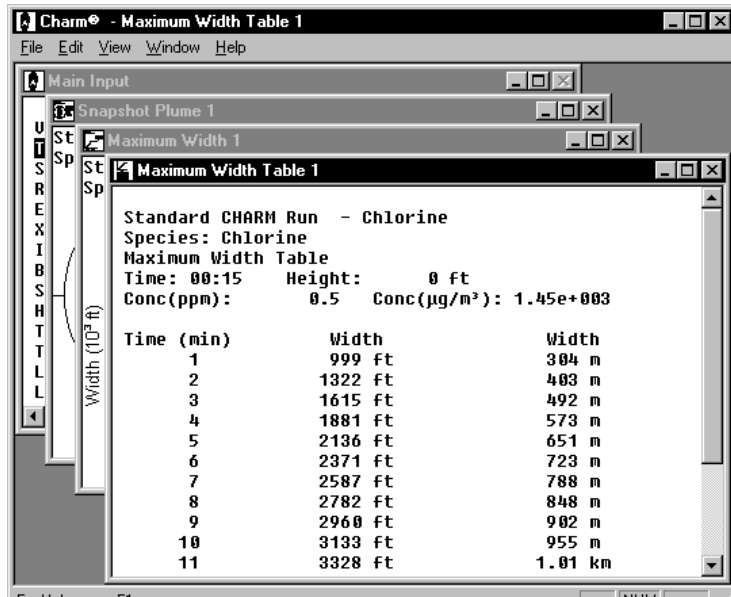


Use the Copy command from the Edit menu to copy the contents of the window to the clipboard. Use the File menu commands to print the Maximum Width plot, or display the maximum width information in the form of a table.

Maximum Width Table

To display the maximum width information in tabular form, first display the Maximum Width plot and then select the Table command from the File menu. The table shows the crosswind width of a user specified concentration as a function of time. The distance is reported in feet, miles, meters, and kilometers for each minute since the release time specified for the plume. Figure 6.22 shows a sample Maximum Width table.

Figure 6.22
Maximum
Width Table



Maximum Concentration Display

Use the Maximum Concentration command on the Displays menu to enter a minimum distance from the release source beyond which CHARM will tabulate and display all maximum concentrations as a function of time.

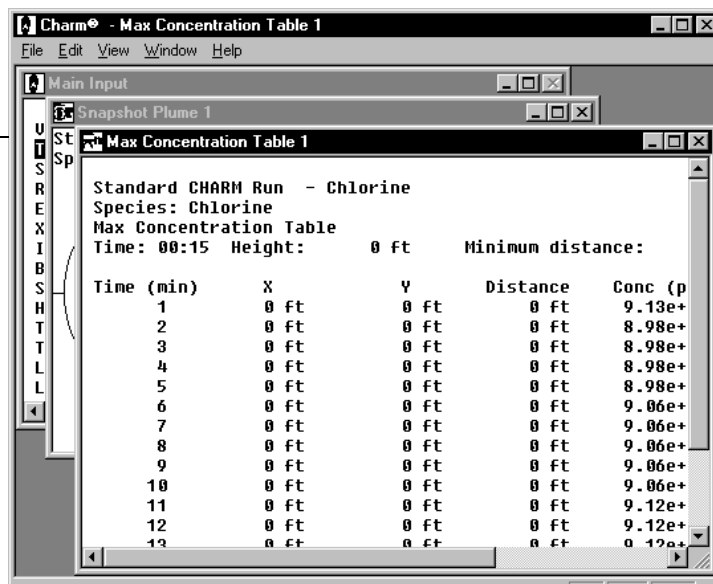
Enter the minimum distance from the source for maximum concentration plot.

0 feet

OK Cancel Help

Enter the distance in feet, miles, meters, or kilometers. Figure 6.23 shows a sample Maximum Concentration Table. Use the File menu commands to print or copy the table.

Figure 6.23
Maximum
Concentra-
tion Table

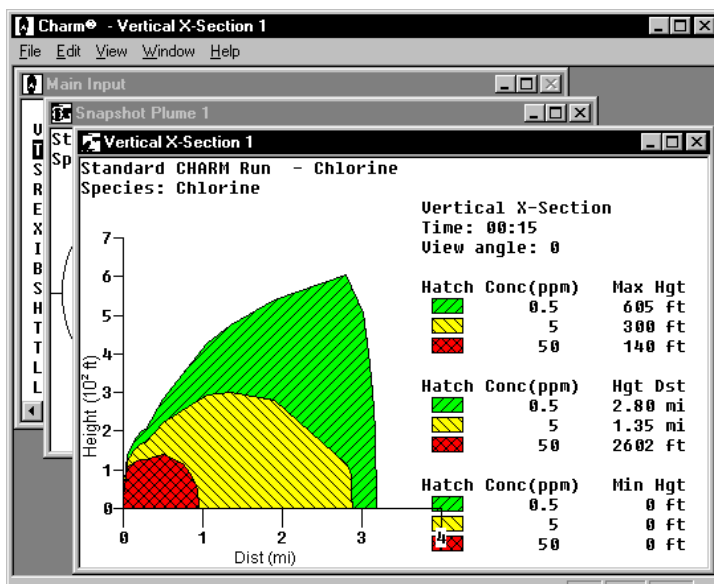


The table shows the maximum concentration of the species in parts per million and micrograms per cubic meter as a function of time. A maximum concentration is calculated for every minute since release. The X and Y locations and the downwind distance of the maximum concentrations are also reported. Use the File and Edit menu commands to print or copy the Maximum Distance table respectively.

Vertical Cross-Section

The Vertical X-section command on the Displays menu plots a vertical cross-section through the middle of the plume. The view is from the source through the middle of the first puff released. Since this display involves one of the longest calculations in the model, it may take some time before the cross-section is displayed. Figure 6.24 shows a sample Vertical Cross-Section display. Use the File menu commands to print, plot, or copy the cross-section display. The Monochrome command on the File menu creates a colorless vertical cross-section whose isopleth concentrations can be printed or plotted.

Figure 6.24
Vertical
Cross-Section
Display



Centerline Concentrations Display

The Centerline Concentrations command on the Displays menu plots the concentrations down the centerline of the plume as a function of distance. The concentrations are listed for the specified height and may not include the maximum concentration.

Centerline Concentrations

Beginning Distance: 0 Ending Distance: 10000

Distance Units: feet

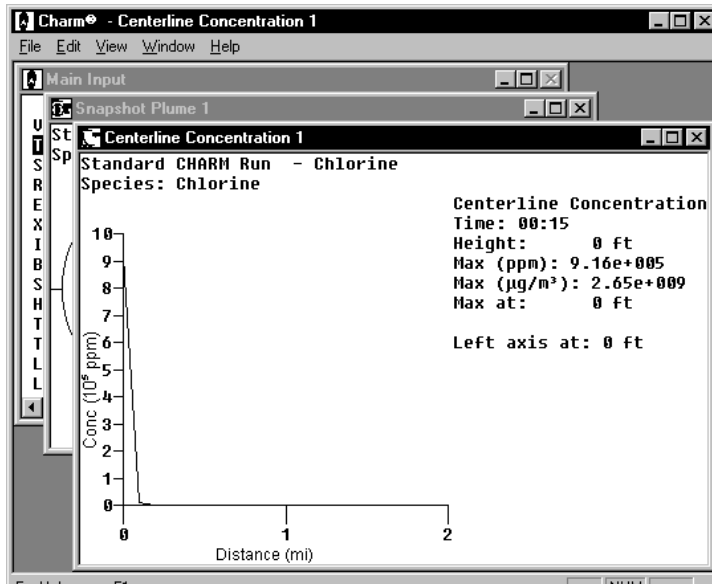
Interval Size: 500 feet

☐ Log Plot

OK Cancel Help

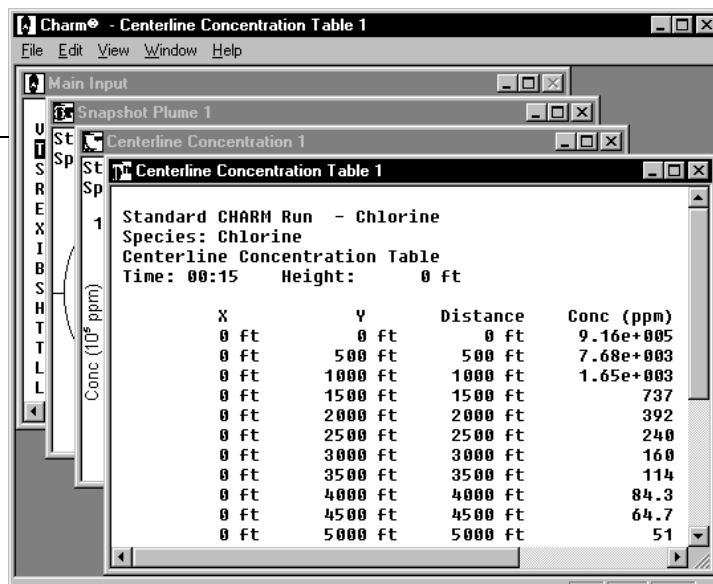
Enter the beginning and ending points of the line to lie along the centerline of the plume. You can also specify the concentration interval by which to show concentrations along the centerline. Figure 6.25 shows a sample Centerline Concentrations display. Use the File and Edit menu commands to print or copy the display respectively.

Figure 6.25
Centerline
Concentration
Plot



To display a centerline concentration table instead of a graph, select the Table command from the File Menu. To plot the log concentration instead of the actual value check the Log Plot option in the dialog box that contains the line and interval information. Figure 6.26 shows a sample Centerline Concentrations Table. Use the File and Edit menu commands to print, or copy the display respectively.

Figure 6.26
Centerline
Concentra-
tions Table



If the concentrations are expected to vary over orders of magnitude, a centerline concentration table of values or log plot for the actual concentrations may be more informative than a linear graph. The centerline concentration table lists the concentrations (parts per million and micrograms per cubic meter) down the centerline of the plume as a function of distance (feet or meters). The table lists the X and Y positions, the distance from the source, and the concentration at each point. A positive X value indicates East and a negative X value indicates West. Similarly, a positive Y value indicates North a negative Y value indicates South. The concentration units are parts per million and micrograms per cubic meter. The concentrations are listed for the specified receptor height and do not necessarily include the maximum concentration.

Plume Half-Widths Display

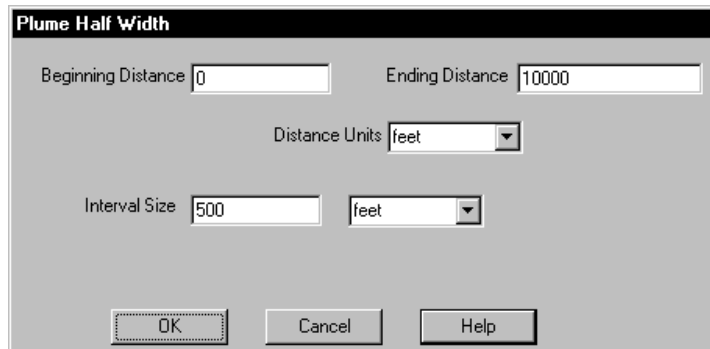
The Plume Half-Widths command on the Displays menu determines the crosswind half-width down the centerline of plume as a function of concentration. The user will be prompted for the downwind spacing of the points along the centerline for the half-width calculations.

Enter a concentration for plotting plume half-widths.

0.5 ppm

OK Cancel Help

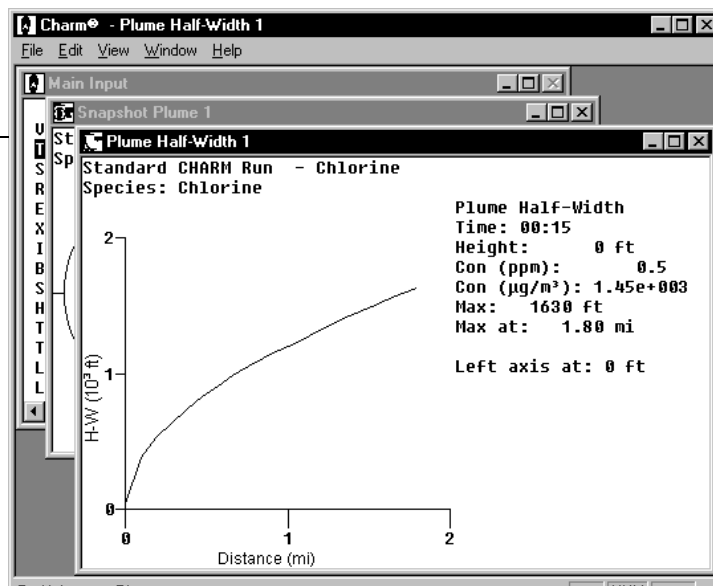
Enter the desired concentration in parts per million or micrograms per cubic meter.



The image shows a software dialog box titled "Plume Half Width". It contains several input fields and buttons. At the top, there are two text boxes: "Beginning Distance" with the value "0" and "Ending Distance" with the value "10000". Below these is a dropdown menu labeled "Distance Units" with "feet" selected. Further down is another set of inputs: "Interval Size" with the value "500" and a second dropdown menu also labeled "feet" with "feet" selected. At the bottom of the dialog are three buttons: "OK", "Cancel", and "Help".

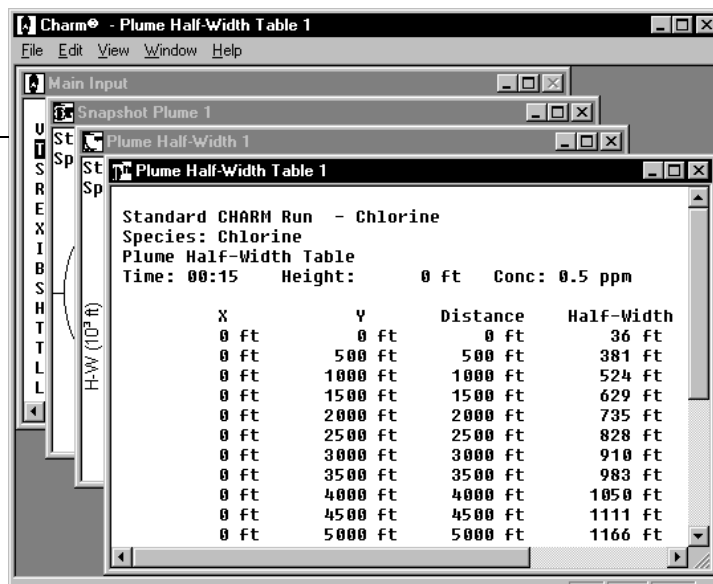
Enter the beginning and ending points of the line to lie along the centerline of the plume. Figure 6.27 shows a sample Plume Half-Width plot. Use the File or Edit menu commands to print or copy the graph.

Figure 6.27
Plume Half-Width Plot



To display a plume half-width table instead of a graph, select the Table option from the File menu. Figure 6.28 shows a sample Plume Half-Width Table. Use the File and Edit menu commands to print or copy the display respectively.

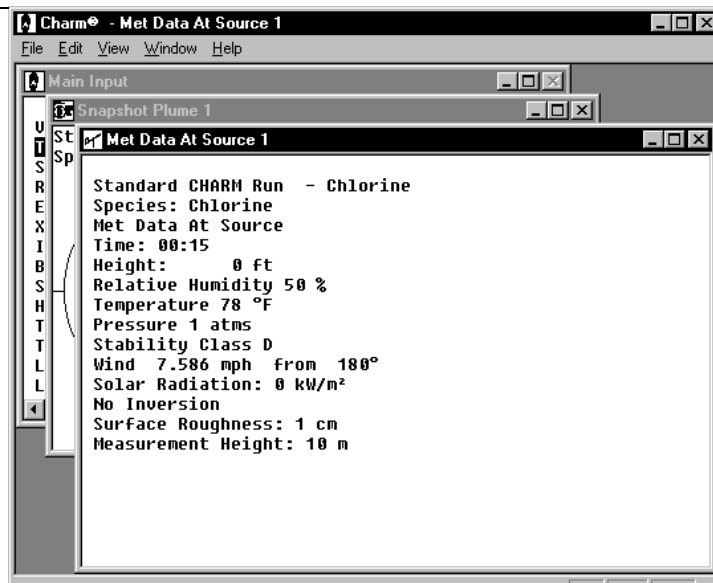
Figure 6.28
Plume Half-Width Table



Met Data Display

The Met Data command on the Displays menu shows the meteorological data at the source location. The values for the current receptor height and the time since release specified for the Snapshot Plan Plume View display are used. Figure 6.29 shows a sample Met Data display. Use the File and Edit menu commands to print or copy the display respectively.

Figure 6.29
Met Data Display



Integrated Area Display

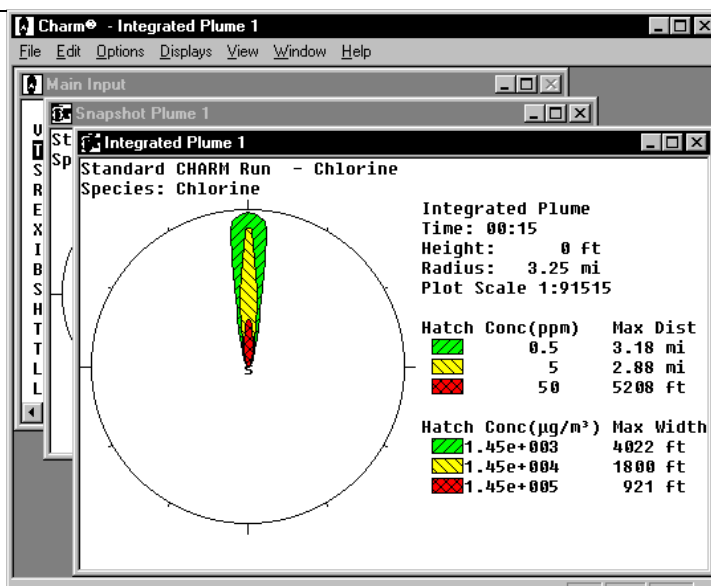
The Integrated Area command on the Displays menu starts a minute by minute calculation of the snapshot plume and displays the Integrated Plan Plume View. The integrated plume display shows all

areas affected by the plume.

The integrated display looks similar to the Snapshot Plume View and has most of the same menus and commands. Refer to the previous section titled "Plan Plume View Displays" for descriptions of the commands on the Options and Displays menus.

The current isopleth concentrations are used for plotting at any time during the release and up to the most recent time requested. The time shown on the integrated plume display is the time currently being calculated. The calculation of area impacts are performed for every minute of the simulation. If the changes in the plume are much more rapid than every minute, the display may not be a smooth representation. Figure 6.30 shows a sample integrated plume.

Figure 6.30
Integrated
Plan Plume
View



Since the calculation requires time, you can stop the calculation by selecting the Cancel button that appears in the plume window. A cancel takes effect after the latest minute's calculations are complete. Therefore, there may be some lag time before you see a cancel response.

The maximum concentrations at each area are displayed. If the wind shifts or the emission rate varies, the areas impacted can also vary. Once an integration calculation has been performed, moving between the Snapshot and Integrated Area plumes does not require new time calculations.

To continue the integration using the same time, select the Continue menu item from the Options menu. To create an integrated plume

using a different time, select the Recalculate menu item from the Options menu.

To generate a Dose Display plot (concentration history) at a specific point, move the cursor to the desired location. Then, double-click the left mouse button or press <Enter>.

To reposition the source within the view port, hold <Ctrl> while you press the appropriate arrow key one or more times. When you release <Ctrl>, the plume is repositioned. Each time you press an arrow key, the plume moves one-sixteenth of the dimension of the display area.

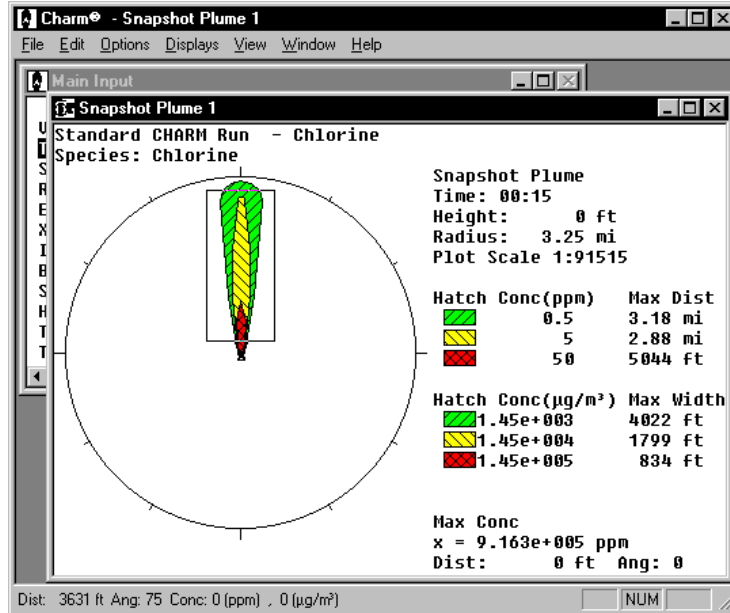
Use the File menu commands to save the release description input or met data in separate files, print the window, or plot the plume. Use the Copy command on the Edit menu to copy the display to the clipboard.

Time-Averaged Footprint

The Time-Averaged Footprint command on the Displays menu shows a view of averaged concentrations at the specified time. The plume is a result of the source term and transport/dispersion calculations averaged over a user-specified time within a user-defined grid (see Averaging Time and Grid Resolution). The isopleth concentrations are represented by differing hatch marks and colors. The user has the option of selecting the entire plume for averaging or a user-defined area of the plume for averaging.

Selected Area of a Time-Averaged Footprint

Selecting the Selected Area submenu on the Time-Averaged Footprint command of the Displays menu changes the cursor to a magnifying glass and requires the user to draw a rubberband box around the area of interest. To do this, find a point on the plume display, click and hold down the left mouse button, drag the mouse to create a rubberband box, and then release the left mouse button. CHARM will only consider those concentrations within the extents of the rubberband box for averaging.



Averaging Time and Grid Resolution for a Time-Averaged Footprint

Selecting the Entire Plume Area or Select Area command from the Time-Averaged Footprint command requires the user to input the desired averaging time and the desired grid size.

Averaging Time And Resolution

Enter an averaging time and number of points in grid.

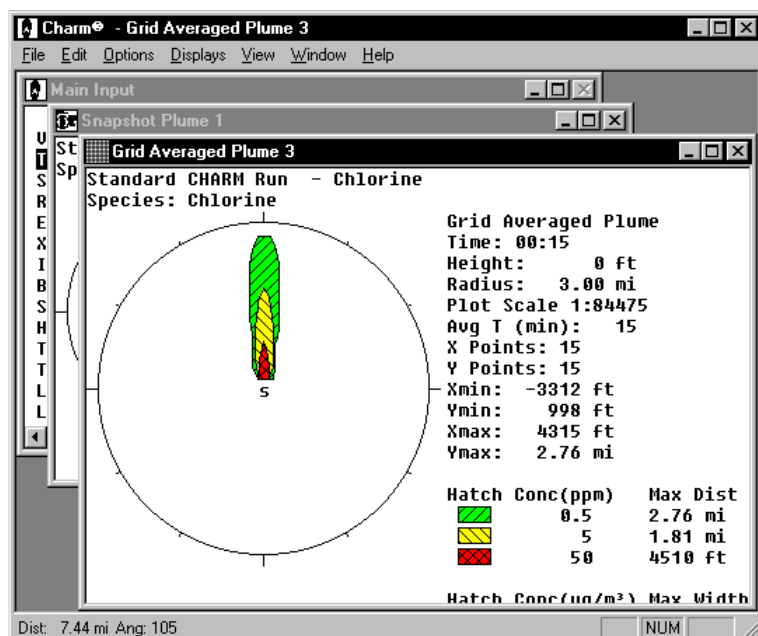
Averaging Time Minutes

X Grid Points

Y Grid Points

The resulting display is a Time-Averaged plume based on this user-defined averaging interval and the user-defined grid size. See Figure 6.31 for example output of a Grid Averaged Plume.

Figure 6.31
Grid
Averaged
Plume View



Circular Population Impact

This command calculates the number of people affected by the listed concentrations, radiation fluxes, or overpressures within a user-

specified radius from the source. The user is initially prompted for the desired radius.

Enter the radius of the circle around the source for population calculation.

20 miles

OK Cancel Help

The number of people is normally determined from the population information available on US Census Bureau Tiger/Line™ 1992 Data.

If a population number is enclosed in brackets, that means that a failure occurred during calculation and the number given is a lower limit of the number of people impacted. This calculation failure occurs when CHARM can not resolve the intersection between the plume outline and a population tract. Often, however, it can be alleviated by changing the source location minutely. If the population number is -1 this indicates that only one population tract was impacted but an error was encountered.

The resulting display is independent of the footprint and only described by the population impacts within the user-specified radius from the source.

Standard CHARM Run - Chlorine
Species: Chlorine
Snapshot Plume
Actual plume and population tract boundaries used
Time: 00:15 Radius from source: 20 mi
x: 0 ft, y: 0 ft

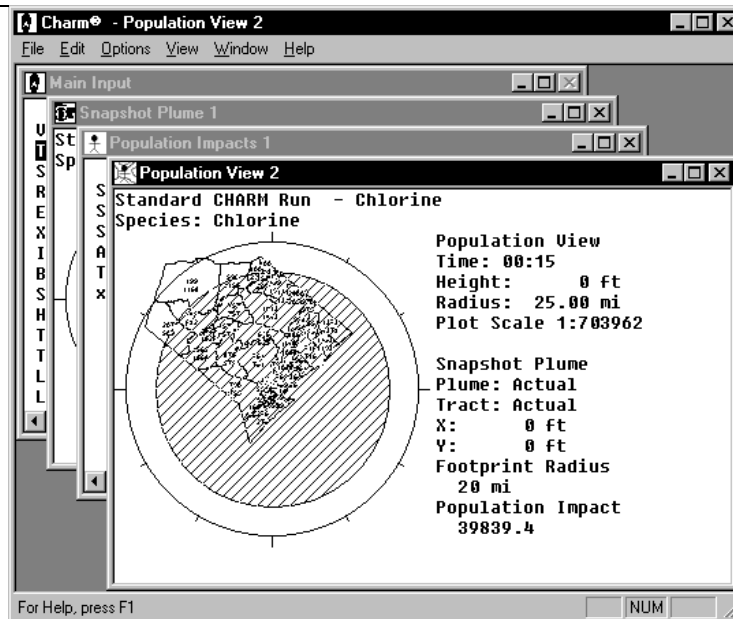
Population	Number
Total	3.98e+004
0 to 4	2.98e+003
5 to 9	3.38e+003
10 to 19	5.73e+003
20 to 49	1.87e+004
50 to 64	4.45e+003
65 and up	4.57e+003
White	3.24e+004
Black	2.95e+003

For Help, press F1

Visual Verify (Population Impact)

From a Population Impact display, use the Visual Verify command on the Displays menu to illustrate overlaying the radius or footprint on to the population tracts that have been preprocessed in the TigerMap Utility and defined in the CHARM Editor (see Figure 6.32).

Figure 6.32
Population
Visual Verify
View

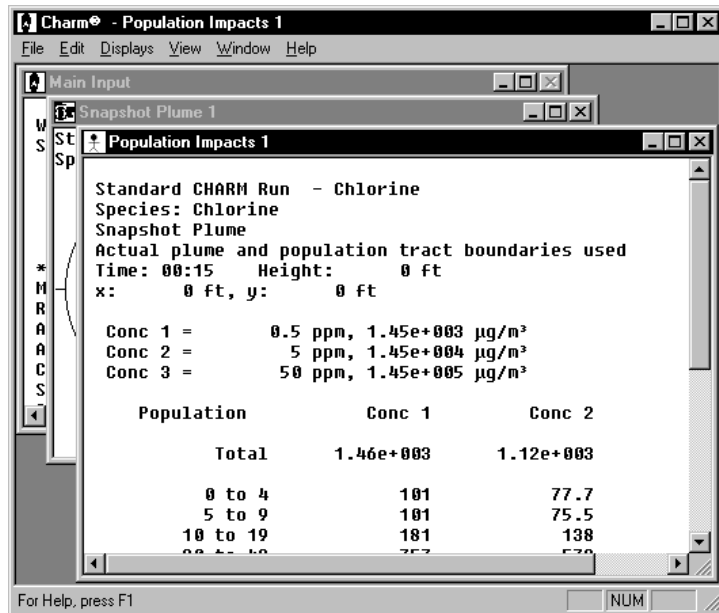


Population Impact

Use the Population Impact command to calculate the number of people affected by the listed concentrations, thermal radiation, or overpressures. The number of people is normally determined from the population information available on U.S. Census Bureau Tiger/Line™ 1992 Data (see CHAPTER 8: Using the TIGERMAP Utility).

If a population number is enclosed in brackets, that means that a failure occurred during calculation and the calculated value is a conservative estimate of the number of people impacted. If the population is -1 then this indicates that only one population tract was impacted but a failure in the calculation was encountered. This failure occurs when CHARM can not resolve the intersection between the plume outline and a population tract. Often, however, the failure can be alleviated by slightly changing the source location. CHARM breaks down the impacted population by age, race, families, households, owners, and renters. Figure 6.33 show the results of a population calculation impact.

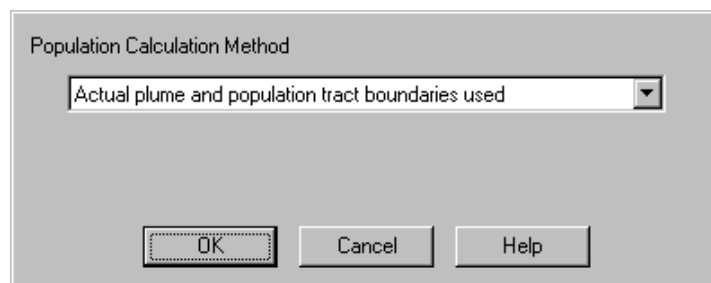
Figure 6.33
Population
Impact
Display



The method of calculation can be changed by selecting the Population Calculation command from the Displays menu. Likewise, you can visually verify overlaying the footprint on to the population tracts that were preprocessed in the TigerMap Utility and defined in the CHARM Editor.

Population Calculation

The method of calculating the population impacts can be selected from the Population Calculation command from the Displays menu. There are three methods of calculation.



I. Actual footprint and population tract boundaries used

Both the footprint and population tract boundaries will be used in the calculation. The calculated area of impact is the intersection of the footprint and the tract. This is the most accurate method. It can take the longest time and is the most prone to a failure in the calculation to determine intersection between the plume outline and the population tracts.

II. Footprint rectangle and actual population tract boundaries used

The footprint is represented as its bounding rectangle. The tract boundary is used as determined from the Tiger/Line™ data. The calculated area of impact is the intersection of the footprint rectangle and the tract. This is the second most accurate method. It is designed to take less calculation time than the actual plume boundary being used. However, this is not always the case. It can also produce a failure in the calculation when determining the intersection between the rectangle inscribing the footprint and the population tract.

III. Footprint and population tract rectangles used

Both the footprint and population tract are represented by their bounding rectangles. The calculated area of impact is the intersection of the footprint and tract rectangles. This is the least accurate method. It is the fastest calculation for determining population impacts and will never fail when determining the intersection between the rectangle inscribing the footprint and the rectangles inscribing the population tracts.

To invoke the selected population calculation method, select Population Impacts command in the Displays menu.

Explosion Overpressures Display

The initial step in generating an explosion overpressure display is to first generate a plume containing sufficient lower explosive concentration limits to allow for deflagration or detonation of the plume. Deflagration occurs when the flame speed is slower than mach 1. Detonation occurs when flame speed is mach 1 or greater.

Displaying Explosion Overpressures

Once a plume has been generated, selecting the Explosion Overpressures command on the Displays menu of the Snapshot Plan Plume View window shows the overpressure footprint resulting from ignition at the specified release time. It is an instantaneous view. Figure 6.34 illustrates a propane plume calculated by CHARM. Figure 6.35 shows the explosion overpressures resulting from the ignition of the plume.

Figure 6.34
Plume View
prior to
Ignition

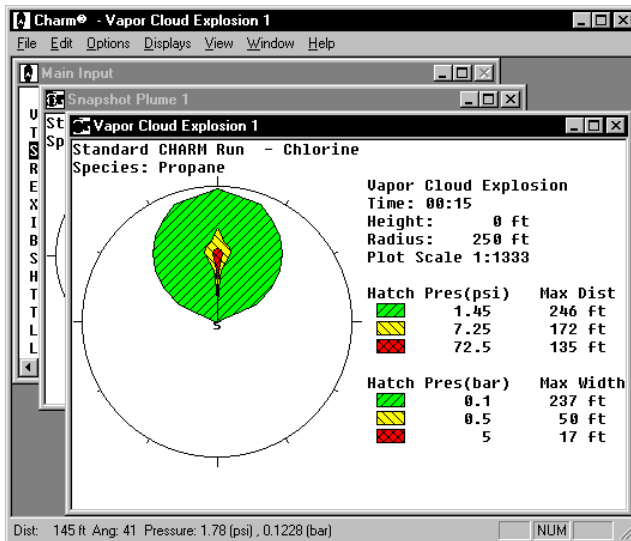
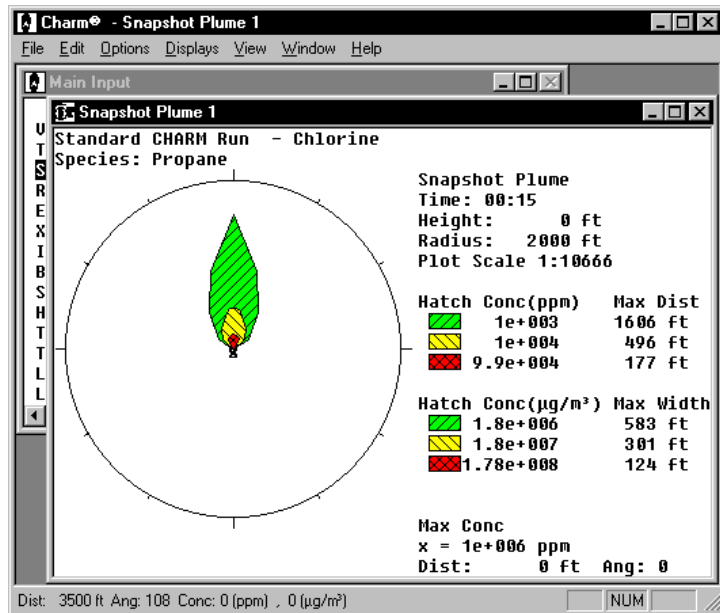


Figure 6.35
Explosion
Overpressure
after Ignition

Changing Potential Overpressures

This command is similar to modifying the isopleths from a Snapshot Plan Plume Display. However, in this case, the user has the option of modifying those potential overpressures which are displayed from the resulting explosion. Select Overpressures from the Options menu and the following dialog box appears.

Enter the overpressures.

Pressure 1	<input type="text" value="0.05"/>	Units <input type="text" value="bar"/>
Pressure 2	<input type="text" value="0.1"/>	
Pressure 3	<input type="text" value="0.5"/>	

Changing Flame Speed

This command allows the user to use the default flame speed defined in the chemical database, modify that flame speed, or specify explosion characteristics from a table by specifying the Expansion Dimension, Mixture Reactivity, and Obstacle Density. If changes are made, the user has the option to reset the flame speed to the default in the chemical database.

Flame Speed

☒ Mach

☐ Specify Explosion Characteristics

Expansion Dimension

☒ 1-D
 ☐ 2-D
 ☐ 3-D

Mixture Reactivity

☒ High
 ☐ Medium
 ☐ Low

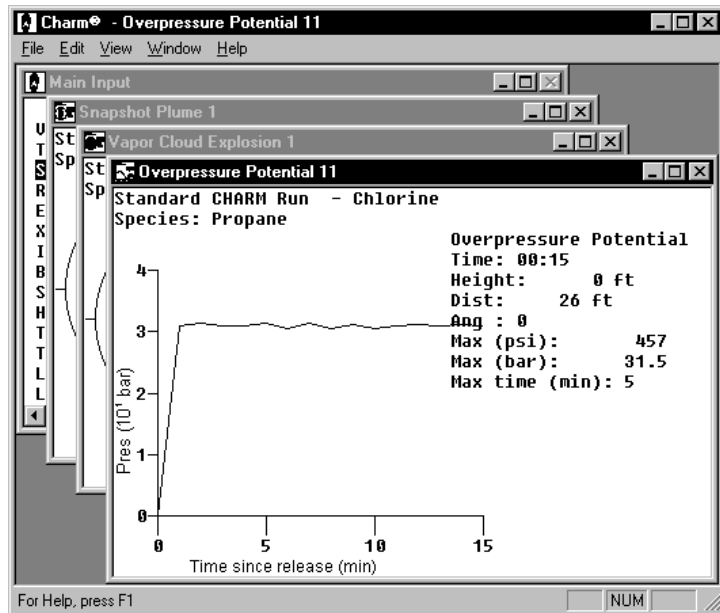
Obstacle Density

☒ High
 ☐ Medium
 ☐ Low

Plotting Potential Explosion Overpressures Versus Time

To generate a plot of potential overpressures as a function of time at a specific location, move the cursor to the desired location. Then double-click the left mouse button or press <Enter>. An example is illustrated in Figure 6.36.

Figure 6.36
Explosion
Overpressure
Potential



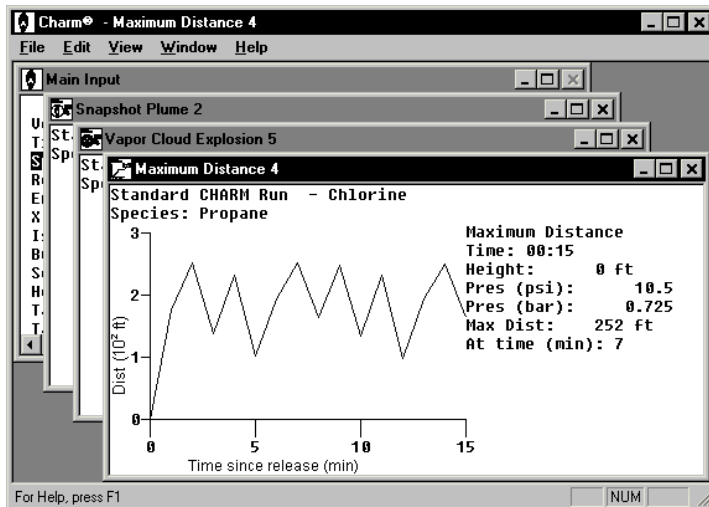
Maximum Distance Overpressure Display

From the Explosion Overpressures display, you can display a maximum distance for an overpressure as a function of time. From the Displays menu, select Max Distance and CHARM will request a single overpressure value and unit for plotting.

The dialog box contains the text: 'Enter an overpressure for plotting maximum distance.' Below this text, there is a text input field containing '0.05' and a dropdown menu showing 'bar'. At the bottom of the dialog box, there are three buttons: 'OK', 'Cancel', and 'Help'.

Figure 6.37 shows the resulting Maximum Distance Overpressure Plot. The plot is also a function of the time calculated since release.

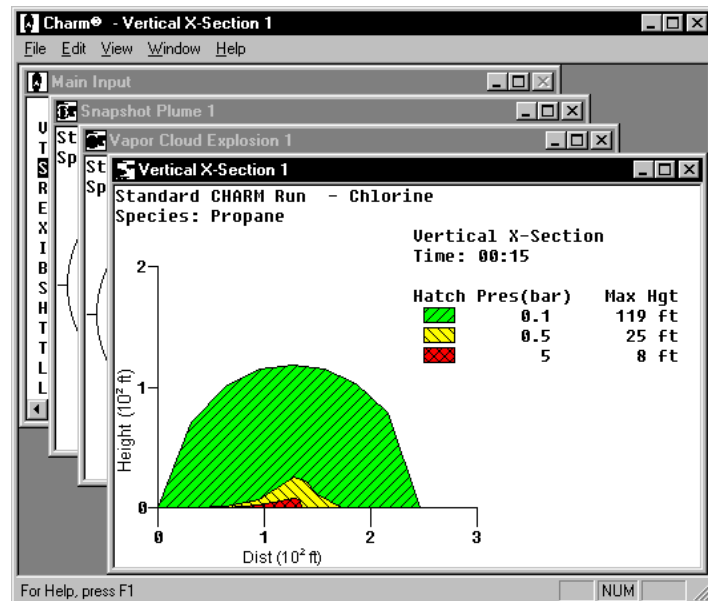
Figure 6.37
Maximum
Distance plot
for Explosion
Overpressures



Displaying an Explosion Overpressures Footprint Cross-Section

From the Explosion Overpressures display, you can display a cross-section of the potential overpressures by selecting the Vertical X-section command from the Displays menu. Figure 6.38 shows the resulting X-section.

Figure 6.38
Vertical
Xsection of
Explosion
Overpressures



Overpressure Damage Estimates

The following are the peak pressures formed in excess of normal atmospheric pressure by blast and shock waves:

Overpressure (psi) <u>Note: 1 bar = 14.5 psi</u>	<u>Expected Damage</u>
0.03	Occasional breaking of large windows already under stress.
0.04	Loud noise (143 dB); sonic boom glass failures.
0.10	Breakage of small windows under strain.
0.15	Typical pressure for glass failure.
0.30	Some damage to house ceilings; 10% window glass breakage.
0.40	Limited minor structural damage.
0.50-1.0	Windows usually shattered; some window frame damage.
0.7	Minor damage to house structures.
1.0	Partial Demolition of houses; made uninhabitable.
1.0-2.0	Corrugated metal panels fail and buckle. Housing wood panels blown in.
1.0-8.0	Range for slight to serious injuries due to skin lacerations from flying glass and other missiles.
1.3	Steel frame of clad building slightly distorted.
2.0	Partial collapse of walls and

Overpressure (psi)
Note: 1 bar = 14.5 psi

Expected Damage

	roofs of houses.
2.0-3.0	Non-reinforced concrete of cinder block walls shattered.
2.3	Lower limit of serious structural damage.
2.4-12.2	Range for 1-90% eardrum rupture among exposed populations.
2.5	50% destruction of home brickwork.
3.0	Steel frame building distorted and pulled away from foundation.
3.0-4.0	Frameless steel panel building ruined.
4.0	Cladding of light industrial buildings ruptured.
5.0	Wooded utility poles snapped.
5.0-7.0	Nearly complete destruction of houses.
7.0	Loaded train wagons overturned.
7.0-8.0	8-12 in. thick non-reinforced brick fail by shearing of flexure.
9.0	Loaded train box cars demolished.
10.0	Probable total building destruction.
15.5-29.0	Range for 1-99% fatalities among exposed populations

Overpressure (psi)

Note: 1 bar = 14.5 psi

Expected Damage

due to direct blast effects.

Source: Lees, F.P, Loss Prevention in the Process Industries, Vo., 1, Butterworths, London and Boston, 1980.

Input Display

The Input command on the Displays menu shows the input data for the current CHARM run just as it appears in the Main CHARM Input Window. This display is for viewing only and no changes can be made. Use the File menu commands to print or copy the display. This menu item becomes very important when viewing or comparing different sets of output for different input parameters. An Input command under the Displays menu of many output displays will yield those input parameters used to obtain the given calculations.

Source/Puff Description Display

The Source/Puff Description command on the Displays menu shows the output of the source term calculation for the current CHARM run. This output contains a detailed description of each portion of a release. See Figures 6.6, 6.7, 6.8, and 6.9 for illustrations of the Source/Puff Description output.

During calculations, the release is divided into a number of puffs. The display includes the data used to describe each puff during the release. You can display the puff descriptions for several CHARM runs at the same time. use the File menu commands to print or copy the display.

Information from the Source/Puff Description display can be used as input for a user-specified release scenario, which requires a complete puff description. First, using a release type similar to the one you want to define, enter the required data in the input window. Next, display or print the Source/Puff Description. Then, using the User Specified After-Release Conditions release type, perform another CHARM run using the data from the Source/Puff Description printout as input. The data cannot be automatically inserted by the program; they must be manually entered into the Main CHARM Input Window.

Emission Rate Display

The Emission Rate command on the Displays menu shows a plot of the emission rate as a function of time throughout the release. The plot results from calculations using values from the CHARM run that created the current plan plume view. The Emission Rate display is the same as the display shown in the Main CHARM Input Window with the command of the same name. (see Figure 6.6 earlier in this chapter).

Use the File and Edit menu commands to print or copy the display respectively.

Site Information Display

The Site Information command on the Displays menu shows a text file window created with the CHARM Editor. The text file contains information that is specific to the release site. It may contain useful information such as general response procedures, telephone numbers, and evacuation exits. The Site Information display is the same as the display shown in the Main CHARM Input Window (see Figure 6.1 earlier in this chapter). Site information text can be printed or copied to the clipboard using the File and Edit menu commands respectively.

Chemical Data Display

The Chemical Data command on the Displays menu shows a text window containing the thermodynamic data and default isopleth concentrations stored in the chemical database for the selected species. The Chemical Data display is the same as the display shown in the Main CHARM Input Window with the command of the same name (see Figures 6.2, 6.3, and 6.4 earlier in this chapter). Chemical data can be printed or copied to the clipboard using the File and Edit menu commands respectively. It can be modified using the CHARM Editor.

Chemical Response Display

The Chemical Response command on the Displays menu shows the emergency response information stored in the chemical database for the selected species. The Chemical Response display is the same as the display shown in the Main CHARM Input Window with the command of the same name (see Figure 6.5 earlier in this chapter). Chemical response text can be printed or copied to the clipboard using the File and Edit menu commands respectively. It can be modified using the CHARM Editor.

Displaying a Map

The Basemap command on the Displays menu of the Main CHARM Input Window offers one way to display a map. When you select the Basemap command, CHARM displays a dialog box in which you can select the map to display. Press F1 or press the 'Help' button to display the on-line help screen.

To scroll a map display with a mouse, use the scroll bars. To scroll a map with the keyboard, use <Page Up>, <Page Down>, and arrow keys.

The Basemap display has menus that provides commands for zooming and unzooming a specified area, displaying another map,

displaying a larger scale map (if one is available), and displaying a map description.

File Menu

The File menu for a map displayed with the Basemap command of the Main CHARM Input Window provides additional commands to those provided by the Options menu of the input window.

The commands available on the File menu for a map display are:

<u>COMMAND</u>	<u>SUMMARY</u>
Open	Displays a selection list of maps for display.
Close	Closes the Basemap display window.
Larger Scale Map	Displays a larger-scaled map that has been defined with the Map Definition command and named with the Expand map name command of the CHARM Editor.
Exit	Exits CHARM.

Options Menu

The Options menu for a map displayed with the Basemap command of the Main CHARM Input Window provides additional commands to those provided by the File menu.

The commands available on the Options menu for a map display are:

<u>COMMAND</u>	<u>SUMMARY</u>
Zoom	Displays an enlargement of a specified map area.
Unzoom	Returns a zoomed map display to its original size when the window was opened.
Map Description	Displays a text description associated with the current map display. This text is for display only as it is editable from within the CHARM Editor.

Zooming a Map Area

To zoom a portion of a map display, you must mark the area to be zoomed. First, select the Zoom option on the Options menu. The cursor changes from a pointer to a magnifying glass. Next, move the cursor to one corner of the area to be zoomed. If you are using a mouse, hold the left mouse button down, move the cursor to the opposite corner of the area to be zoomed, and release the button.

If you are not using a mouse, press <Enter> to mark the first corner of the zoom box, expand the box with the arrow keys, and press <Enter> again to complete the zoom box. The zoom display may not have a one-to-one correlation to the marked area. To return to the initial map display, select the Unzoom command from the Options menu.

Displaying a Map From the Plan View Displays

Plumes, thermal radiation footprints, and overpressure footprints are considered plan view displays. The Map command on the Options menu of a plan view offers another way to display a map.

When the Auto Map Change command on the Options menu is selected, and the map display covers less than the fraction of the display area defined by the Auto Map Fraction command, CHARM automatically switches to a larger-scaled map (if one is defined). To turn off this feature, deselect Auto Map Change in the Options menu by clicking on it.

When the Auto Map Change command is not selected, you decide when to display the larger-scaled map. Use the Larger Scale Map command on the File menu to manually display the expanded map. In this case, the map must be defined and assigned an expanded map name using the CHARMED editor. Use the Expand Map Name command in the Map Definition editor to identify the larger-scaled map.

Selecting an Icon on a Map

The map display may show icons that represent other map locations or possible release locations. These icons are positioned and defined with the Map Definition command of the CHARM editor. A map location icon looks like boxes within boxes.



A release location icon looks like a plume within a box.



Selecting an icon displays another map of the location or a selection list of releases at the location. To select an icon on a map in the Basemap display, move the cursor over the icon. If you are using a mouse, click either button. If you are not using a mouse, press <Enter>. To select an icon on a map in a footprint display, press and hold <Shift> while you move the cursor over the icon, and select the icon by double-clicking the left mouse button or pressing <Enter>.

When you select a map location icon, CHARM displays the map that has been defined for that location. This map may also have selectable icons representing other maps and releases.

When you select a release location icon on a map in the Basemap display, CHARM checks for automatic meteorological data from the time of the release to the present time. If no met data are available, CHARM displays a message that allows you to stop the run. If the run continues, CHARM performs calculations in one of two ways, depending on the mode of operation defined by the EmergencyMode variable in the CHARM.INI file. If EmergencyMode = 1 or is not defined, then CHARM will display a real-time footprint, updating the display minute by minute. If EmergencyMode = 0, CHARM calculations continue for the duration of the emission plus 30 minutes. Then the time used for the footprint display is the time at which the lowest value of interest (e.g. concentration) has maximum aerial extent.

3-Dimensional Plume

The 3D Plume command on the Displays menu of the Plan Plume View offers a method to view a concentration in 3 dimensions. CHARM initially requests a single concentration to display.

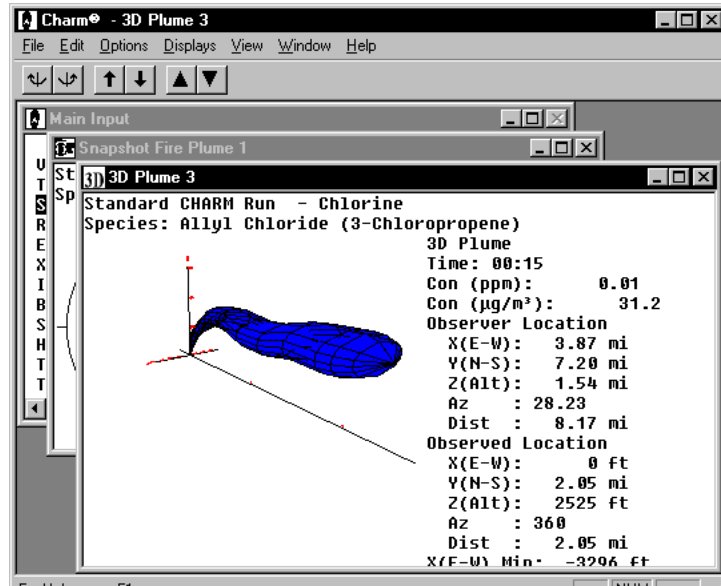
Enter a concentration for a 3D display.

0.01 ppm

OK Cancel Help

Once the concentration of interest has been entered, press the OK button and CHARM displays the 3D Plume Window. Figure 6.39 illustrates the 3D Plume Display

Figure 6.39
3D Plume
Display



This window presents a three-dimensional view of a concentration plume. Only one concentration may be viewed at a time. The observer location and observed location may be changed. The observed location is the point at the center of the observer's view. Tools can be used to move the observer around or away and towards the observed location. The observer can also go up and down. The tools are available either as icons on the toolbar or keystrokes.

Moving the Observer

The observer can be moved with respect to the observed location. The observer can be moved around the point, closer to the point, and farther from the point. The observer can also move up and down. The observer can not move below surface level ($z=0$). The observer can be moved via the mouse or keyboard.

Moving via the Mouse

Press the button icons on the toolbar. The tools represent up, down, near, far, left, and right.

Moving via the Keyboard

Direction

Up

Down

Key

<Ctrl> + Up Arrow

<Ctrl> + Down Arrow

Left	Left Arrow
Right	Right Arrow
Near	Up Arrow
Far	Down Arrow

Setting the Observer Location

This dialog box allows you to change the location of the observer. The observer will continue to look at the same observed location from a different position. The observer's location can be specified in either Cartesian or cylindrical coordinates. Select the appropriate button for the desired coordinate system. When one coordinate system is selected, the other ignores user input although it will update as new coordinates are entered.

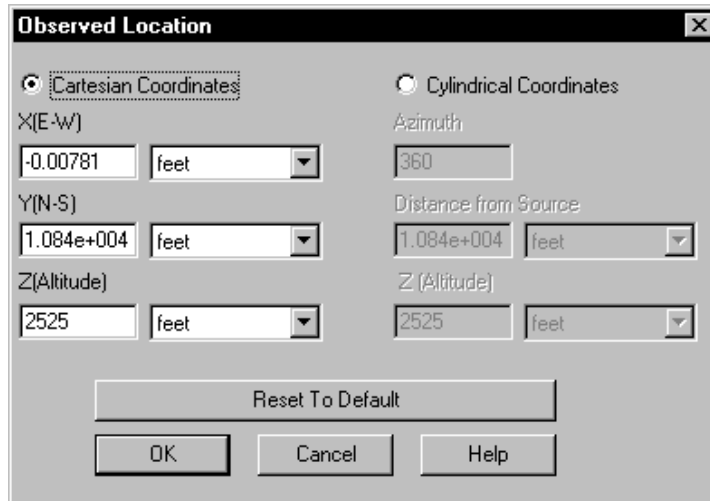
The x,y coordinate system is with respect to the release location. That is, the release location is (0,0) in Cartesian coordinates. The release location is at zero distance in cylindrical coordinates. The z or altitude value is with respect to ground level. The azimuth is given in the meteorological sense from the release location. The direction can be entered in degrees or in points of the compass. Degrees refer to the 360-degree directional compass, where North is 0 or 360, East is 90, South is 180, and West is 270. Points of the compass refer to North (N), East (E), South (S), West (W), and the points between, such as Northeast (NE) and South Southeast (SSE).

If you want to reset the location to what it was when the plume was initially drawn press the "Reset to Default" button.

Setting the Observed Point

This dialog box allows you to change the location of the observed point. The observer will stay at the current position and look at this new observed location. The observed location can be specified in

either Cartesian or cylindrical coordinates. Select the appropriate button for the desired coordinate system. When one coordinate system is selected, the other ignores user input although it will update as new coordinates are entered.



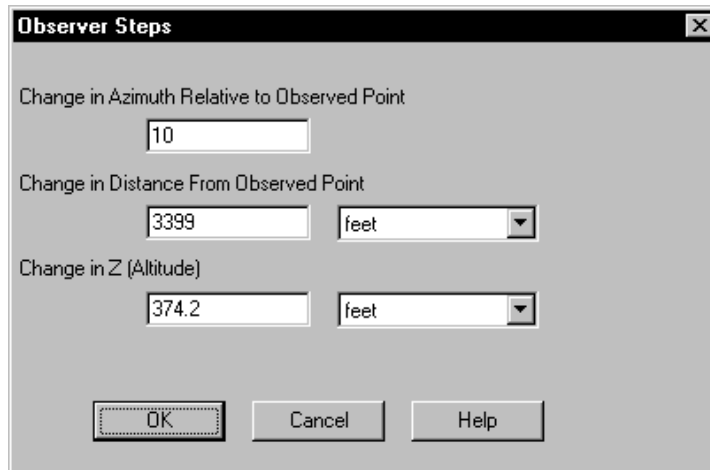
The image shows a dialog box titled "Observed Location" with a close button (X) in the top right corner. It contains two radio buttons: "Cartesian Coordinates" (selected) and "Cylindrical Coordinates". Under "Cartesian Coordinates", there are three input fields: "X(E-W)" with a value of "-0.00781", "Y(N-S)" with a value of "1.084e+004", and "Z(Altitude)" with a value of "2525". Each of these fields has a unit dropdown menu set to "feet". Under "Cylindrical Coordinates", there are two input fields: "Azimuth" with a value of "360" and "Distance from Source" with a value of "1.084e+004", both with unit dropdown menus set to "feet". At the bottom, there is a "Reset To Default" button, and below that, "OK", "Cancel", and "Help" buttons.

The x,y coordinate system is with respect to the release location. That is, the release location is (0,0) in Cartesian coordinates. The release location is at zero distance in cylindrical coordinates. The z or altitude value is with respect to ground level. The azimuth is given in the meteorological sense from the release location. The direction can be entered in degrees or in points of the compass. Degrees refer to the 360-degree directional compass, where North is 0 or 360, East is 90, South is 180, and West is 270. Points of the compass refer to North (N), East (E), South (S), West (W), and the points between, such as Northeast (NE) and South Southeast (SSE).

If you want to reset the location to what it was when the plume was initially drawn press the "Reset to Default" button.

Setting the Observer Step Distances

This dialog box allows you to change the stepsizes of the observer. There are three dimensions the observer can move in. The observer can move vertically (up and down from the ground), radially (closer or farther from the observed location), or azimuthally about the observed location. The values given in this dialog box define the increment to be taken every time a movement tool or appropriate key is pressed.



Observer Steps

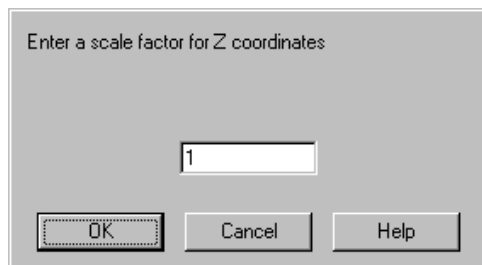
Change in Azimuth Relative to Observed Point

Change in Distance From Observed Point

Change in Z (Altitude)

Setting the Z Scale

This dialog box allows the user to enter a dimensionless number to scale the plume z coordinates. Normally, a plume is much larger in the horizontal than the vertical direction. To make viewing easier the z values of the plume can be increased to make the vertical distribution easier to discern. CHARM attempts to provide a scale factor determined on plume dimensions. This scale will be seen when the scale factor given here is 1.0.

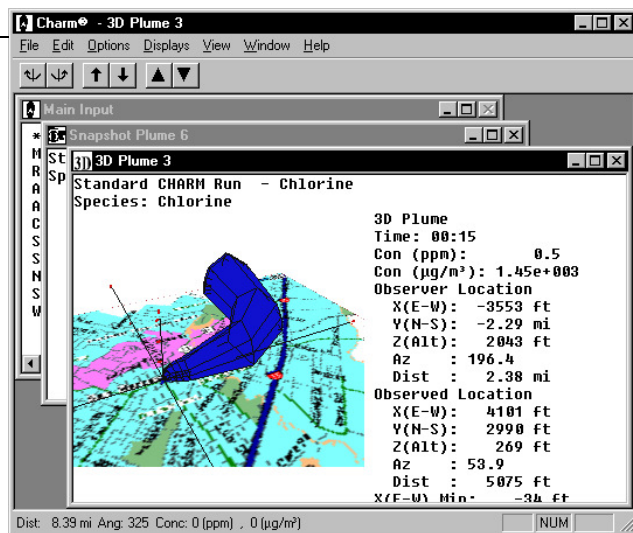


Enter a scale factor for Z coordinates

Displaying a 2D Map in the 3D Plume View Display

Use the Map section of the Options menu from the 3D Plume Display to display a map. CHARM allows the user to overlay a 3D plume on a 2D map (see Figure 6.40).

Figure 6.40
3D Plume
Overlayed on
2D Map



Chapter 7: Using CHARM for Emergency Response

Use CHARM's emergency response mode to quickly display stored maps of the release site, input data, plumes or footprints, tables, graphs, and other useful information. The emergency mode displays data resulting from input and calculations stored in the planning mode.

Emergency Response Files

CHARM's emergency response mode requires a map that has been edited with the CHARM Editor (CHARMED) and at least one release scenario that has been created and saved with CHARM. If CHARM was allowed to assign file name extensions when the files were stored, the default extension for map files is .MAP and the default extension for release scenario files is .EMG. The default extensions may be changed (see section 'CHARM.INI File Description' in CHAPTER 3: Getting Started). However, extensions other than these may have been assigned to the file name. For discussion purposes, this document refers to these files as .MAP and .EMG files.

Map Files

When the CHARM program starts, it searches for a map file with the name BASEMAP.MAP and its corresponding definition file BASEMAP.MFD. If such files exist, the map is displayed immediately and the CHARM considers this to be in the Emergency Response Mode. If these files do not exist, CHARM automatically displays the Main CHARM Input Window in Planning Mode. From the Main CHARM Input Window, you can enter Emergency Response Mode by selecting a map display using the Basemap command on the Displays menu.

Map Requirements

All maps used in CHARM must first be edited using the Map Definition command of the CHARM Editor (CHARMED.EXE). A point and scale must be specified for each map. To be useful in the emergency response mode, a map must be defined with at least one release location icon. This icon identifies the release scenarios that are defined at the location. The map may also have map location icons that point to smaller-scaled maps. A map may also have a larger-scaled map associated with it and also text information describing attributes associated with the map (e.g. the date that the map was last updated).

Release Location Icons

If the map display has one or more release location icons, you can select an icon and display a list of stored scenarios. A release location icon looks like a plume within a box.



The scenario contains the input data. If the map has no release location icons, you can select a release using the Scenarios command on the File menu of the input window. For more information on creating, moving, and deleting release location icons, see 'Defining a Release Location' in CHAPTER 4: Using the CHARM Editor.

Map Location Icons

If the map display has map location icons, you can select a map location icon and display a smaller-scaled map. A map location icon looks like boxes within a box.



Each map can point to another map. If the map has no map location icons, you can select a map using the New Map command on the Basemap menu of the input window. It is important the user define the larger-scale map of the map associated with the map icon such that it points back to the map utilizing the map icon. This will allow the user to go back and forth between larger-scaled and detailed maps. For more information on creating, moving, and deleting map location icons, see 'Defining a Map Location' in CHAPTER 4: Using the CHARM Editor.

Release Scenario Files

The emergency response data files typically have the default .EMG file name extension. Files with the .EMG extension contain stored input data from a CHARM run, which is called a release scenario.

In the emergency response mode, CHARM displays the titles in a scenario selection list (.EMG files) when you click on a release icon on a map display. In planning mode, you can display the titles by selecting the Scenarios command from the File menu of the Main CHARM Input Window. You can select from the list in the dialog box.

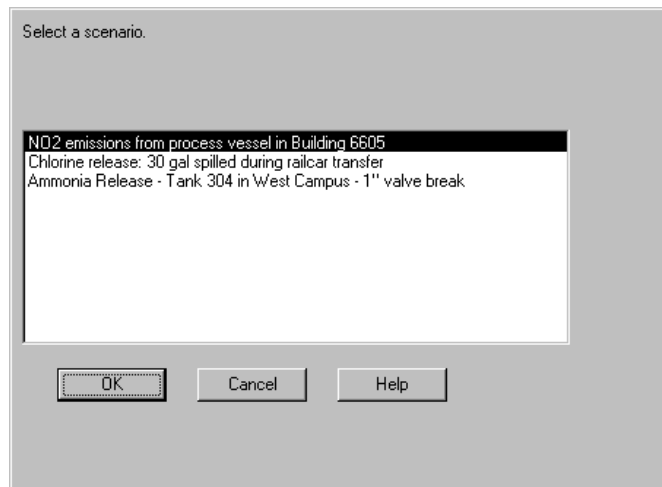
Emergency Response Mode Procedures

CHARM's emergency response mode is useful only when a base map has been defined with at least one release location icon. The emergency response mode requires that the input for at least one release has been previously stored in a scenario file.

To use the emergency response mode:

8. Start the CHARM program. The method you use to start CHARM depends on the system and the version of Windows you are using. Refer to Chapter 3, "Getting Started", for a description of these methods.
9. CHARM displays a base map (BASEMAP.MAP) if one is defined. Otherwise, CHARM displays the Main CHARM Input Window.

If the base map is displayed, look for release or map location icons. If the map has a release icon at the release site, select the icon to display a list of release scenarios. Since more than one map may define the release area, the base map may not have a release icon. Instead, the map may have one or more map location icons that you can select to display a smaller-scaled map of the area. Continue selecting map icons and looking for a release icon at the site. Select the icon to display a scenario selection list.

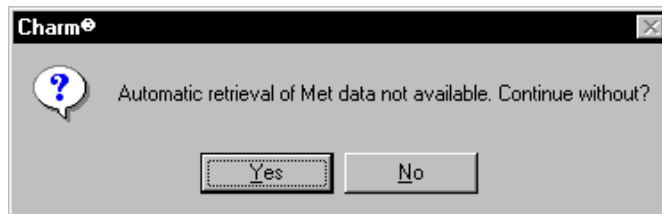


If the base map has no release or map location icons, select the Main Input from the Window menu to display the input window. Then, select the Scenarios command from the File menu to display the selection list.

If the Main CHARM Input Window is displayed instead of a map, you can select a map using the Basemap command on the Displays

menu. Then follow the procedures described previously, as if a base map was initially displayed.

10. If the Auto Met Polling command on the MetFile menu is not enabled, CHARM displays a dialog box indicating that automatic met data are not available.



Select OK or press <Enter> to continue calculations without automatic data, or select Cancel to stop. You may want to go to the Main CHARM Input Window and change the default met parameters.

If automatic met polling is available, CHARM displays a dialog box requesting the time of release in 24-hour clock time. Then CHARM begins performing the calculations. Depending on the mode of operation defined by the EmergencyMode variable in CHARM.INI, CHARM will proceed to calculate in one of two manners. If EmergencyMode = 1 or is not defined, then CHARM will display a real-time footprint, updating the display minute by minute. If EmergencyMode = 0, CHARM calculations continue for the duration of the emission plus 30 minutes. Then, the time used for the footprint display is the time at which the lowest value of interest (e.g. concentration) has maximum areal extent.

11. Use the commands on the Options and Displays menus to show the desired information. More than one display can be viewed on the same screen at a time. Refer to CHAPTER 6, "Understanding CHARM Displays," for detailed information.
12. Press the F1 key to access on-line help. CHARM displays those commands and procedures available for the Basemap window. Refer to Chapter 8, "Menu and Command Reference" for detailed information.

Real-Time Met Data Acquisition (METINTER)

METINTER.EXE is a separate standalone program which provides the interface between external meteorological data and the CHARM program. The program is represented by an icon with the sun, cloud, and rain in the CHARM group.

Each MetInter program has been customized for the specific meteorological data logger of file to be accessed. There are only a few options available in the program.

CHARMED must be run before MetInter will operate properly. CHARMED is used to define the Communications Parameters to be used by MetInter. See section "Setting the Communications Parameters" in CHAPTER 4: Using the CHARM Editor for more information.

MetInter uses the concepts of station and site. A station is a location which can be directly accessed or dialed up. A station may have data for multiple sites. MetInter can interface to a single station at any one time. The data from all the sites will be collected and stored. The data from only one site will be displayed in the MetInter Data Window. If the User Inverse Square command is selected from the MetFile menu in CHARM, then the data from all sites are used to determine the meteorological parameters at a specific point. Otherwise, only the data in the MetInter Data Window will be used by CHARM.

The METINTER Window

The METINTER window has only two menus: the Help Menu for acquiring on-line help, and the Options menu.

The Options menu provides a command for each of the following:

Data Window Visible	Makes the Data Window visible or invisible.
Data Window on Top	Forces the Data Window to always be displayed in front of all other windows.
Select Met Station	Allows the selection of which station MetInter should connect to.
Select Met Site	Allows the selection of which site at a station will have its data displayed in the Data Window.
Exit	Exits Metinter.

Data Window Visible Command

This option toggles whether the Data Window is visible or not. If active the Data Window will be visible. If the Data Window on Top option is selected, then the Data Window will always be forced in front of all other windows. Otherwise the Data Window may be hidden by other windows. If the Data Window has been selected to be visible, then this option will have a check mark next to it.

Data Window on Top Command

This option toggles whether the Data Window is always in front of all other windows or not. If active, the Data Window will be in front of all other windows, even those in another application. The Data Window Visible command must also be selected to see the Data Window. If the Data Window has been selected to be on top, then this option will have a check mark next to it.

Select Met Station Command

Select the station for MetInter to connect to. See the section “Defining Stations ID’s” in CHAPTER 4: Using the CHARM Editor for more information on defining stations to be used with MetInter. Only one station can be connected with MetInter at any one time. The data from all other met stations may be lost (depending on the data logger at the station).

A station may have one or more sites connected to it. If the Use Inverse Square command from the MetFile menu has been selected in CHARM, the data from all the sites will be used to determine the meteorological data at any point. The data from one site can be displayed in the Data Window. The site which will have its data displayed is selected using the Select Met Site command.

Select Met Site Command

Select which met site at the current station will have its data displayed in the Data Window. See the section “Defining Site ID’s” in CHAPTER 4: Using the CHARM Editor for more information on defining sites to be used with MetInter. Only one station can be connected with MetInter at any one time. Only one site at that station can have its data displayed in the Data Window. The station to connect to is selected by the Select Met Station command.

A station may have one or more sites connected to it. If the Use Inverse Square command from the MetFile menu has been selected in CHARM,

then the data from all the sites will be used to determine the meteorological data at any point. Otherwise, CHARM will use the data in the Data Window.

Chapter 8: Using the TIGERMAP Utility

CHARM has the capability of predicting population impacts based on U.S. Census Bureau Tiger/Line™ 1992 data. The TIGERMAP utility is a preprocessor which is used to extract only the information necessary for use with CHARM. The program reads U.S. Census Bureau Tiger/Line™ 1992 data (available on CD-ROM) and creates maps and/or population files. An icon for starting TIGERMAP is in the CHARM Group box.



Contact the U.S. Census Bureau directly for ordering the data files needed. Their number is (301) 457-4100. Once the TigerLine data has been preprocessed, files for use with CHARM must be selected in CHARMED (see section “Defining Population Files for Use With CHARM” in CHAPTER 4 “Using the CHARM Editor”). Once the files have been selected in CHARMED, select the Population Impacts command from the Displays menu on a footprint display in CHARM (see section “Population Impacts” in CHAPTER 6 “Understanding CHARM Displays”).

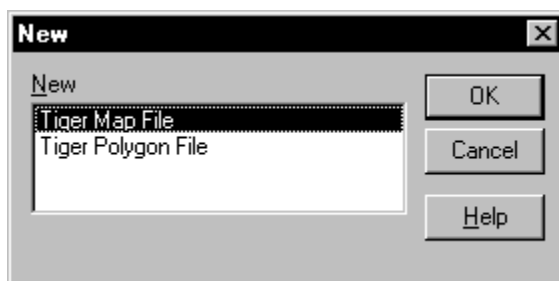
The TIGERMAP Window

Like CHARM, the main TIGERMAP window is an MDI frame with several menus. The View and Help menus contain the standard commands found in other CHARM related programs. The File menu contains the following commands:

New	Creates a Map or Population window.
Open	Opens a preprocessed TigerMap Map or Population file.
Recent File	Shows up to the last four files used.
Exit	Exits TigerMap.

Selecting the New command will prompt the user for the type data to pre-process - geographical information or population data. Selecting

Tiger Map File will process geographical information while selecting Tiger Polygon File will process population tracts.



Processing Tiger/Line Geographical Data

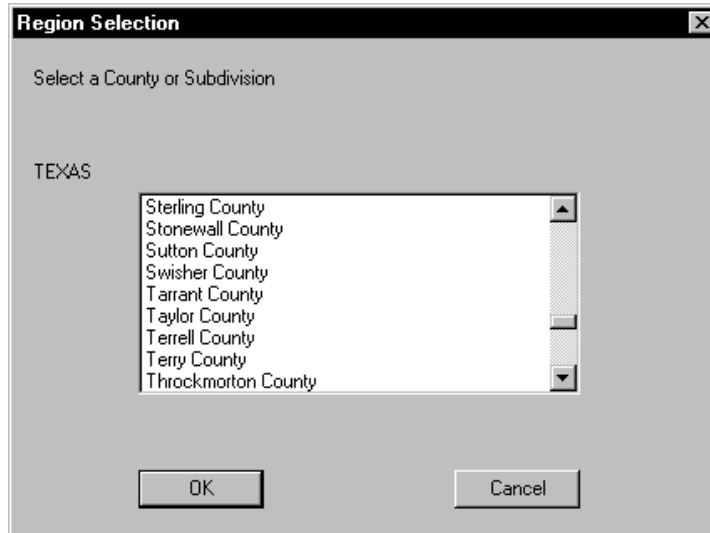
File Menu

Once the New command has been selected or a data file has been opened with the Open command on the File menu, the TIGERMAP MDI menu bar changes appropriately. The following menu commands become available from the File menu for Tiger Map File:

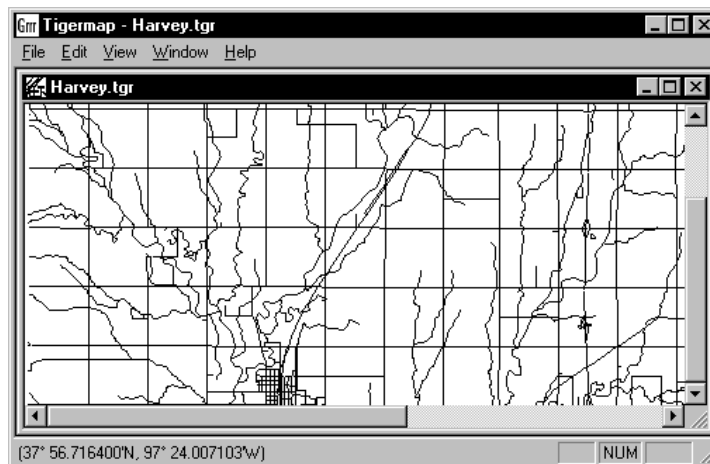
New	Creates a new map or polygon window.
Open	Opens an existing map or polygon file.
Close	Closes the active window.
Save	Saves an opened file using the same file name.
Save As	Save a file to a specified file name.
Process Tiger Map	Requests a state and county to process into a map.
Merge Tigers To Clipboard	Requests a number of map files to merge and send to the clipboard.
Exit	Exits TigerMap

Process TigerMap Command

Use this command to create a map file in TigerMap. You will be asked to select the state and county or district to process.

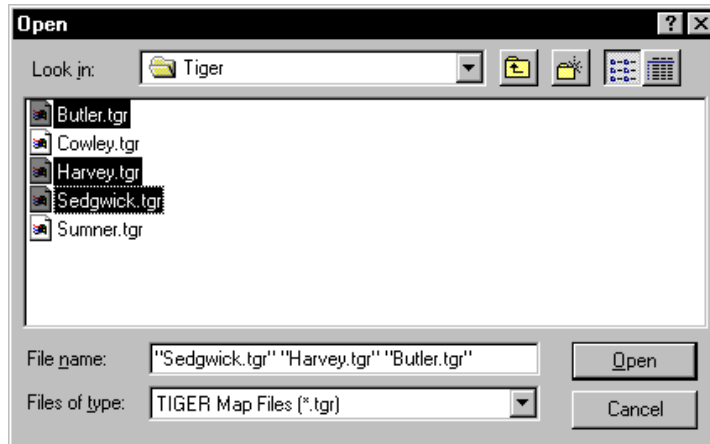


The Census data is on a county by county basis. Each county needed has to be processed separately. Later the maps of each county can be merged into one map with the use of the Merge Tigers To Clipboard command. The following figure illustrates output from processing the geographical information from Tiger/Line data.



Merge Tigers to Clipboard Command

Use this command to merge a number of county maps into a single map. The following example dialog box displays pre-processed Tiger/Line map files for selection to be merged.



To select multiple files, hold down the <Ctrl> key while left mouse clicking on the desired .TGR files. Select Open and the resulting merged map will be sent to the clipboard where it can be accessed by the Map Definition Utility in CHARMED or a drawing program capable of accessing a Windows Metafile. You will be asked to select the files to process. When the merging is done the last county read is displayed. Each county map processing is done with the Process Tiger Map command.

Edit Menu

The Edit menu offers the following commands:

Zoom	Displays an enlargement of a specified map area.
Unzoom	Returns a zoomed map display to its original size when the window was created/opened.
Show Text	Display text.
Set Text Size	If text is being displayed, set the size of text.
Set Latitude/ Longitude Limits	Use this command to define latitude and longitude limits to be used when creating a map file.
Set Tiger Data Directory	This dialog box allows you to define the location of the Census Bureau

CDROM data.

Zoom/Unzoom Commands

Use this command to zoom a portion of the map display. Select the Zoom command from the Edit menu. The cursor changes from a pointer to a magnifying glass. Next, move the cursor to one corner of the area to be zoomed. If you are using a mouse, hold the left mouse button down, move the cursor to the opposite corner of the area to be zoomed, and release the button. During this process, notice that a rubberband box is drawn around the area that you intend to zoom until you release the left mouse button.

If you are not using a mouse, press <ENTER> to mark the first corner of the zoom box, expand the box with the arrow keys, and press < Enter> again to complete the zoom box. The zoom display may not have a one-to-one correlation to the marked area. To return to the initial map display, select the Unzoom command from the Edit menu.

Show Text Command

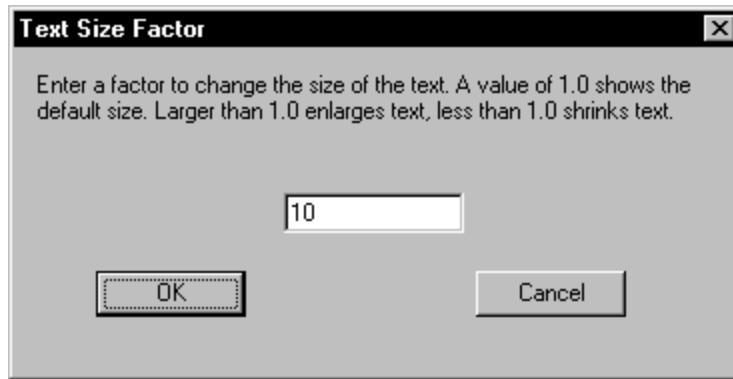
Use this command to have the text drawn with the map file. The text is the label for each object. The amount of text for a map can be quite large and take a long time for a redraw.

Note: If this option is set, then text will be sent to the clipboard along with the rest of a map or polygon drawing. Sending text along with a map can make redrawing very slow.

The text will not be drawn regardless if this option is selected or not if the drawn text would be too small to be seen legibly. The text size can be set by the Set Text Size command.

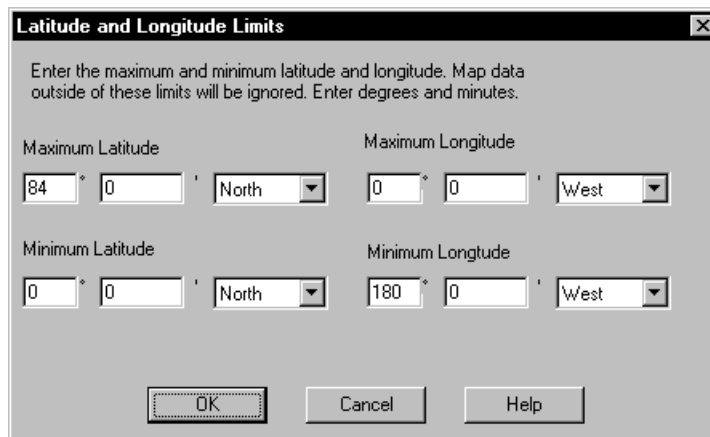
Set Text Size Command

Use this command to set relative map text size. When a map file is first displayed a default text size is assumed. The default text size depends on the areal coverage of the map file. This option can be selected to change the size. The default size is 1.0. To double the text size use 2.0. To halve the text size use 0.5. Whether text is displayed at all can be controlled by the Show Text command.



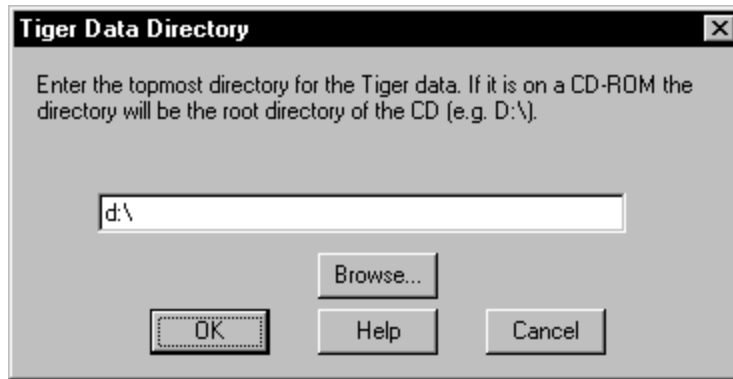
Set Latitude/Longitude Limits Command

Use this command to define latitude and longitude limits to be used when creating a map file. If a feature lies completely outside of the limits it is not made part of the map. If part of a feature (e.g. street segment) is inside the limits it will be drawn.



Set Tiger Directory Command

This dialog box allows you to define the location of the Census Bureau CDROM data. For example, if your CD is on drive D the directory would be D:\. Use the Browse button to search and set the drive and directory where the Tiger/Line data exists.



Processing Tiger/Line Population Files

File Menu

Once the New command has been selected or a data file has been opened with the Open command on the File menu, the TIGERMAP MDI menu bar changes appropriately. The following menu commands become available from the File menu for Tiger Map File:

New	Creates a new map or polygon window.
Open	Opens an existing map or polygon file.
Close	Closes the active window.
Save	Saves an opened file using the same file name.
Save As	Save a file to a specified file name.
Process Population File	Requests a state and county to process into a population polygon file.
Merge Pop Files To Clipboard	Requests a number of population files to merge and send to the clipboard.
Import Landview II Data	Use this command to create a population polygon file in TigerMap. You will be asked to select the state and county or district to process. The Landview II data is on a county by county

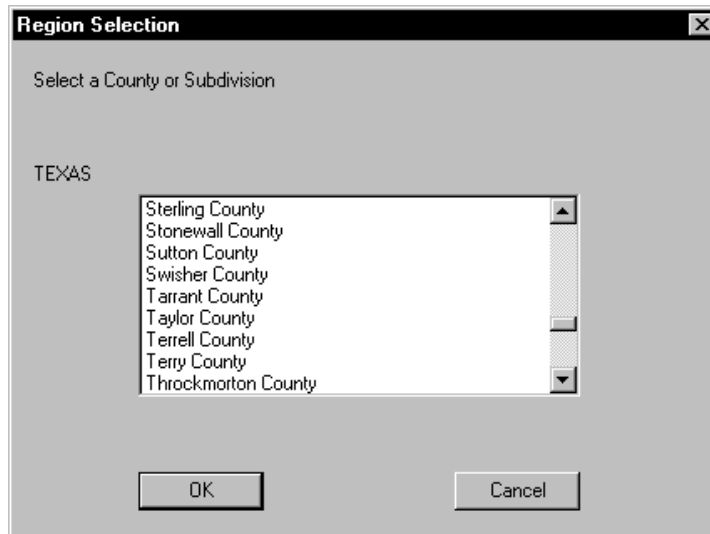
basis.

Exit

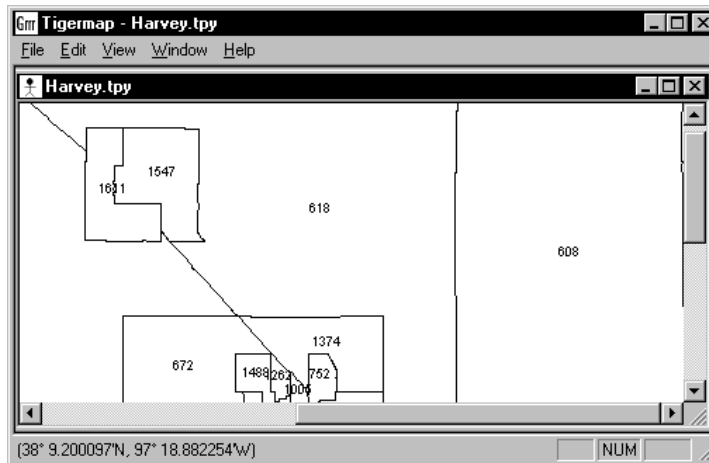
Exits TigerMap

Process Population File Command

Use this command to create a population polygon file in TigerMap. You will be asked to select the state or county or district to process.



The Census data is on a county by county basis. Each county needed has to be processed separately. Later the polygon files of each county can be merged into a map with the use of the Merge Pop. Files To Clipboard command. More importantly these population files can be declared in CHARMED so that CHARM may use them to determine calculation impacts from a concentration, thermal radiation, or overpressure footprint. The following figure illustrates the results of processing the data.



The TigerMap Utility associates total number of people with each tract, along with some other data including age, race, home owners, and renters. Later in CHARM when determining population impacts, CHARM assumes that the total number of people in a tract is uniformly dispersed throughout the tract.

Merge Pop. Files To Clipboard Command

Use this command to merge a number of county polygon population files into a map. The resulting map will be sent to the clipboard where it can be accessed by CHARMED or a drawing program capable of accessing a Windows Metafile. You will be asked to select the files to process. When the merging is done the last county read is displayed. Each county needs to be processed into a population file separately. County population processing is done with the Process Population File command.

Import Landview II Data Command

Use this command to create a population polygon file in TigerMap. You will be asked to select the state and county or district to process. The Landview II data is on a county by county basis. Each county needed has to be processed separately. Later the polygon files of each county can be merged into a map with the use of the Merge Pop. Files To Clipboard command. More importantly these population files can be declared in CHARMED so that CHARM may use them to determine calculation impacts from a concentration, thermal radiation, or overpressure footprint.

The Landview II data can be put on your hard disk after purchasing a Landview CDROM by following the instructions provided. You can also download the data from the Internet. Simple instructions are:

1. Go to site <http://www.RTK.NET/landview>.
2. Select the desired County and State and press the Submit Query button.
3. If you want the complete Landview system download all the files and follow instructions.
4. If you only need the data for inclusion into CHARM you only need to download the Dbase files, the MARPLOT files, and the installation script.
5. Put the downloaded files into a directory for expansion.
6. Run the batch file lvinstal. Ignore any error messages.
7. Define the Data Directory in Tigermap as the directory where the files were expanded.

The batch file lvinstal will write over any files of the same names already in the directory.

For Tigermap to work the only files required are:

In the directory where the expansion occurred - states.dbf, counties.dbf, and cen_blk.dbf.

Two subdirectories down (the county subdirectory) - censusb.sum and censusb.obj

Edit Menu

The Edit menu offers the following commands:

Zoom	Displays an enlargement of a specified map area.
Unzoom	Returns a zoomed map display to its original size when the window was created/opened.
Show Text	Display text.
Set Text Size	If text is being displayed, set the size of text.
Set Latitude/Longitude Point	Defines a Latitude/Longitude point in the x/y Cartesian coordinate system to be used in CHARMED.
Set Tiger Data Directory	This dialog box allows you to define the location of the Census Bureau CDROM data.

Zoom/Unzoom Commands

Use this command to zoom a portion of the map display. Select the Zoom command from the Edit menu. The cursor changes from a pointer to a magnifying glass. Next, move the cursor to one corner of the area to be zoomed. If you are using a mouse, hold the left mouse button down, move the cursor to the opposite corner of the area to be zoomed, and release the button. During this process, notice that a rubberband box is drawn around the area that you intend to zoom until you release the left mouse button.

If you are not using a mouse, press <ENTER> to mark the first corner of the zoom box, expand the box with the arrow keys, and press <Enter> again to complete the zoom box. The zoom display may not have a one-to-one correlation to the marked area. To return to the initial map display, select the Unzoom command from the Edit menu.

Show Text Command

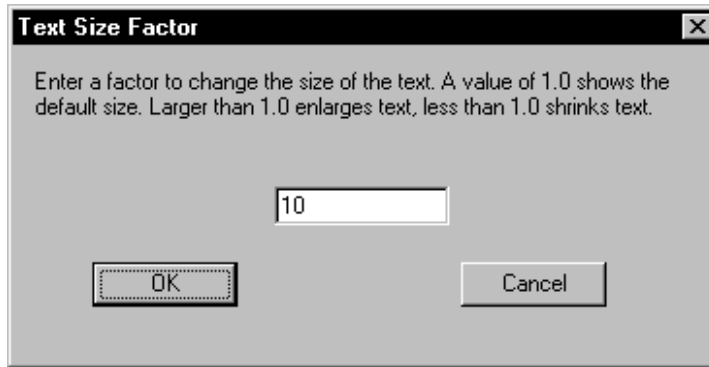
Use this command to have the text drawn with the tract data. The text is the population for each tract.

Note: If this option is set, then text will be sent to the clipboard along with the rest of a map or polygon drawing.

The text will not be drawn regardless if this option is selected or not if the drawn text would be too small to be seen legibly. The text size can be set by the Set Text Size command.

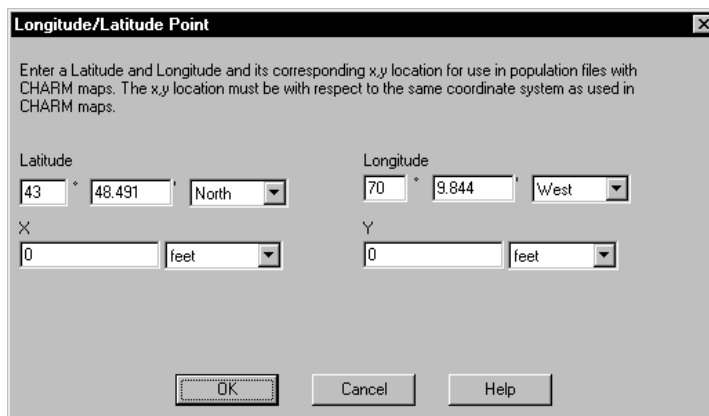
Set Text Size Command

Use this command to set relative map text size. When a map file is first displayed a default text size is assumed. The default text size depends on the areal coverage of the map file. This option can be selected to change the size. The default size is 1.0. To double the text size use 2.0. To halve the text size use 0.5. Whether text is displayed at all can be controlled by the Show Text command.



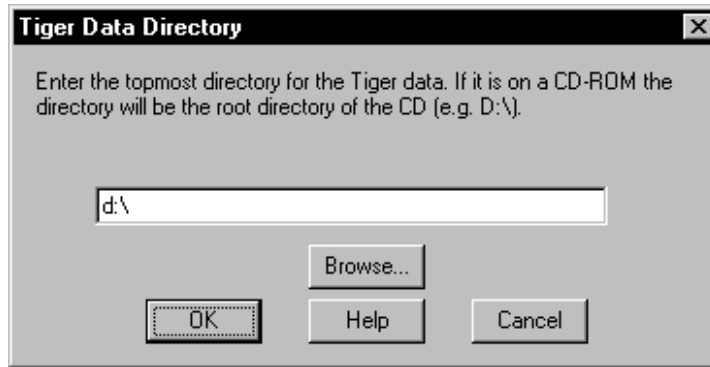
Set Latitude/Longitude Point Command

Use this command to define latitude and longitude point which corresponds to a Cartesian coordinate in the reference frame used for defining the location of maps and release sites. This is required so that CHARM knows where the population polygons are with respect to a footprint.



Set Tiger Directory Command

This dialog box allows you to define the location of the Census Bureau CDROM data. For example, if your CD is on drive D the directory would be D:\. Use the Browse button to search and set the drive and directory where the Tiger/Line data exists.



Creating a Map File for Use With CHARM

To create a map for use with CHARM using U.S. Census Bureau Tiger/Line™ 1992 data, follow these steps:

1. Upon selecting New from the File menu, select TigerMap File from the New window.



2. Select the Process Tiger Map command in the File menu and press <OK>.
3. In the dialog boxes with follow, select the state and county to process. If only one state is available for selection, the state selection will be skipped.
4. Wait for the processing to be complete. This can take a very long time. Pressing cancel on the progress dialog box will stop the processing and all information will be lost.
5. Save the map file with the Save As command in the File menu.
6. Select the Merge Tigers To Clipboard command.
7. Run CHARMED®.

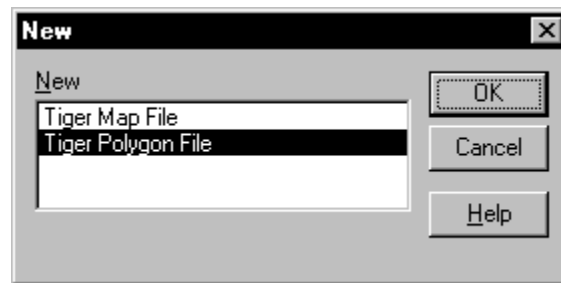
8. Select Map Definition in CHARMED.
9. Paste the map in the clipboard into CHARMED. See 'Defining Maps for Use with CHARM' in CHAPTER 4: Using the CHARM Editor for more information on defining the map.

Once you have created and defined those files for use with CHARM using TIGERMAP and CHARMED, you can display the map two different ways in CHARM. For more information on displaying a map in CHARM, see CHAPTER 6 :CHARM Displays.

Creating a Population File for Use With CHARM

To create a population file for use with CHARM using U.S. Census Bureau Tiger/Line™ 1992 data, follow these steps:

1. Upon selecting New from the File menu, select Tiger Polygon from the New window.



2. Select the Process Population command in the file menu.
3. In the dialog boxes which follow select the state and county to process. If only one state is available for selection, the state selection will be skipped.
4. Wait for the processing to be complete. This can take a very long time. Pressing cancel on the progress dialog box will stop the processing and all information will be lost.
5. Save the population file with the Save As command in the File menu.
6. Select the Merge Pop. Files To Clipboard command.
7. Run CHARMED®.
8. Define the population files(s) using the Select Population Files command in CHARMED.

Once you have created and defined those files for use with CHARM using TIGERMAP and CHARMED, you can calculate population impacts from a plan footprint display in CHARM.

For more information on calculating population impacts in CHARM, see CHAPTER 6 “CHARM Displays”.

Chapter 9: Menu and Command Quick Reference

The purpose of this reference is to help you quickly find related information for CHARM menus and commands in this manual. The menus are listed in alphabetical order. The commands are listed as close as possible to their locations on the menus. Although this list provides a complete command listing, some commands appear only on the menus of specific CHARM displays, while other commands appear shaded on the menu and are not currently selectable. If a command is fully described in this reference, no page number is given. The menus will exist in CHARM, CHARMED, and/or the TIGERMAP Utility.

Define Menu (Map Definition Window in CHARMED)

Zoom

Page 73

Displays an enlarged map of the specified area of the current map display.

Unzoom

Page 73

Returns a zoomed map area to its initial size when the window was opened.

Change Default Size

An unzoomed map size can be changed by entering a scale factor in a map window.

Define Point

Page 74

Define an x,y point of reference for a map you intend to display in CHARM.

Define Scale

Page 75

Display a scale for a map you intend to display in CHARM.

Define Map Location

Page 77

Place an icon on a map display that points to another map.

Define Release Location

Page 78

Place an icon on a map display that identifies the location of one or more defined release scenarios.

Define Expand Map Name

Page 82

Specify the name of a larger scaled map than the one being defined.

Map Description

Page 79

Allows the user to define pertinent information describing the currently displayed map.

Displays Menu (Main CHARM Input Window)

When the Displays menu is selected, the cursor changes momentarily to an hour glass as CHARM calculates the source term.

Basemap

Page 160

Displays a map which has been created with third party software and defined in the CHARM Editor CHARMED for use in emergency response mode.

Site Information

Page 161

Displays a text file window containing site-specific information. This information may contain emergency phone numbers, evacuation routes, etc.

Chemical Data

Page 162

Displays thermodynamic data and plot concentrations from the chemical database for the selected species.

Chemical Response

Page 163

Displays a text window containing the emergency response information for the selected chemical species of interest.

Source/Puff Calculation

Page 164

Displays the description resulting from the source term calculations using in the Main CHARM Input Window for data.

Emission Rate

Page 166

Displays a plot of the emission rate as a function of time for the input data in the Main CHARM Input Window.

BLEVE Radiation

Page 166

Displays a footprint of thermal radiation resulting from a fireball/BLEVE.

Pool Fire

Page 169

Displays a submenu for selecting the footprint of the thermal radiation associated with the fire, or a plume of the unburned material of interest that makes it through the flames.

Jet Fire Radiation

Page 169

Displays the footprint of thermal radiation resulting from a jet fire.

Mechanical Overpressures **Page 172**

Displays a footprint of potential overpressures from a bursting sphere.

Plume **Page 174**

Displays a snapshot view of the plume at the specified time after release.

Displays Menu (Plan Footprint View)

Maximum Distance **Page 195**

Plots the maximum distance downwind of the specified concentration as a function of time.

Maximum Width **Page 197**

Plots maximum crosswind width of a user specified concentration as a function of time.

Maximum Concentration **Page 199**

Displays a table of maximum concentrations as a function of time.

Vertical Xsection **Page 200**

Plots a vertical cross-section through the middle of the plume. The line of sight runs from the release site through the middle of the initial puff.

3D Plume **Page 225**

Presents a three dimensional view of a concentration plume.

Centerline Concentrations **Page 201**

Plots the concentrations down the centerline of the plume as a function of distance.

Plume Half-Widths **Page 203**

Determines the crosswind half-width down the centerline of the plume as a function of concentration.

Met Data **Page 206**

Shows the meteorological data at the source location at the present receptor height and at the time specified for the Snapshot Plan Plume View display.

Integrated Area **Page 206**

Starts a minute by minute calculation of the plume display, showing all areas affected by the plume.

Time Averaged Footprint	Page 208
Displays a time averaged plume based on the user-defined averaging interval and the user-defined grid size. The user will be prompted for the averaging time and grid resolution. The user has the option of selecting an area of the footprint or the entire plume from a submenu.	
Circular Population Impact	Page 210
Predicts population impacts using Census Bureau data. The impacted area is a circular region described by the user by specifying a radius out from the source location.	
Population Impact	Page 212
Predicts population impacts using Census Bureau data. The number of people impacted depend on the Population Calculation type.	
Population Calculation	Page 213
Select the type of calculation to use when predicting population impacts.	
Explosion Overpressures	Page 214
Shows a footprint of potential overpressures if the displayed cloud ignited.	
Input	
Shows the input data for the current CHARM run just as it appeared in the Main CHARM Input Window.	
Source/Puff Calculation	Page 164
Shows the output of the source term calculation for the CHARM run that created the current plan plume view.	
Emission Rate	Page 166
Shows a plot of the emission rate as a function of time throughout the release.	
Site Information	Page 161
Displays a text file window containing site-specific information.	
Chemical Data	Page 162
Displays thermodynamic data and plot concentrations from the chemical database for the selected species.	
Chemical Response	Page 163
Displays a text window containing the emergency response information for the selected chemical species.	

Visual Verify**Page 211**

Displays the population tracts relative to the plume in order to visually verify that the plume indeed overlays the population tracts appropriately. The number of people affected within a tract will be displayed over the number representing the total population for that tract. If it is determined that the plume is not correctly overlayed on the population tracts, the user may adjust the inaccuracy by repositioning the plume or redefining the lat/long point within the TigerMap Utility.

Edit Menu (Plan Footprint Displays)

Copy

Sends text and/or graphics in the current window to the Windows clipboard where it can be retrieved by other programs. If the window contains text only, all the text (visible or not) is sent to the clipboard. If the window contains graphics, a bitmap and a metafile representation of the visible contents of the window is sent to the clipboard.

Change Run Title

Changes the title of the CHARM run and all windows that are using the same data.

Edit Menu (TIGERMAP Utility)

Zoom**Page 242**

Displays an enlarged map of the specified area of the current map display.

Unzoom**Page 242**

Returns a zoomed map area to its initial size when the window was opened.

Show Text**Page 242**

Use this command to have the text drawn with the map or polygon file. If the drawing is a polygon file the text is the population for each polygon drawn at the geometric center of the polygon. If the drawing is a map file the text is the label for each object. The amount of text for a map can be quite large and take a long time for a redraw. The text will not be drawn regardless if this option is selected or not if the drawn text would be too small to be seen legibly. The text size can be set by the Set Text Size command.

Set Text Size**Page 242**

Use this command to set relative map text size. When a map file is first displayed a default text size is assumed. The default text size depends on the areal coverage of the map file. This option can be selected to change the size. The default size is 1.0. To double the text size use 2.0. To halve the text size use 0.5. Whether text is displayed at all can be controlled by the Show Text command.

Set Latitude/Longitude Limits**Page 243**

Use this command to define latitude and longitude limits to be used when creating a map file. If a feature lies completely outside of the limits it is not made part of the map. If part of a feature (e.g. street segment) is inside the limits it will be drawn.

Set Latitude/Longitude Point**Page 249**

Use this command to define a latitude and longitude point which corresponds to a Cartesian coordinate in the reference frame used for defining the location of maps and release sites. This is required so that CHARM knows where the population polygons are with respect to a footprint.

Set TIGER Data Directory**Page 249**

This dialog box allows you to define the location of the Census Bureau CDROM data. For example, if your CD is on drive D the directory would be D:\.

Edit Menu (CHARM Editor)

Chemical Database**Page 59**

Add, modify, or delete species data in the chemical database.

Import Previous Database**Page 27**

Requests the path to the previous version of the CHARM database. Once the path is entered, CHARM will attempt to update the current database from those records in the previous database.

Update Plot Concentrations**Page 27**

Requests the path to the previous version of the CHARM database. Once the path is entered, CHARM will attempt to update the default plot concentrations in the current database from those records in the previous database. The user will be prompted for verification.

Pack Chemical Database	Page 64
Physically removes logically deleted records from the chemical database.	
Local Met Comm Parameters	Page 66
Sets the parameters for local communications with a meteorological tower.	
Network Met Server Location	Page 28
Requests the name/location of the server from which the meteorological interface will run.	
File Location	Page 28
Specifies where CHARM can find CHARM system required files.	
Site Information	Page 64
Allows site-specific information to be entered.	
Map Definition	Page 72
Reads maps to be defined for use in CHARM.	
Select Population Files	Page 84
Requests the names of the population files which were pre-processed using 1992 TigerLine Census Bureau data and the CHARM TIGERMAP Utility.	
Change Password	Page 28
Defines CHARM/System password to regulate CHARMED entry.	
Undo	
Undo the last text edit.	
Cut	
Remove the currently selected text from the active window and put it on the clipboard.	
Copy	
Copy the currently selected data from the active window and put it on the clipboard.	
Paste	
Insert a copy of the clipboard contents into the active window at the insertion point.	
Copy Data	Page 37
Copy the data in the Chemical Data Sheet to the clipboard in comma	

delimited format in the order it is displayed in the Chemical Data Window.

Paste Data

Page 37

Paste the comma delimited data from the clipboard into the Chemical Data Sheet in the order it is displayed in the Chemical Data Window.

Import From DIPPR

Page 37

Displays a selection list of all the species in the DIPPR chemical database for import into the CHARM database.

Exit

Exits CHARMED and closes the main CHARMED MDI window. If the Prompt at Exit command on the Options menu is selected, CHARMED will first prompt the user before exiting. If changes were made, the user is prompted as to whether or not the changes should be stored. The Exit command functions the same in CHARMED as it does in other Windows programs.

File Menu

Emergency Response Text

Page 61

Modifies emergency response text that is specific to the chemical of interest in the CHARM Editor.

Monochrome

Page 200

Remove the color from the vertical cross-section, thereby displaying only the hatch marks.

Table

View the current plot as records of numbers.

New

Page 94

Restores all the values on the Main CHARM Input Window to their default values.

Open

Page 94

Displays a dialog box requesting the name of an input file to open.

Copy

Sends text and/or graphics in the current window to the Windows clipboard where it can be retrieved by other programs. If the window contains text only, all the text (visible or not) is sent to the clipboard. If the window contains graphics, a bitmap and a metafile representation of the visible contents of the window is sent to the clipboard.

Scenarios

Page 94

Displays a selection list of the titles of release scenarios created and stored previously in CHARM.

Save**Page 96**

Saves the input data from the Main CHARM Input Window.

Save As**Page 96**

Displays a dialog box in which you can enter the name of the file being saved.

Save Input As

Saves the release description input data for the current plan plume view under a different, user-specified file name.

Save Met As

Saves the meteorological input data for the current plan plume view under a different, user-specified file name.

Print

Prints all the text contained in the current window, whether the text is visible or not. This is a standard command for most text windows. For graphics windows, this command will print the display in the current window.

Print Preview**Page 97**

Prints all the text and graphics contained in the current window. This is a standard command for most text windows.

Printer Setup**Page 97**

Allows the user to change the current printer configuration.

Save As Default**Page 93**

Saves the current scenario described in the CHARM Input Window as the default scenario.

Close

Closes the active CHARM window in the CHARM MDI. Select the Exit command (described below) to terminate CHARM.

Larger Scale Map**Page 189**

Displays a larger-scaled map that has been defined and assigned an expanded map name.

Process Population File**Page 245**

Use this command to create a population polygon file in TigerMap. You will be asked to select the state and county or district to process.

The Census data is on a county by county basis. Each county needed has to be processed separately.

Import Landview II Data

Page 246

Use this command to create a population polygon file in TigerMap. You will be asked to select the state and county or district to process. The Landview II data is on a county by county basis. Each county needed has to be processed separately.

Merge Pop Files to Clipboard

Page 246

Use this command to merge a number of county polygon population files into a map. The resulting map will be sent to the clipboard where it can be accessed by CHARMED or a drawing program capable of accessing a Windows Metafile. You will be asked to select the files to process. When the merging is done the last county read is displayed. Each county needs to be processed into a population file separately. County population processing is done with the Process Population File command.

Process Tiger Map

Page 250

Use this command to create a map file in TigerMap. You will be asked to select the state and county or district to process. The Census data is on a county by county basis. Each county needed has to be processed separately. This command has been removed.

Merge Tigers to Clipboard

Page 250

Use this command to merge a number of county maps into a single map. The resulting map will be sent to the clipboard where it can be accessed by CHARMED or a drawing program capable of accessing a Windows Metafile. You will be asked to select the files to process. When the merging is done the last county read is displayed. Each county needs to be processed into a map separately. County map processing is done with the Process Tiger Map command. This command has been removed.

Exit

Exits CHARM and closes the main CHARM MDI window. If the Prompt at Exit command on the Options menu is selected, CHARM will first prompt the user before exiting. If changes were made, the user is prompted as to whether or not the changes should be stored. The Exit command functions the same in CHARM as it does in other Windows programs.

Help Menu

Help

Offers you help on the current task or command.

Index

Offers an index to topics on which you can get help.

Using Help

Provides general instructions on using help.

Search for Help On

Displays a list of keywords used in CHARM from which a list of related topics may be displayed.

About

Displays the version number and standard information required by Windows. This is a standard Windows command.

MetFile Menu

New

Page 99

Restores all met data fields to their default values.

Open

Page 100

Displays a dialog box requesting the name of a met file to open.

Save

Page 101

Saves the current met data in a user-specified file.

Save As

Page 101

Saves the met data under a different, user-specified file name.

Save As Default

Page 99

Saves the current met data described in the CHARM Input Window as the default met data.

Solar Radiation Worksheet**Page 101**

Use a worksheet to determine solar radiation value. Solar radiation is a function of latitude/longitude, cloud cover, time of day, and the day of the year.

Automatic Poll**Page 101**

Initiates conversation between CHARM and the met interface (METINTER.EXE) to automatically read stored meteorological data.

Stop Poll**Page 100**

Signals CHARM to stop real-time data acquisition.

Use Inverse Square**Page 100**

Invokes inverse square weighting algorithm for use with multiple sites when using real-time data acquisition.

Calculate Solar Radiation**Page 100**

Calculates the solar radiation as real-time met data is acquired.

Options Menu (Main CHARM Input Window)

Prompt At Exit**Page 103**

Switch to prompt the user before exiting CHARM.

Time is Minutes-Seconds**Page 103**

Switch to run CHARM in Minutes/Seconds mode or Hours/Minutes mode.

Options Menu (Basemap Window)

Zoom**Page 224**

Displays an enlarged map of the specified area of the current map display.

Unzoom**Page 224**

Returns a zoomed map area to its initial size when the window was opened.

Map Description**Page 188**

Allows the user to view pertinent information describing the currently displayed map.

Options Menu (Plan Footprint Displays)

Recalculate

Page 208

Recalculated the impacted area from the beginning on an Integrated Area Display.

Continue

Page 207

Continues simulation of the currently displayed plume integration on an Integrated Area Display.

Overpressures

Page 173

Specifies up to three pressure values for the three distances shown on an Overpressure footprint display.

Distances

Page 174

Specifies up to three distances from the source for the pressure and energy flux values shown on a BLEVE Thermal Radiation or Mechanical Overpressures footprint display.

Energy Fluxes

Page 167

Specifies up to three energy flux values for the three distances shown on a BLEVE Thermal Radiation display.

Isopleths

Page 180

Specifies the concentrations plotted on plume displays, graphs, and tables.

Averaging Time

Page 181

Enter the averaging time in minutes from 1 to the present plot time for a time averaged plume. The average taken is the running average. The concentrations at a specific point are averaged over time to determine a time-weighted average.

Grid Size

Page 182

Enter the number of points to be used in the grid when generating a Time-Averaged Plume. The grid is 2-dimensional and, therefore, the user must enter the number of points in the X direction (East/West) and the Y direction (North/South).

Time Averaged Footprint

Page 208

Displays a time averaged plume based on the user-defined averaging interval and the user-defined grid size. The user has the option of selecting an area of the footprint or the entire plume from a submenu.

Show Grid**Page 182**

This option removes/shows the user-defined grid for the Time-Averaged Plume. A check by the menu item displays the grid, whereas no check by the menu item indicates the option is not active and the grid is not visible.

Grid Display**Page 182**

If the Show Grid option is on, this option displays the user-defined grid for the Time-Averaged Plume as a series of points or as a wire mesh. A check by either menu item indicates this option is turned on, whereas no check by the menu item indicates the option is not active and the grid points are not visible.

Scale Radius**Page 183**

Changes the radius of the view port (solid circle) on the plume display according to a user-specified scale.

Scale Ratio**Page 184**

Changes the radius of the view port according to a user-specified ratio.

Distance Circles**Page 184**

To supplement the display of a plan view, additional circles can be drawn for a given radial increment within the large circle.

Receptor Height**Page 185**

Specifies the height above ground of the display.

Transparency**Page 185**

Changes the display from a colored, opaque plume to a "ghost" plume denoted only by concentration hatch marks, thereby allowing the map areas beneath the plume to be seen.

No Hatch**Page 185**

A toggle indicating whether or not the hatch marks on a footprint display and in the legend are displayed. A check by the menu item indicates this option is turned on, whereas no check by the menu item indicates the option is not active and the hatch marks are visible.

Use Auto Scale**Page 186**

A toggle switch indicating that CHARM will automatically scale the display to show the entire footprint whenever aspect changes are made to the display. A check by the menu item indicates this option is turned on, whereas no check by the menu item indicates the option is not active and that CHARM will automatically scale the display.

Decay**Page 186**

Specifies the time (half-life) required for half of the emitted material to decay into neutral products.

Map**Page 186**

Displays a dialog box in which you can select a map to display.

No Map**Page 187**

Removes current map from display.

Location**Page 187**

Relocates the source of the release on the current map display.

Map Description**Page 187**

Displays pertinent information describing the currently displayed map.

Reset Source**Page 188**

Resets the position of the source to the center of the view port.

Auto Map Change**Page 188**

Enables CHARM to automatically display a larger-scaled map when the scale of the current map display is not large enough to cover a significant portion of the plot area. If checked, CHARM will attempt to select the map with best coverage.

Auto Map Fraction**Page 188**

Defines the fraction of the footprint display area which must be covered by a map to preclude CHARM from trying to go to a larger scale map.

Larger Scale Map**Page 189**

Displays the larger-scaled map associated with the current map.

New Time**Page 189**

Specifies the time since release for the footprint display.

Time Circles**Page 189**

Draws dashed circles around the source that indicate the location to which the current wind speed can move a parcel of air from the source in the number of minutes specified.

Replay

Once a Snapshot Plan Plume View display has been generated, the user may display the plume at every minute (or every second if Time mode is Minutes-Seconds) up to the current time since release. The user may cancel the automation at any time before the current time since release by hitting the <Cancel> button in the display window..

Create ASCII File**Page 190**

Generates a file to hold a description of a footprint of impact (concentration, thermal radiation, or overpressure) which can be transferred to other programs.

Create Shape File**Page 193**

This command enables the user to generate a file which describes a footprint of impact (concentration, thermal radiation, or overpressure) which can be transferred to ArcView for display.

Observer Location**Page 227**

Change the location of the observer in a 3-dimensional display of a plume.

Observed Point**Page 227**

Change the location of the observed point in a 3-dimensional display of a plume.

Observer Step Distances**Page 228**

Change the incremental stepsizes of the observer when altering the location of the observer in a 3-dimensional display of a plume.

Z Scale**Page 229**

Enter a dimensionless number to scale the plume z coordinates in the 3-dimensional plume display.

Monochrome**Page 183**

Remove the color from the 3D Plume view, thereby displaying only the 3D frame.

View Menu

Status Bar

The status bar is displayed at the bottom of the CHARM window. To display or hide the status bar, use the Status Bar command in the View menu.

The left area of the status bar describes actions of menu items as you use the arrow keys to navigate through menus. This area similarly shows messages that describe the actions of toolbar buttons as you depress them, before releasing them. If after viewing the description of the toolbar button command you wish not to execute the command, then release the mouse button while the pointer is off the toolbar button.

The right areas of the status bar indicate which of the following keys are latched down:

<u>Indicator</u>	<u>Description</u>
CAP	The Caps Lock key is latched down.
NUM	The Num Lock key is latched down.
SCRL	The Scroll Lock key is latched down.

Window Menu

Cascade

Arranges multiple opened windows in an overlapped fashion.

Tile

Vertically arranges multiple opened windows in a non-overlapped fashion.

Arrange Icons

Use this command to arrange the icons for minimized windows at the bottom of the main window. If there is an open window at the bottom of the main window, then some or all of the icons may not be visible because they will be underneath this window.

1, 2, ...

CHARM displays a list of currently open windows at the bottom of the Window menu. A check mark appears in front of the name of the active window. Choose a window from this list to make it the active window.

Appendix A: Enhancements in CHARM Ver. 9.1

Functional software changes in CHARM Version 9.1 that are not found in CHARM Version 9.0 include the following:

- RMP distance is calculated for thermal radiation displays.
- For (x,y) plot displays, the user may toggle a mesh grid on or off.
- CHARM now supplies the user with container information as a species exits the container.
- CHARM displays a list of the five most recently opened scenario files in the File menu in the Main CHARM Input.
- CHARM displays a list of the five most recently opened meteorological files in the Met File menu in the Main CHARM Input Window.
- When using a Container/Surface Release Type, CHARM will calculate the pool diameter/area using a depth of 1 cm to comply with RMP specifications.
- Depending on the chemical, the solar radiation used for liquid evaporation may not be used completely for evaporation purposes.
- You may define a time schedule for user-defined stability classes under the meteorological parameters.
- You can execute the MS Windows Calculator program from within CHARM to do necessary calculations quickly and easily.
- CHARM version 9.1 comes with documentation inserts into the version 9.0 User's Manual, and updated on-line help, which includes information taken from quarterly training sessions.

RMP Distance

Risk Management Planning (RMP) dictates that flammables must be modeled and a distance determined at which 5 KW/m² is attained for 40 seconds. RMP distance is calculated in Fireball/BLEVE, Jet Fire, and Pool Fire Thermal Radiation displays. Figures A-1 - A-3 illustrate where the RMP distance is displayed in each output.

Figure A-1
BLEVE
Display
Illustrating
RMP
Distance

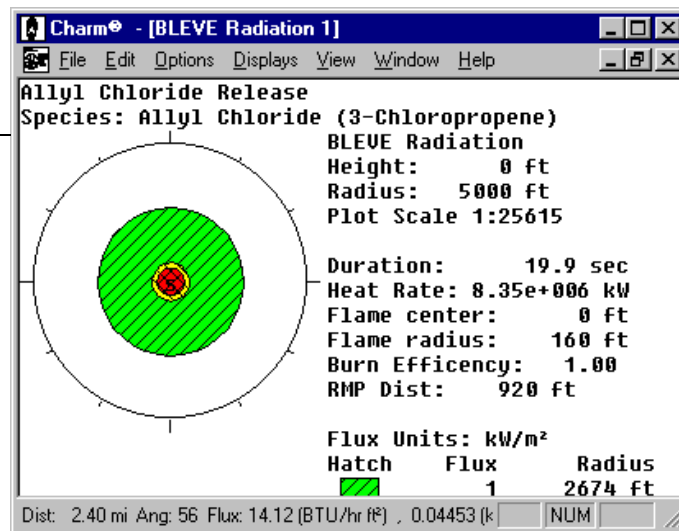


Figure A-2
Jet Fire
Display
Illustrating
RMP
Distance

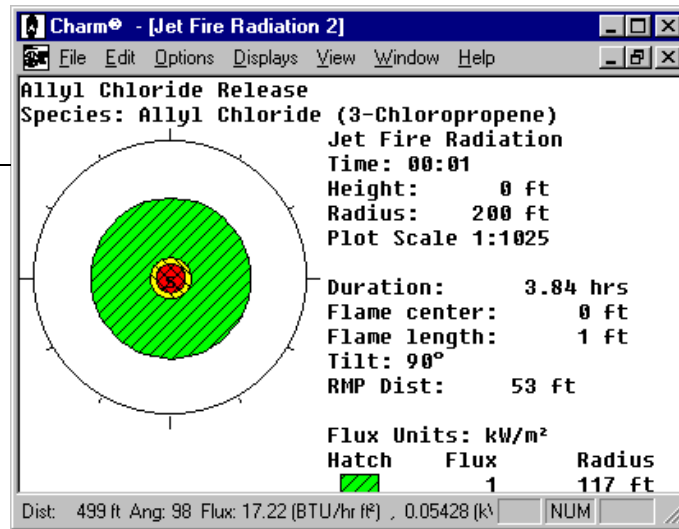
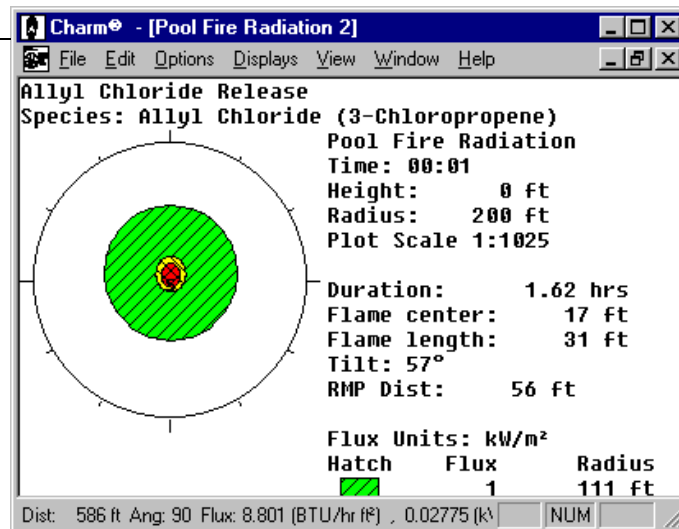


Figure A-3
Pool Fire
Display
Illustrating
RMP
Distance



Grid Plots

For all (x,y) plot displays, the user may toggle a mesh grid on or off by selecting/deselecting the 'Grid Plot' menu item under the 'File' menu. Figures A-4 and A-5 illustrate the mesh grid as it is (not) displayed on a plot.

Figure A-4
Example of
Plot with
Grid OFF

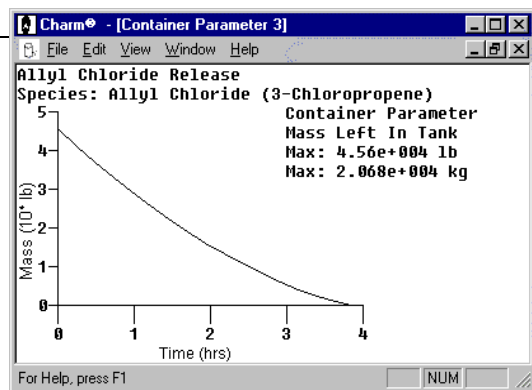
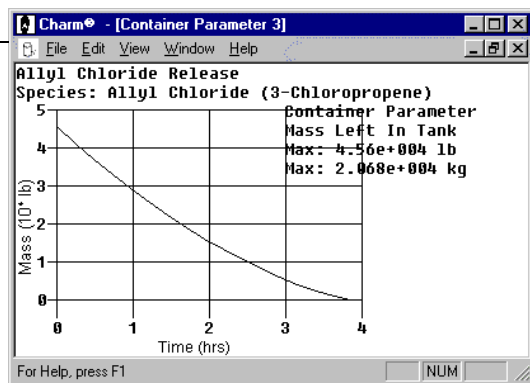


Figure A-2
Example of
Plot with
Grid ON

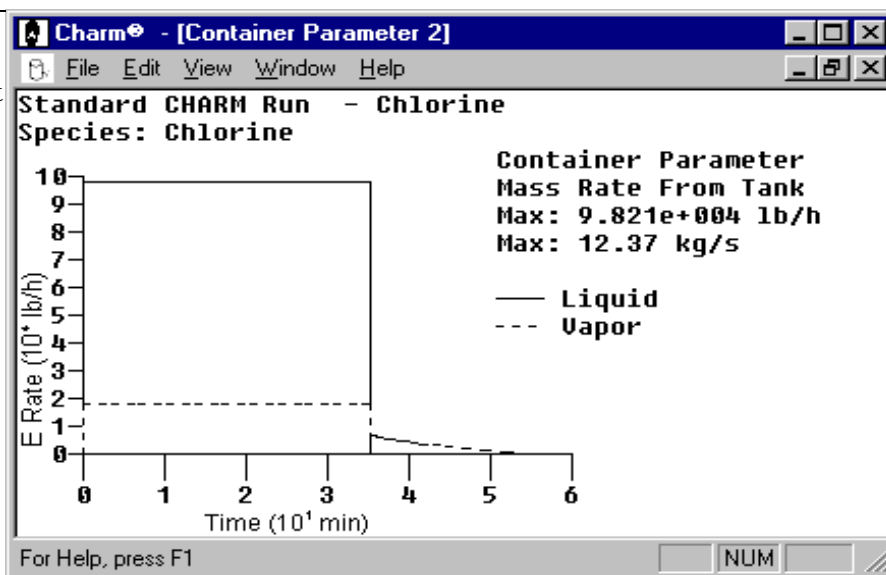


Container Information

CHARM now supplies the user with container information as a species exits the container. The output may be displayed in graphical or tabular format.

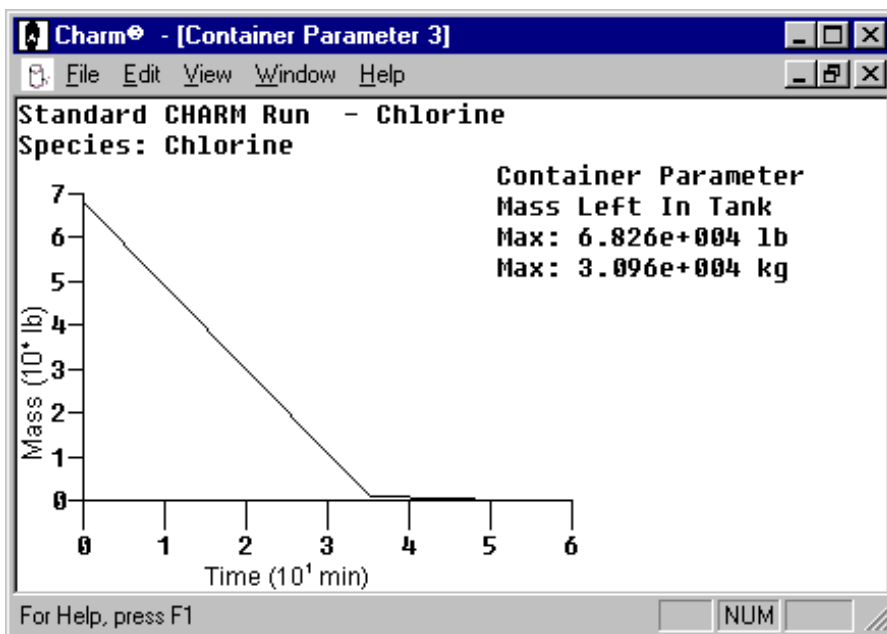
To generate a Mass Rate vs. Time Plot, select the 'Container Info' menu item from the 'Displays' menu located on the Main CHARM Input Window menu bar, or on any footprint display menu bar. Select the sub-menu item labeled 'Mass Rate'. Figure A-6 illustrates a plot of the mass rate exiting from a container as a function of time.

Figure A-6
Mass Rate
vs. Time Plot



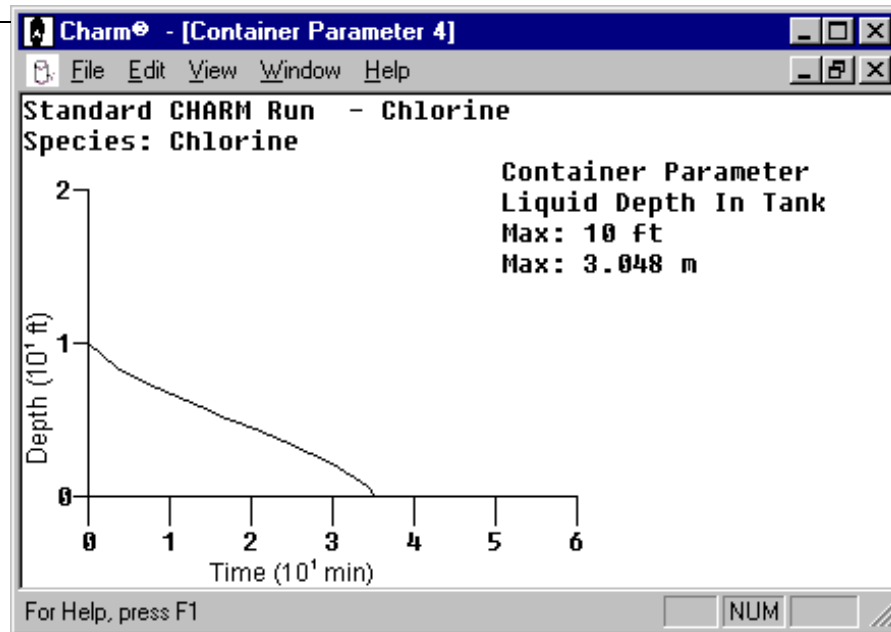
To generate a Mass Amount vs. Time Plot, select the 'Container Info' menu item from the 'Displays' menu located on the Main CHARM Input Window menu bar, or on any footprint display menu bar. Select the sub-menu item labeled 'Mass Amount'. Figure A-7 illustrates a plot of the mass amount exiting from a container as a function of time.

Figure A-7
Mass Amt
vs. Time Plot



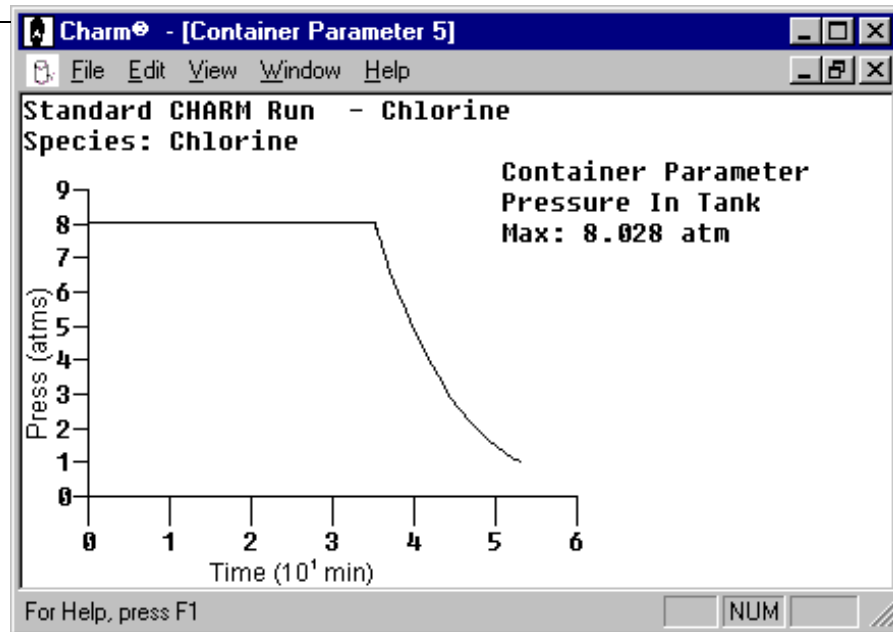
To generate a Liquid Depth vs. Time Plot, select the 'Container Info' menu item from the 'Displays' menu located on the Main CHARM Input Window menu bar, or on any footprint display menu bar. Select the sub-menu item labeled 'Liquid Depth'. Figure A-8 illustrates a plot of the liquid remaining in the container as a function of time.

Figure A-8
Liquid
Depth vs.
Time Plot



To generate a Pressure vs. Time Plot, select the 'Container Info' menu item from the 'Displays' menu located on the Main CHARM Input Window menu bar, or on any footprint display menu bar. Select the sub-menu item labeled 'Pressure'. Figure A-9 illustrates a plot of the pressure in a container as a function of time.

Figure A-9
Pressure vs.
Time Plot



Recent Scenario Files

CHARM displays a list of the five most recently opened scenario files in the 'File' menu in the Main CHARM Input Window. Choosing a file from this list makes it the current scenario in the Main CHARM Input Window.

Recent Meteorological Files

CHARM displays a list of the five most recently opened meteorological files in the Met File menu in the Main CHARM Input Window. Choosing a met file from this list makes it the current met parameters in the Main CHARM Input Window.

Estimating Pool Diameter In Accordance with RMP

When using a Container/Surface Release Type, CHARM will calculate the pool diameter/area using a depth of 1 cm to comply with RMP specifications.

To access this parameter in CHARM, select the 'Description Dialog Input' command from the 'Options' menu in the Main CHARM Input Window. With the 'Container/Surface Description' selected as the release type, select the 'Pool' tab and locate the radio button labeled 'Estimate with 1 cm depth'. Press the 'Apply' button at the bottom of the window and CHARM will calculate the pool diameter based on a 1 cm depth.

The screenshot shows the CHARM software window with the 'Pool' tab selected. The interface includes several input fields and a tabbed menu at the top. The 'Height of surface above ground' is set to 0 feet. The 'Maximum Diameter' section has two radio buttons: 'Estimate with 1 cm depth' (selected) and a value of 25 feet. The 'Mitigation Time' is set to 0 minutes. The 'Solar Radiation Pool Evaporation Efficiency' is set to 1. The bottom of the window has buttons for 'OK', 'Cancel', 'Apply', and 'Help'.

Solar Radiation Pool Evaporation Efficiency

When using a Container/Surface or Pool/Lagoon release type, the solar radiation used for liquid evaporation may not be used completely for evaporation purposes. For instance, some of the solar radiation may not be incorporated into the evaporation, depending on the reflectivity of the species to light.

To access this parameter in CHARM, select the 'Description

Dialog Input' command from the 'Options' menu in the Main CHARM Input Window. With the 'Container/Surface Description' or the 'Pool/Lagoon' selected as the release type, select the 'Pool' tab and locate the single line edit box labeled 'Solar Radiation Pool Evaporation Efficiency'. You may enter a value 0.0 - 1.0.

Charm

Basic | Location | Building | Container | Storage | Hole | Pool | Surface | Pipe | Fire/Droplets

Height of surface above ground:

Maximum Diameter

☐ Estimate with 1 cm depth

☒

Mitigation Time:

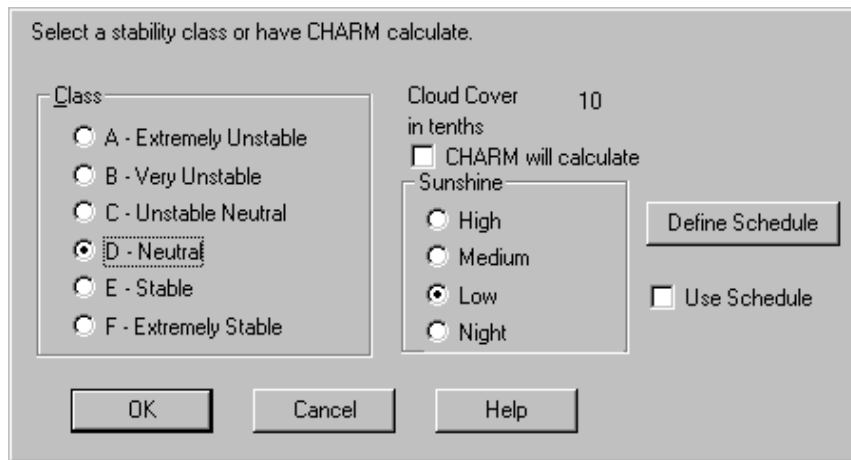
Solar Radiation Pool Evaporation Efficiency:

OK Cancel Apply Help

Stability Class Schedule

You may define a time schedule for user-defined stability classes under the meteorological parameters. CHARM will use this schedule for dispersion calculations and calculation of wind profiles if a surface roughness is defined. Linear interpolation will be used to determine surface roughness at any given point.

To access this parameter in CHARM, double-click on Stability Class in the meteorological parameters in the Main CHARM Input Window. The following dialog box will appear:



Select a stability class or have CHARM calculate.

Class

- ☐ A - Extremely Unstable
- ☐ B - Very Unstable
- ☐ C - Unstable Neutral
- ☒ D - Neutral
- ☐ E - Stable
- ☐ F - Extremely Stable

Cloud Cover 10
in tenths

☐ CHARM will calculate

Sunshine

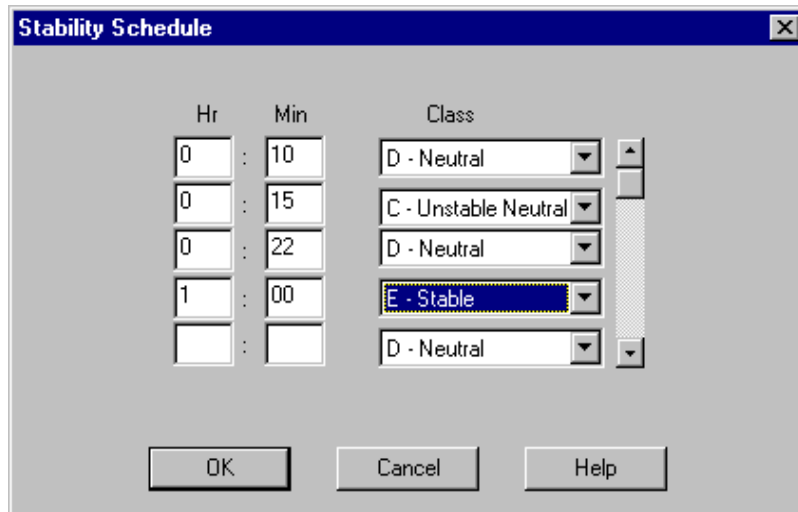
- ☐ High
- ☐ Medium
- ☒ Low
- ☐ Night

Define Schedule

☐ Use Schedule

OK Cancel Help

Click on the 'Use Schedule' checkbox and click on the 'Define Schedule' button. The following dialog box will appear:



Stability Schedule

Hr	Min	Class
0	10	D - Neutral
0	15	C - Unstable Neutral
0	22	D - Neutral
1	00	E - Stable
		D - Neutral

OK Cancel Help

Enter stability class values in chronological order since release. Use the scroll bar to input additional data.

Alternatively, the user may define the stability class schedule from the 'Met Dialog Input' command under the 'Options' menu in the

Main CHARM Input Window. Select the 'Stability Class' tab after the following dialog box is displayed.

CHARM

Main Stability Class Solar Winds

☐ CHARM will calculate

Class

- ☐ A - Extremely Unstable
- ☐ B - Very Unstable
- ☐ C - Unstable Neutral
- ☒ D - Neutral
- ☐ E - Stable
- ☐ F - Extremely Stable

Cloud Cover Tenths

Sunshine

- ☐ High
- ☐ Medium
- ☒ Low
- ☐ Night
- ☐ Use Solar Radiation

Define Schedule

☐ Use Schedule

OK Cancel Apply Help

Click on the 'Use Schedule' checkbox and click on the 'Define Schedule' button. Once again, the dialog box defining stability class schedule will appear.

Stability Schedule

Hr	Min	Class
0	10	D - Neutral
0	15	C - Unstable Neutral
0	22	D - Neutral
1	00	E - Stable
		D - Neutral

OK Cancel Help

Enter stability class values in chronological order since release. Use the scroll bar to input additional data.

Appendix B: Enhancements in CHARM Ver. 9.3

NOTE: CHARM Version 9.2 is exclusive to the Japanese version of CHARM and was not an update to the English version.

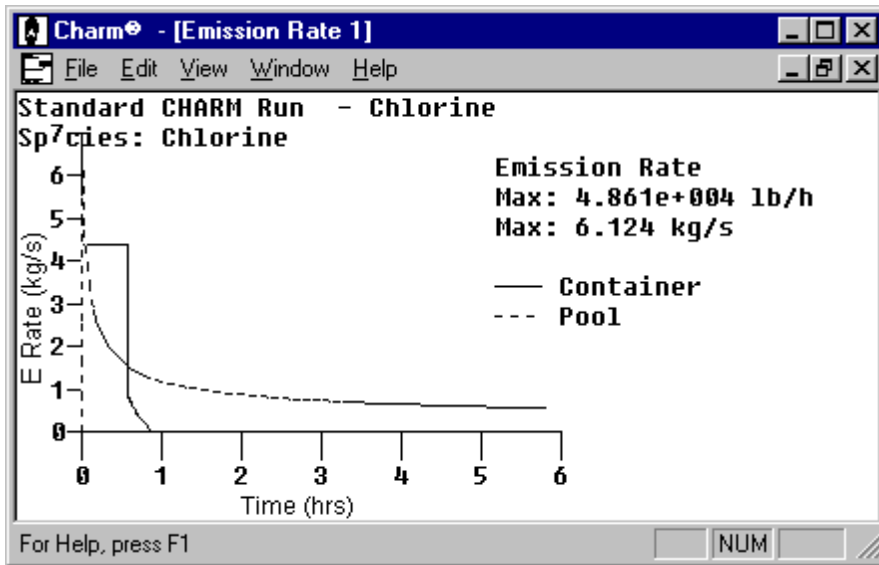
Functional software changes in CHARM Version 9.3 that are not found in CHARM Version 9.1 include the following:

- From an Emission Rate plot within CHARM proper, the user has the ability to copy either the container rate, the pool rate, or the total combined rates of the pool and the container into the User Specified Emission Rate Schedule in the User-Specified release type. Once copied from the Edit menu of the Emission Rate plot, the selected rates may be pasted into the emission rate schedule with the push of a button.
- The 'Dose at Point' menu item under the Displays Menu for Plan concentration views in CHARM proper allows the user to input a specified point to generate a Dose Plot (or concentration history plot) rather than double-clicking on the display.
- CHARM version 9.3 comes with documentation inserts into the version 9 User's Manual, and updated on-line help.

Copy Container, Pool, Total Rate

Once a scenario has been modeled using any one or the three release types (i.e. Container/Surface, Pool/Lagoon, User-Specified After Release Conditions), the user may view the emission rate as a function of time.

Figure B-1
Example
output of
Emission
Rate Plot



Select the Edit menu to view the section allowing the user to copy either the Container Rate, the Pool Rate, or the Total Rate consisting of both the Container Rate and the Pool Rate to the clipboard.

Once copied, the user may paste the data into the emission rate schedule of a User-Specified release. To do so, change the release type to User-Specified After Release Conditions and change the emission rate type to User-Specified Rate.

Figure B-2
Emission
Rate
Scheduler
Input
Window

Emission Rate Scheduler

Time units

☒ hrs
☐ min
☐ sec

Emission rate units

☐ lbs/hr ☐ scfm ☐ cfm
☒ g/s ☐ scms ☐ cms

Time Emission rate

Add

Delete

Clear

Change

Save Change

Paste Data

OK Cancel Help

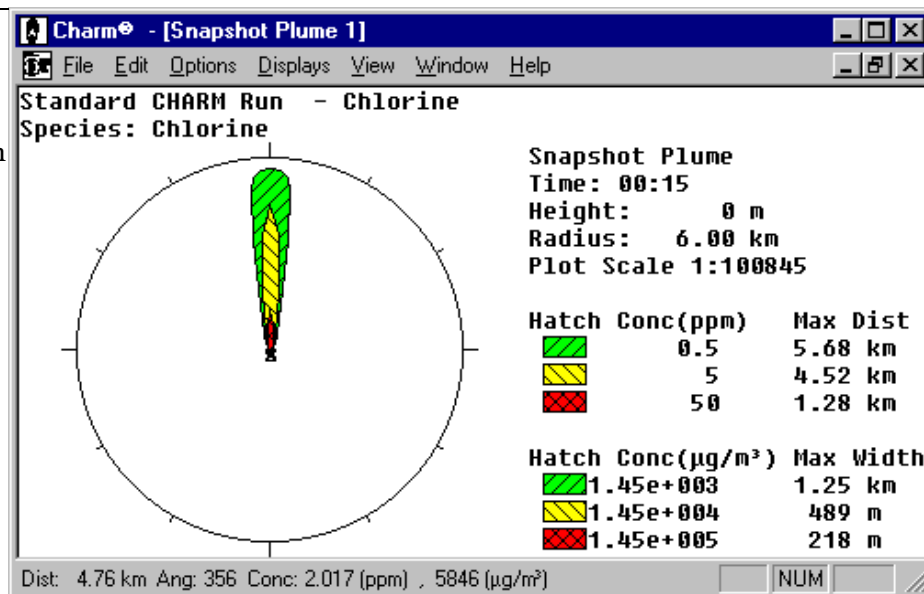
If the copied data exists in the clipboard, notice the Paste Data button is activated. Simply press the Paste Data button and the data, which

includes both time since release and emission rate, will be loaded into the emission rate schedule. This allows the user the flexibility to modify or tweak the data.

Dose At Point

The Dose Plot (or concentration history) is normally displayed by generating a Plot Plan Snapshot view of the isopleths of interest, moving the cross-hair to the desired point, and either double-clicking the left mouse button or pressing <Enter>. The desired point is generally specified by locating the distance and direction (or angle) from the source in the status bar at the bottom of the window

Figure B-3
Example of
Snapshot
Plan Plume
Display from
which the
user may
obtain a
Dose Plot



The 'Dose at Point' menu item under the Displays Menu for Plan concentration views in CHARM proper allows the user to input a specified point to generate a Dose Plot (or concentration history plot) rather than double-clicking on the display. This method allows the user to input an exact location by specifying the distance and direction of the point of interest from the source.

Figure B-4
Input
window
requesting
direction
and distance
from source
to generate
Dose Plot

Enter the direction and distance from source to exposure point.

Distance

Direction

Appendix C: Enhancements in CHARM Ver. 9.4

Functional software changes in CHARM Version 9.4 that are not found in CHARM Version 9.3 include the following:

- A glitch in the algorithm for estimating the “RMP Distance” for jet fire radiation effects has been corrected. The previous glitch only affected scenarios where the time step shown in the release profile of the “source puff” calculation is less than 40 seconds.
- The near-field dispersion algorithm has been changed to reduce enhanced dispersion at the source. The effects of this revision are to generally lower dispersion impacts as well as lower vapor cloud explosion overpressure impacts in the near field. This change is going back to the approach used prior to Version 9.3.
- The X-Y plot axes’ labels have been changed to eliminate exponential notation. Originally all tick marks were labeled between 1 and 10 and the axis label had the multiplier. Now the tick marks are labeled with their actual values with no multiplier notation.
- The “3D Plume” display shows multiple concentration isopleths corresponding to the isopleths shown on the 2D snapshot plume view. Previously, only one isopleth was shown in the 3D view, and the user was prompted to specify the concentration when selecting this option.
- A number of internal changes were made to the code that have no effect on the results but make maintenance and expandability of the code easier. Some changes make it easier to input data. For example, drag and drop input and output has been added to all tables (e.g. emission rates, winds, and stability class).
- CHARM Version 9.41 was released shortly after Version 9.4. An error in the calculation of the flame length for a jet fire was corrected.
- CHARM Version 9.4 comes with updated documentation, including on-line help and inserts into the CHARM User's Manual.

Appendix D: Enhancements in CHARM Ver. 9.5

Functional software changes in CHARM Version 9.5 that are not found in CHARM Version 9.4 include the following:

- The color for each isopleth can be user defined. They no longer are restricted to just green, yellow, and red.
- A number of internal changes were made to the code such as some spelling corrections and text placement.

Appendix E: Enhancements in CHARM Ver. 9.6

Functional software changes in CHARM Version 9.6 that are not found in CHARM Version 9.5 include the following:

- The number of isopleth values has been increased from 3 to 6. The code has been revamped to make further increases, if needed, more easily implemented. The isopleth values and colors can be altered in a single screen
- The 3D display has been enhanced to allow the use of the mouse for moving the observer and observed direction. The display has been made to move more smoothly.
- The CHARM version 9.6 help files have been reviewed to make them more useful and complete.

Isopleth Value and Color

When a plan or 3-D view is in a window the isopleths (concentration, thermal radiation, or explosion overpressures) that are plotted can have their values and colors changed.

Figure E-1
Example
input screen
for defining
isopleth
value and
color.

	Value	Color
1	1	Green
2	3	Yellow
3	20	Red
4		Cyan
5		Purple
6		Magenta

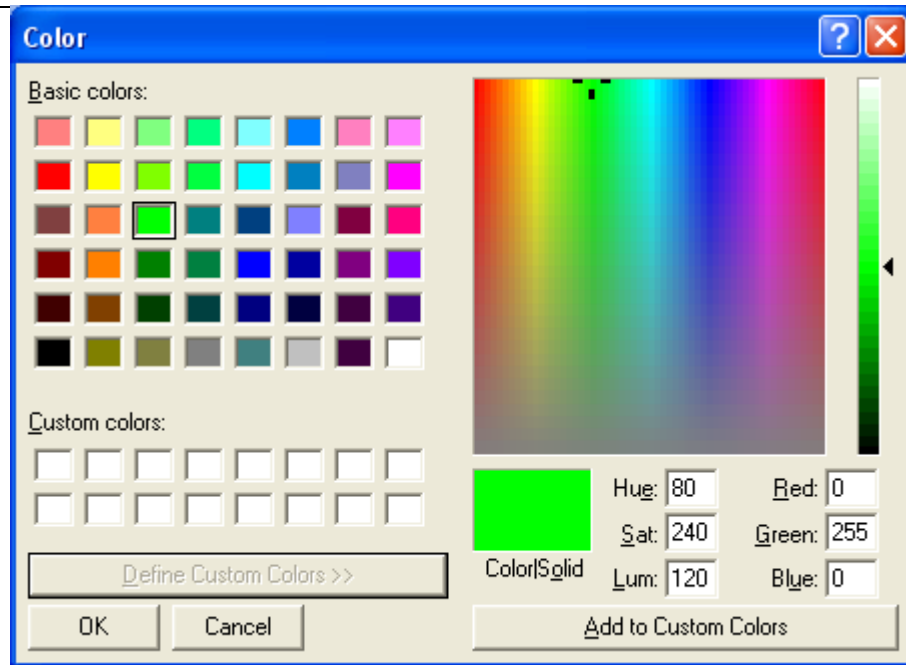
ppm

OK Cancel

Select the Isopleths... item in the Options menu to view a dialog box similar to the one in Figure E-1.

You can enter a value directly into column labelled Value. To change the color, double click on the color to change and the dialog box shown in Figure E-2 will be displayed. A new color can be selected directly from the boxes on the left or a custom color can be created by selecting a point in the area to the right.

Figure E-2
Color
Selection
Dialog



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