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Integrated Reliability and Risk Analysis System (IRRAS) Version 2.5

Reference Manual

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K.D. Russell, D.M. Snider, M.B. Sattison, H.D. Stewart, S.D. Matthews, K.L. Wagner, "Integrated Reliability and Risk Analysis System (IRRAS) User's Guide - Version 1.0 (DRAFT)," NUREG/CR-4844, EGG-2495, June 1987

ABSTRACT

The Integrated Reliability and Risk Analysis System (IRRAS) is a state-of-the-art, microcomputer-based probabilistic risk assessment (PRA) model development and analysis tool to address key nuclear plant safety issues. IRRAS is an integrated software tool that gives the user the ability to create and analyze fault trees and accident sequences using a microcomputer. This program provides functions that range from graphical fault tree construction to cut set generation and quantification.

Version 1.0 of the IRRAS program was released in February of 1987. Since that time, many user comments and enhancements have been incorporated into the program providing a much more powerful and user-friendly system. This version has been designated IRRAS 2.5 and is the subject of this Reference Manual. Version 2.5 of IRRAS provides the same capabilities as Version 1.0 and adds a relational data base facility for managing the data, improved functionality, and improved algorithm performance.

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- Howard D. Stewart - for his support in designing the overall IRRAS concepts and for his software support in implementing these concepts.

- Dale M. Snider and Kurt L. Wagner - for their contribution to the graphical concepts and software development in both IRRAS 1.0 and the improved methods of IRRAS 2.5.

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INTEGRATED RELIABILITY AND RISK ANALYSIS SYSTEM
(IRRAS) VERSION 2.5
USER'S GUIDE

EXECUTIVE SUMMARY

The Integrated Reliability and Risk Analysis System (IRRAS) is being developed at the Idaho National Engineering Laboratory (INEL) as the U.S. Nuclear Regulatory Commission's (NRC's) state-of-the-art microcomputer-based probabilistic risk assessment (PRA) model development and analysis tool to address key nuclear plant safety issues.

IRRAS is an integrated PRA software tool that gives the user the ability to create and analyze fault trees and accident sequences using a microcomputer. This program provides functions that range from graphical fault tree and event tree construction to cut set generation and quantification.

The INEL's role in the IRRAS program is that of software developer and interface to the user community, including training and technology transfer. Version 1.0 of the IRRAS program was released in February of 1987 to prove the concept of performing this kind of analysis on microcomputers. That version contained many of the basic features needed for fault tree analysis and was well received by the PRA community. Since the release of Version 1.0, many user comments and enhancements have been incorporated into the program, providing a much more powerful and user-friendly system. This version has been designated IRRAS 2.5.

IRRAS has all the capabilities and functions required to create, modify, reduce, and analyze fault tree models used in the analysis of complex systems and processes. IRRAS uses advanced graphic and analytical techniques to achieve the greatest possible realization of the potential of the microcomputer. Version 2.5 of IRRAS provides all of the same capabilities as Version 1.0 and adds a relational data base facility for managing the data, improved functionality, and improved algorithm performance.

1. INTRODUCTION

The Integrated Reliability and Risk Analysis System (IRRAS) software development project was started as a result of a recognized need for microcomputer-based software to aid the probabilistic risk assessment (PRA) analyst. The initial scope of the project was to provide a software package which could demonstrate the feasibility of using the microcomputer as a workstation for performing PRA analyses. This package did not necessarily need to perform all of the functions required; however, it did need to provide certain essential functions such as fault tree construction, failure data input, cut set generation, and cut set quantification. The result of this software development project was IRRAS 1.0. That version of the software was released in February of 1987 and contained only the essential concepts mentioned above.

IRRAS 1.0 was an immediate success and clearly demonstrated not only the tremendous need but also the feasibility of performing this work on a microcomputer. As a result of this success, IRRAS 2.0 development was begun. This package was designed to be a comprehensive PRA analysis package and included all the functions necessary for a PRA analyst to perform his or her work. The areas that were not treated in version 1.0 were addressed, and a complete, integrated package was developed. Since IRRAS version 2.0 was a complete rewrite from version 1.0, a thorough test plan was necessary. The major features of IRRAS 2.0 along with an Alpha test were completed in early March of 1988. Following the Alpha test, approximately 15 sites were selected from among the sites currently using IRRAS 1.0. and were sent a Beta test version of IRRAS 2.0. In May of 1988, we completed the Beta test and began work on fixing any bugs found and including those desired new features which could reasonably be incorporated into version 2.0. IRRAS 2.0 was released in June 1990 and work began on the development of IRRAS 2.5.

IRRAS version 2.5 is an integrated PRA software tool that gives the user the ability to create and analyze fault trees and event trees using a personal computer (PC). This program provides functions for fault tree and event tree construction and analysis. The fault tree functions range from graphical fault tree construction to fault tree cut set generation and quantification. The event tree functions include graphical event tree construction, the linking of fault trees, defining accident sequences, generating accident sequence cut sets, and quantifying them.

The objective of the IRRAS development is to provide the U.S. Nuclear Regulatory Commission (NRC) with a PC-based tool that can be used by NRC staff to evaluate incidents in a timely manner. IRRAS 1.0 was released in February 1987. Since that time, it has been distributed to over 400 users in the United States. These users include NRC staff, national laboratories, contractors, vendors, utilities, architectural engineering firms, consultants, universities, other government agencies, and their contractors. IRRAS is being used as an analysis tool in the resolution of generic issues, inspection activities, and other NRC programs.

At the center of the PRA is the fault tree model. This model, along with component reliability data, provides the basis for risk analysis in most PRA methods. Prior to the development of IRRAS, an analyst would generate models using an alphanumeric text editor. The information would be input in a format compatible with the analysis software, such as SETS, used to process the information. When changes to the model were needed, the analyst would go back to the text file and modify the card images to reflect the changes in the logic model. The analyst would then resubmit them to generate the new cut sets. This process is prone to errors and difficult for the analyst to

visualize. IRRAS helps eliminate this problem.

IRRAS automates the model creation, manipulation, modification, and quantification processes. Designed for the IBM-PC[a] and compatibles, IRRAS is readily accessible and portable. Taking advantage of fault tree solving algorithms developed at the Lawrence Livermore National Laboratory, IRRAS is quite fast and powerful.

IRRAS simplifies the analysis process and automates the construction of input to the analysis software. The analyst can graphically construct and modify fault trees. IRRAS gives the users better visualization of the fault tree and simplifies the construction and maintenance. The program supports all of the basic constructs involved in fault tree construction, including NOT gates. Once the fault tree is constructed, the program automatically generates the alphanumeric input for the analysis software. The component reliability information is then easily input into the IRRAS data base using specially designed menus and screens.

After constructing the system fault tree models, the analyst processes these models with an integrated fault tree analysis package. This package includes the capability to read a fault tree and failure rate data associated with the basic events. The program then generates the minimal cut sets of the fault tree and quantifies the fault tree top event probability using the minimal cut set upper bound. Importance measures for both cut sets and basic events are calculated. The results are documented in various reports generated by the program. The user may select truncation of cut sets by size and/or probability and specify the gate where reduction is to begin. The user may perform some cut set level analysis by using a cut set editor to modify the cut sets, save the new cut sets, and recalculate the minimal cut set upper bound and the new importance measures.

The analyst defines accident sequences in terms of the systems. IRRAS 2.5 has the ability to link fault trees according to the accident sequence logic to create core damage sequence cut sets. These accident sequence cut sets are then quantified to determine the accident sequence frequency. Importance measures are also calculated.

Many features of mainframe codes have been incorporated into IRRAS 2.5. Improved fault tree reduction techniques, such as identification of independent subtrees and coalescing gates, help to speed up the analysis and make it possible to process larger logic models. Error-checking routines have been added to ensure that the input can be processed when it is time to analyze the fault trees.

In IRRAS 2.5, the graphical fault tree logic can be directly generated from alphanumeric input. This allows the user to read mainframe code input files, such as SETS, and generate the fault tree graphics. The logic models are then easily modified for re-analysis.

IRRAS 2.5 includes fault tree, event tree and cut set editors to improve the analysis capabilities without requiring complete regeneration and reduction of the fault trees. Basic event or initiating event frequencies are easily changed. Cut sets are easily modified with the cut set editor

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to add recovery actions, or cut sets may be deleted if desired. These changes can be saved in the data base and quantified as desired.

The sections that follow provide the user with the detailed information needed to become familiar with IRRAS 2.5. Sections 3 through 10 present a step-by-step approach to using the basic capabilities of IRRAS. Appendix A provides the specifics of hardware requirements and installation; Appendix B provides a more detailed treatment of data base relations and other supporting documentation. Appendix C contains data interchange formats.

NOTE: It should be noted that this document assumes the reader is familiar with PRA methods and terminology. This manual does not instruct the reader in PRA methodology, but merely serves as a reference manual for the IRRAS user.

2. GETTING TO KNOW IRRAS 2.5

The purpose of this section is to give you, the user, an overview of what IRRAS 2.5 can do. We begin with brief discussions of the IRRAS 2.5 modules. (Each module roughly corresponds to a major function or feature.) Next, we explain a little about the IRRAS 2.5 data base so you can get a feeling for what happens to the information you put in IRRAS 2.5. Finally, we give some pointers on how to best get around inside the program with some special keys.

2.1 IRRAS 2.5 Modules

We have structured IRRAS 2.5 so that the various functions are contained in individual modules or program units. Each module is activated by the use of a command from a menu on the screen. The main modules are SELECT Family, BUILD Fault Trees, FAULT Trees Analysis, CREATE Event Trees, ANALYZE Sequences, MODIFY Data Base, REPORT on Data Base, and UTILITY Options. Each module is described below.

The SELECT Family module is used to select the family data set you wish to work with and provides the capability of copying raw (MAR-D) data files or IRRAS data base files into a specific family.

The BUILD Fault Trees module is used to build and edit fault tree models and output them to several hard copy hardware devices. Fault trees can be drawn using the keyboard or a mouse. If you use the keyboard, you'll soon see the advantages of getting a mouse. We have used pop-up menu technology in this module to make tree drawing as simple as possible.

The FAULT Tree Analysis module is used to quantify the fault tree. Here you determine the minimal cut sets, calculate the probability of failure of the top event of the fault tree, calculate the importance measures of the basic events and the cut sets, and perform uncertainty analysis on the top event failure probability. Sensitivity analysis can be done by changing the failure probability of basic events and requantifying.

The CREATE Event Trees module is used to build, edit, and link event trees in a fashion similar to the way the fault trees are constructed in IRRAS 2.5. This greatly simplifies and automates the event tree construction and analysis process.

The ANALYZE Sequences module is a powerful sequence analyzer. This module generates the cut sets for an accident sequence by combining the cut sets for the fault trees that make up the sequence. Comparisons are made between the cut set lists for successful and failed fault trees to eliminate impossible failure combinations (similar to the delete term option in SETS). Once the sequence cut sets have been generated, you can quantify the sequence, calculate importance measures, and perform uncertainty analysis. The results can be displayed on the screen, sent to a printer, or written to a file for later use.

The MODIFY Data Base module provides access to the IRRAS 2.5 relational data base that is created, in part, from use of the other modules. Figure 1 shows the structure of this data base. All information is grouped into families. A family can be a facility, a group of systems, or any other logical group for which fault trees or sequences are desired. You define the families and assign

descriptions in this module. Fault trees are assigned to families in the BUILD Fault Trees module. Sequences are created and assigned descriptions in the MODIFY Data Base module. Basic events are automatically extracted from the fault trees assigned to the family, but you must assign reliability data and descriptions in the MODIFY Data Base module. All additions, deletions, and modifications to the data base are made here. Section 2.2 and Appendix B provide more detailed information on the data base.

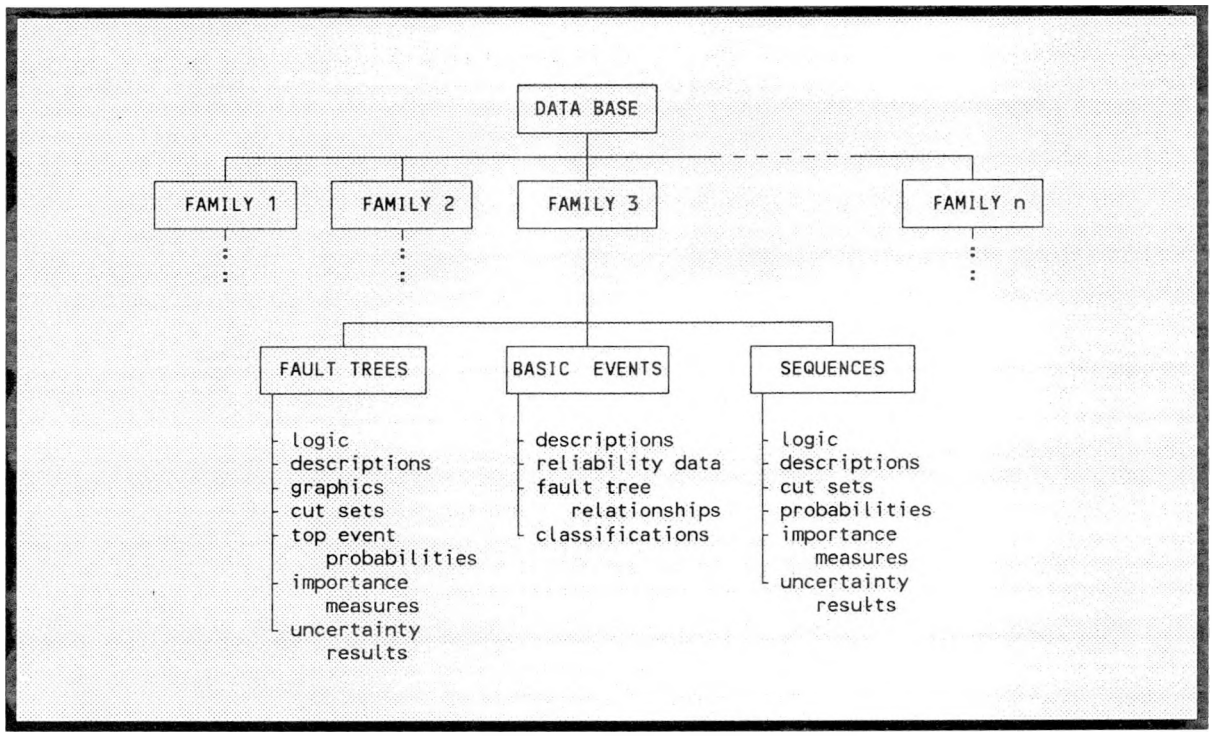


Figure 1. IRRAS 2.5 data base structure.

The REPORT on Data Base module lets you see what is in the IRRAS 2.5 data base. Reports are available on families, basic events, attributes, systems, event trees, sequences, end states, and user information.

The last module, UTILITY Options, performs program and computer-related tasks such as setting new machine constants after a hardware configuration change or interfacing with SETS or the PRA data base. The Utility option consists of five functions: Define Constants, Load MAR-D Data Files, Extract MAR-D Data Files, Version 1.0/2.5 Interface, and Recover Data Base. The first option, Define Constants, is used to indicate system hardware configuration, set uncertainty and cut set defaults, and set event tree graphics defaults. The second option, Load MAR-D data Files, allows you to load raw files into IRRAS. Extract MAR-D Data Files allows you to output the IRRAS data base records into files that conform to MAR-D data format. The Version 1.0/2.5 Interface allows you to convert data base files using IRRAS Version 1.0 software to IRRAS Version 2.5, or from Version 2.5 to Version 1.0. Finally, the Recover Data Base option allows you to rebuild the index files to each relation in the data base.

2.2 IRRAS 2.5 Data Base Concepts

Before you can use IRRAS 2.5 effectively, you need a good understanding of the IRRAS 2.5 data base structure and concepts. The data base provides an effective way to manage the inputs and outputs of the various modules.

The IRRAS 2.5 data base is divided into families. A family is the first thing that must be created when using IRRAS 2.5. As delivered, IRRAS 2.5 provides an initial family called DEMO FAMILY. (Once you are comfortable with IRRAS 2.5, you may want to clear this family from the data base.) A family is any logical grouping of fault trees and sequences with their associated basic events, cut sets, reliability data, and descriptions. Access to any portion of the data base is obtained through the appropriate family.

A fault tree is automatically assigned to the current family selected when the BUILD Fault Trees module is exited. The basic events used by the fault tree are checked against the events already assigned to the family. Only new basic events are added to the family list. Thus, for a given family there is only one list that contains all the basic events for all the fault trees in the family. This ensures that the reliability data used for a basic event in one tree are identical to those used for the same event in another tree in the family.

The family relation maintains data common to all fault trees in the family, including

- family name and description,
- basic event names and attributes,
- event-to-fault tree association,
- event-to-sequence association,
- fault tree change status information, and
- sequence change status information.

The fault tree relation maintains data for the following fault tree attributes:

- fault tree name and description,
- fault tree logic,
- graphic representation,
- minimal cut sets,
- top event probability,
- importance measures, and

- uncertainty analysis results.

Similarly, the relation defined for an accident sequence includes:

- name and description,
- logic (combination of successful and failed systems),
- minimal cut sets,
- sequence probability,
- importance measures, and
- uncertainty analysis results.

The event tree relation includes:

- event tree name and description,
- graphic representation, and
- initiating event.

A relation is also maintained to track event changes relating to event class and event probability.

Unrelated to trees and/or families is the user/system data.

The relations are permanent relations used to maintain the IRRAS 2.5 data base. For each relation, three files exist:

- *.DAT,
- *.IDX, and
- *.BLK.

The *.DAT file contains the actual data and information about which data constitutes a "key". The *.IDX file contains indices into the data for keyed fields. Finally, the *.BLK file contains variable length data (such as cut sets) that are accessible through pointers contained in the *.DAT file.

Appendix B contains a detailed report of the contents of each relation in the data base, including temporary relations (file number = 0).

2.3 Other Things You Should Know

The installation procedure for loading IRRAS 2.5 into your computer is found in Appendix A. The loading process creates three new directories if they do not already exist. These are \PRADATA, \PRATOOLS, and \HALO88. The PRATOOLS directory contains the program, the \PRADATA\DEMO directory contains sample data, and the HALO88 directory contains the graphics package. These directories take approximately 4000K of memory on the hard disk when first loaded. Of course, storage requirements go up as you use the program and generate more data.

IRRAS 2.5 uses approximately 550K of internal memory when executed, therefore, resident programs such as Sidekick must be unloaded before using IRRAS 2.5 on a 640K machine.

The following procedure assumes your system is running DOS 3.0 or newer. If your DOS version is older than 3.0, you must upgrade to use IRRAS 2.5.

To start IRRAS 2.5, simply change directories to PRADATA (CD\PRADATA), type IRRAS, and press <Enter>. (The <> designates pressing the indicated key.) This will execute IRRAS 2.5 with the keyboard as the graphics input device unless you have a mouse and have loaded your mouse driver. If so, then you may use either input device interchangeably.

On the very first entry into IRRAS 2.5 after installation, the IRRAS Constants form will appear. This form is shown in Figure 2. With this form, you tell the program the configuration of your hardware and the default values desired for various functions within the program. This form, once completed, will not appear on subsequent entries into IRRAS. If you desire to change a default or your hardware configuration has changed, this form can be called up from the UTILITY Options menu (see Section 10).

When this form is filled out properly, press <Enter> to place the information in the data base. Another defaults/constants screen will appear. This screen, shown in Figure 3, establishes the defaults for the fault tree graphics. Once this is filled in properly, press <Enter>, and a third and final screen (Figure 4) will appear with defaults for the event tree editor. Fill this screen in as required and press <Enter>.

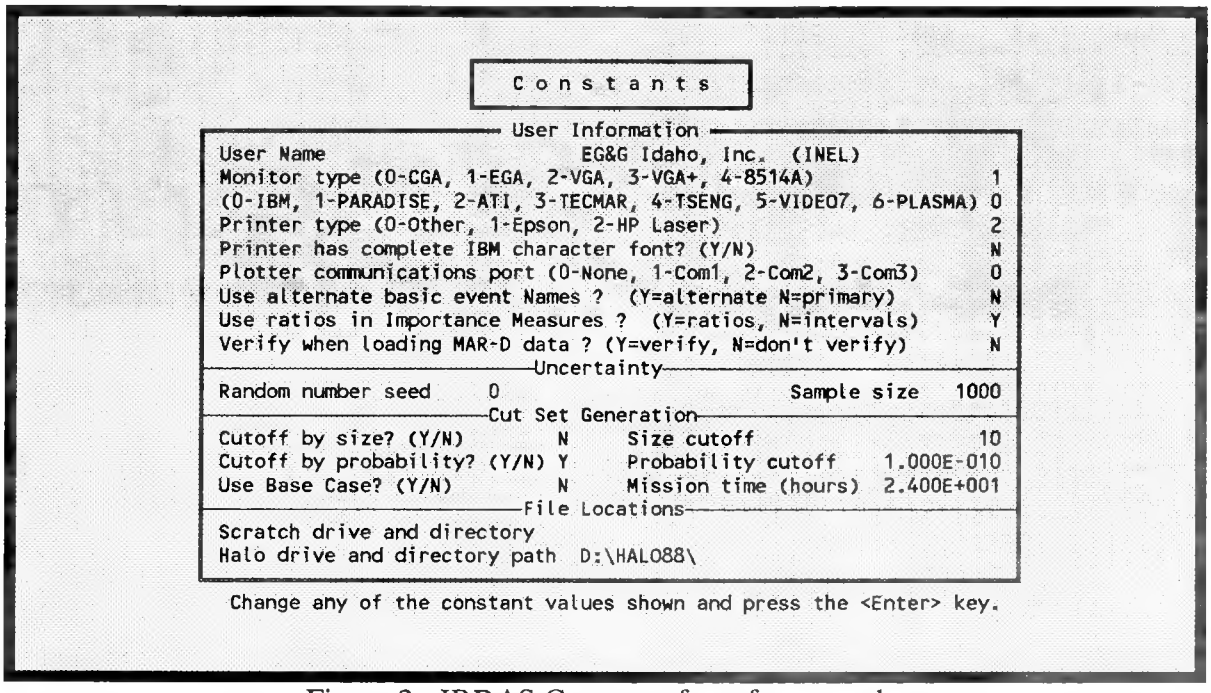


Figure 2. IRRAS Constants form for example.

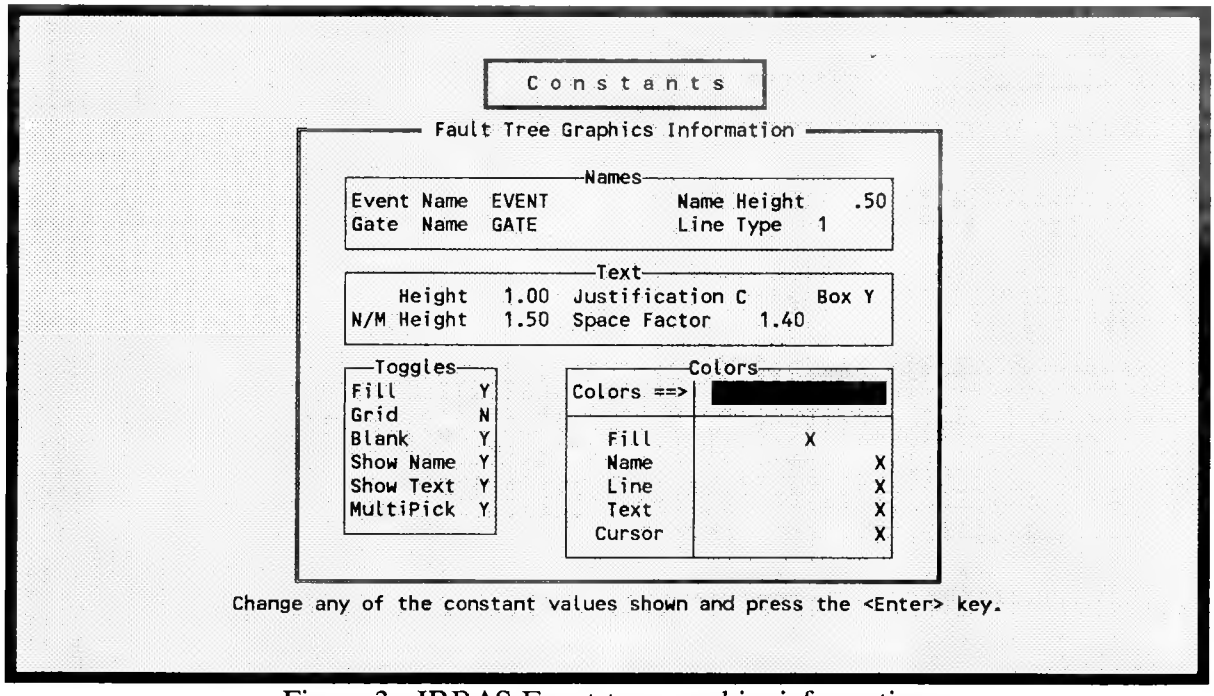


Figure 3. IRRAS Event tree graphics information.

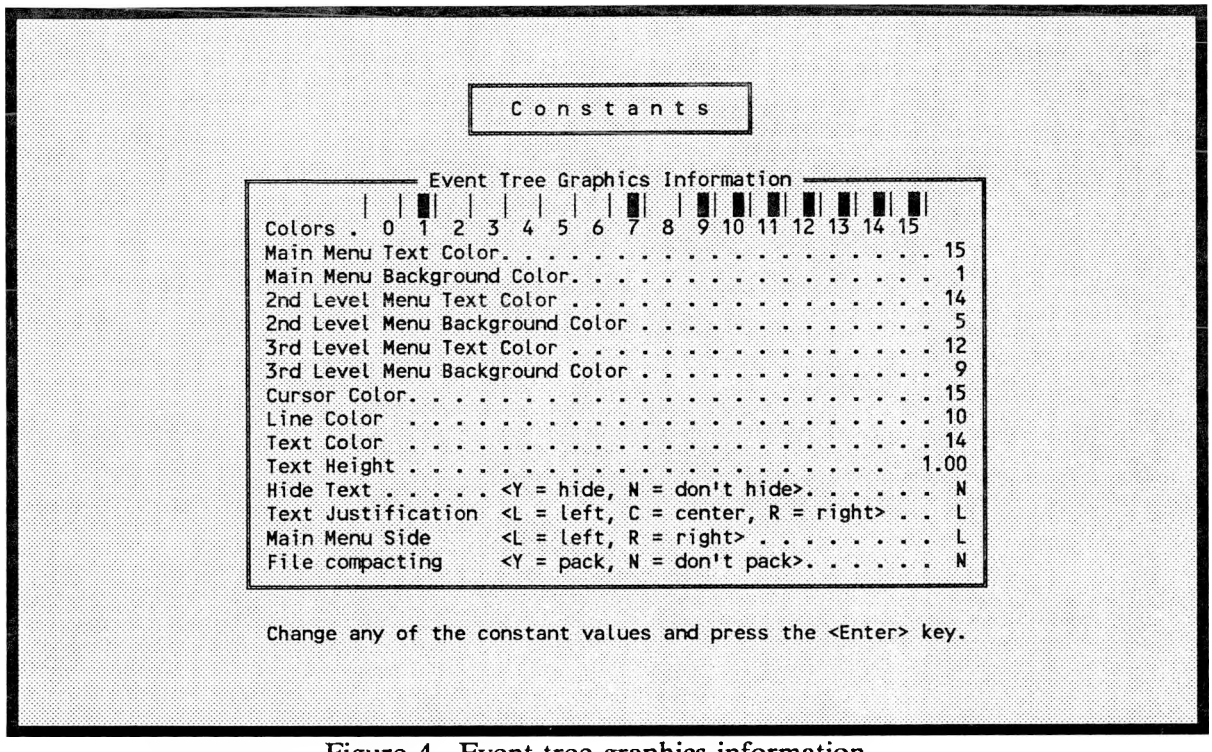


Figure 4. Event tree graphics information.

2.4 Getting Around Inside IRRAS 2.5

Option selection from any menu with a vertical list of options can be done in several ways. The up and down arrow keys can be used to move a highlight through the options. When the highlight is on the desired option, press <Enter> to select the option. The <Space bar> will also move the highlight through the options. Another method of selecting an option is to type in the letter(s) of the option and press <Enter>. On menus that have horizontal lists of options, the highlighted letter(s) of the option must be typed in the option field followed with <Enter>.

Certain portions of the program have help screens as aids to the user. These help screens are accessed by pressing the <F1> key. The <Esc> key is used to cancel or abort a function.

Pressing <Alt> H causes the Key Functions help screen to appear. This screen is shown in Figure 5. This screen identifies the functions of some special keys for use on fill-in-the-blank type forms used in IRRAS 2.5.

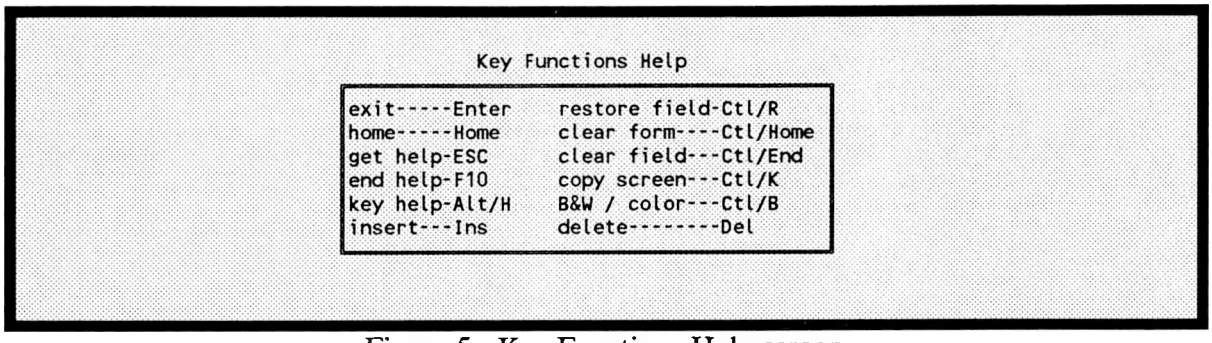


Figure 5. Key Functions Help screen.

The carriage return <CR> or <Enter> key sends a completed form to the program for execution. The arrow keys and <Tab> key move the cursor around the fields on a form. The <Home> key moves the cursor to the home field on the form. The <Ins> key inserts characters in the text in a field. The <F10> key terminates a help screen. <Ctrl> R restores a field to its original setting. <Ctrl> <Home> clears all entries in all fields on the form. <Ctrl> <End> clears the selected field. <Ctrl> B switches the display between black and white and color. <Ctrl> K copies the screen into a file on the disk named SCREEN.CPY. Multiple uses of <Ctrl> K will cause each screen to be appended to the bottom of the SCREEN.CPY file.

2.5 *Invoking IRRAS*

As mentioned earlier, to invoke IRRAS type **IRRAS** at the C:\PRADATA prompt. When you invoke this option, the main menu will be displayed (see Figure 6). Each of the menu options is discussed in the following sections.

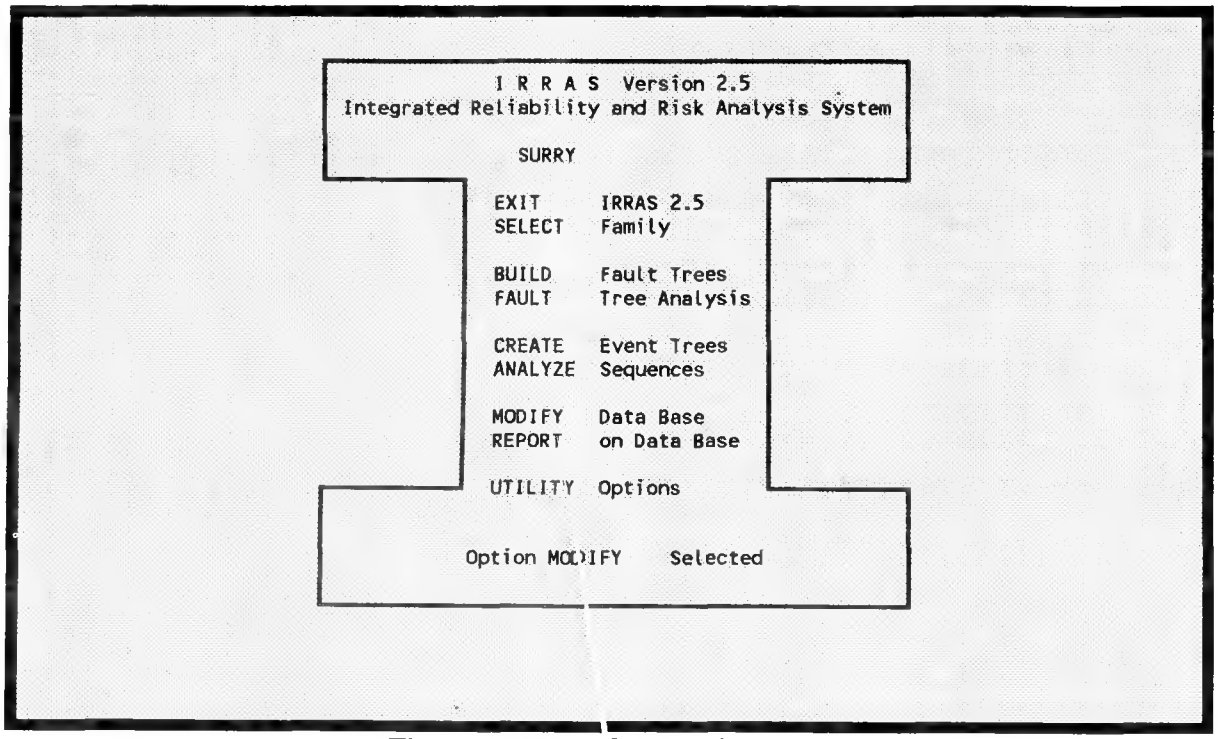


Figure 6. IRRAS 2.5 main menu.

3. SELECT FAMILY

This option allows you to select the family data set you wish to work with and provides the capability of copying IRRAS data base files into a specific family. A family is a group of models, such as those for a single plant, unit, or facility. When the family is successfully selected, the name is shown in the upper left corner of the screen.

The current directory is the current family unless you select another family. IRRAS retains the last family you selected when you exited the program so when you enter IRRAS again the last family is the current family. The Select Family screen (Figure 7) lists all families in the IRRAS data base. The select family function provides four options: Exit, Select, Family Copy, and Copy. In addition, three function keys are available:

<Esc> Exits the select family option.

<F1> Displays on-line help messages.

<F5> Allows you to position the cursor on a specified family. When you press <F5> a black line will appear on the screen. Enter all or part of the family name you wish to locate and press <Enter>. The family which most closely matches the name entered will be located. This function is especially useful when you have several screens of families to display.

3.1 Exit

Typing <E> in the option field and pressing <Enter>, or pressing <Esc> will return you to the IRRAS main menu.

3.2 Select

This option is used to select the family data files that will be accessed during subsequent IRRAS functions. To invoke the option, type <S> in the option field, highlight a family, and press <Enter>. If a family is not highlighted, the message **Position the cursor over the family to select** will be displayed. When a family is highlighted and selected you will be returned to the IRRAS main menu where the selected family name will appear at the top. For later functions, the selected family name will appear in the box in the upper left corner of the screen. If for any reason the family cannot be selected, the message **Unable to select desired family** appears, the previously selected family will be retained, and you will be given another chance to select a family. If the highlighted family's data version does not match the current software version, the version update screen appears (Figure 8), and you will be asked if you want to rebuild the data. To select the family, the data must be rebuilt, so enter a <Y> to rebuild, and then select the desired family. If you type <N>, that family's data will not be rebuilt, that family will not be selected, the former selected family will be retained, and the message **Unable to select desired family** appears.

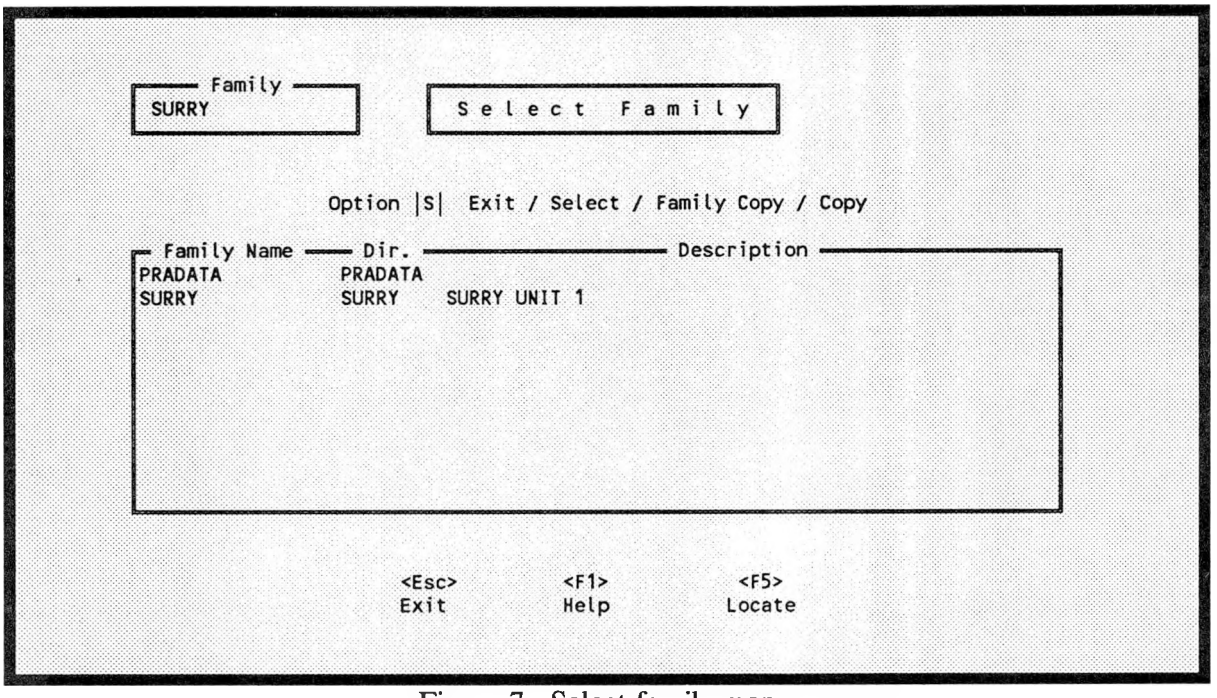


Figure 7. Select family menu.

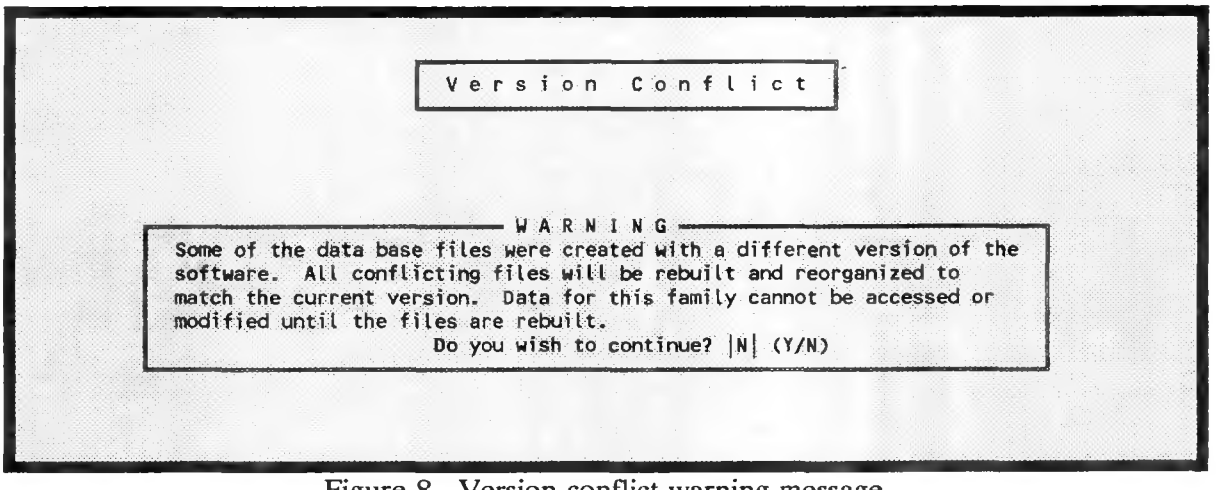


Figure 8. Version conflict warning message.

3.3 Family Copy

This option provides the means of copying data base files between families. To invoke this option, type <F> in the option field, highlight a family, and press <Enter>. If no family has been highlighted, the message **Position the cursor over the family to copy from** appears at the bottom of the screen. If this message appears, highlight a family and press <Enter>. The message **Position the cursor over the family to copy to** will then appear. Again, highlight a family and press <Enter>. All family data base files will be copied from the first family highlighted to the second family highlighted. When the files are copied, the message **Family successfully copied** appears.

3.4 Copy

This option provides the means of copying any file (raw data and/or a MAR-D file) into any family. To invoke this option, type <C> in the option field, highlight the family to copy to, and press <Enter>. If no family is highlighted, the message **Position the cursor over the family to copy to** is displayed at the bottom of the screen. If this message appears, highlight a family and press <Enter>. A new screen, File Copy (shown in Figure 9), requesting the path and file name of the source data being copied into the selected family is displayed. Specify the entire path of the data to be copied and press <Enter> (For example, A:*.* or D:\RAWDATA\DEMO*.*). A confirmation message **File(s) successfully copied** is displayed when the files have been copied.

Entering an invalid path, a non-existent file name, or just pressing <Enter> without a path specified results in the data not being located, and displays an error message **Unable to locate requested file(s)**. To return to the Select Family screen without copying a file, press <Esc>. The message **Copy attempt terminated at users's request** appears and the Select Family screen is redisplayed.

If you want to copy to a family that does not yet exist, you must first add the family. To add a family, see the Modify Data Base option. After you have added the family, you may return to the Select Family option and copy your data base into the new family.

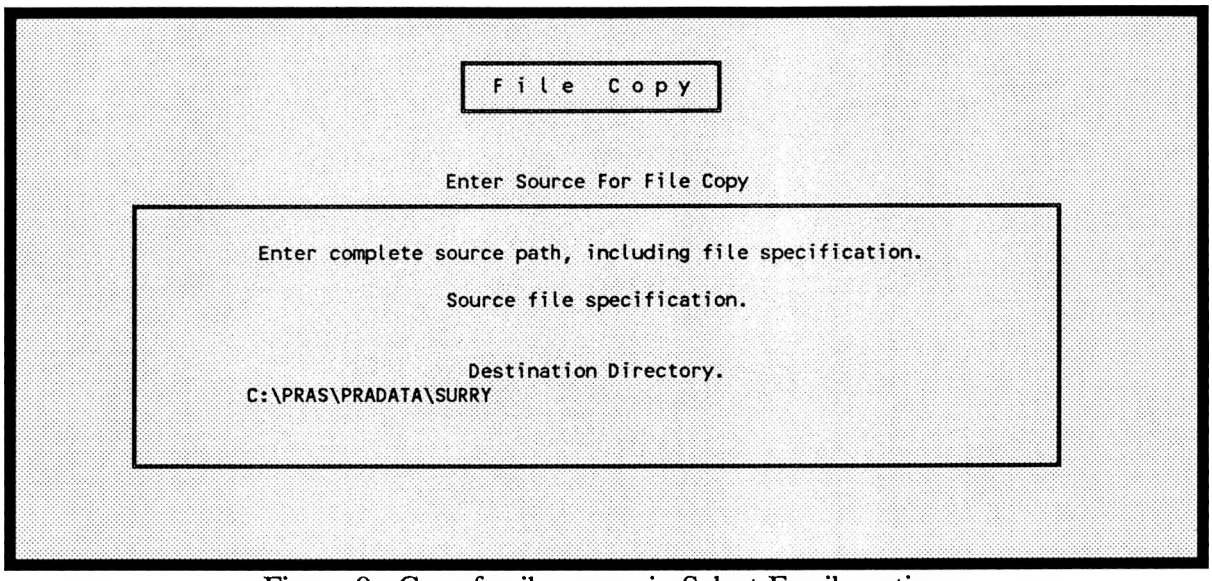


Figure 9. Copy family screen in Select Family option.

4. BUILD FAULT TREES

This option allows you to graphically build and edit fault tree models and output them to several hard copy hardware devices. The defaults for the hardware devices are set in the constants screen (Figure 2). When this option is selected, Figure 10 is displayed.

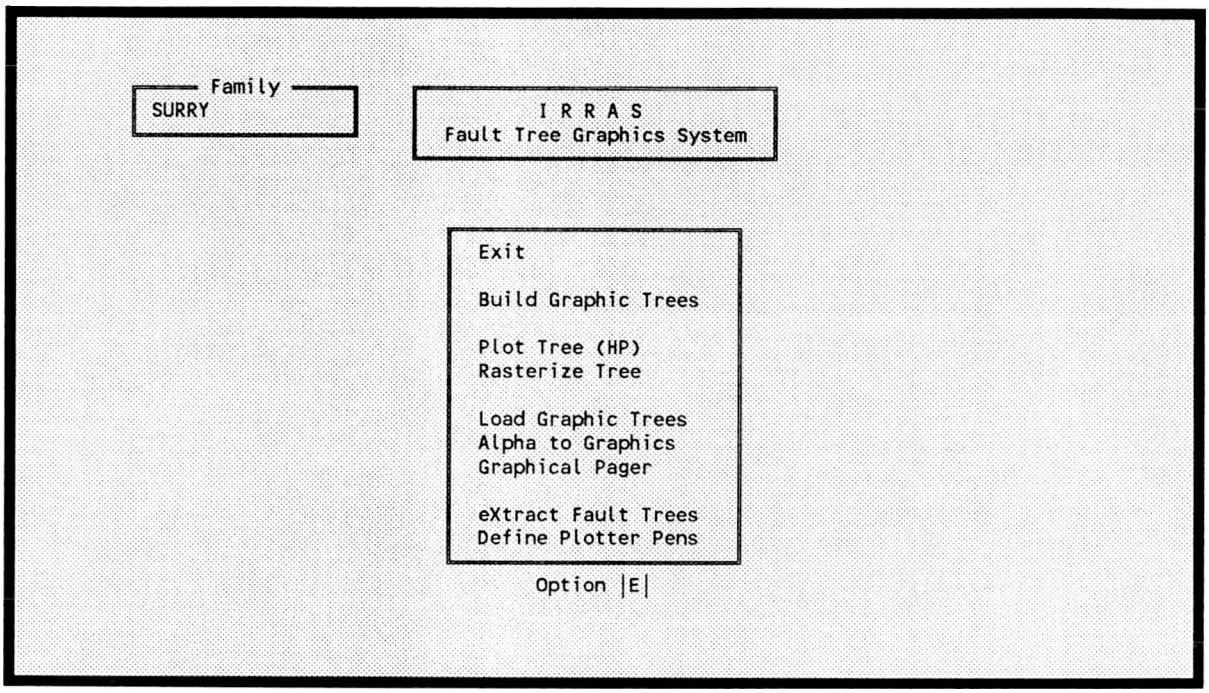


Figure 10. Build fault trees menu.

As shown, the following options are available:

Exit	-	Returns you to the IRRAS Main Menu.
Build Graphic Trees	-	Allows you to construct the actual fault tree diagram.
Plot tree	-	Allows you to plot an HP graphics file.
Rasterize Tree	-	Allows you to "rasterize" a selected fault tree diagram. This process is used to prepare and format the diagram for printing on a laser output device.
Load Graphic Trees	-	Allows you to load graphics files.
Alpha to Graphics	-	Allows you to convert an alpha file to a graphical format.

Graphical Pager	-	Allows you to break-up a diagram into multiple pages.
eXtract Fault Trees	-	Allows you to extract fault trees, clear extracted fault trees, and display extracted fault trees.
Define Plotter Pens	-	Allows you to assign colors to your plotter pens.

Each of these options is discussed in the following paragraphs.

4.1 Build Graphic Trees

This option allows you to construct the actual fault tree diagram. You may start building from scratch or from an existing file to generate or modify logic. When this option is selected, Figure 11 will be displayed. The editing commands are shown in the left column, while the rest of the screen is the drawing surface. Many of the commands listed in the editing column have additional pop-up menus associated with them. The cursor is used to position pop-up menus, draw lines, place drawing symbols, and select menu options.

To invoke any of the editing commands (using a mouse), position the cursor over the desired editing command on the active menu. The active menu is the last menu you pulled up or moved. When the editing command box is highlighted (a white line outlines the box), press the left mouse button. The command is now invoked. Each editing command is described in the following paragraphs.

4.1.1 EXIT

This option terminates the editing session and returns you to the previous screen. To invoke this option, position the cursor over the EXIT box and press the left mouse button or <Enter>.

4.1.2 MOVE

The move command, which is represented by ←→, allows you to position the editing command menu anywhere on the screen. When you invoke this command, a white line surrounds the entire editing menu. Drag the cursor to position the outline at the new location and press the left mouse button or <Enter>. The menu will be displayed at the new location.

4.1.3 SHOW

This command clears the screen and re-displays the currently defined diagram.

4.1.4 BILD

This command allows you to generate drawing symbols. When you invoke this command, an additional pop-up menu is displayed (Figure 12). This submenu contains all the constructs needed to create fault tree models. These constructs are

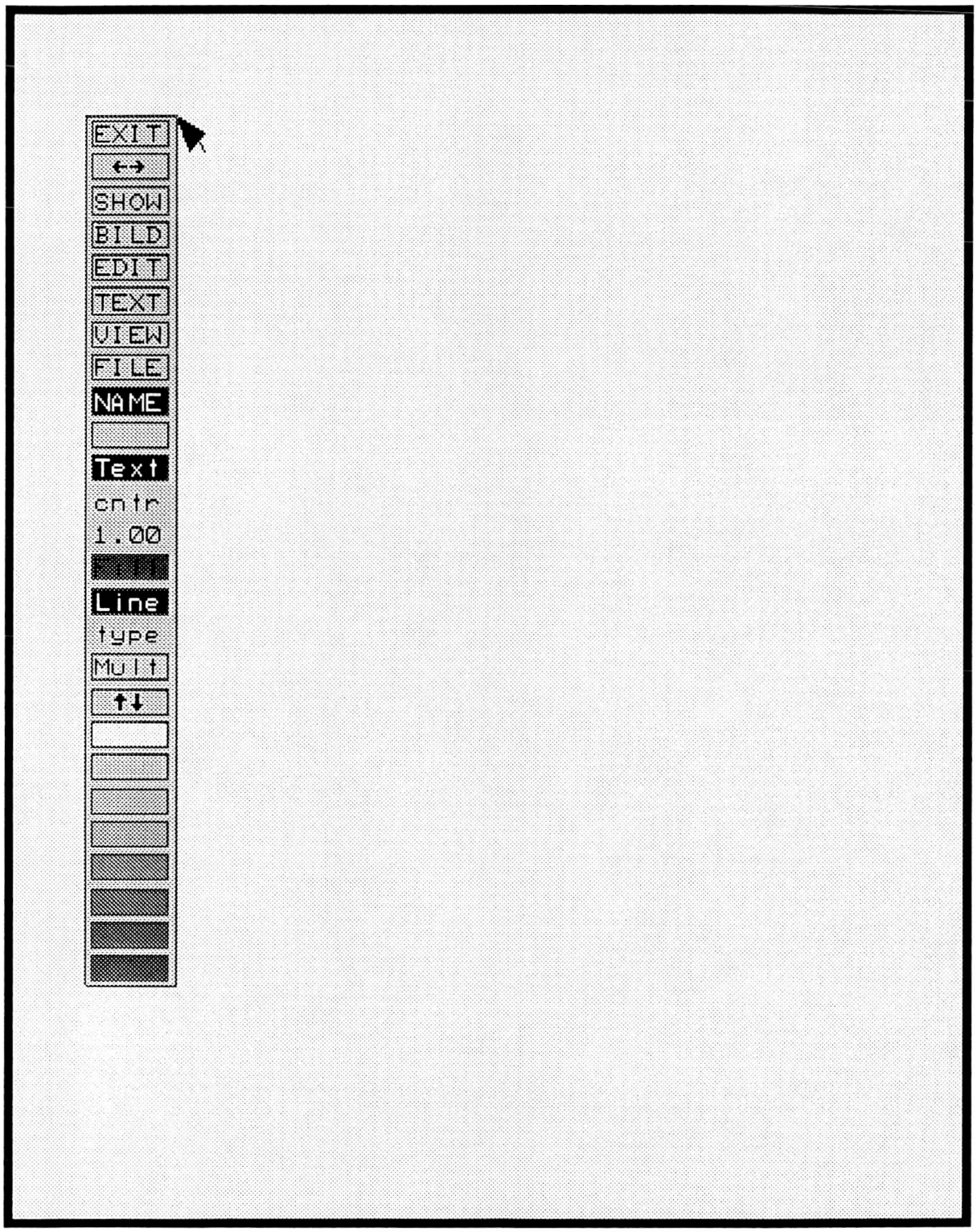


Figure 11. Editing commands for the BILD option.

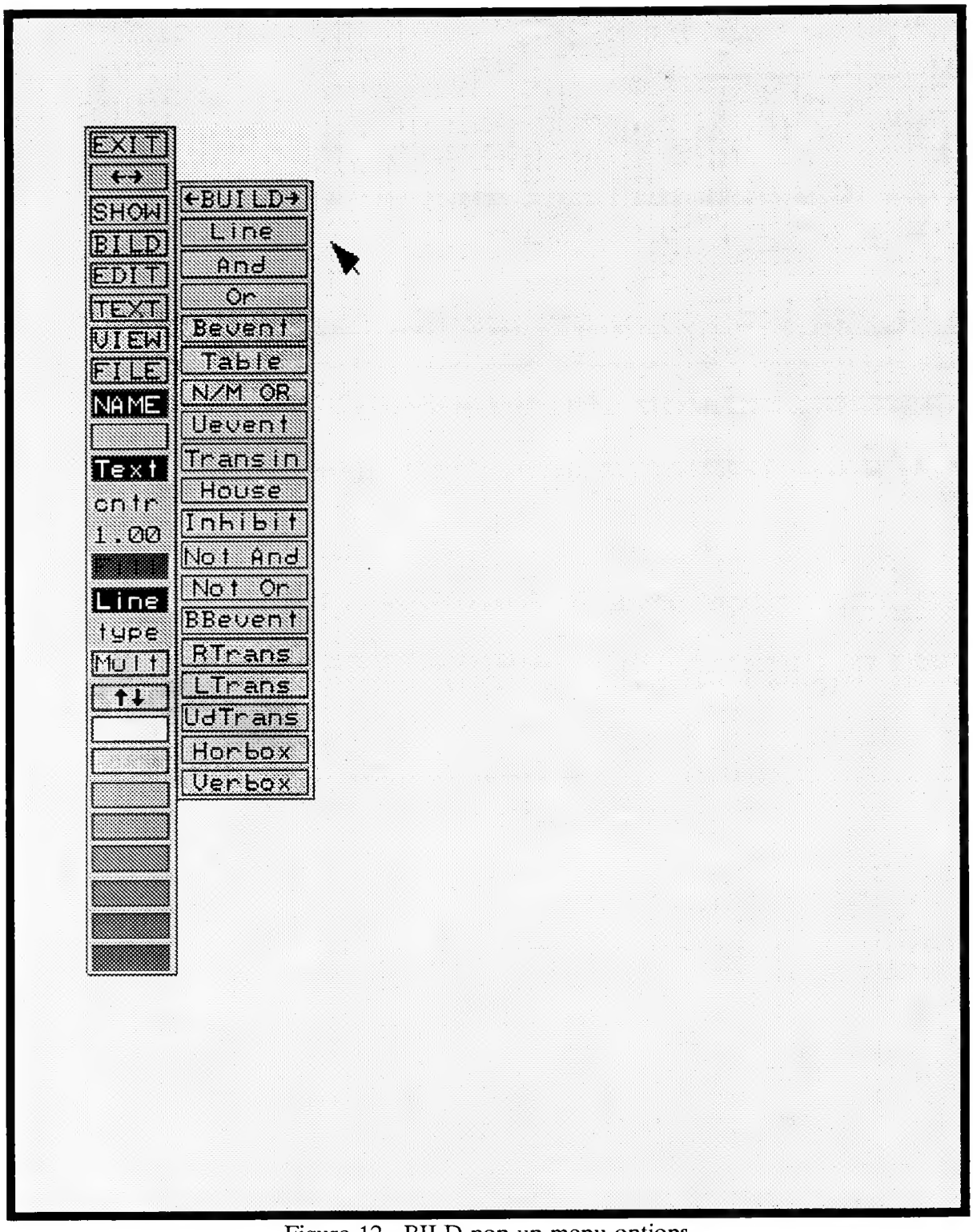


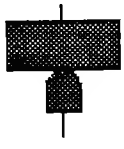
Figure 12. BILD pop-up menu options.

←BUILD→

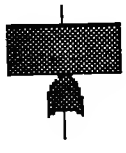
Allows you to move the BUILD pop-up menu to a new location on the screen. When you invoke this command, a white outline box appears. Drag the cursor to position the outline to the desired location and press the left mouse button or <Enter>. The BUILD pop-up menu will be re-displayed at the new location.

Line ——————

Allows you to draw lines. When you invoke this option, you will be prompted with **Enter points for line.** The cursor will change from an arrow to a cross hair. Position the cross hair at the point where you want the line to begin, press the left mouse button or <Enter>. The cross hair will now change into a small dot. Drag the cursor in the direction you want the line to follow. When satisfied with the length and direction of the line, press the left mouse button or <Enter>. If the multipick option is turned on (see Section 4.1.16), the prompt **Enter points for next line** will appear. You may draw another line or press the right mouse button to terminate line mode. If you terminate line mode, the cross hair will return. Press the right mouse button to return to the normal cursor mode (arrow).

And 

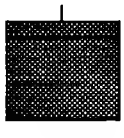
Generates the "And" symbol. Move the symbol to the desired screen location and press the left mouse button or the <Enter> key. If the multipick option is turned on (see Section 4.1.16), another And symbol will appear automatically. You can position this symbol to the desired location or press the right mouse button to terminate And symbol generation.

Or 

Generates the "Or" symbol. Move the symbol to the desired screen location and press the left mouse button or the <Enter> key. If the multipick option is turned on (see Section 4.1.16), another Or symbol will appear automatically. You can position this symbol to the desired location or press the right mouse button to terminate Or symbol generation.

Bevent 

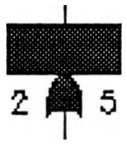
Generates the "Bevent" symbol. Move the symbol to the desired screen location and press the left mouse button or the <Enter> key. If the multipick option is turned on (see Section 4.1.16), another Bevent symbol will appear automatically. You can position this symbol to the desired location or press the right mouse button to terminate Bevent symbol generation.

Table 

Generates the "Table" symbol. Move the symbol to the desired screen location and press the left mouse button or the <Enter> key. If the multipick option is turned on (see Section 4.1.16), another Table symbol will appear

automatically. You can position this symbol to the desired location or press the right mouse button to terminate Table symbol generation.

N/M OR



Generates the "N/M OR" symbol. Move the symbol to the desired screen location and press the left mouse button or the <Enter> key. The prompt **Enter N (out of) M values** will appear at the bottom of the screen. Enter the required values (i.e. 2 5) and press <Enter>. If the multipick option is turned on (see Section 4.1.16), another N/M OR symbol will appear automatically. You can position this symbol to the desired location or press the right mouse button to terminate N/M OR symbol generation.

Uevent

Generates the "Uevent" symbol. Move the symbol to the desired screen location and press the left mouse button or the <Enter> key. If the multipick option is turned on (see Section 4.1.16), another Uevent symbol will appear automatically. You can position this symbol to the desired location or press the right mouse button to terminate Uevent symbol generation.

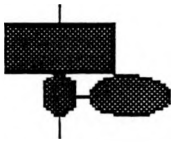
Transin

Generates the "Transin" symbol. Move the symbol to the desired screen location and press the left mouse button or the <Enter> key. If the multipick option is turned on (see Section 4.1.16), another Transin symbol will appear automatically. You can position this symbol to the desired location or press the right mouse button to terminate Transin symbol generation.

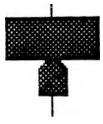
House

Generates the "House" symbol. Move the symbol to the desired screen location and press the left mouse button or the <Enter> key. If the multipick option is turned on (see Section 4.1.16), another House symbol will appear automatically. You can position this symbol to the desired location or press the right mouse button to terminate House symbol generation.

Inhibit



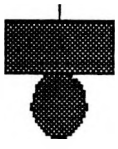
Generates the "Inhibit" symbol. Move the symbol to the desired screen location and press the left mouse button or the <Enter> key. If the multipick option is turned on (see Section 4.1.16), another Inhibit symbol will appear automatically. You can position this symbol to the desired location or press the right mouse button to terminate Inhibit symbol generation.

Not And 

Generates the "Not And" symbol. Move the symbol to the desired screen location and press the left mouse button or the <Enter> key. If the multipick option is turned on (see Section 4.1.16), another Not And symbol will appear automatically. You can position this symbol to the desired location or press the right mouse button to terminate Not And symbol generation.

Not Or 

Generates the "Not Or" symbol. Move the symbol to the desired screen location and press the left mouse button or the <Enter> key. If the multipick option is turned on (see Section 4.1.16), another Not Or symbol will appear automatically. You can position this symbol to the desired location or press the right mouse button to terminate Not Or symbol generation.

BBevent 

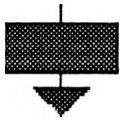
Generates the "BBevent" symbol. Move the symbol to the desired screen location and press the left mouse button or the <Enter> key. If the multipick option is turned on (see Section 4.1.16), another BBevent symbol will appear automatically. You can position this symbol to the desired location or press the right mouse button to terminate BBevent symbol generation.

RTrans 

Generates the "RTrans" symbol. Move the symbol to the desired screen location and press the left mouse button or the <Enter> key. If the multipick option is turned on (see Section 4.1.16), another RTrans symbol will appear automatically. You can position this symbol to the desired location or press the right mouse button to terminate RTrans symbol generation.

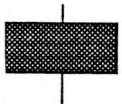
LTrans 

Generates the "LTrans" symbol. Move the symbol to the desired screen location and press the left mouse button or the <Enter> key. If the multipick option is turned on (see Section 4.1.16), another LTrans symbol will appear automatically. You can position this symbol to the desired location or press the right mouse button to terminate LTrans symbol generation.

UdTrans 

Generates the "UdTrans" symbol. Move the symbol to the desired screen location and press the left mouse button or the <Enter> key. If the multipick option is turned on (see Section 4.1.16), another UdTrans symbol will appear automatically. You can position this symbol to the desired location or press the right mouse button to terminate UdTrans symbol generation.

Horbox  Generates the "Horbox" symbol. Move the symbol to the desired screen location and press the left mouse button or the <Enter> key. If the multipick option is turned on (see Section 4.1.16), another Horbox symbol will appear automatically. You can position this symbol to the desired location or press the right mouse button to terminate Horbox symbol generation.

Verbox  Generates the "Verbox" symbol. Move the symbol to the desired screen location and press the left mouse button or the <Enter> key. If the multipick option is turned on (see Section 4.1.16), another Verbox symbol will appear automatically. You can position this symbol to the desired location or press the right mouse button to terminate Verbox symbol generation.

4.1.5 EDIT

This option allows you to modify fault tree diagrams. In addition to modifying the actual diagram, you may use this option to load existing diagrams and modify various attributes of the drawing. When you invoke the EDIT option, a pop-up menu (Figure 13) will be displayed. The first box, ←EDIT→, is used to position the pop-up menu to a new location on the screen. The remaining editing options are described in the following paragraphs.

4.1.5.1 ATTRIBUTES. This option allows you to specify the actual attributes of the symbols and text used in the fault tree diagram. Attributes include text size, line type, fill, font size, etc. Changing the attributes does not affect the global (default) values. Only the specific objects selected while in the given mode (i.e., Fill Col, Line Col, etc.) will be affected. When you invoke this option an additional pop-up menu is displayed as shown in Figure 14. The following attributes may be modified:

Fill Col - This attribute allows you to change the color for the drawing symbols. When you pick this option, the message **Pick a new color from the color bar** will be displayed at the bottom of the screen. To select a color, position the cursor over the desired color and press the left mouse button. (**NOTE:** The ↑↓ (color) option is active at this time. This option will display the additional color selections available.) Next, you will be prompted to **Pick shapes to be modified.** The cursor will change to a cross hair. Box the shapes to be changed by marking opposite corners. To box the symbols, position the cursor on the symbols to change and press the left mouse button. The cross hair is replaced with a small white dot. Drag the cursor over the shapes to be changed. An outline box appears. When the box surrounds the desired shapes completely, press the left mouse button. The box will disappear and the selected symbols will change to the new color. If

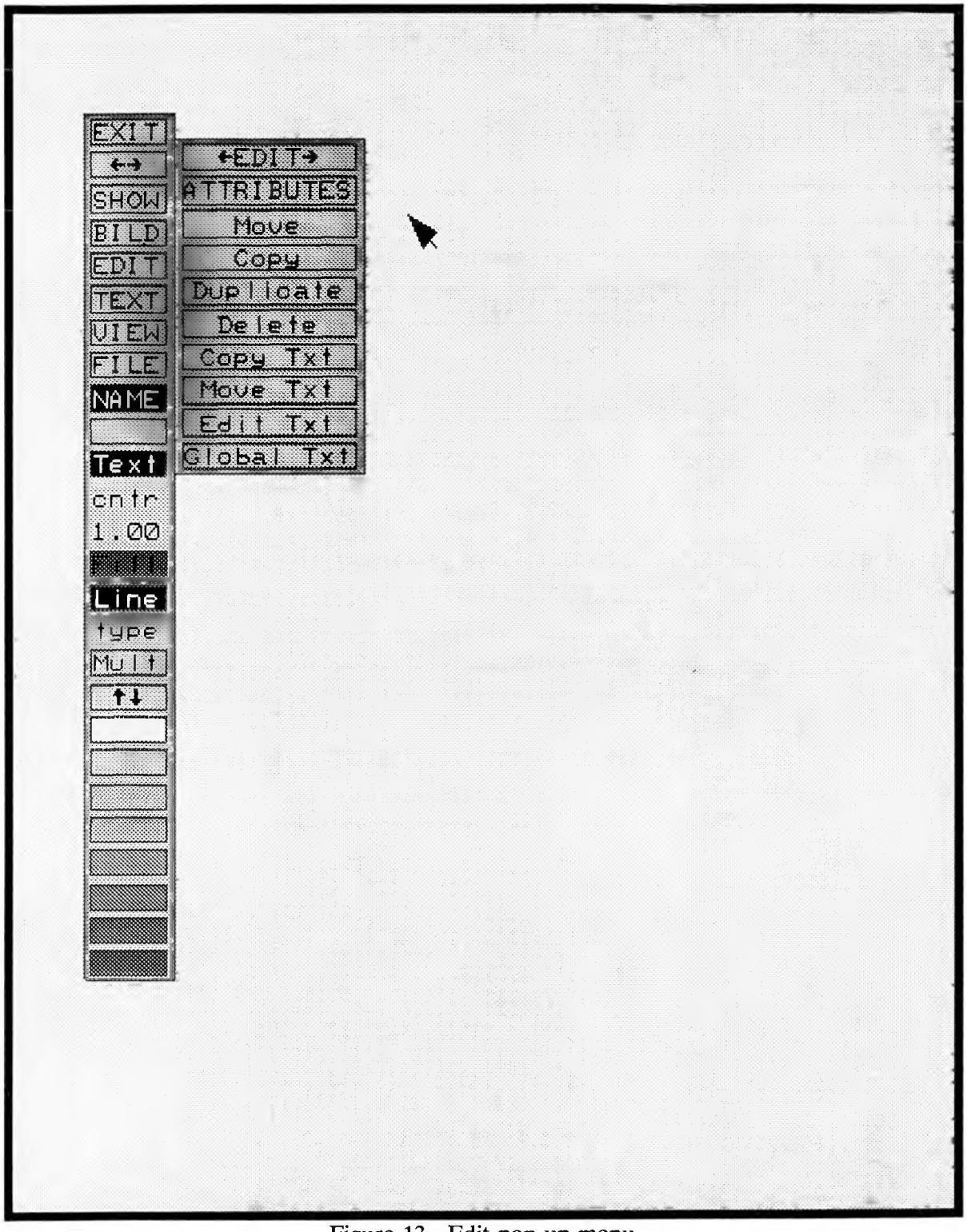


Figure 13. Edit pop-up menu.

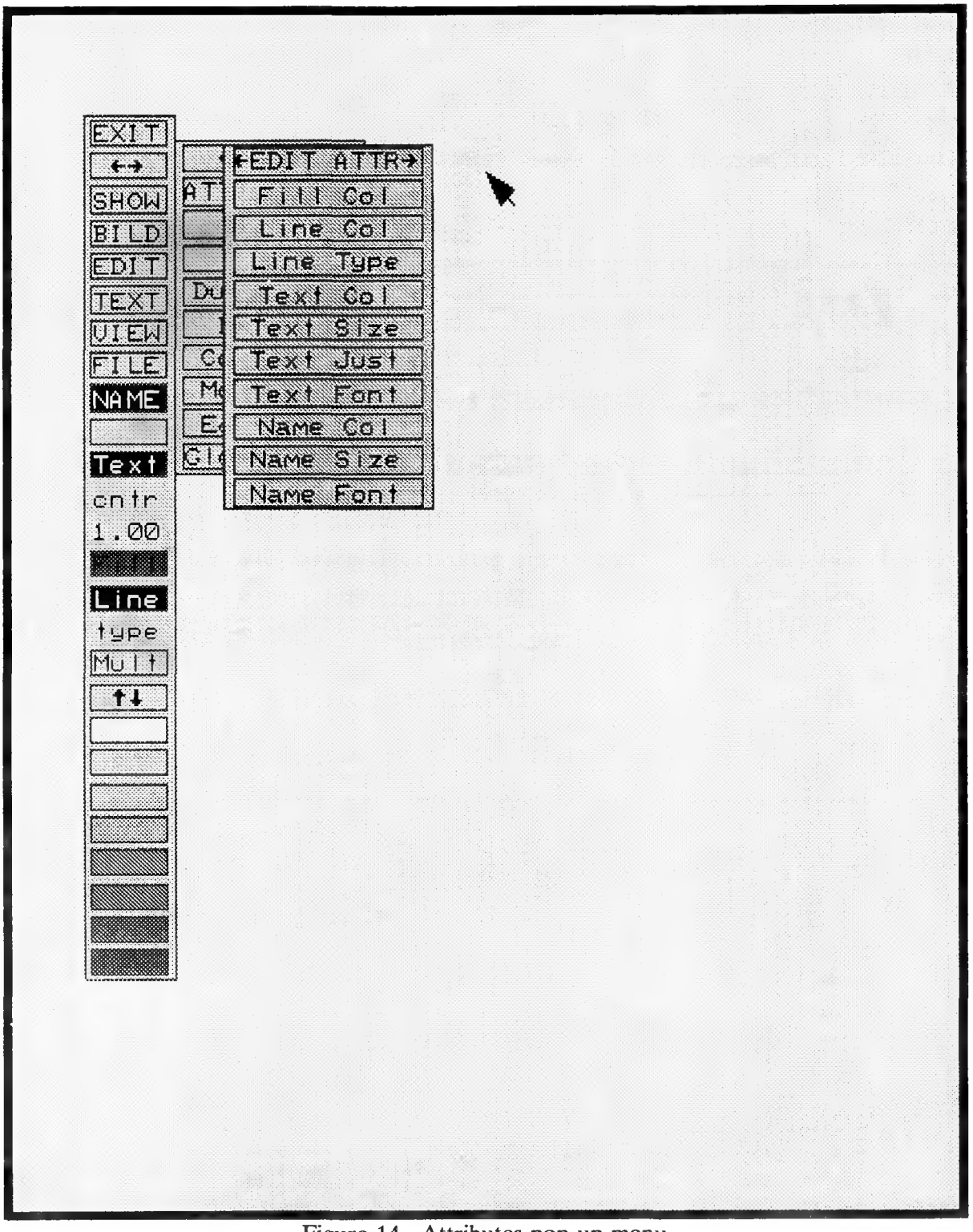


Figure 14. Attributes pop-up menu.

no shapes change color, then the selected box was not large enough to include any shapes. If the multipick option is turned on (see Section 4.1.16), you will be prompted to **Pick next shapes to be modified.** At this point you may select more shapes or press the right mouse button to terminate this process.

Line Col - This attribute allows you to change the color of the lines in the current diagram. Again, you will be prompted to **Pick a new color from the color bar.** To select a color, position the cursor over the desired color box and press the left mouse button. (**NOTE:** The ↑↓ (color) option is active at this time. This option will display the additional color selections available.) Next, you will be prompted to **Pick the lines to be modified.** The cursor will change from an arrow to a cross hair. Box the lines to be changed by marking opposite corners. To box the lines, position the cursor on the lines whose color you wish to change and press the left mouse button. The cross hair is replaced by a small white dot. Drag the cursor through the lines to be modified. A box appears surrounding the chosen lines. When the box completely surrounds the chosen lines, press the left mouse button. The box will disappear and the selected line(s) will change to the new color. If the multipick option is turned on (see Section 4.1.16), you will be prompted to **Pick next lines to be modified.** At this point, you may choose additional lines to change, or press the right mouse button to terminate the process.

Line Type - This attribute allows you to select the line type. When you select this option, a small window appears displaying the three available line types (solid, broken, or dotted line). You will be prompted to **Pick line type.** The cursor will change to a cross hair. Position the cross hair over the desired line type, and press the left mouse button. Next, you will be prompted to **Pick lines to be modified.** Box the lines to be changed by marking the opposite corners of the region. Choose the lines to be modified by positioning the cursor over the lines to be modified and pressing the left mouse button. Again, the cursor changes to a small dot. Drag the cursor over the lines to be modified. An outline box will appear. When the box completely surrounds the lines to be modified, press the left mouse button. The box will disappear and the selected lines will change to the new line type. If the multipick option is turned on (see Section 4.1.16), you will be prompted to **Pick next lines to be modified.** At this point, you may select more lines or press the right mouse button to terminate the process. Upon termination, the normal cursor will return.

Text Col This attribute option allows you to change the color of the text in your fault tree diagram. When you invoke this option, you will be prompted to **Pick a new color from the color bar.** Position the cursor over the desired color and press the left mouse button. (**NOTE:** The ↑↓ (color) option is active at this time. This option will display the

additional color selections available.) Next, you will be prompted to **Pick text to be modified.** The cursor will change from an arrow to a cross hair. Box the text to be changed by marking the opposite corners of the text area. To box the area, position the cursor over the text to be changed and press the left mouse button. A small dot will appear. Drag the cursor over the text until the outline box surrounds all the desired text. Press the left mouse button. All selected text will change to the new color. If the multipick option is turned on (see Section 4.1.16), you will be prompted to **Pick next text to be modified.** At this point you can select more text or press the right mouse button to terminate the process. The color change will only affect the selected text.

Text Size - This attribute option allows you to specify the height of the text in your diagram. When you invoke this option, you will be prompted to **Enter text size.** Text sizes are indicated by a number between 0.01 and 66.00, with 66 being the full 66 lines from the top to the bottom of the screen. This roughly corresponds to the 66 lines on a full sheet of regular paper. For the purpose of writing text in gate blocks, a text size of about 0.5 is appropriate. The size looks too small on the screen, but it is a good size for sending to a laserjet printer. Larger text sizes will be necessary for printers with lower resolution. Next, you will be prompted to **Pick text to be modified.** Position the cursor on the text to be resized and press the left mouse button. A small dot will appear. Drag the cursor over the text to be resized. When the outline box completely surrounds the text to be modified, press the left mouse button. The box will disappear and the selected text will be displayed in the new text size. If the multipick option is turned on (see Section 4.1.16), you will be prompted to **Pick next text to be modified.** At this point you can select more text, or press the right mouse button to terminate the process. This new text size will only affect the selected text.

Text Just - This attribute allows you to justify selected portions of the text in your diagram. When you invoke this option, you will be prompted to **Pick text to be modified.** Position the cross hair over the text to be justified and press the left mouse button. A small dot will appear. Drag the cursor over the text to be justified. When the outline box completely surrounds the desired text, press the left mouse button. The outline box will disappear and the selected text will be justified (see Section 4.1.11 for a complete discussion on setting the justification). If the multipick option is turned on (see Section 4.1.16), you will be prompted to **Pick next text to be modified.** At this point you may select additional text to be justified or press the right mouse button to terminate the process. Only the selected text will be justified. The remaining text will be unchanged.

Text Font

This attribute option allows you to select the font type for selected text. When you select this option an additional pop-up menu will be displayed (Figure 15). Select the desired font type by positioning the cursor over the font and pressing the left mouse button. You must select a font (or cancel) in order to continue. Next, you will be prompted to **Pick text to be modified.** Position the cursor over the text to be changed and press the left mouse button. A small dot will appear. Drag the cursor over the text to be modified. When the box completely surrounds the text to be modified, press the left mouse button. The selected text will be displayed in the new font size. If the multipick option is turned on (see Section 4.1.16), you will be prompted to **Pick next text to be modified.** At this point you may select more text, or press the right mouse button to terminate the process. Only the selected text will carry the new font type. The remaining text (unselected) will remain unchanged.

Name Col - This attribute option allows you to change the color of the default or given name of the symbol/shape. When you select this option, you will be prompted to **Pick a new color from the color bar.** Position the cursor over the desired color and press the left mouse button. (**NOTE:** The ↑↓ (color) option is active at this time. This option will display the additional color selections available.) Next, you will be asked to **Pick shapes to be modified.** Position the cross hair over the shapes to be changed and press the left mouse button. A small dot will appear. Drag the cursor over the shapes to be modified. You must be sure to place the box completely around the shape and not just the name. When the box surrounds the desired shapes, press the left mouse button. The selected symbol name(s) will change to the new color. If the multipick option is turned on (see Section 4.1.16), you will be prompted to **Pick next shapes to be modified.** At this point you may select additional shapes or press the right mouse button to terminate the process.

Name Size - This attribute option allows you to specify the height of the shape name in your diagram. When you invoke this option, you will be prompted to **Enter text size.** Text sizes are indicated by a number between 0.01 and 66.00, with 66 being the full 66 lines from the top to the bottom of the screen. This roughly corresponds to the 66 lines on a full sheet of regular paper. For the purpose of writing text in gate blocks, a text size of about 0.5 is appropriate. The size looks too small on the screen, but it is good for sending to a laserjet printer. Larger text sizes will be necessary for printers with lower resolution. Next, you will be prompted to **Pick shapes to be modified.** Position the cursor on the shape to be modified and press the left mouse button. A small dot will appear. Drag the cursor over the text to be

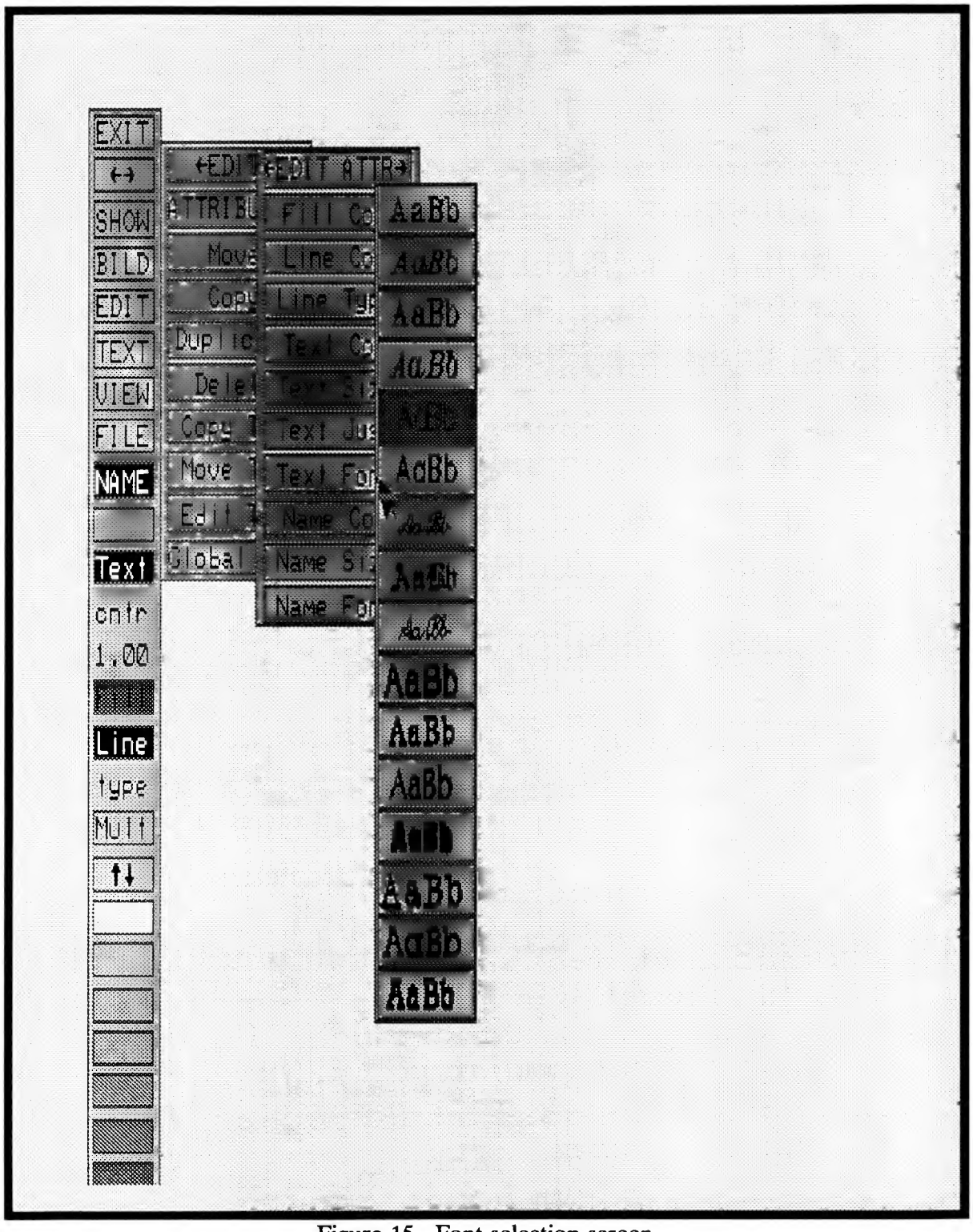


Figure 15. Font selection screen.

changed. When the box surrounds the shapes to be modified, press the left mouse button. If the multipick option is turned on (see Section 4.1.16), you will be prompted to **Pick next shapes to be modified.** At this point you can select more shapes, or press the right mouse button to terminate the process. This new text size will only affect the selected shapes.

Name Font

This attribute option allows you to select the font type the shape name will have in your diagram. When you select this option an additional pop-up menu will be displayed (Figure 15). Select the desired font type by positioning the cursor over the font and pressing the left mouse button. Next, you will be prompted to **Pick shapes to be modified.** Position the cursor over the shapes to be changed and press the left mouse button. A small dot will appear. Drag the cursor over the text to be modified. When the box surrounds the shapes to be modified, press the left mouse button. If the multipick option is turned on (see Section 4.1.16), you will be prompted to **Pick next shapes to be modified.** At this point you may select more shapes, or press the right mouse button to terminate the process. Only the selected shapes will carry the new font type. The remaining shapes (unselected) will be unchanged.

4.1.5.2 Move. This editing option allows you to move a portion of the diagram to a new location. When you invoke this option, you will be prompted to **Box region to be moved - press CANCEL to quit.** Position the cross hair over the region to be moved and press the left mouse button. A small dot will appear. Drag the cursor over the region until the box completely surrounds the region to be moved, and press the left mouse button. Next, you will be prompted to **Pick reference point - press CANCEL to reselect.** The reference point is used to give you some indication of the position of the object being moved relative to the box. Position the cross hair at the location where you want the selected region to be moved to. Next, you will be prompted to **Position Box at new location - press CANCEL to reselect.** Use the cursor to move the box to the exact position where you want the box to appear. When you are satisfied with the new position press the right mouse button. The selected region will be moved to this new location. If the multipick option is turned on (see Section 4.1.16), you will be returned to the **Position box at new location ...** prompt. At this point you may select a new location to move the selected symbols or press the right mouse button to return to the "box region" prompt. At this point you may select another region to move or press the right mouse button to terminate the process.

4.1.5.3 Copy. This editing option allows you to copy a portion of the diagram and move it to a new location. This option does not create an exact copy, but rather copies the structure of the objects. When you invoke this option, you will be prompted to **Box region to be copied - press CANCEL to quit.** To box the region to be copied, mark the opposite corners of the region. Position the cross hair on the region to be copied and press the left mouse button. A small dot will appear. Drag the cursor over the region to be copied until the box completely surrounds the region. Press the left mouse button. You will be prompted to **Pick reference point - press CANCEL to reselect.** Position the cursor at the location you want the region to be copied to and press the left mouse button. The selected region will now be copied and displayed at the chosen location. If the multipick option is turned on (see Section 4.1.16), you will be returned to the **Position Box at new location -**

press CANCEL to reselect prompt. At this point you can copy the selected region to another location on the diagram, or press the right mouse button to terminate the process. If the process is terminated, you will be returned to the "box region" prompt. You may select another region to copy or press the right mouse button to terminate the process.

4.1.5.4 Duplicate. This editing option allows you to duplicate a portion of the fault tree diagram. This option makes an **exact** copy. Duplicate replicates the structure, logic, and even the names used. When you invoke this option, you will be prompted to **Box region to be duplicated - press CANCEL to quit.** To box the region to be duplicated, mark the opposite corners of the region. Position the cross hair at the area to be duplicated and press the left mouse button. A small dot appears. Drag the cursor over the area to be duplicated until the outline box completely surrounds the desired area. When complete, press the left mouse button. The box will disappear and you will be prompted to **Pick reference point - press CANCEL to reselect.** Position the cursor at the desired point and press the left mouse button. An outline box the size of the selected area will appear. You will be prompted to **Position Box at new location - press CANCEL to reselect.** Position the cursor at the desired location and press the left mouse button. The selected area will be duplicated (an exact copy) and displayed at the new location. If the multipick option is turned on (see Section 4.1.16), another outline box will appear and you will be prompted to **Position Box at new location - press CANCEL to reselect.** At this point, you can duplicate the region again, or press the right mouse button to terminate the process. You will be returned to the **Box region to be duplicated** prompt. You may select another region to be duplicated or press the right mouse button to cancel the process.

4.1.5.5 Delete. This editing option allows you to delete any portion of the displayed fault tree diagram. When you invoke this option, you will be prompted to **Pick region to be deleted.** Position the cursor at the place you want to delete and press the left mouse button. A small dot will appear. Drag the cursor over the area to be deleted until the outline box completely surrounds the area. Press the left mouse button. Next, you will be prompted **Delete region? Left = delete, Right = cancel.** If the boxed area is the area you want to delete, press the left mouse button. If it is not the desired region, press the right mouse button. If the multipick option is turned on (see Section 4.1.16), you will be prompted to **Pick next region to be deleted.** At this point you may select another region to delete, or press the right mouse button to terminate the process.

4.1.5.6 Copy Txt. This option allows you to copy text from one area of the diagram to another. When you invoke this option, you will be prompted to **Pick text to be copied - press CANCEL to quit.** Position the cross hair on the text to be copied. A small dot will appear. Drag the cursor over the text until the outline box completely surrounds the entire text. Press the left mouse button. Next, you will be prompted to **Pick reference point - press CANCEL to reselect.** The reference point is used to give you some indication of the position of the object being moved relative to the box. Position the cursor at the desired point and press the left mouse button. You will be prompted to **Position Box at new location - press CANCEL to reselect.** The selected text will now be displayed at the new location. (The text still remains at its original location). If the multipick option is turned on (see Section 4.1.16), you will be prompted to **Position Box at new location.** At this point you may copy the text to yet another location or press the right mouse button to terminate the process. You will be returned to the **Pick text to be copied - press CANCEL to quit** prompt. You may select another piece of text to copy or press the right mouse button to terminate the copy text process.

4.1.5.7 Move Txt. This editing option allows you to move text from one area of the diagram to another. When you invoke this option, you will be prompted to **Pick text to be moved - press CANCEL to quit.** To mark the text to be moved, box the opposite corners of the text region. Position the cross hair at the start of the text to be moved, and press the left mouse button. A small dot will appear. Drag the cursor over the text to be moved until the outline box completely surrounds the desired text. Press the left mouse button. Next, you will be prompted to **Pick reference point - press CANCEL to reselect.** The reference point is used to give you some indication of the position of the object being moved relative to the box. Position the cursor at the desired location and press the left mouse button. You will be prompted to **Position Box at new location - press CANCEL to reselect.** Move the cursor until the box is positioned at the point where you want to move the text. Press the left mouse button again. The text will be moved to the new location. If the multipick option is turned on (see Section 4.1.16), the box will appear again and you will be prompted to **Position Box at new location - press CANCEL to reselect.** At this point you can move the same text to yet another location or press the right mouse button to terminate the process. If you choose to terminate, you will be returned to the **Pick text to be moved** prompt. You may choose more text to move or press the right mouse button to cancel the move text option. **NOTE:** When you move text, the selected text will be removed from its original position.

4.1.5.8 Edit Txt. This editing option allows you to edit text. When you invoke this option, you will be prompted to **Box text to be edited.** To box the text to be edited, mark the opposite corners of the text region. Position the cursor at the text to be modified and press the left mouse button. A small dot will appear. Drag the cursor over the text to be modified until the outline box surrounds all the desired text. Press the left mouse button. A large window will appear displaying the selected text in a readable format. The text is displayed one line at a time. To edit the text, simply type over the existing text. You may use the <Ins> and <Del> keys to add and delete characters as necessary. In addition, you may use the backspace and end keys. Backspace moves all characters from the right of the cursor to the left one space. The End key positions the cursor at the end of the current line. When complete, press <ESC> and the next line of text will appear. When complete, you will be prompted to **Box text to be edited** (if the multipick option is turned on - see Section 4.1.16. At this point you can select additional text to modify or press the right mouse button to terminate the process.

4.1.5.9 Global Txt. This editing option allows you to replace a specified word or group of words with a new word(s) at each and every occurrence in the fault tree diagram. When you invoke this option, you will be prompted to **Enter search string:.** Enter the word or phrase to be replaced (up to 42 characters are allowed for one search) and press <Enter>. Next, you will be prompted to **Enter replacement string:.** Enter the replacement word or phrase (again, up to 42 characters are allowed) and press <Enter>. Every occurrence will be replaced. When complete, the normal cursor (arrow) will return. **NOTE:** All occurrences of the strings will be replaced. For example, if you have a string in a text area you wish to change and that string also happens to be part of a NAME, both instances will be replaced with the new string.

4.1.6 TEXT

The TEXT command allows you to create titles, labels, descriptions, and names for your fault tree diagram. When you invoke this option, Figure 16 will be displayed. Each of the text submenu options is described in the following paragraphs.

The first option shown, ←TEXT→, is used to move the options menu to a new location. Position the cursor on the ←TEXT→ box and press the left mouse button. An outline box will appear. Position the box to the desired location and press the left mouse button. To remove the text suboptions menu, position the cursor anywhere in the text suboptions column and press the right mouse button.

The remaining TEXT suboptions are discussed in the following paragraphs.

4.1.6.1 Add Text. This text suboption allows you to add text anywhere on the fault tree diagram. When you invoke this option, you will be prompted to **Pick location for text.** Position the cursor where you want to add text and press the left mouse button. A window will appear. This window can hold up to 10 lines of text. Type in the new text as you want it to appear on the diagram. When finished, press <Esc>. When you return to the diagram, the newly added text will be included. If the multipick option is turned on (see Section 4.1.16), you will be prompted to **Pick next location for text.** At this point, you can choose another location to add text, or press the right mouse button to terminate the process.

4.1.6.2 Edit Text. This text suboption allows you to edit any of the text appearing on the diagram. When you invoke this option, you will be prompted to **Box text to be edited.** Position the cross hair at the beginning of the text you wish to modify and press the left mouse button. A small dot will appear. Drag your cursor over the text until the outline surrounds the text you wish to modify. When the text is surrounded, press the left mouse button. A window will appear displaying the first line of the selected text. To modify the text, simply type over the existing text. Use the <Ins> and <Del> keys to add and delete characters as necessary. In addition, you may use the Backspace and End keys. Backspace moves all characters from the right of the cursor to the left one space. The End key positions the cursor at the end of the current line. When complete, press <ESC>. If the multipick option is turned on (see Section 4.1.16), you will be returned to the **Box text to be edited.** prompt. At this point, you may box more text to be edited or press the right mouse button to terminate the process.

4.1.6.3 FONT. This text suboption allows you to change the FONT type of the text. When you invoke this option, Figure 17 will be displayed. To select a font, position the cursor on the desired font and press the left mouse button. The font is now selected. New text will now appear in the new font style. This option updates the global font default. **NOTE:** The currently selected font is shown in a different color.

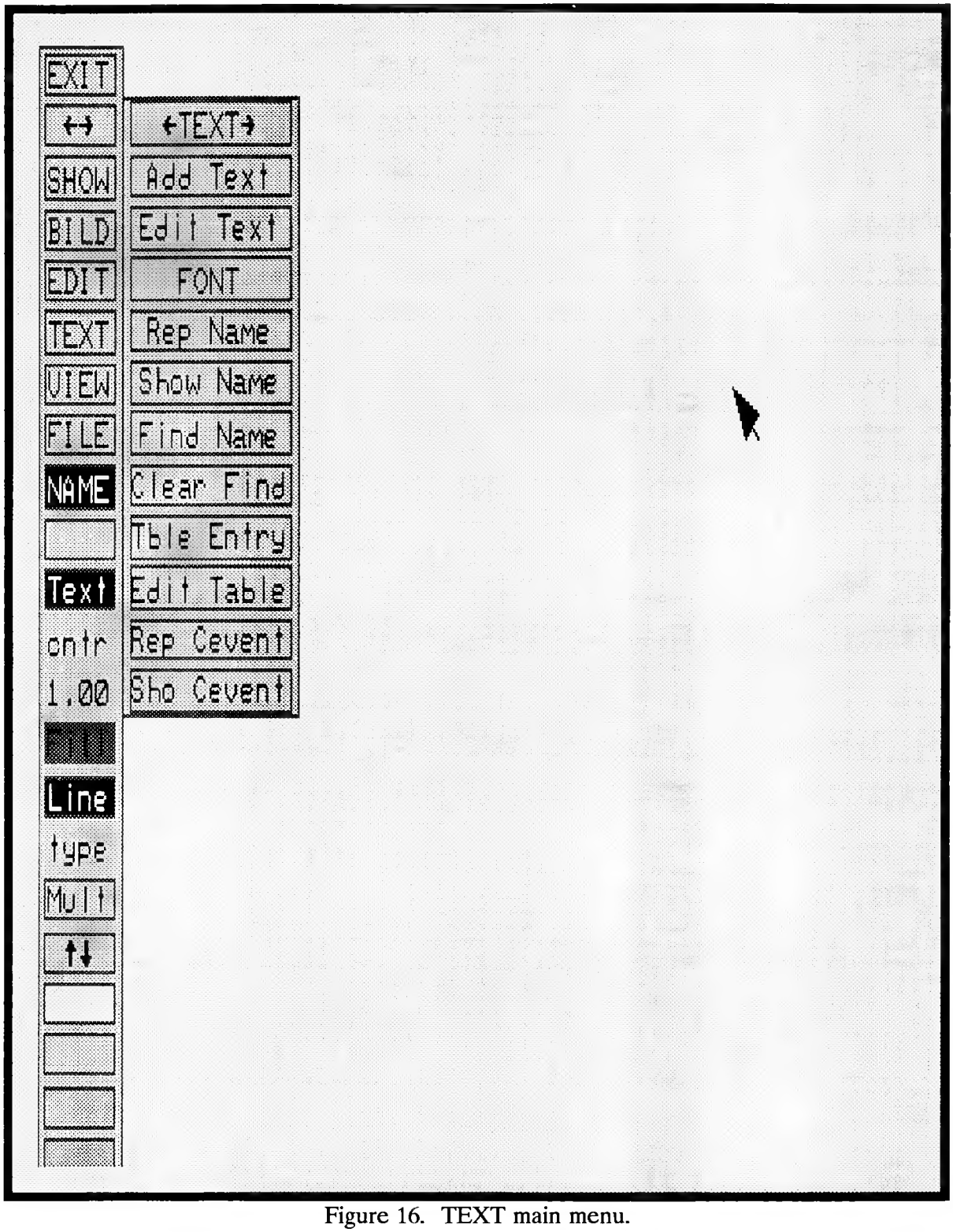


Figure 16. TEXT main menu.

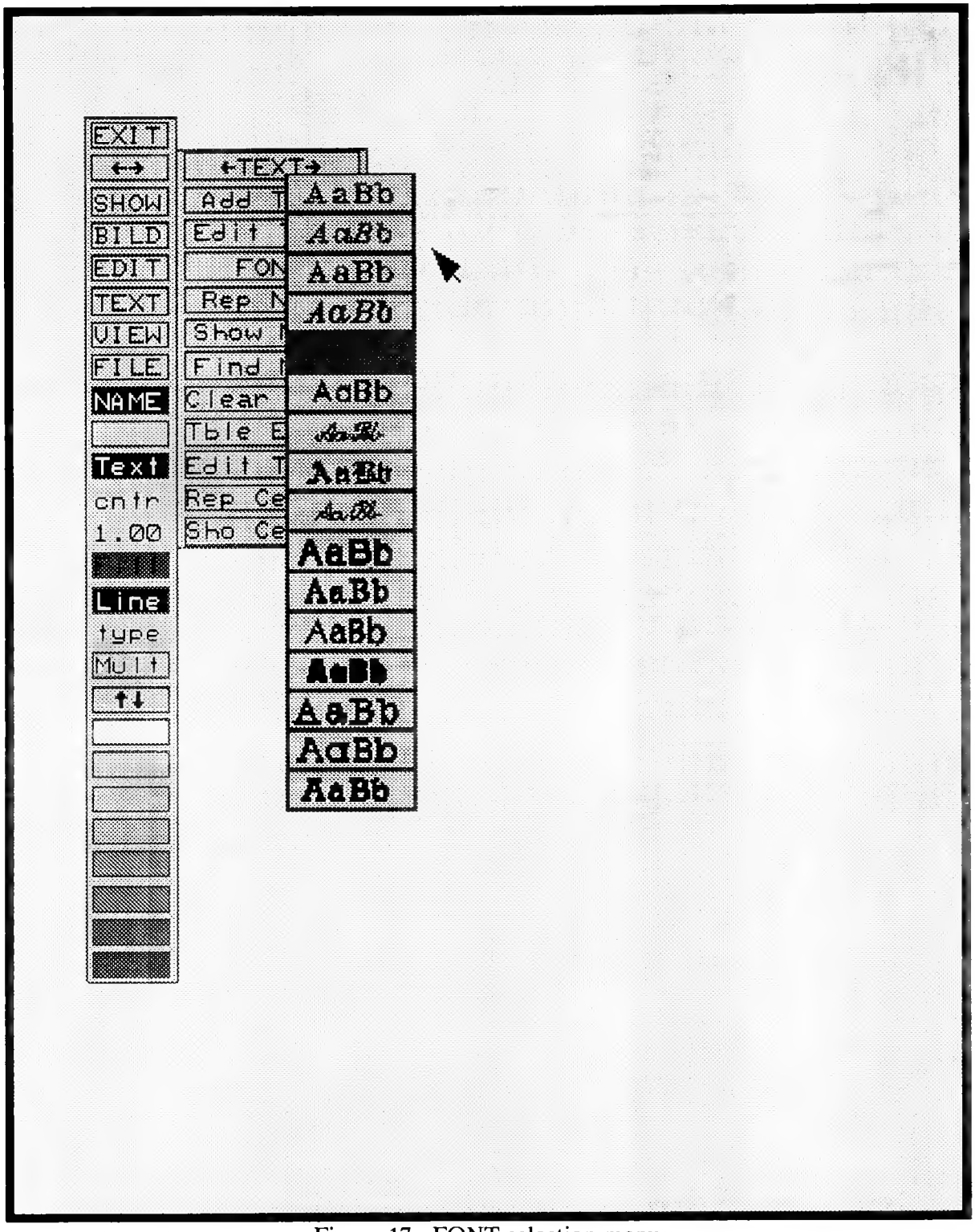


Figure 17. FONT selection menu.

4.1.6.4 Rep Name. This text suboption allows you to name or replace a name. When you invoke this option you will be prompted to **Pick shape to be named.** Position the cursor on the shape to be named and press the left mouse button. The prompt **Enter new name or CR for =>** will be displayed. Enter a new label and press <Enter>. The shape(s) will be renamed. If the multipick option is turned on (see Section 4.1.16), you will be returned to the **Pick next shape to be named** prompt. At this point you may choose another shape to label or press the right mouse button to terminate the process.

4.1.6.5 Show Name. This text suboption allows you to display (in readable characters) a shape name. When you invoke this option, you will be prompted to **Pick the shape.** Position the cross hair on the desired shape and press the left mouse button. The name for the selected shape will be displayed at the bottom of the screen. If the multipick option is turned on (see Section 4.1.16), the cross hair returns and you may select another shape or press the right mouse button to terminate the process.

4.1.6.6 Find Name. This text suboption allows you to locate a specific shape name on your diagram. When you invoke this option, you will be prompted with **Enter name >**. Enter the shape name you wish to locate and press <Enter>. A broken dotted line will outline the shape containing the specified label. This outline will appear until you invoke the Clear Find option.

4.1.6.7 Clear Find. To invoke this option, position the cursor over the Clear Find menu option, and press the left mouse button. All highlight outlines will be cleared from the screen.

4.1.6.8 Tble Entry. This option allows you to add entries to an existing table. When you invoke this option, you will be prompted to **Pick Table.** Position the cross hair over the table to be modified and press the left mouse button. You will be prompted to **Enter name (terminate with CR) >**. Enter the new table entry and press <Enter>. If the multipick option is turned on, you will be prompted with **Next name (terminate with CR) >**. At this point you may enter another table entry or press the <Enter> key to terminate the process. Upon pressing <Enter> you will be returned to the **Pick next Table** prompt. At this point, you may mark another table symbol for entry or press the right mouse button to terminate the process.

4.1.6.9 Edit Table. This option allows you to edit individual table entries. When you invoke this option, you will be prompted to **Pick gate, event, or tab.** Position the cross hair on the desired gate, event, or table and press the left mouse button. A window will appear displaying the names. You are prompted to **Pick the name to modify,-use "@" in 1st col to delete.** Position the cursor over the name to modify and press the left mouse button. You will be prompted to enter a new name. Enter the name and press <Enter>. To cancel or terminate this process, press the right mouse button.

4.1.6.10 Rep Cevent. This option allows you to rename or change the name (label) given to the event part of an inhibit gate. When you select this option you will be prompted to **Pick INHIBIT gate.**

4.1.6.11 Sho Cevent. This option allows you to view the Cevent name associated with the inhibit gate. When you invoke this option, you will be prompted to **Pick the INHIBIT gate.**

4.1.7 VIEW

This option allows you to change the position and size of the displayed diagram. You may move the drawing up, down, right, left, zoom in, zoom out, or restore the drawing to its original size and/or position. You may also use a toggling method to display/not display names and text, and display a grid. When you select this option, Figure 18 will be displayed.

The first box, ←VIEW→, is used to move the VIEW menu to a new location on the screen. To invoke this option, position the cursor on the ←VIEW→ box and press the left mouse button. An outline box will appear. Move the outline to the desired location on the screen and press the left mouse button. In addition, you can remove the VIEW option box by positioning the cursor on the any command in the VIEW menu and pressing the right mouse button or pressing the <Esc> key. The VIEW submenu consists of the following options:

- down arrow: Invoking this option allows you to shift the graphics downward. To invoke this option, position the cursor in the down arrow box and press the left mouse button or <Enter>. The message **Pick new bottom edge** will be displayed. Move the cross hair to the position which is to become the new bottom of the display and press left mouse button or <Enter>. The diagram will adjust accordingly. At this point, you can select a new bottom edge or terminate the function by pressing the right mouse button or <Esc>. The above mentioned message will remain on the screen until you terminate the process. The message **View Changed** appears at the bottom of the screen.

- up arrow: Invoking this option allows you to shift the diagram upward. To invoke this option, position the cursor in the up arrow box and press the left mouse button on <Enter>. The message **Pick new top edge** will be displayed. Move the cross hair to the position which is to become the new top edge of the display and press the left mouse button or <Enter>. The diagram will shift accordingly. At this point you may select a new top edge or terminate the process by pressing the right mouse button or pressing <Esc>. The above mentioned message will remain on the screen until you terminate the process. The message **View Changed** appears at the bottom of the screen.

- right arrow: Invoking this symbol allows you to shift the diagram to the right. To invoke this option, position the cursor in the right arrow box and press <Enter>. The message **Pick new right edge** will appear on the screen. Move the cross hair to the position which is to become the new right edge of the display and press <Enter>. The diagram will shift accordingly. At this point you may select a new right edge or press the right mouse button to terminate the process. The above mentioned message will remain on the screen until you terminate the process.

- left arrow: Invoking this option allows you to shift the graphics display to the left. To invoke this option, position the cursor in the left arrow box and press the left mouse button or <Enter>. The message **Pick new left edge** will be displayed. Move the cursor to the position which is to become the new left edge of the display and press the left mouse button or <Enter>. At this point, you may select a new left

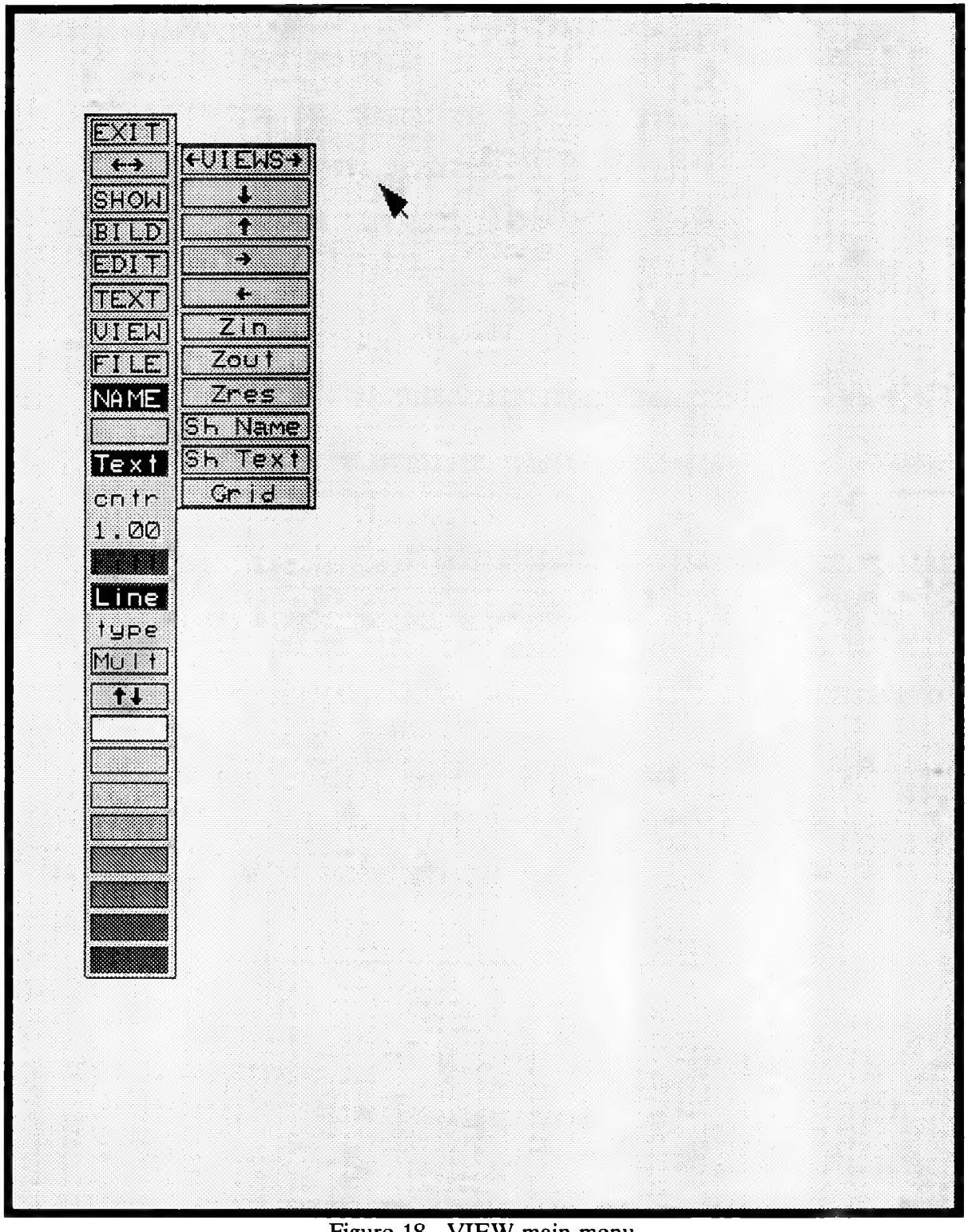


Figure 18. VIEW main menu.

edge again or press the right mouse button or <Esc> to terminate the process. The message **View changed** appears at the bottom of the screen.

- Zoom in: Invoking this option allows you to fill the screen with a small portion of the original display (magnifies the selected portion of the screen). To invoke this option, position the cursor in the Zin (zoom in) box and press the left mouse button or <Enter>. The message **Pick two corners of box** will be displayed. Move the cursor at the start of the diagram to be enlarged and press the left mouse button. A small dot appears. Drag the cursor across the desired area until it is completely surrounded by the outline box. Press the left mouse button. The portion of the original display enclosed by the box will now fill the entire screen. The display can be restored to its original size by invoking the Zres (zoom restore) option.

- Zoom out: Invoking this option allows you to shrink the screen by approximately 50%. To invoke this option, position the cursor in the Zout (zoom out) box and press the left mouse button or <Enter>. The entire display will be reduced. To restore the display to its original size, invoke the Zres option.

- Zoom Restore: This option restores any display created by Zin (zoom in) or Zout (zoom out) to the original display size or to the last saved file. To invoke this option, position the cursor in the Zres box and press the left mouse button or <Enter>.

- Sh Name: This option allows you to toggle the setting to display or not display names. Sh Name displays all the names in your diagram. No Name does not display any of the names in your diagram.

- Sh Text: This option allows you to toggle the text setting from Sh Text to No Text. Sh Text displays all defined text. No Text does not display the text.

- GRID: This option displays a grid behind your diagram to allow you to line up symbols and text. This is a toggle switch. To turn the grid on position the cursor in the GRID option box and press the left mouse button or <Enter>. To turn the grid off, repeat the same steps.

4.1.8 FILE

This option allows you to perform various file maintenance utilities including loading, saving, merging files, and printing hard copies of your diagrams. When you invoke this option, Figure 19 will be displayed. Each FILE option is discussed in the following paragraphs.

The first box, ←FILE→, is used to move the FILE menu to a new location on the screen. To invoke this option, position the cursor on the ←FILE→ box and press the left mouse button. An outline box will appear. Move the outline to the desired location on the screen and press the left mouse button. In addition, you can remove the FILE options box by positioning the cursor on any command in the FILE menu and pressing the right mouse button or pressing the <Esc> key.

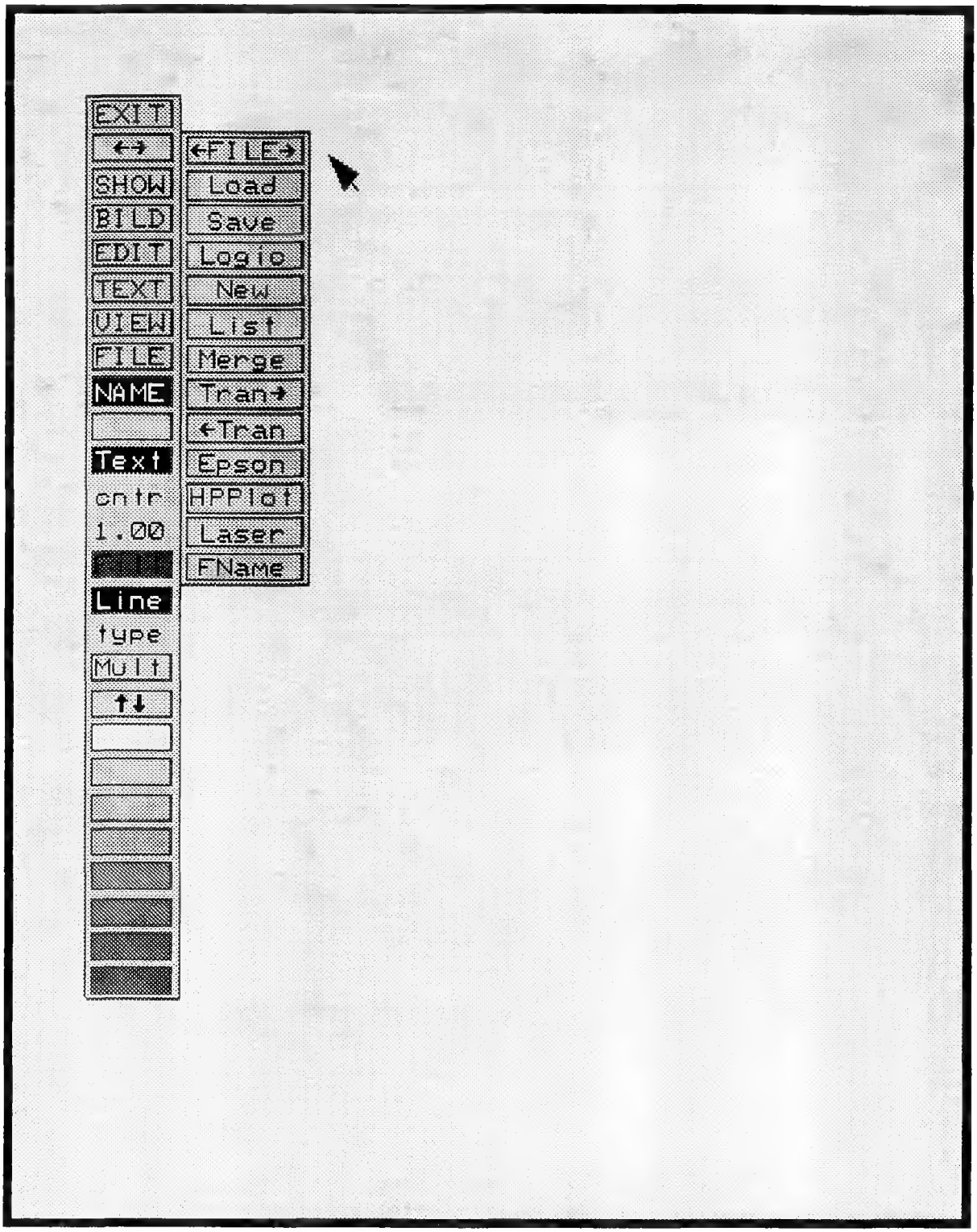


Figure 19. FILE main menu.

4.1.8.1 Load. This FILE suboption allows you to load any Fault Tree File (graphics) with the extension ".DLS" onto the screen. When you invoke this option, you will be prompted to **Enter file name >**. Enter the name of the file you wish to load and press <Enter>. The diagram will appear on the screen. If you do not remember your file name, use the LIST suboption to display all existing file names in the current directory.

4.1.8.2 Save. This FILE suboption allows you to save all changes made to the diagram. When you invoke this option you will be prompted to **Enter file name or CR for File ...>**. The default file name will consist of the currently displayed diagram and an extension of .DLS. Enter a new file name if desired or press <Enter> to save the diagram under the default name. If the default file name already exists (i.e., you have saved your diagram previously), the message **File already exists. Do you wish to replace? Y/N>**. If you wish to write the changes over the existing file, type a Y and press <Enter>; otherwise, enter an N.

4.1.8.3 Logic. This FILE suboption allows you to save the logic of the diagram. When you invoke this option, you are prompted to **Enter file name or CR for file XX >**, where XX is the file name of the currently displayed diagram. Enter the new file name and press <Enter>. When complete, the message **Logic saved** will be displayed at the bottom of the screen.

4.1.8.4 New. This FILE suboption allows you to essentially cancel your current editing session. All changes made since the last save will not be applied. When you invoke this option, the screen will be cleared and you will be returned to Figure 11.

4.1.8.5 List. This FILE suboption displays the list of files currently residing in the default directory. When you invoke this option, a pop-up menu will be displayed showing all the files contained in the current directory. You will be prompted to **Pick the file to load**. Position the cursor over the file to load and press the left mouse button or <Enter>. The file will be loaded and displayed on the screen.

4.1.8.6 Merge. This FILE suboption allows you to merge the contents of two files into a single file. When you invoke this option, you will be prompted to **Pick the file to load**. Position the cursor over the desired file name and press the left mouse button or <Enter>. Next, you will be prompted to **Pick location for the top center of merged file**. Position the cross hair at the desired location and press the left mouse button or <Enter>. The screen will be cleared and then reshown with the merged files displayed.

4.1.8.7 Tran→. This FILE suboption allows you to view the drawing defined in the file given in the transfer name.

4.1.8.8 ←Tran. This FILE suboption allows you to view the drawing which define(s) the transfer logic. Transfers allow you to create Fault trees consisting of many pages.

4.1.8.9 Epson. This option formats the diagram for an Epson printer and sends it to the local Epson printer.

4.1.8.10 HPPlot. This option formats the diagram for an HP Plotter and writes it to a file, which can be printed at your convenience using the Plot Tree (HP) option. (See Section 4.2.)

4.1.8.11 Laser. This option formats the diagrams for a laser printer and sends it to the local laser printer to be printed.

4.1.8.12 FName. This option displays the current filename of the diagram being displayed. When you invoke this option, the file name will be displayed at the bottom of the screen.

4.1.9 NAME

This option allows you to change the defaults for the name symbols. When you invoke this option, Figure 20 will be displayed. Each option is described below:

- Name Col: This option allows you to change the color of the name. Position the cursor on the desired color bar and press the left mouse button. (**NOTE:** The ↑↓ (color) option is active at this time. This option will display the additional color selections available.) The NAME box will change to the default color.

- Name Size: This option allows you to change the text size of the name. When you invoke this option, you will be prompted to **Enter text size >**. As mentioned earlier, text sizes are indicated by a number between 0.01 and 66.00, with 66 being the full 66 lines from the top to the bottom of the screen. This roughly corresponds to the 66 lines on a full sheet of regular paper. Enter the desired text size and press <Enter>.

- Dflt Gate: This option allows you to assign a default name to the gate. When you invoke this option you will be prompted to **Enter gate default name >**. Enter the name (up to 9 characters are allowed) and press <Enter>.

- Dflt Event: This option allows you to assign a default name for an event. When you invoke this option you will be prompted to **Enter event default name >**. Enter the desired name (up to 9 characters are allowed) and press <Enter>.

4.1.10 Text

This option allows you to set a default color for the text in your diagrams. To invoke this option position the cursor over the Text box and press the left mouse button. You will be prompted to **Pick a new color from the color bar.** Position the cursor on the desired color box and press the left mouse button. (**NOTE:** The ↑↓ (color) option is active at this time. This option will display the additional color selections available.) All text will now be displayed in this color. If the diagram already exists, only the new text will be displayed in the new color. You must return to the ATTRIBUTES option to change the existing text color (if desired).

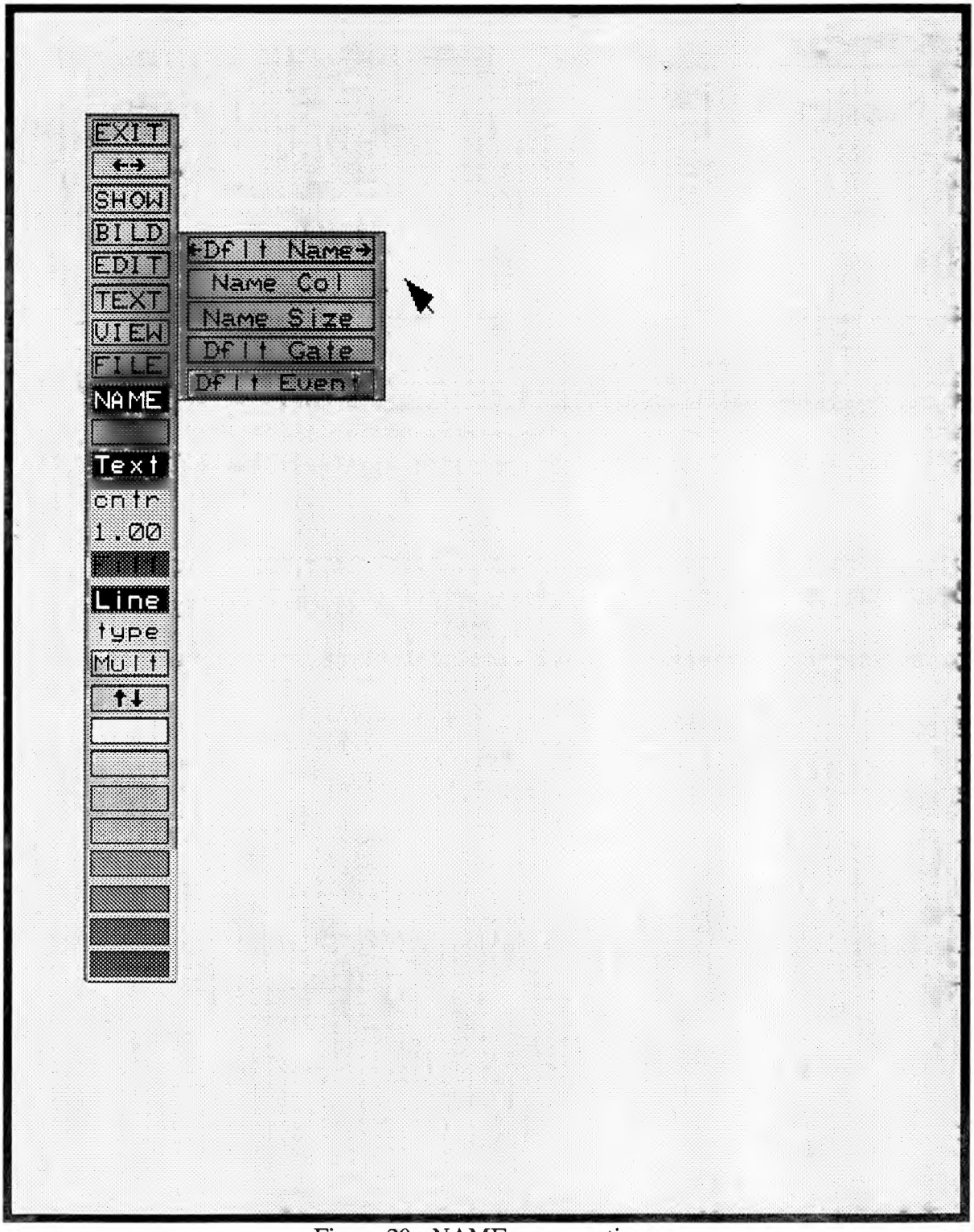


Figure 20. NAME menu options.

4.1.11 cntr/left/right

This option allows you to set the justification for your diagrams. Justification is where the text will be placed offset from the placement point. This works as a toggle switch. To change justification, position the cursor over the cntr (default) box and press the left mouse button or the <Enter> key. You will see the box change from cntr to rght (right). Press the left mouse button or <Enter> key again, and the box will change from rght to left.

Left justification means the text will be anchored at the left bottom corner, or the text will flow to the right of where it was placed. Center justification means the text will be centered about the placement point. Right justification means the text will be placed to the left of the placement point. Set the toggle for the desired justification.

4.1.12 Text Size (0.50)

This option allows you to set a default text size for your diagrams. The default value is .5. Text size ranges from .001 to 9.0. For the purpose of writing text in gate blocks, a text size of about 0.5 is appropriate. The size looks too small on the screen, but it is good for sending to a laser printer. **REMEMBER**, here you are setting the default text size. You may always change the text size for special text by invoking the ATTRIBUTES option, under the EDIT command.

4.1.13 Fill

This option allows you to select a color for the drawing symbols. When you invoke this option you will be prompted to **Pick a new color from the color bar.** Position the cursor over the desired color and press the left mouse button. (**NOTE:** The ↑↓ (color) option is active at this time. This option will display the additional color selections available.) The Fill box will change to the newly selected color. All drawing symbols created in your diagram will be displayed in this selected color. If you modify an existing drawing, the symbol colors won't change. To change the color of existing symbols you must invoke the ATTRIBUTES suboption from the EDIT option.

4.1.14 Line

This option allows you to select a color for the lines that connect the text and symbols in the diagram. When you invoke this option you will be prompted to **Pick a new color from the color bar.** Position the cursor over the desired color and press the left mouse button. (**NOTE:** The ↑↓ (color) option is active at this time. This option will display the additional color selections available.) The Line box will change to the selected color. All lines generated in your diagram will be this selected color. Again, if you are modifying an existing drawing the lines won't change to this color. To change existing lines to the new color you must invoke the ATTRIBUTES suboption for the EDIT option.

4.1.15 type

This option allows you to set a default line type for your diagrams. When you invoke this option, a small window appears displaying the three line types (solid, broken, and dotted). To select a line type, position the cross hair over the desired line type and press the left mouse button. All lines drawn in your diagram will be of this type. If you have an existing drawing that you are

modifying, remember - the existing lines do not change. To change existing lines you must access the ATTRIBUTES suboption under the EDIT option.

4.1.16 Mult

This option allows you to toggle between multiple pick and single pick. The multipick option allows you to continue with a given process until terminated. For example, when creating an "AND" gate, the symbol will reappear after each placement until you cancel the process by pressing the right mouse button. If single pick (sngl) is turned on, the user must return to the menu and select "AND" again after each placement.

4.1.17 Scroll Color Bar (up and down arrow)

This option allows you to scroll the color bar to display the additional color selections available. Position the cursor on the color bar scroll box (up and down arrow) and press the left mouse button or <Enter> key. The next series of colors available will be displayed.

4.2 Plot Tree (HP)

This option allows you to plot HP graphics files. To use this option, a .HPP file must first be created (see Section 4.1.8.10). When you invoke this option, Figure 21 will be displayed. All available plot files are displayed. The following options are available:

Exit	-	Returns you to Figure 10.
Plotter	-	Sends the specified file to the plotter.
Hpgl	-	Converts the .HPP files.
Delete	-	Deletes the plotter file.

In addition, the following function keys are available:

<Esc>	-	Returns you to the previous screen.
<F1>	-	Displays on-line help messages.
<F2>	-	Marks a line of files for further processing. When you mark a line, an asterisk will appear in front of the first file name.
<F3>	-	Marks all the displayed files for further processing.
<F4>	-	Allows you to mark a range of files for further processing.

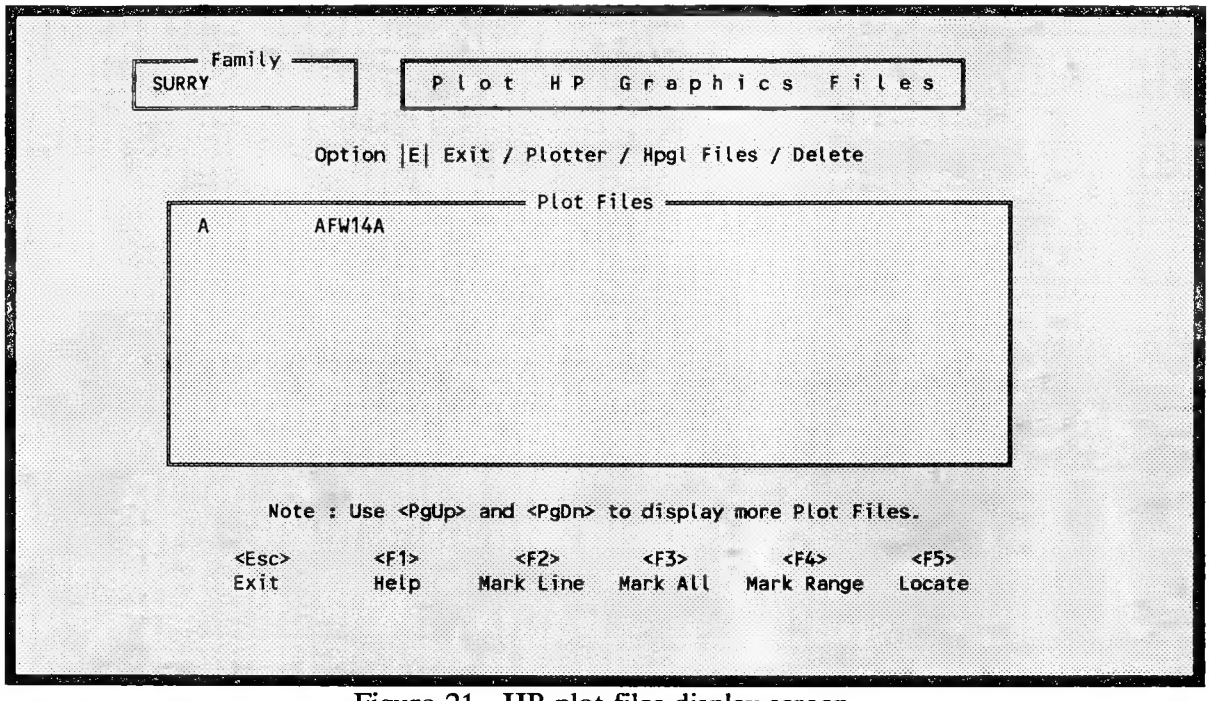


Figure 21. HP plot files display screen.

<F5> - Allows you to locate a specific file for further processing. When you invoke this function, Figure 22 will be displayed. Enter the file name to locate and press <Enter>. The specified file will be highlighted. If the file name does not exist, an error message will be displayed, and you will be returned to the previous screen.

4.2.1 Plotter

This option takes the .HPP files generated in the HP Plotter option in the graphics editor (Build) and sends that information (after a conversion) to the HP Pen Plotter (7475). If a plotter is not defined, you will receive the message **Plotter not attached.**

4.2.2 Hpgl Files

This option converts the .HPP files. This allows you to print the files later via batch processing or send the file to a printer which emulates (e.g., plotter cartridge in Wordperfect) the pen plotter.

4.2.3 Delete

This option allows you to delete a plot file from the current directory. To invoke this option enter a <D> in the option field, highlight the file to delete, and press <Enter>. The file will be deleted.

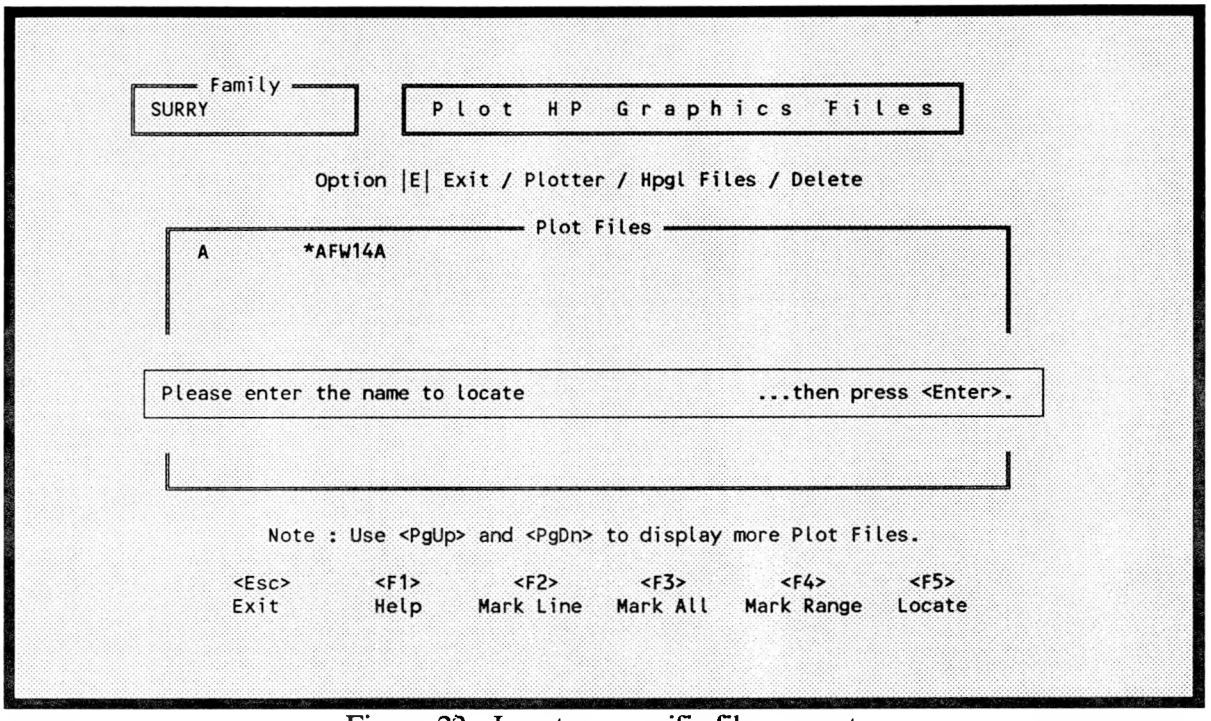


Figure 22. Locate a specific file prompt.

4.3 *Rasterize Tree*

This option allows you to rasterize fault tree diagrams for printing. Obtaining a "laser printed" output of a fault tree diagram is done in two steps, First, you must select which drawings to rasterize. Once the drawings have been rasterized, you must exit the program and use the DOS COPY command to send the files to the laser printer. This command is **Copy /b filename.RAS**.

When you select this option, Figure 23 will be displayed. As shown all fault tree files in the current directory will be displayed. Two options are available: Low Resolution Rasterize and High Resolution Rasterize. In addition, the following function keys are available:

<Esc> - Returns you to the previous screen.

<F1> - Displays on-line help messages.

<F2> - Marks a line of files for further processing. When you mark a line, an asterisk will appear in front of the first file name.

<F3> - Marks all the displayed files for further processing.

<F4> - Allows you to mark a range of files for further processing.

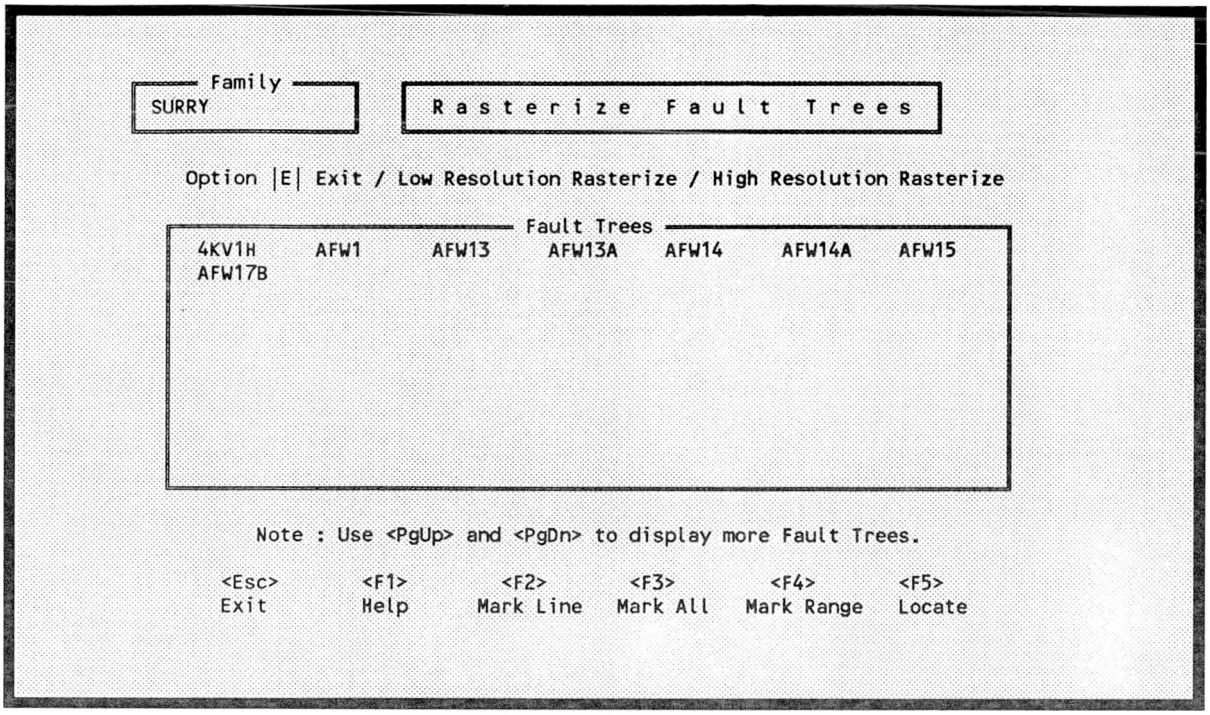


Figure 23. Select files to rasterize.

<F5> - Allows you to locate a specific file for further processing. When you invoke this function, Figure 22 will be displayed. Enter the file name to locate and press <Enter>. The specified file will be highlighted. If the file name does not exist, an error message will be displayed, and you will be returned to the previous screen.

4.3.1 Low Resolution Rasterize

This option rasterizes the selected fault tree to 150 dots per inch. To invoke this option, enter an <L> in the option field, highlight the file(s) to be rasterized, and press <Enter>. A message will be displayed telling you that the rasterizing is being performed. A percent complete will also be displayed so you can track the progress of the rasterizing. When complete, a message will be displayed notifying you that the raster image has been created.

4.3.2 High Resolution Rasterize

This option rasterizes the selected fault tree to 300 dots per inch. This option provides you with the highest quality of output available. To invoke this option, enter an <H> in the option field, highlight the file(s) to be rasterized, and press <Enter>. A message will be displayed telling you that the rasterizing is being performed. A percent complete will also be displayed so you can track the progress of the rasterizing. When complete, a message will be displayed notifying you that the raster image has been created.

4.4 Load Graphic Trees

This option allows you to load graphics file. When you invoke this option, Figure 24 will be displayed. As shown, two options are available: Exit and Load. In addition, the following function keys are available:

<Esc> - Returns you to the previous screen.

<F1> - Displays on-line help messages.

<F2> - Marks a line of files for further processing. When you mark a line, an asterisk will appear in front of the first file name.

<F3> - Marks all the displayed files for further processing.

<F4> - Allows you to mark a range of files for further processing.

<F5> - Allows you to locate a specific file for further processing. When you invoke this function, Figure 22 will be displayed. Enter the file name to locate and press <Enter>. The specified file will be highlighted. If the file name does not exist, an error message will be displayed, and you will be returned to the previous screen.

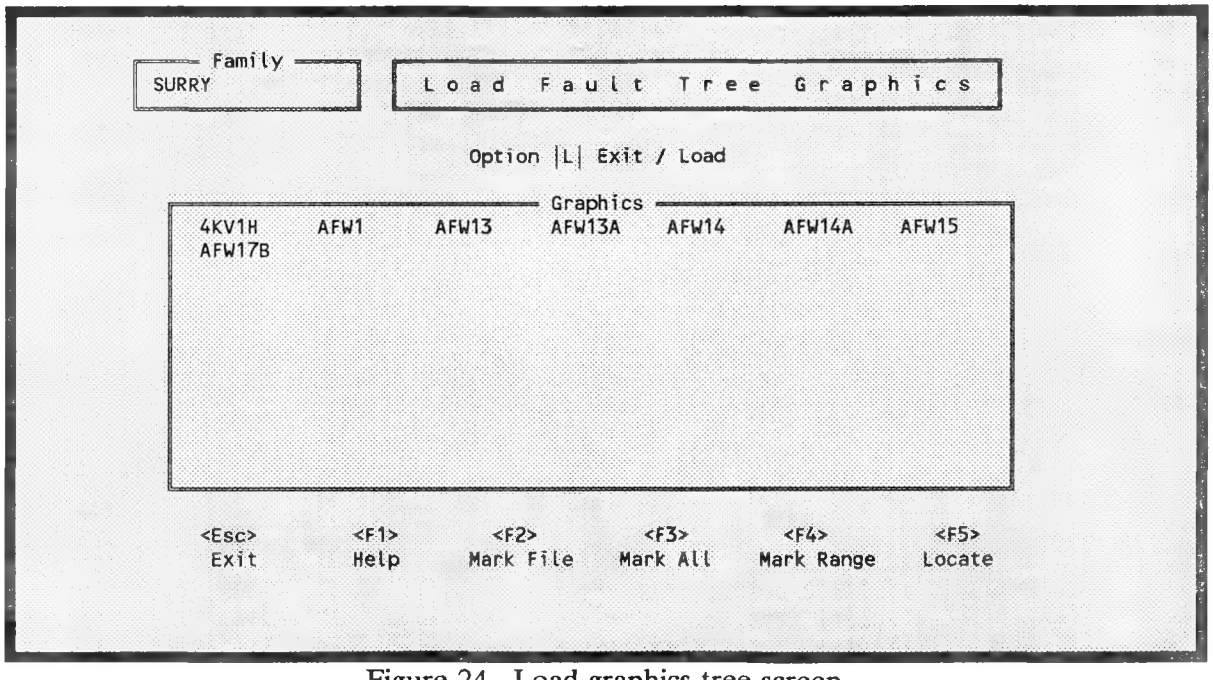


Figure 24. Load graphics tree screen.

4.4.1 Exit

This option returns you to the previous screen (Figure 10). To invoke this option, enter an <E> in the option field and press <Enter>, or press the <Esc> key.

4.4.2 Load

This option allows you to load graphics into the system. A conversion of the selected file will be performed. To invoke this option, enter an <L> in the option field, highlight the file or mark the files to be loaded using the function keys, and press <Enter>. A message will be displayed telling you that the selected file(s) is being converted.

4.5 Alpha to Graphics

This option allows you to convert an alpha file to a graphical format. Use this option when you define the fault tree logic with an ASCII file. No graphical information is contained in this file, therefore a conversion must be performed. When you invoke this option, Figure 25 will be displayed. As shown, two options are available: Exit and Convert. In addition, the following function keys are available:

<Esc>	-	Returns you to the previous screen.
<F1>	-	Displays on-line help messages.
<F2>	-	Marks a line of files for further processing. When you mark a line, an asterisk will appear in front of the first file name.
<F3>	-	Marks all the displayed files for further processing.
<F4>	-	Allows you to mark a range of files for further processing.
<F5>	-	Allows you to locate a specific file for further processing. When you invoke this function, Figure 22 will be displayed. Enter the file name to locate and press <Enter>. The specified file will be highlighted. If the file name does not exist, an error message will be displayed, and you will be returned to the previous screen.

4.5.1 Exit

This option returns you to the previous screen (Figure 10). To invoke this option, enter an <E> in the option field and press <Enter>, or press the <Esc> key.

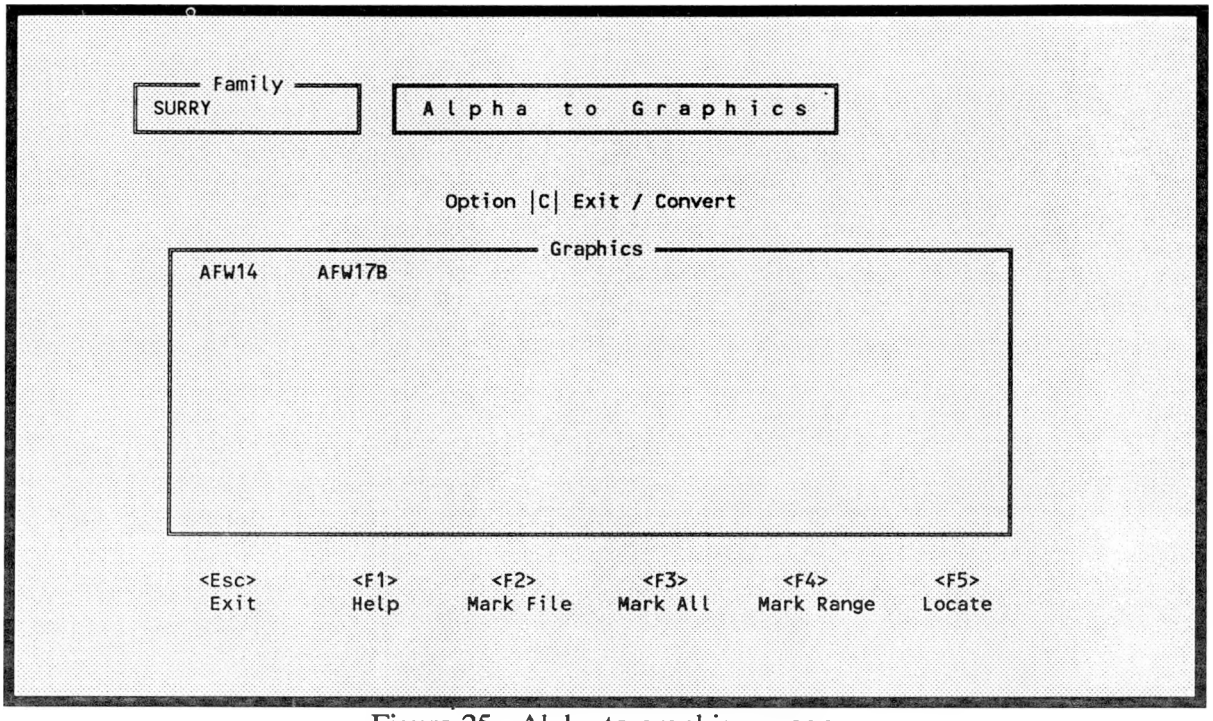


Figure 25. Alpha to graphics screen.

4.5.2 Convert

This option allows you to convert an alpha file(s) to a graphical format. To invoke this option, enter a <C> in the option field, highlight the file or mark the files (using the function keys) you wish to convert. A small window will appear at the top of the screen (as shown in Figure 26). Two prompts are displayed asking you whether you want to use tables and/or boxed events in the newly created graphic file. Indicate with a Y or N. Press <Enter> when complete. A message will appear notifying you that the graphics image has been created.

4.6 Graphical Pager

This option allows you to break up larger drawings into many pages or smaller drawings. When you invoke this option, Figure 27 is displayed. Each menu option is discussed in the following paragraphs.

4.6.1 ←PAGE→

This option allows you to move the menu to another location on the screen. To invoke this option, position the cursor on the ←PAGE→ box and press the left mouse button. An outline box will appear. Move the box to the desired location and press the left mouse button again. The pop-up menu will be displayed at the new location.

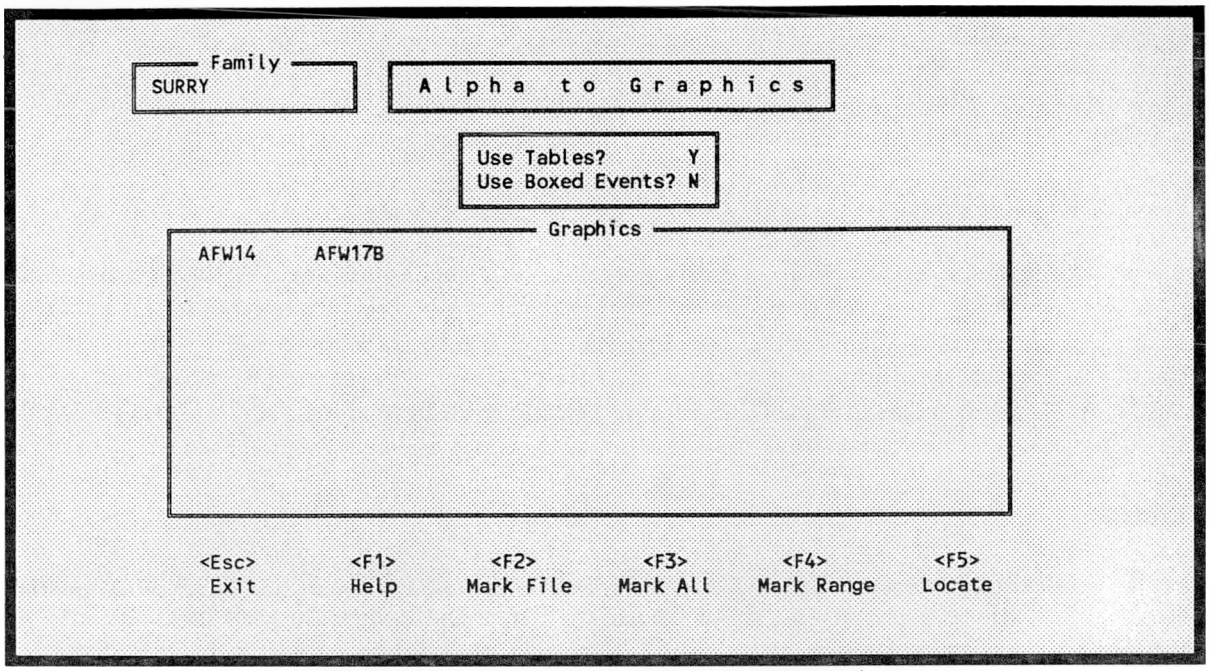


Figure 26. Set table/box toggle for conversion.

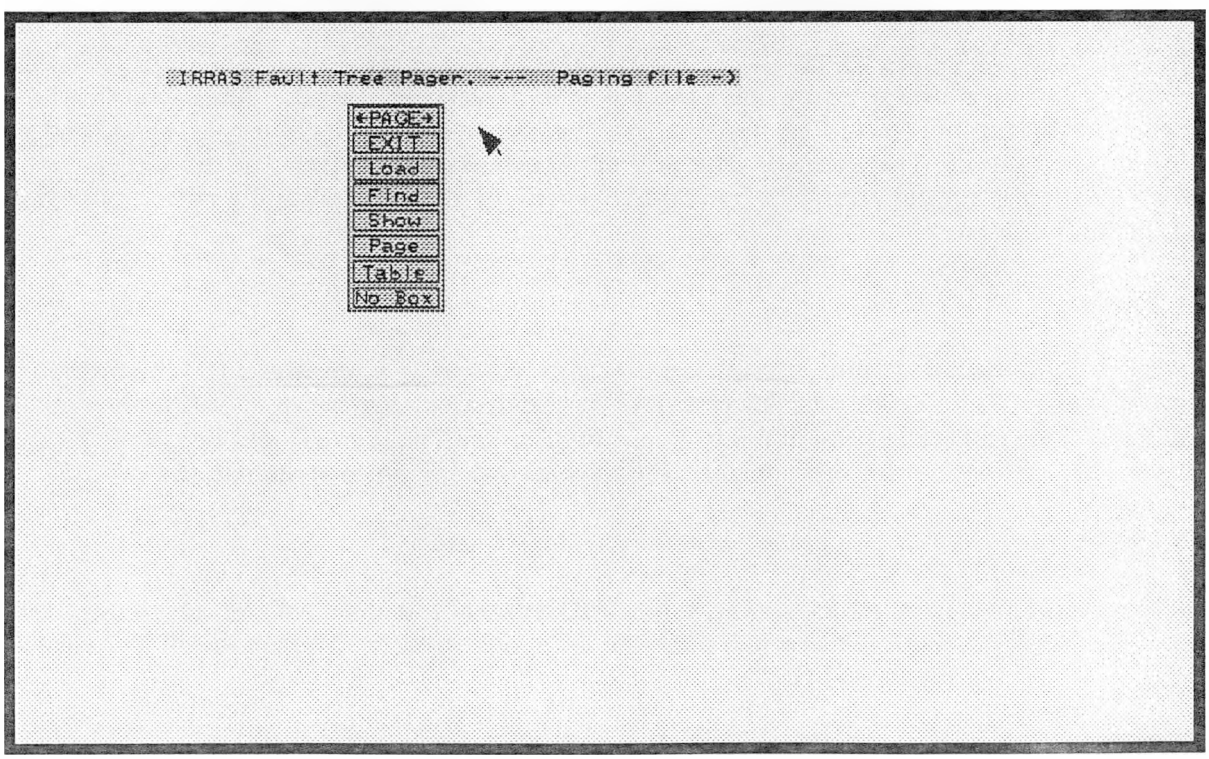


Figure 27. Graphical pager pop-up menu.

4.6.2 Exit

This option returns you to the previous screen (Figure 10). To invoke this option, enter an <E> in the option field and press <Enter>, or press the <Esc> key.

4.6.3 Load

This option allows you to load a file and display it on the screen. To invoke this option, position the cursor on the Load box and press the left mouse button. A pop-up menu will appear listing all files currently available. The message **Pick the file to transfer to** will be displayed at the bottom of the screen. Position the cursor on the desired file and press the left mouse button. The message **Logic loaded successfully** will be displayed at the bottom of the screen and the selected file will be displayed.

4.6.4 Find

This option allows you to locate a specific event or label on the diagram. When you invoke this option, you will be prompted to **Enter name >**. Enter the name you wish to locate and press <Enter>. The symbol containing the entered name will be highlighted with a broken dotted line. The dotted line will remain until you invoke another option.

4.6.5 Show

This option allows you to display the labels in a readable format. When you invoke this option, you will be prompted to **Pick a shape**. Position the cross hair on the desired shape and press the left mouse button. The event or label will be displayed at the bottom of the screen. At this point you may position the cross hair on another symbol or shape or press the right mouse button to terminate the process.

4.6.6 Page

This option allows you to insert or transfer a page break in your diagram. When you invoke this option you will be prompted to **Select a Gate for the desired page break**. Position the cross hair at the appropriate gate and press the left mouse button. The page break will be created. At this point you may create another page or press the right mouse button to terminate the process.

4.6.7 Table

This option toggles generation of "tables" rather than "basic events." To toggle this option, position the cursor on the Table box and press the left mouse button. The menu will be redisplayed and the Table box will now read No Tab.

4.6.8 Boxed

This option toggles generation of "boxed basic events" rather than "basic events." To toggle this option, position the cursor on the Boxed option and press the left mouse button. The menu will be redisplayed and the Boxed option will now read No Box.

4.7 Extract Fault Trees

This option allows you to extract fault trees from the data base. When you create a fault tree diagram and save it, the .DLS file is saved in the data base as well as in a temporary .DLS file. When you delete the temporary .DLS file, the file still exists in the data base. This option allows you to extract the .DLS file from the data base. When you invoke this option, Figure 28 will be displayed. On this screen all the fault trees residing in the current directory are displayed. Four options are available: Exit, eXtract Trees, Clear Extracted Trees, and Display Extracted Trees. In addition, the following function keys are available:

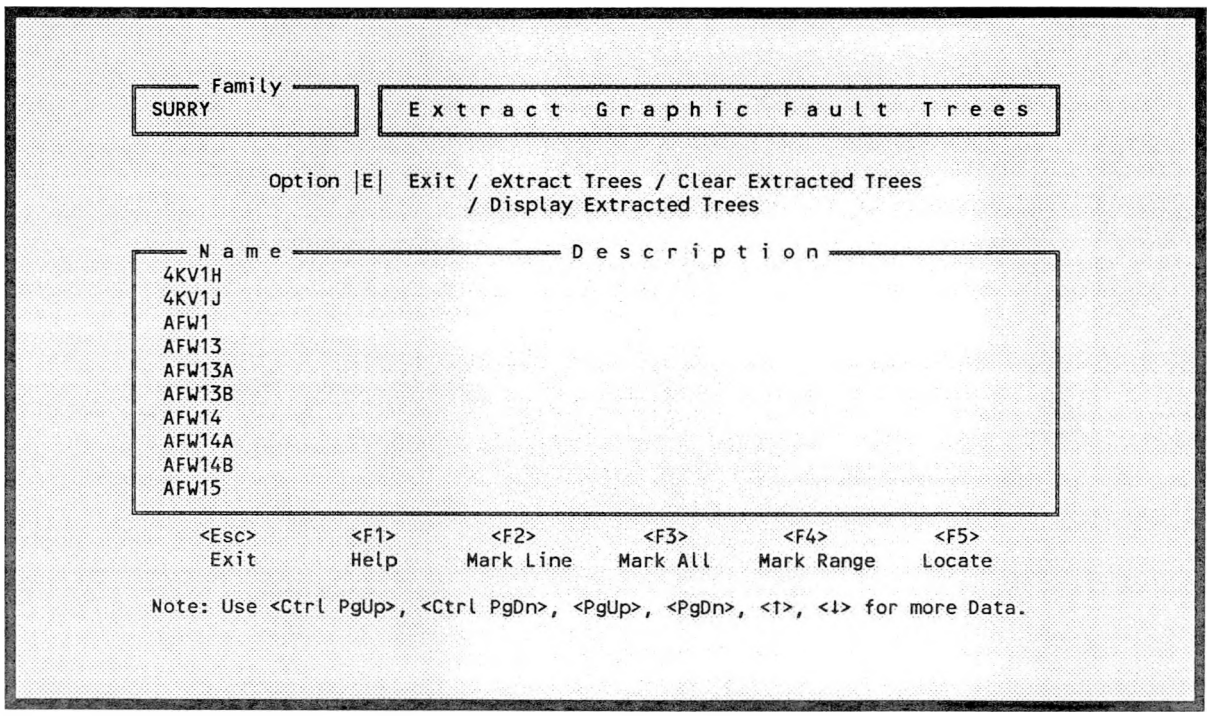


Figure 28. Extract fault trees screen.

<Esc> - Returns you to the previous screen.

<F1> - Displays on-line help messages.

<F2> - Marks a line of files for further processing. When you mark a line, an asterisk will appear in front of the first file name.

<F3> - Marks all the displayed files for further processing.

<F4> - Allows you to mark a range of files for further processing.

<F5> - Allows you to locate a specific file for further processing. When you invoke this function, Figure 22 will be displayed. Enter the file name to locate and press <Enter>. The specified file will be highlighted. If the file name does not exist, an error message will be displayed, and you will be returned to the previous screen.

4.7.1 Exit

This option returns you to the previous screen (Figure 10). To invoke this option, enter an <E> in the option field and press <Enter>, or press the <Esc> key.

4.7.2 eXtract Trees

This option allows you to remove specific trees from the data base. To invoke this option, enter an <X> in the option field, highlight the tree to be extracted or mark the trees to be extracted (using the function keys) and press <Enter>. A message will be displayed notifying you that the tree(s) was successfully extracted.

4.7.3 Clear Extracted Trees

This option allows you to clear all extracted trees from a file. To invoke this option, enter a <C> in the option field, highlight the file to be cleared or mark the files using the function keys, and press <Enter>. A warning screen will appear (Figure 29) telling you that all existing *.DLS files will be deleted. Enter a <Y> to delete or an <N> to terminate the process. Remember, this deletion only deletes the extracted picture file. The picture file will still reside in the data base.

4.7.4 Display Extracted Trees

This option allows you to display all the extracted trees to date. To invoke this option, enter a <D> in the option field and press <Enter>. A screen similar to the one shown in Figure 30 will be displayed. Press <Enter> to return to the previous screen.

4.8 Define Plotter Pens

This options allows you to assign colors to the plotter pens. When you invoke this option, a screen will be displayed showing 16 colors. Select the color to be mapped by positioning the cross hair over the desired color and pressing the left mouse button. You will then be prompted to Enter number of pen >. Enter the number of the pen that will contain the previously defined color. Continue this process until all pens have been defined. To terminate the process, position the cursor on the STOP symbol and press the left mouse button.

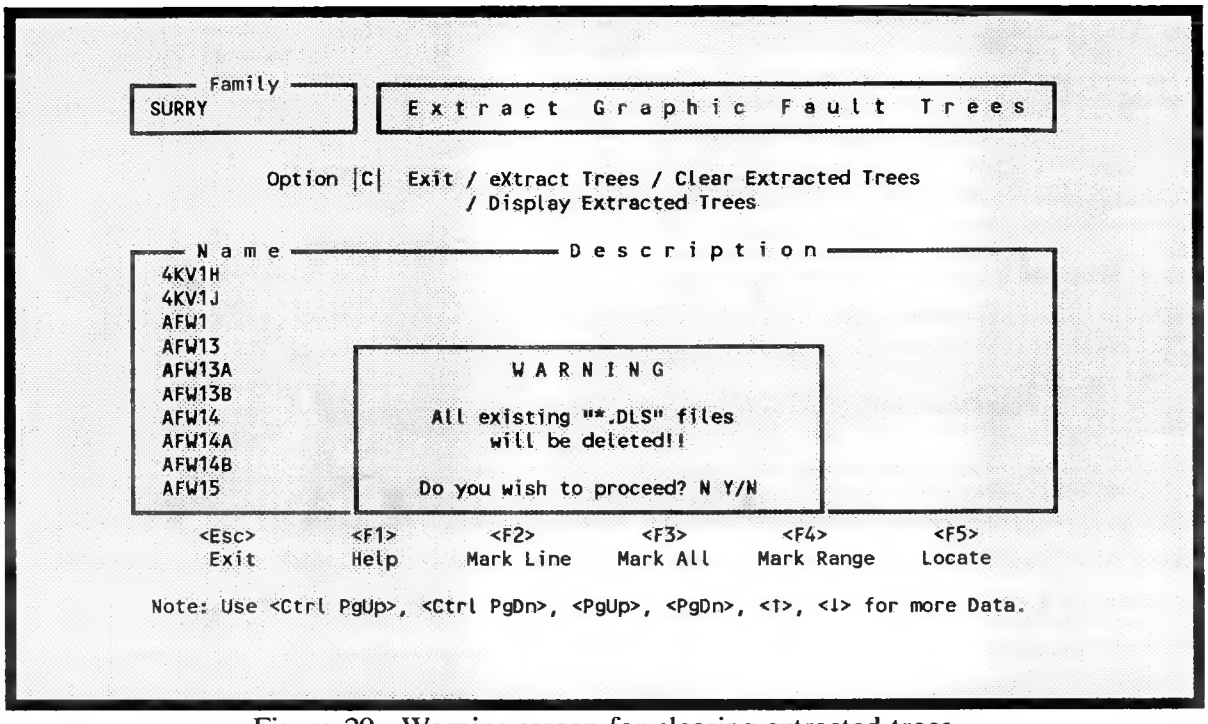


Figure 29. Warning screen for clearing extracted trees.

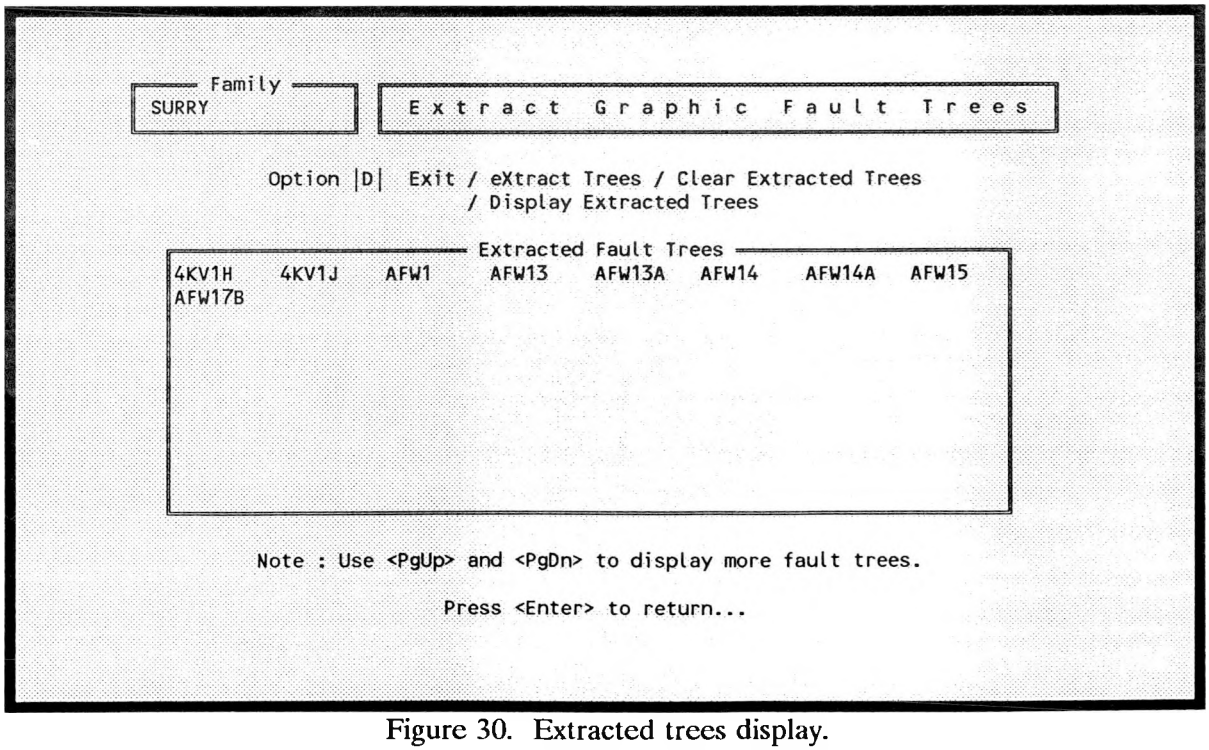


Figure 30. Extracted trees display.

5.0 FAULT TREE ANALYSIS

The Fault Tree Analysis option consists of the following five functions.

1. Modify Event Data includes adding, deleting, and modifying change sets. Change sets contain information about the probability/class changes that are to be applied to basic events during fault tree analysis. Within a change set you may modify selected event probabilities, and reset those event probabilities to the base case values. In addition, you may perform a base case update which takes all current event data and makes it the new base case data. The original base case data is overwritten in this process. You may also add, modify, or delete user-defined histograms.

2. Analyze Systems includes updating the cut sets, quantifying the cut sets, running uncertainty analyses, and updating the base case.

3. Display Results presents the analyses in various report forms.

4. The Cut Set Editor provides the means to modify the fault tree cut sets.

5. Logic Editor provides a means for editing the fault tree logic in an alphanumeric format.

Keys that you will frequently use are

<Esc>	Escape cancels your last choice and returns you to the previous screen.
<F1>	Help briefly explains the function of a field and may show you examples of data entered.
<F2>	Mark/Unmark tags items for use in the selected option.
<F3>	Clear All Marked events removes the marks (*) from the listed items. If no items are marked, this option will mark all of the items.
<F4>	Mark/Unmark range of items to more easily tag large numbers of items for processing.
<F5>	Locate an item. This option will display a blank field in the center of the screen, and a message **Please enter name to locate** will appear. The user should enter all or part of the name to be located and then press <Enter>. This feature will place the highlight on the located name. If the required name is not found, then the next name in alphabetical order will be highlighted.

To invoke this option, highlight FAULT Tree Analysis and press <Enter>. The fault tree analysis main menu is shown in Figure 31. The options available from the fault tree analysis main menu are: Exit, Modify Event Data, Analyze Systems, Display Results, Cut Set Editor, and Logic Editor. These options and their functions will be discussed in the following paragraphs.

5.1 Exit

The Fault Tree Analysis screen appears with Exit as the default choice in the command line

(see Figure 31). Press <Enter> to return to the IRRAS main menu.

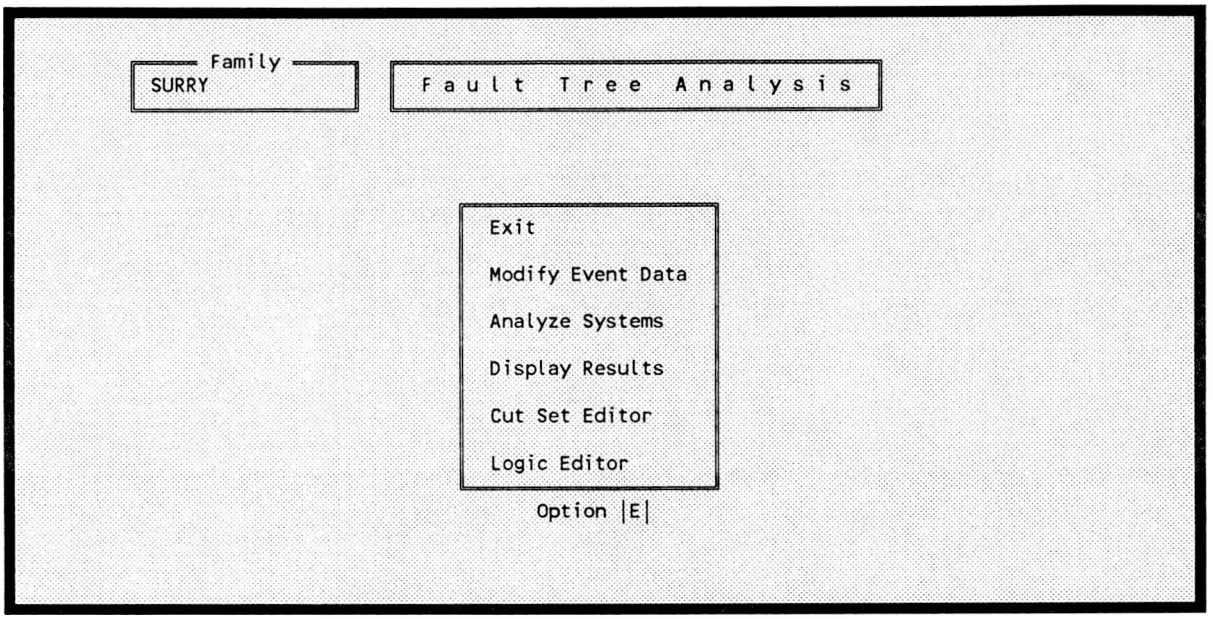


Figure 31. Fault tree analysis main menu.

5.2 Modify Event Data

The event data can be manipulated to examine the changes in the probabilities of plant accidents and accident sequence failures based on basic events. The probability of events occurring can be recalculated. You may generate change sets to be applied to the basic events for later propagation through the fault tree cut sets. You may update the base case which will replace the present base case data with current data.

From the Modify Event Data option, the following operations may be performed: add, modify, or delete change sets; create and reset individual event probability changes; define a class probability change for a group of events; add, modify, or delete user-defined histograms; update the base case event data with the current case event data; generate new current case event data using the temporary modifications made to the marked change sets; and create reports that reflect the event modifications that currently exist within the data base.

Highlight Modify Event Data or type <M> to select this option and press <Enter>. The Change Sets screen shown in Figure 32 will be displayed. A change set is a set of sensitivity data modifications to be applied to the basic events. Change Sets modify the current case basic event failure. A change set consists of a class change and/or many probability changes for a group of basic events.

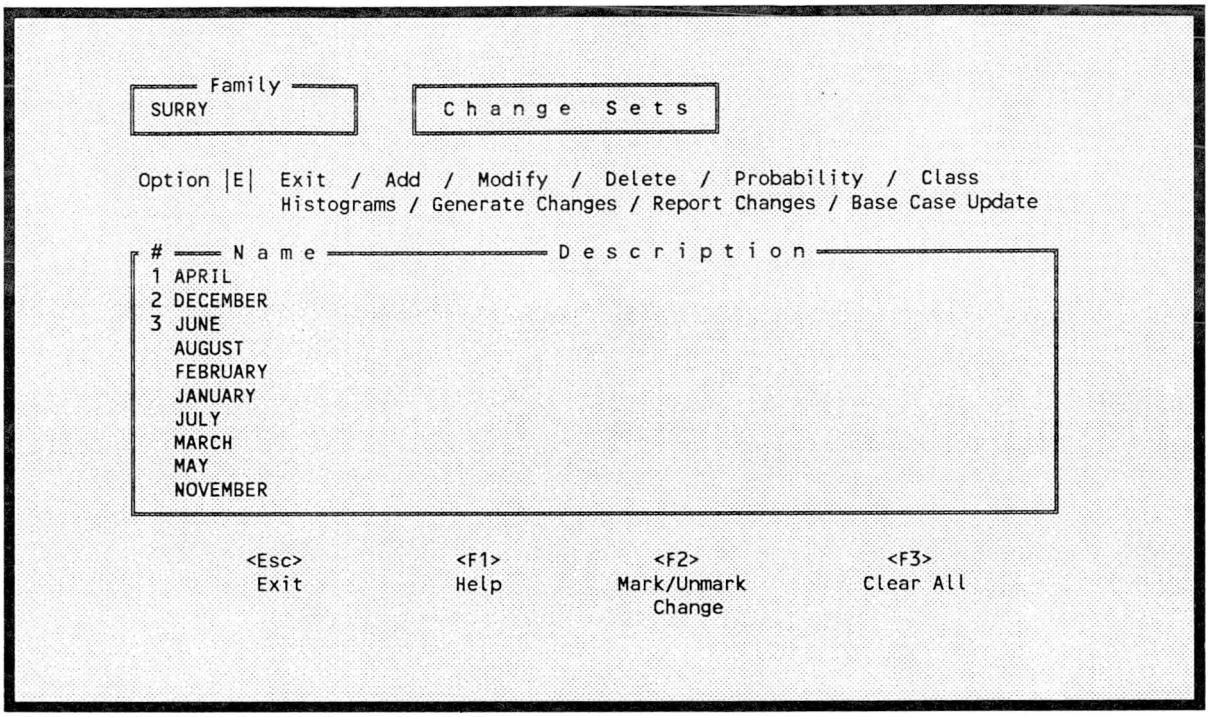


Figure 32. Change sets menu.

5.2.1 Exit

Type <E> in the option field and press <Enter>, or press the <Esc> key to return to the Fault Tree Analysis screen (Figure 31).

5.2.2 Add

The Add function is used to add a change set name and description to the data base. You supply a name (up to 16 characters) and a description (up to 60 characters). The current date is supplied by the system but you may change it if you wish.

To activate the add function, type <A> (Add) in the option field and press <Enter>. The Add Change Set screen shown in Figure 33 will be displayed.

To exit the Add Change Set screen without entering a new change set, press <Esc> or move the cursor to the option field by pressing <Home>, type <E> (Exit), and press <Enter>.

The Add Change Set screen is displayed with the <A> (Add) option as the default entry in the option field. After entering the desired data and pressing <Enter>, the message **New change record added** is displayed at the bottom of the screen and you are returned to the previous screen (Figure 34). If the name you entered already exists, the message **Duplicate change record**

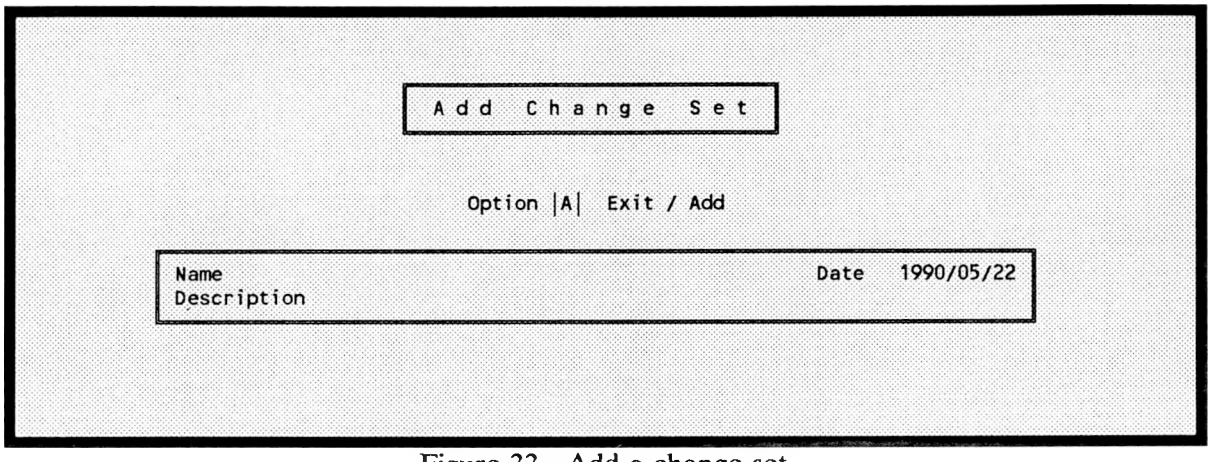


Figure 33. Add a change set.

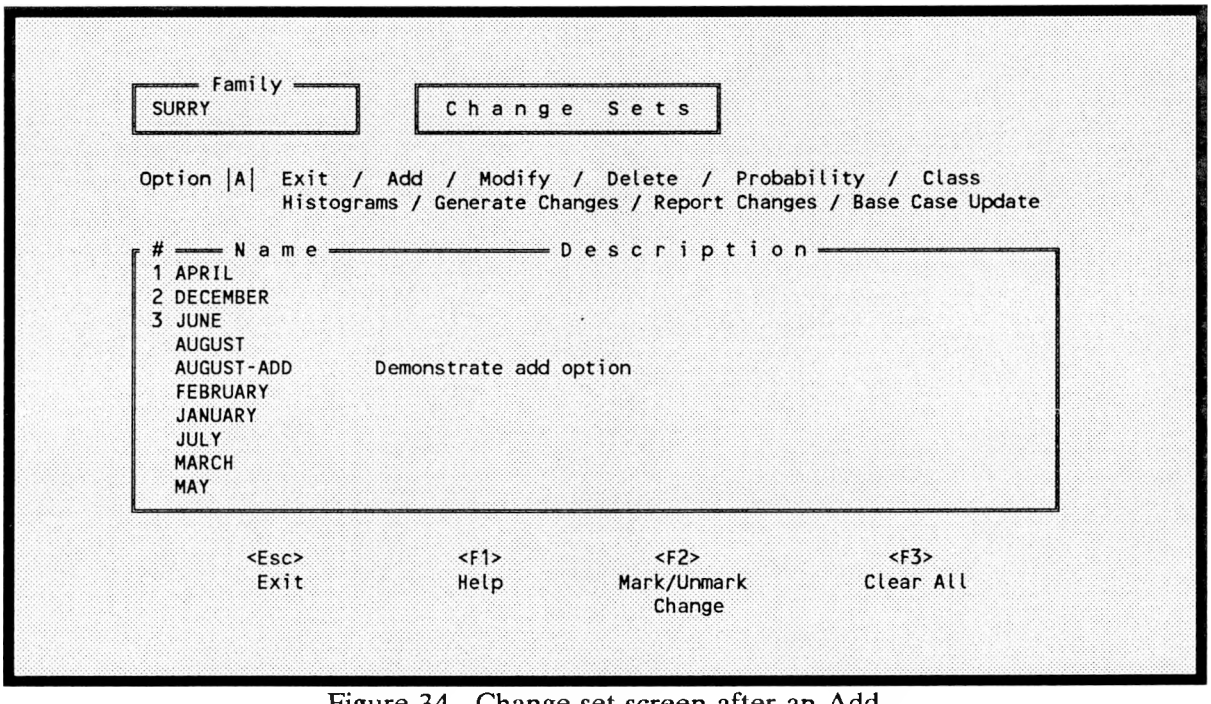


Figure 34. Change set screen after an Add.

name - not added is displayed at the bottom of the screen.

To exit the Add Change Set screen, press <Esc> or move the cursor to the option field by pressing <Home>, type <E> (Exit), and press <Enter>.

5.2.3 Modify

This option allows you to modify the name, description, and/or date for an existing change set. To invoke this function, type <M> in the option field, highlight the change set you want to modify and press <Enter>. The Modify Change Set screen (shown in Figure 35) appears. If you do not indicate the change set you want to modify before pressing <Enter>, a message **Record must be highlighted first** appears.

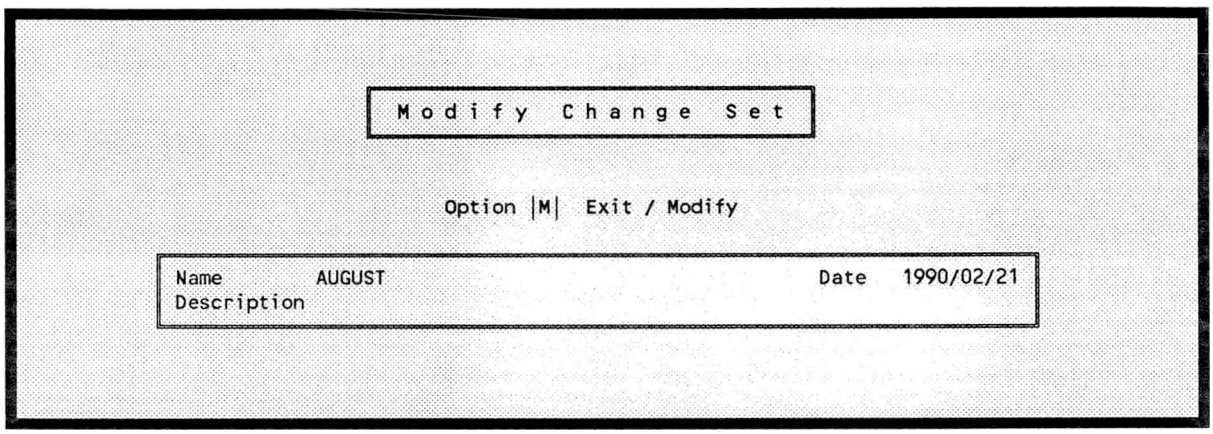


Figure 35. Modify change set.

Edit the name, description, and/or date and press <Enter> to execute the change. A confirmation message, **Record modified**, is displayed. To return to the Change Sets screen, press <Esc> or move the cursor to the option field by pressing <Home>, type <E> (Exit), and press <Enter>.

5.2.4 Delete

This function is used to remove a change set from the data base. To invoke this function, type <D> in the option field, highlight the change set you wish to delete, and press <Enter>. (If you did not indicate the change set to delete before pressing <Enter>, a message **Record must be highlighted first** appears.) The Delete Change Set screen (Figure 36) is displayed with a blank option field. Type <D> and press <Enter> to remove the change set. You will be returned to the Change Sets screen, and a message **Change record deleted** is displayed.

If the option field is blank and you press <Enter>, you will return to the previous screen (Change Sets). To exit the Delete Change Set screen without deleting a record, press <Esc> or type <E> (Exit) in the option field, and press <Enter>. Either of these actions returns you to the previous screen and cancels the delete option.

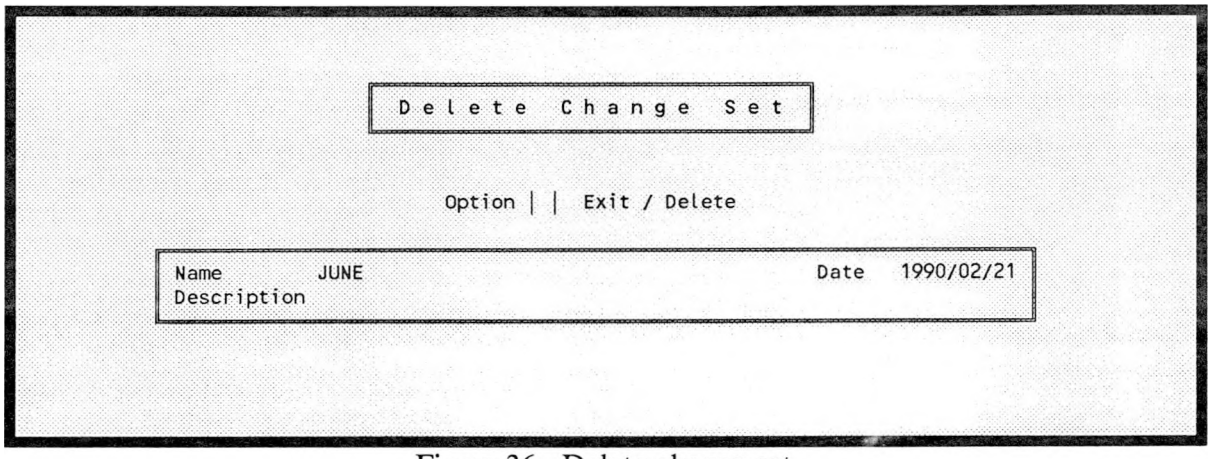


Figure 36. Delete change set.

5.2.5 Probability

This function allows you the flexibility to experiment with setting different basic event failures and uncertainty data. These data values may be set for a single event or for a specified group of events. The function also provides a reset option to set data values back to the base case values. To invoke this function, type <P> in the option field, highlight a change set, and press <Enter>. The Select Event screen (Figure 37) appears with <P> (Probability) as the default option. The change set name is shown in the upper right corner in the Change Set box.

5.2.5.1 Exit. This function returns you to the previous screen. To invoke this function, type <E> (Exit) in the option field and press <Enter>, or press the <Esc> key.

5.2.5.2 Probability. This function allows you to modify the current uncertainty and failure data values. This current data can then be applied to the specified events for use during fault tree analysis. The changes applied to basic event data may be for a single event or a group of marked events.

To invoke this function, type <P> (Probability) in the option field, highlight an event or mark a group of events (using F2 and/or F4 function keys) and press <Enter> (Figure 38). If only a single event has been selected then the Event Probability Changes screen (for a single event) will be displayed (Figure 39). The display is divided into three data areas: Event Attributes, Uncertainty Data, and Failure Data. The Event Attributes data display is for information only; no changes may be made to the data fields in this display. The Uncertainty Data/Failure Data areas display both the base case and current data values. You may change only the current data values.

If a group of events were marked (Figure 38), using the function keys (F2 and F4) shown at the bottom of the screen, and the cursor was in the option field, then upon pressing <Enter> the Events Probability Changes (for a group of events) screen will be displayed (Figure 40). This display is divided into two data areas: Uncertainty Data and Failure Data. As before, both the

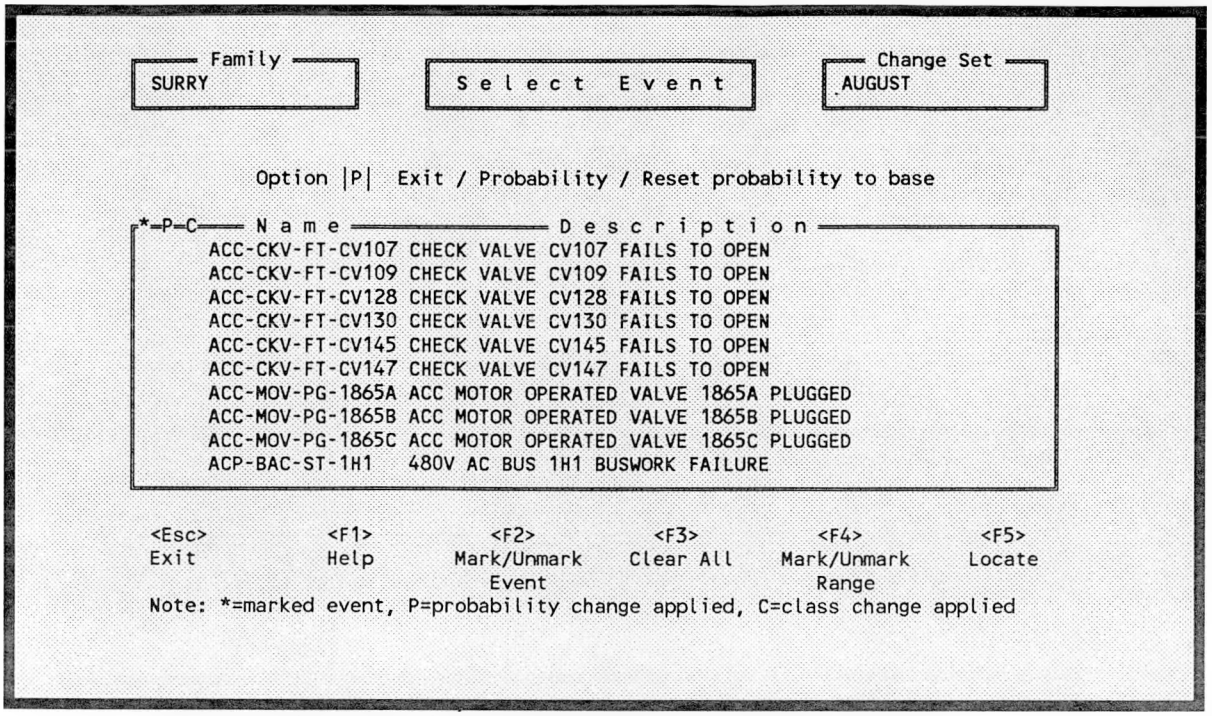


Figure 37. Select an event for probability changed.

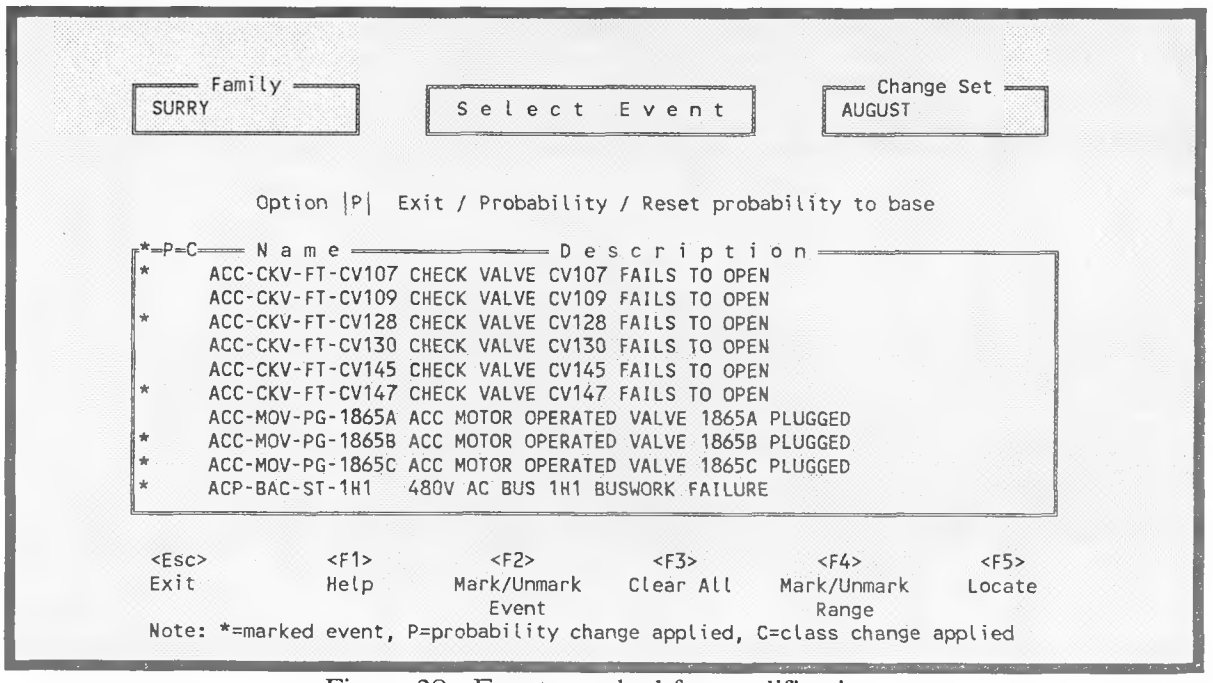


Figure 38. Events marked for modification.

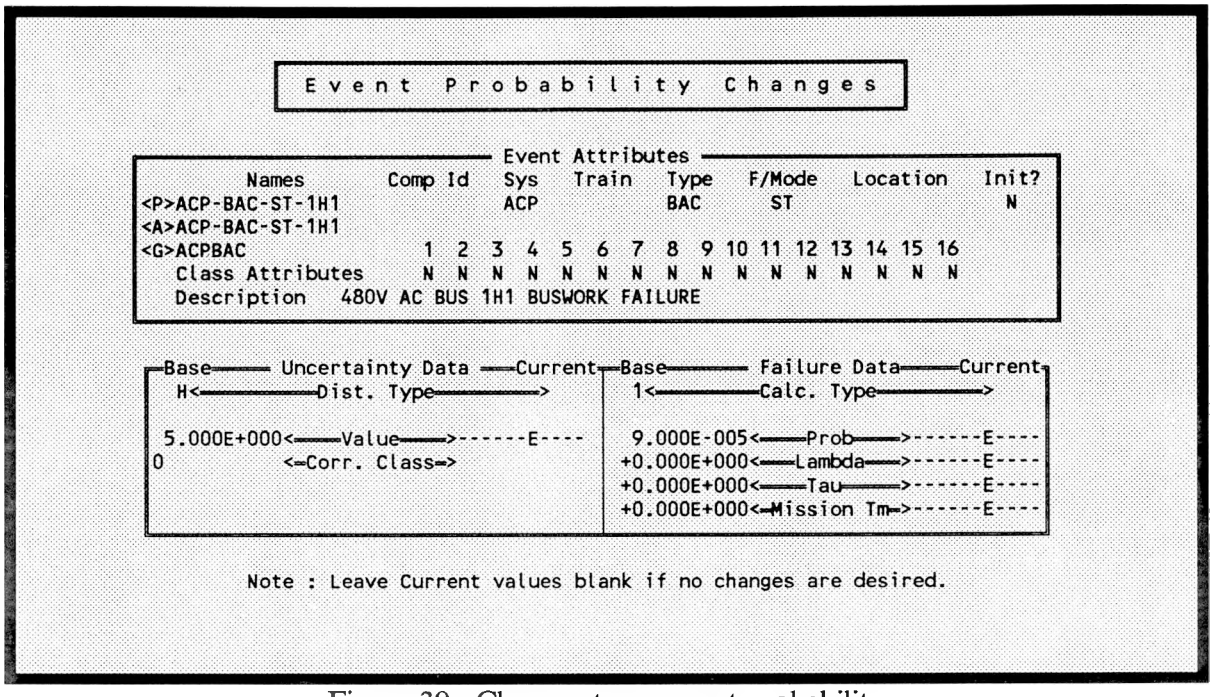


Figure 39. Changes to an event probability.

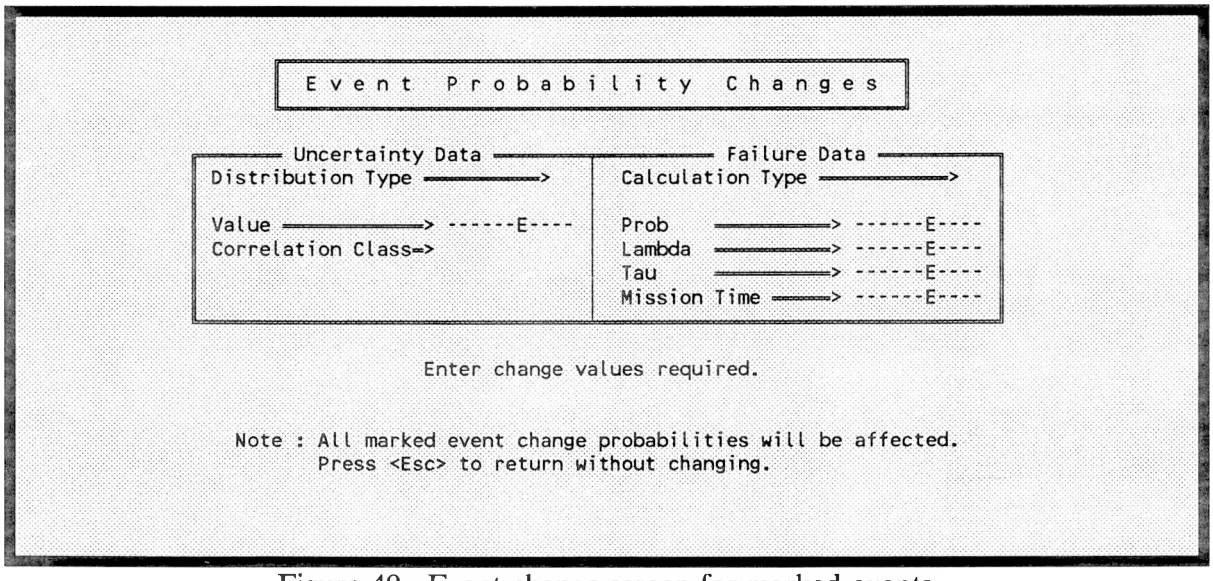


Figure 40. Event change screen for marked events.

base case and current data values are shown but you may only change the current values. The changes entered on this screen will be applied to all marked events.

The probability changes that are made are reflected on the Select Event display by

showing a "P" to the left of the effected events. Probability changes have a higher priority than class changes. When both are applied to an event, the probability change will be used during fault tree analysis. This is indicated by flagging the effected events with a "P" and "c" as shown in Figure 41.

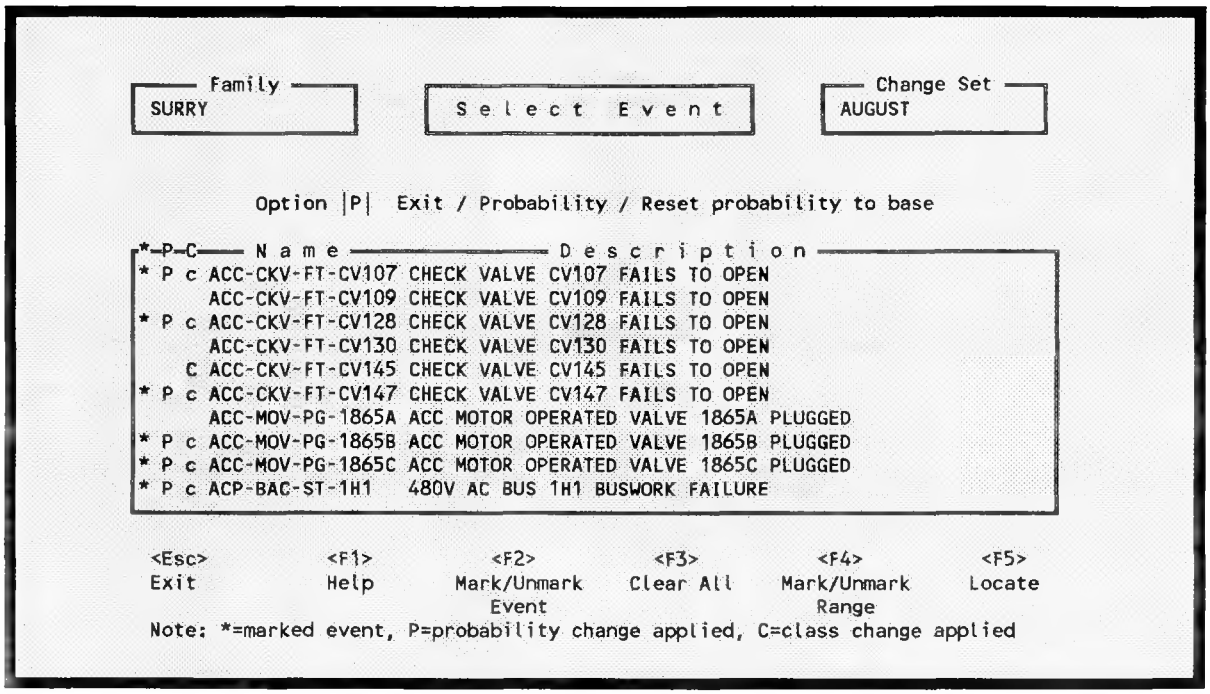


Figure 41. Event probability and class changes flagged.

On the Event Probability Changes display, help screens are supplied for all data entry fields. Pressing function key F1 when the cursor is in any data entry field will cause the help screen to be displayed. Most of the help forms contain a data entry field at the bottom of the display. This field may be used to enter the desired data value, which will then be transferred into the proper data field upon exiting the help screen. Highlighting an item in the help form list will set the correct value in the data entry field.

Currently, there are seven predefined distribution types available. The predefined distribution types are normal, lognormal, beta, gamma, chi-squared, uniform, and exponential. In addition to these predefined distribution types, the user-defined histograms may be used. The default distribution type is the lognormal. Figure 42 shows the help form associated with the distribution type field on the Event Probability Changes screen. From this help screen, help forms associated with each of the seven predefined distribution types are available. To view these distribution help forms, you must press the <F1> key while the cursor is positioned on the desired distribution type.

Correlation classes are used to account for data dependencies among like events in the data base. Correlation classes consist of four character upper-case values. A blank correlation class indicates that there are no data dependencies. When running the uncertainty analyses, the same

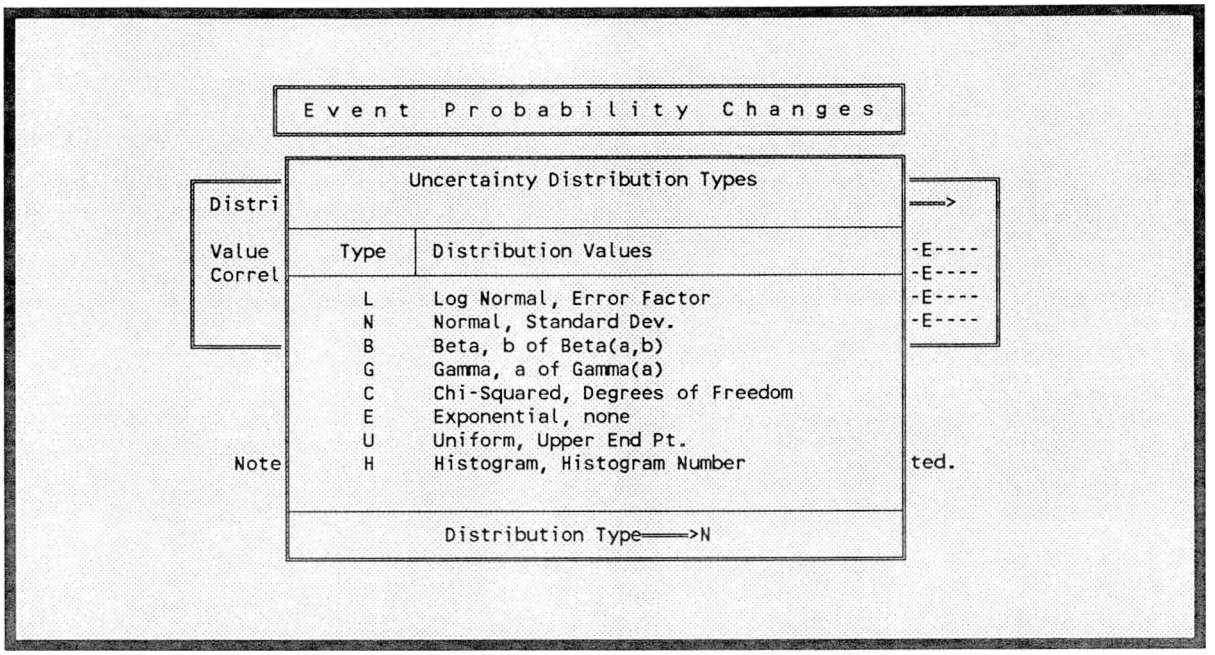


Figure 42. Uncertainty distribution types (probability change).

sample value will be used for all basic events with the same correlation class.

In the Failure Data box the calculation type is a numerical reference to the calculation method to be used. There are eleven types numbered 1 through 9, T, and F. When your cursor is in the Calculation Type field, press <F1> for an explanation of these calculations. The help screen is shown in Figure 43.

The following symbols are used in the equations for calculating failure probability:

P = failure probability of the basic event,
p = failure probability,
bp = base case failure probability,
L = failure rate per hour, input as lambda,
t_m = mission time expressed in hours, input as a default, and
T = average time to repair expressed in hours, input as tau.

An equation for each calculation type follows:

Calculation Type 1 $P = p$.

Calculation Type 2 $P = L * t_m$.

Calculation Type 3 $P = 1 - \text{Exp}(-L * t_m)$.

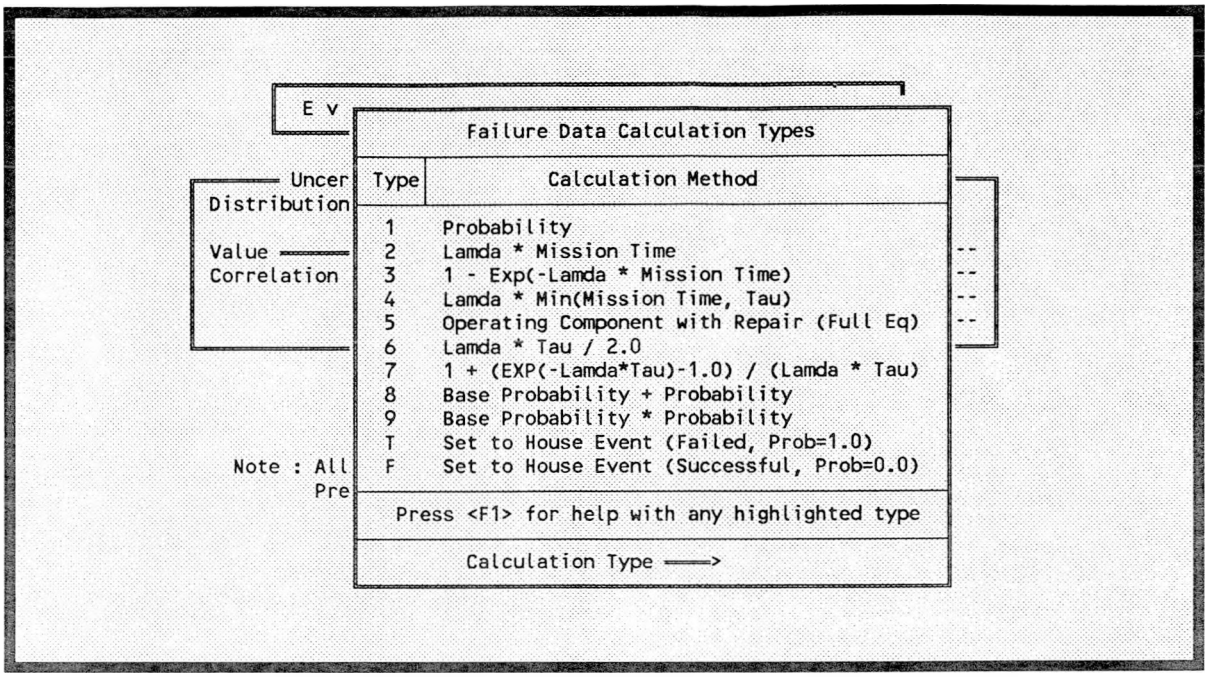


Figure 43. Failure data calculation types (probability changes).

Calculation Type 4 $P = L * \text{Min}(t_m, T)$.

Calculation Type 5 $P = ([L * T] / [1 + \{L * T\}]) * (1 - \text{EXP}[-\{(L + 1) / T\} * t_m])$.

Calculation Type 6 $P = L * (T/2)$.

Calculation Type 7 $P = 1 + (\text{EXP}[-L * T] - 1) / (L * T)$.

Calculation Type 8 $P = bp + p$.

Calculation Type 9 $P = bp * p$.

Calculation Type T $P = 1.0$ (House event - failed).

Calculation Type F $P = 0.0$ (house event - successful).

5.2.5.3 Reset Probability to Base. This option allows you to reset the probability changes (not class changes) for a selected event to the base case values. You may reset probability changes for a single event, a group of events, or all events.

To reset the probability change for a single event, type an <R> (Reset probabilities) in the option field, highlight the desired event name and then press <Enter>. The message **"Reset HIGHLIGHTED probability change? (Y/N)"** is displayed at the bottom of the screen. To reset the probability back to the base case value enter <Y> for yes. To terminate the reset operation enter <N> for no.

To reset the probability changes for a group of events, mark the desired events using the F2 and/or F4 keys, type an <R> in the option field and press <Enter>. The message **"Reset ALL marked probability changes? (Y/N)"** is displayed at the bottom of the screen. Press <Y> to complete the reset operation, or <N> to terminate the reset operation.

To reset all event probabilities to the base case values, clear all existing marks with the F3 key, type an <R> in the option field and press <Enter>. The message **"Reset ALL probability changes? (Y/N)"** is displayed at the bottom of the screen. Press <Y> to perform the reset operation, or <N> to terminate the reset operation.

5.2.6 Class Change

This option allows you to change event data parameters for a specified group of events. To invoke this option, enter a <C> in the option field, highlight the desired change set, and press <Enter>. (If you do not highlight a change set before pressing <Enter>, the message **A line must be highlighted** will be displayed at the bottom of the screen.) Upon pressing <Enter>, the screen in Figure 44 will be displayed. All data fields in the three data areas are data entry fields. The event class is defined by entering data in the Event Attributes data fields. The more of these fields that are filled in the finer the class definition becomes.

The class changes that you request are reflected on the Select Event display by showing a <C> to the left of the affected events (Figure 45). Probability changes have a higher priority than class changes. When both are applied to an event, the probability change will be used during event tree analysis. This is indicated by flagging the effected events with a "P" and "c" as shown in Figure 45.

On the Class Change display, help screens are supplied for all data entry fields. Pressing function key F1 when the cursor is in any data entry field will cause the help screen to be displayed. Figure 46 and Figure 47 show the help screens for Distribution Type and Calculation Type, respectively. Most of the help forms in this situation contain a data entry field at the bottom of the display. This field may be used to enter the desired data value, which will then be transferred into the proper data field upon exiting the help screen. Highlighting an item in the help form list will set the correct value in the data entry field.

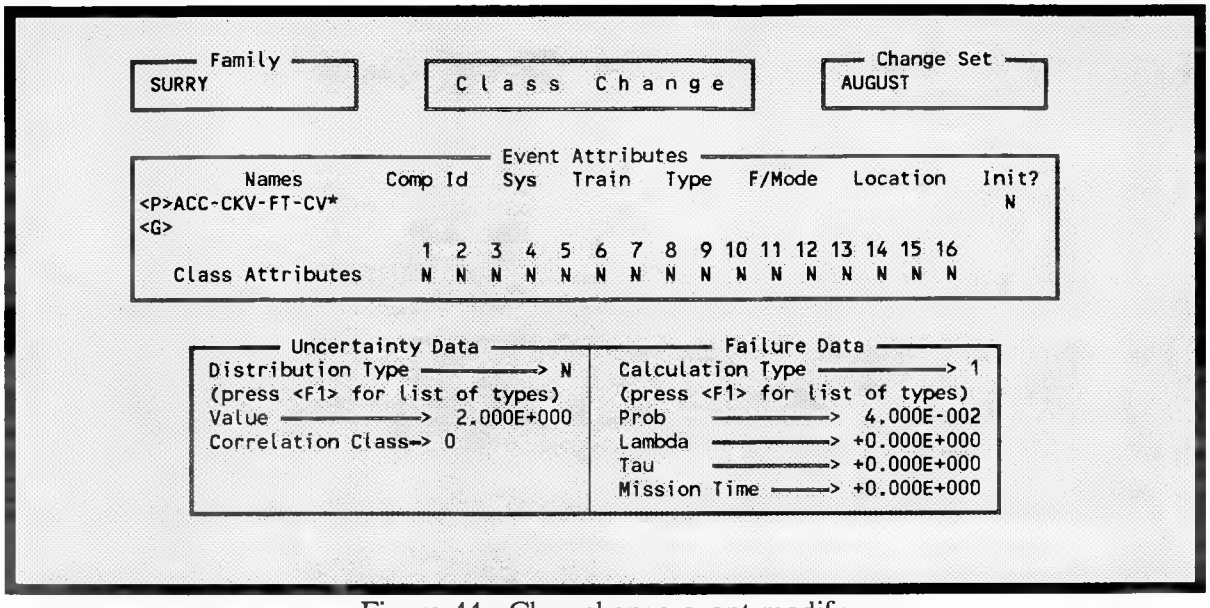


Figure 44. Class change event modify.

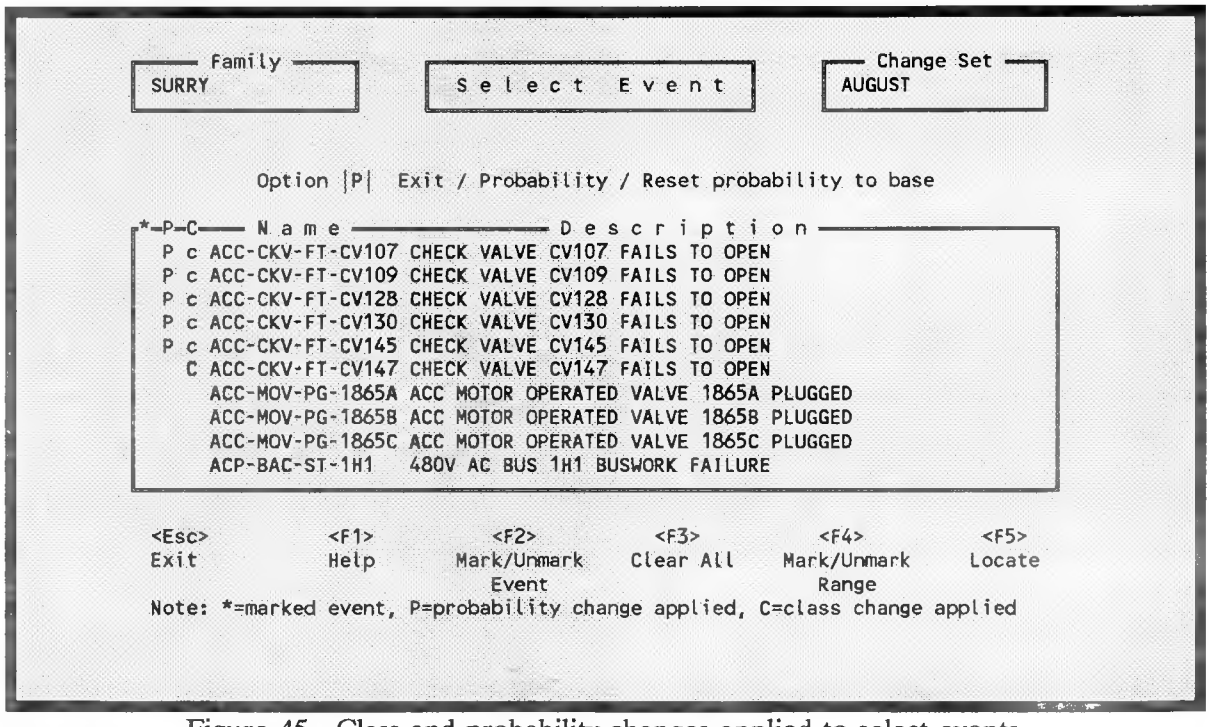


Figure 45. Class and probability changes applied to select events.

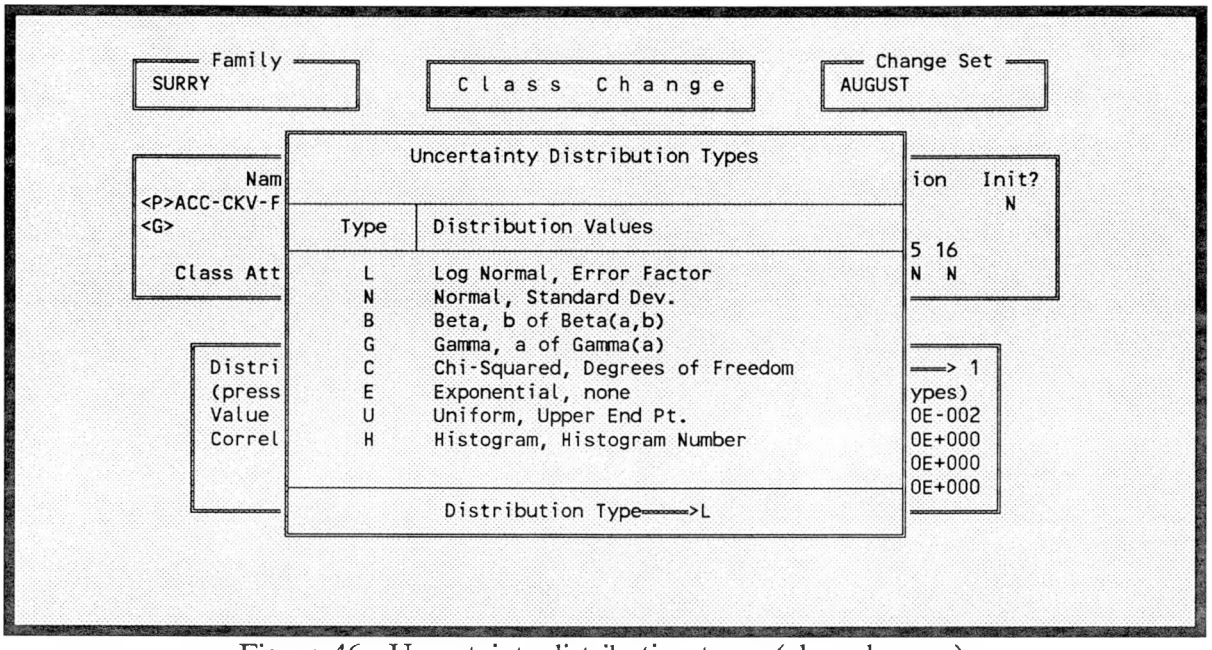


Figure 46. Uncertainty distribution types (class changes).

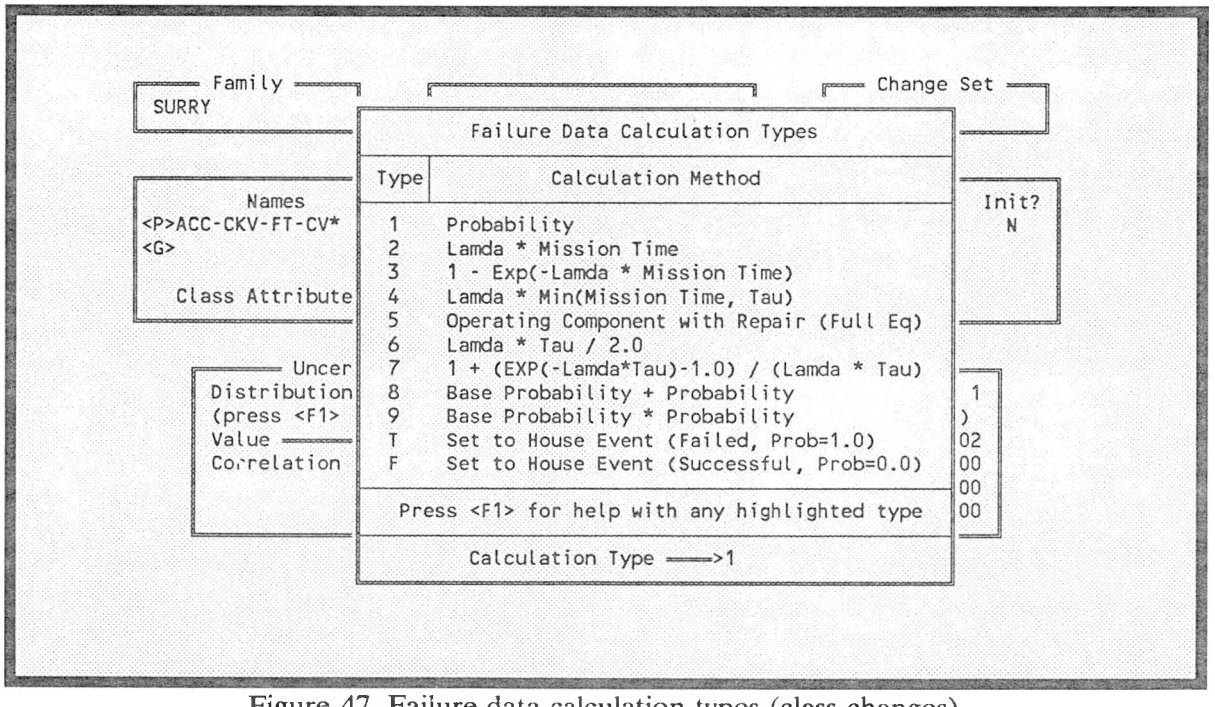


Figure 47. Failure data calculation types (class changes).

Currently, there are seven predefined distribution types available. The predefined distribution types are normal, lognormal, beta, gamma, chi-squared, uniform, and exponential. In addition to these predefined distribution types, user defined histograms may be used. The default distribution type is the lognormal. Figure 46 shows the help form associated with the distribution type field on the Event Probability Changes screen. From this help screen, help forms associated with each of the seven predefined distribution types are available. To view these distribution help forms, press the <F1> key while the cursor is positioned on the desired distribution type.

Correlation classes are used to identify basic events whose failure data are derived from the same data source. This information is used in the uncertainty analysis. Correlation classes consist of four upper-case values. A blank correlation class indicates that there are no data dependencies. When running the uncertainty analyses, the same sample value will be used for all basic events with the same correlation class.

In the Failure Data box the calculation type is a numerical reference to the calculation method to be used. There are eleven types numbered 1 through 9, T, and F. When your cursor is in the Calculation Type field, press <F1> for an explanation of these calculations. The screen shown in Figure 47 will be displayed.

The following symbols are used in the equations for calculating failure probability

P = failure probability of the basic event,
p = failure probability,
bp = base case failure probability,
L = failure rate per hour, input as lambda,
t_m = mission time expressed in hours, input as a default, and
T = average time to repair expressed in hours, input as tau.

An equation for each calculation type follows:

Calculation Type 1 $P = p$.

Calculation Type 2 $P = L * t_m$.

Calculation Type 3 $P = 1 - \text{Exp}(-L * t_m)$.

Calculation Type 4 $P = L * \text{Min}(t_m, T)$.

Calculation Type 5 $P = ([L * T] / [1 + \{L * T\}]) * (1 - \text{EXP}[-\{(L + 1) / T\} * t_m])$.

Calculation Type 6 $P = L * (T/2)$.

Calculation Type 7 $P = 1 + (\text{EXP}[-L * T] - 1) / (L * T)$.

Calculation Type 8 $P = bp + p$.

Calculation Type 9 P = bp * p.

Calculation Type T P = 1.0 (House event - failed).

Calculation Type F P = 0.0 (house event - successful).

To reset a class change set, enter the class change option and blank out the name fields, and press <Enter>. This will return the event data parameters to the base case values and return you to the Select Event screen.

5.2.7 User-Defined Histograms

This option allows you to create, modify, and delete user-defined histograms for uncertainty analysis. This is a useful option for allowing you to input your own uncertainty distribution for a basic event that may not be able to be expressed with one of the predefined distribution types. The Edit Histograms screen (Figure 48) displays the names of all the currently existing histograms. A unique number is associated with each histogram and is listed on the Edit Histograms screen to the left of the histogram name. The format type is also provided. There are two histogram format types: percentage format and range format. If the histogram was entered in a percentage format, a "P" will be displayed in the type field. If the histogram is in range format, an "R" will appear in the type field. To activate this option type an <H> (Histograms) in the option field of the Change Sets screen and press <Enter>.

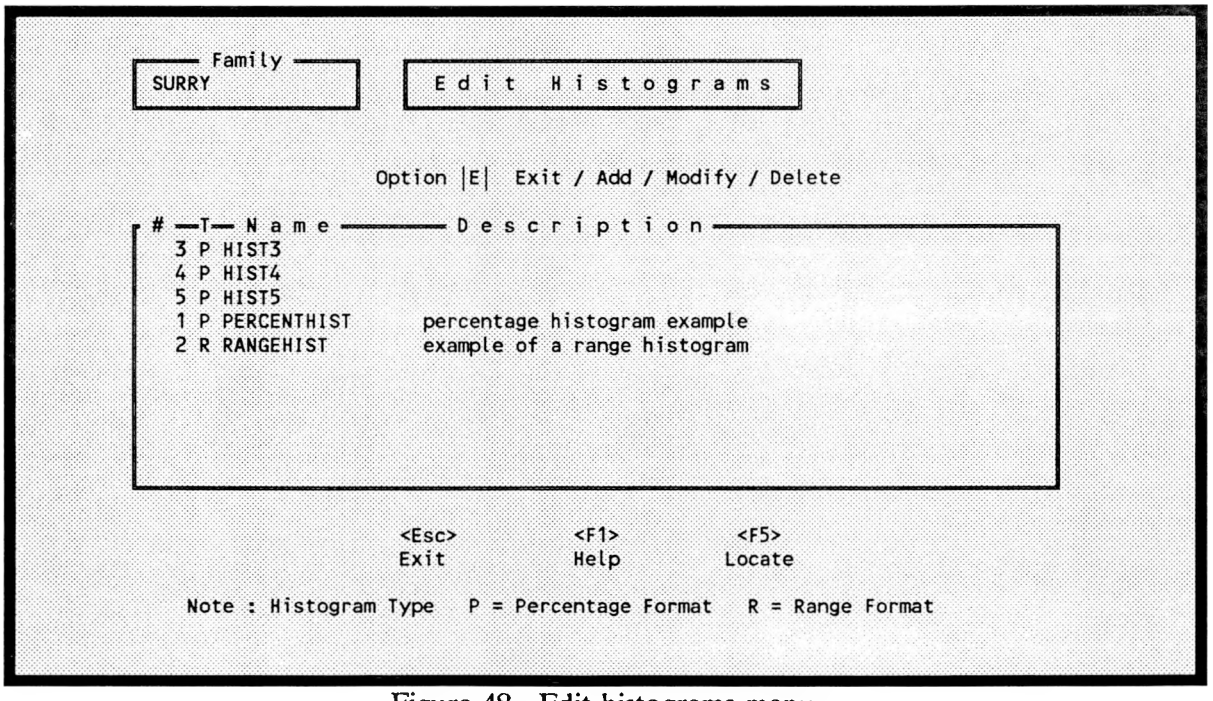


Figure 48. Edit histograms menu.

5.2.7.1 Exit. To return to the Change Sets screen, type an <E> (Exit) in the option field and press <Enter>, or press the <Esc> key.

5.2.7.2 Add Histograms. This option allows you to create a user-defined distribution type. To add a new histogram to the data base, type an <A> (Add) in the option field and press <Enter>. At this point, Figure 49 is displayed and you are given the choice of adding the histogram data in either a percentage format or in a range format.

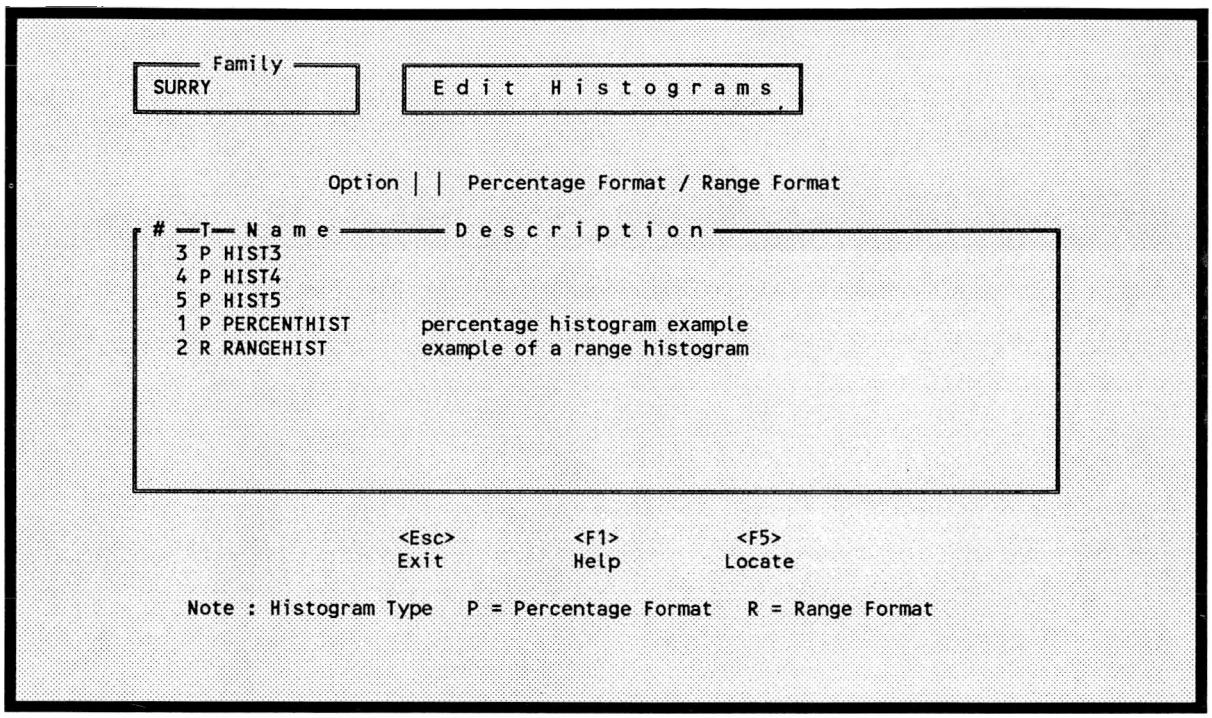


Figure 49. Select percentage or range format for the histogram.

If you wish to add a percentage histogram to the data base, enter a <P> (Percentage) in the option field. Entering a <P> in the option field will cause a Percentage Format Histogram screen to appear. On this screen you should type in a name and a description for the new histogram. Then you should enter the percentages for the histogram along with the corresponding probabilities. Figure 50 demonstrates how to enter a percentage histogram, given that 15% of the data points have a probability of 0.04, 46% of the data points have a probability of 0.12, 36% of the data points have a probability of 0.02, and the remaining 3% of the data points have a probability of 0.8. The sum of the percentages entered must total 100% for the histogram to be accepted as a valid percentage histogram (Figure 51). In the upper right-hand area of the screen is a box that shows the current sum of the percentages which have been input and the remaining percentage needed to reach the 100% total.

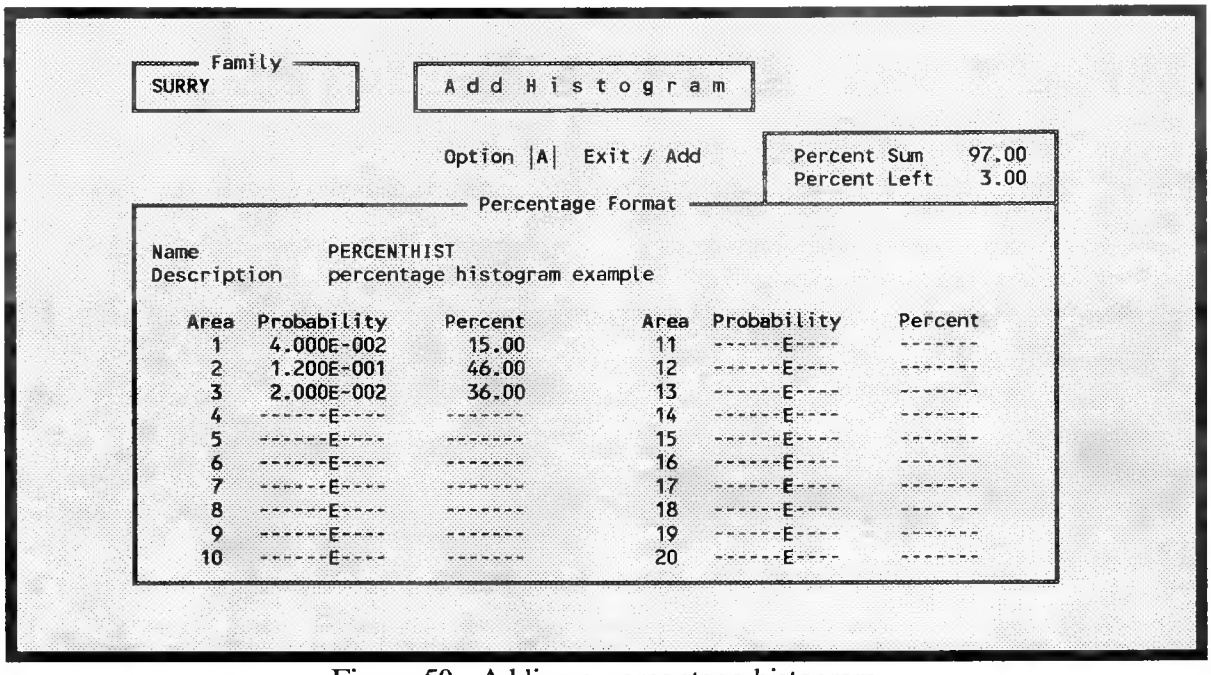


Figure 50. Adding a percentage histogram.

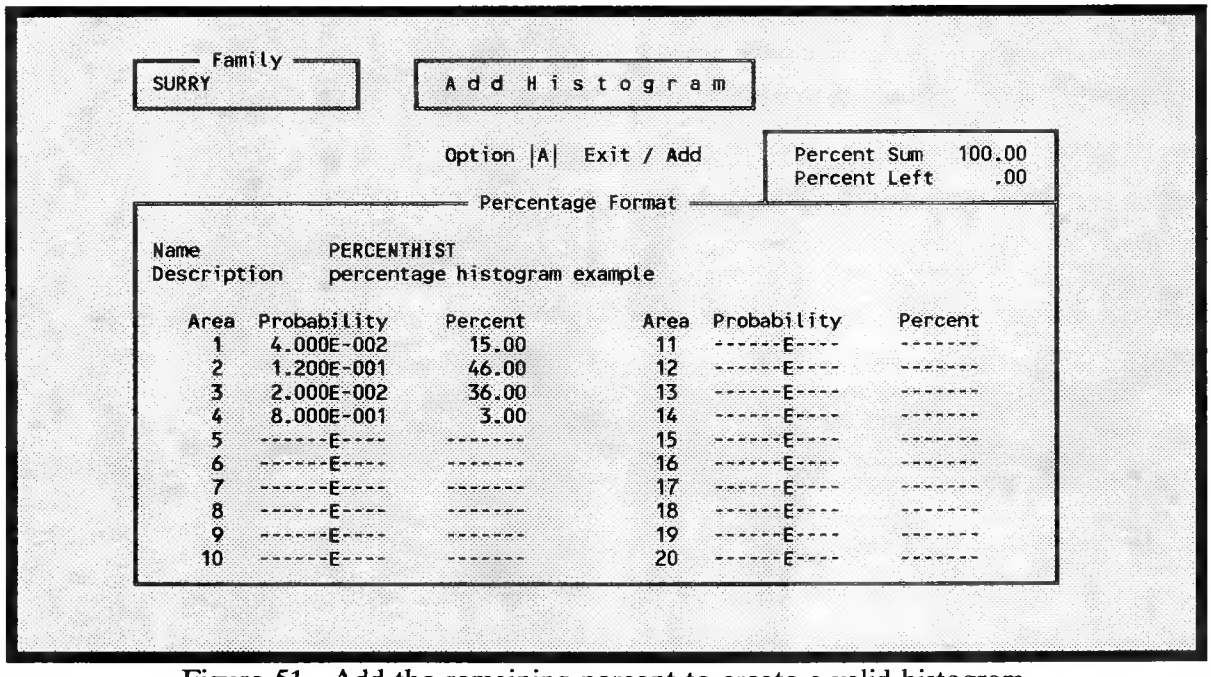


Figure 51. Add the remaining percent to create a valid histogram.

If you wish to add a range histogram to the data base, enter an <R> (Range) in the option field of the Add Histograms screen. This action will bring up a Range Format Histogram screen (Figure 52). On this screen you should type in a name and a description for the range histogram. Then, you should enter the starting point, the ending point and the probability associated with the first bin of the histogram. Next, for each successive bin of the histogram, an ending point, and a probability should be entered. There is a maximum of 20 bins allowed for each range histogram. Figure 52 is an example of inputting a range histogram whose data points lie on the closed interval of 0.0 and 1.5. The probability associated with the data points on the sub-interval of 0.0 and 0.4 is 0.05 (Bin 1), the probability for the sub-interval of 0.4 and 0.8 is 0.3 (Bin 2), the probability for the sub-interval of 0.8 and 1.2 is 0.06 (Bin 3), and the probability for the last sub-interval of 1.2 to 1.5 is 0.2 (Bin 4).

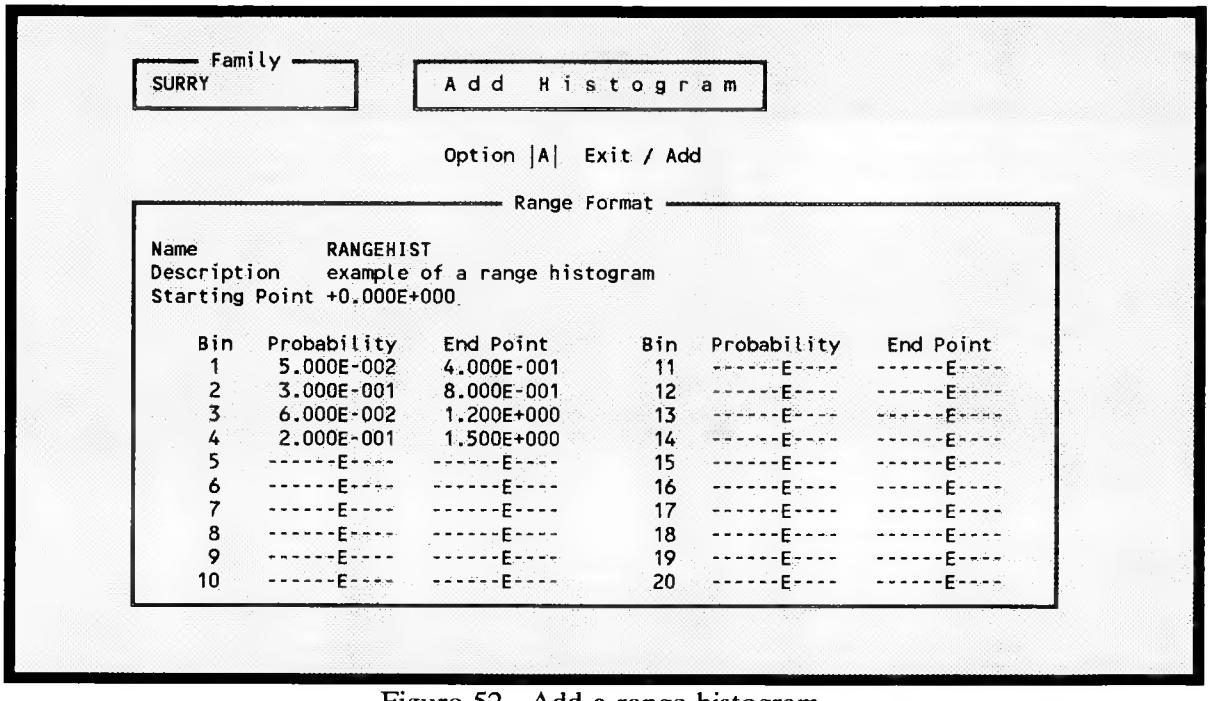


Figure 52. Add a range histogram.

Once you have typed in the histogram data, enter an <A> in the option field and press <Enter> to save the newly created histogram. However, if you wish to exit the Add process without saving the new histogram, enter an <E> in the option field or press the <Esc> key.

5.2.7.3 Modify Histograms. To modify a currently existing histogram, type an <M> (Modify) in the option field of the Edit Histograms screen, highlight the desired histogram and press <Enter>.

If you selected to modify a percentage histogram, then the histogram data will be displayed in percentage format. You may make modifications to the histogram's name, description, or any of the probabilities or percentages. The percentages must still total 100% before it will be accepted as a valid percentage histogram. Figure 53 demonstrates the screen for modifying histograms in percentage format.

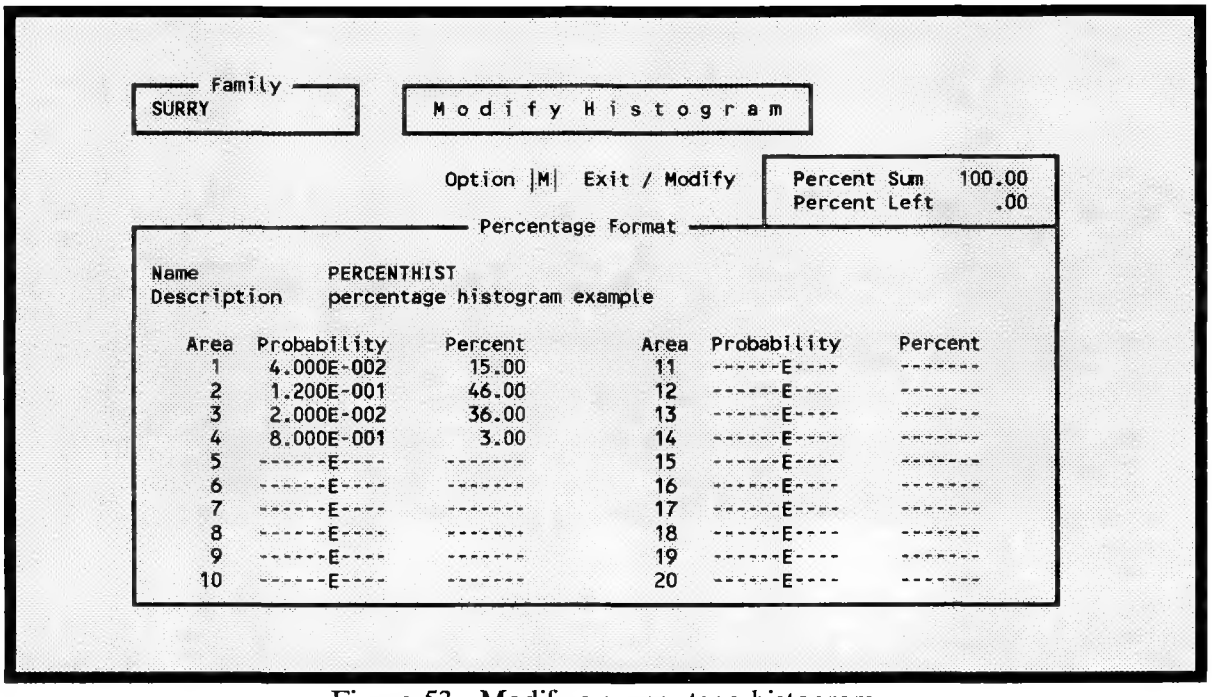


Figure 53. Modify a percentage histogram.

If you selected to modify a range histogram, then the histogram data will be displayed in range format. You may change the histogram's name, description, and any of the bin's starting points, ending points or probabilities. Figure 54 demonstrates the screen for modifying histograms in range format.

If you wish to save the modifications made to the selected histogram, type an <M> (Modify) in the option field of the Modify Histograms screen and press <Enter>. If you wish to exit this screen without modifying the histogram, enter an <E> in the option field and press <Enter>, or press the <Esc> key.

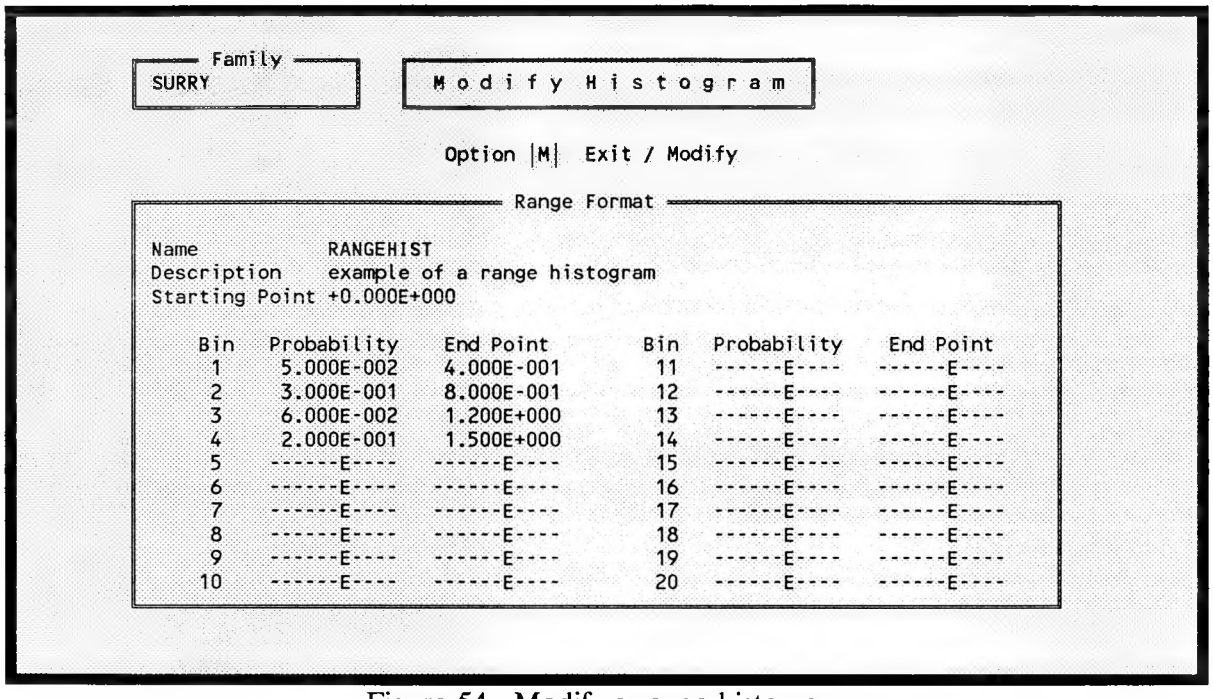


Figure 54. Modify a range histogram.

5.2.7.4 Delete Histograms. To delete an existing histogram from the data base, type a <D> in the option field of the Edit Histograms screen, highlight the histogram to be deleted, and press <Enter>.

This action will result in displaying the selected histogram in the appropriate format on the Delete Histograms screen. To delete the histogram, type a <D> in the option field and press <Enter>. To exit the Delete Histograms screen without deleting the histogram being displayed, press the <Esc> key or enter an <E> (Exit) in the option field. Figure 55 and Figure 56 show examples of the Delete Histograms screen for percentage histograms and range histograms, respectively.

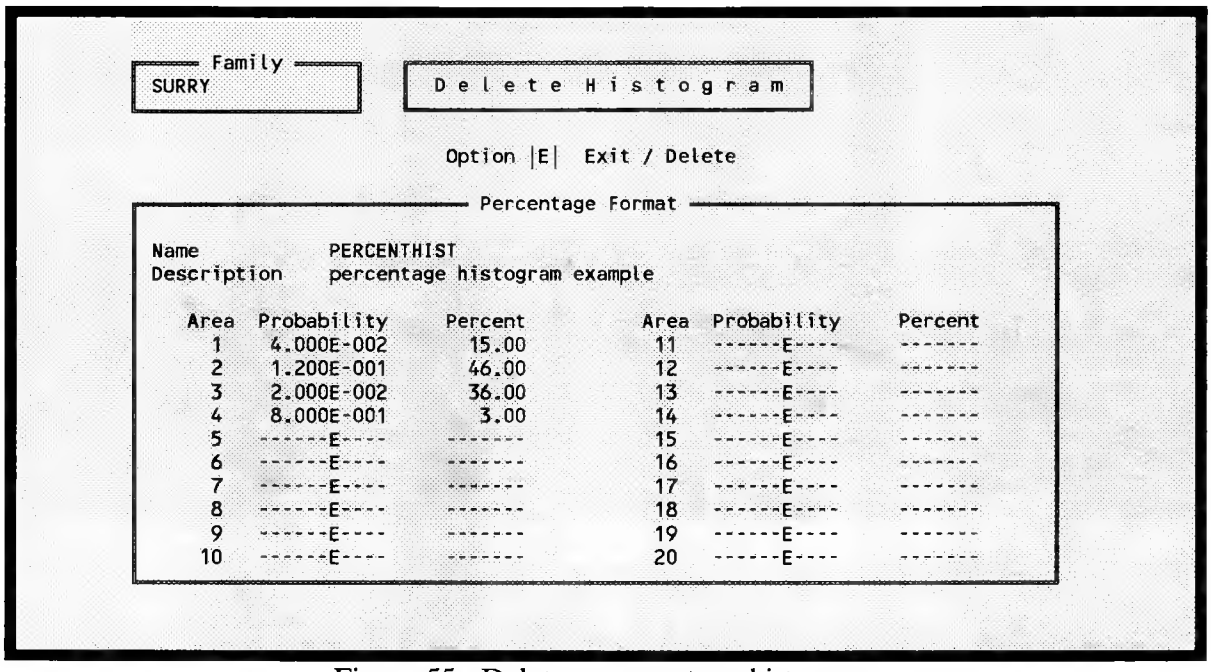


Figure 55. Delete a percentage histogram.

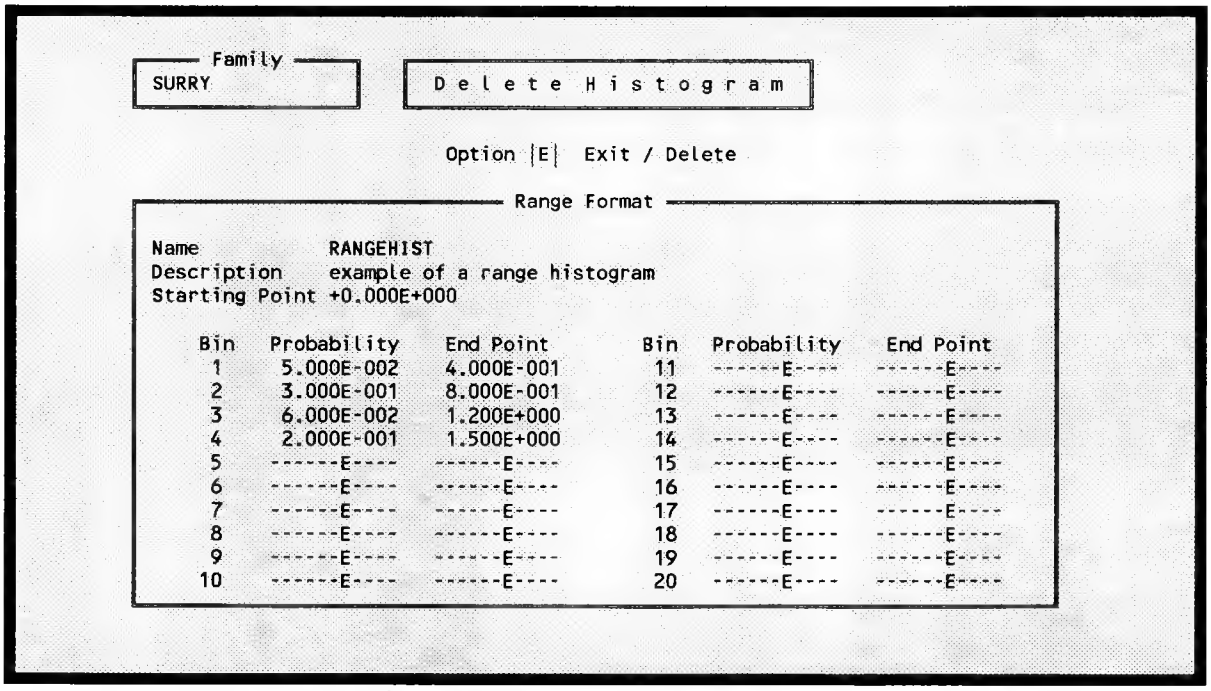


Figure 56. Delete a range histogram.

5.2.8 Generate Changes

This option applies the event data modifications specified by the selected change sets to the basic event data file. This option must be executed prior to any data analysis if you wish the change set modifications to be reflected in the analysis results. The Generate Changes option creates new current event data, which is used when a user wishes to run any analysis involving event failure or uncertainty data.

To activate this function, type <G> (Generate Changes) in the option field, use the function key <F2> to mark the change sets to be used during the generation process, and then press <Enter>. Upon pressing <Enter>, the default mission time is displayed at the bottom of the screen (Figure 57). If you do not wish to change the mission time, press <Enter>. **New event data has been generated with changes** is displayed when the changes are successfully generated. If no changes were made, the message **New event data has been generated (no changes)** is displayed at the bottom of the Change Sets screen.

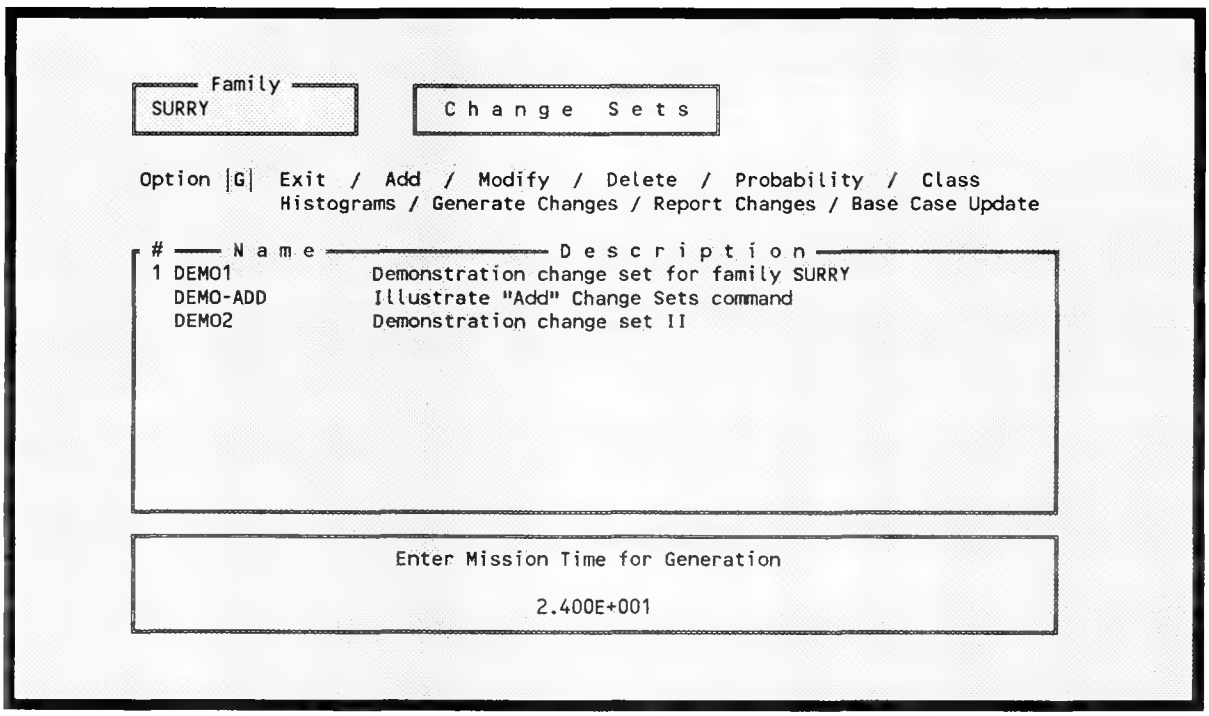


Figure 57. Set mission time for generate changes.

This option transfers the temporary values for the basic events marked with either a probability change or a class change in the marked change set to the current event data values. If an event in the change set has both a class change and a probability change associated with it, the probability change takes precedence over the class change when generating new current case event data values. If the event does not have an associated probability change or class change, then the current case event data values will be set equal to the base case data for that event.

If you select the Generate Changes option without marking any of the change sets, then the current case data will be initialized to the base case data.

If more than one change set is marked when you enter the Generate Changes option, then the probability and class changes in the change sets marked with the highest number will take precedence over any changes from lower numbered change sets.

For example, three change sets (CS) are marked and Event A has both a probability change and a class change associated with it in CS 2. Event B has a probability change in CS 1, and a class change in CS 3. Event C has only a class change in CS 1. Event D has no probability changes or class changes associated with it in any of the three marked change sets. The outcome of the Generate Changes option on these three marked changes sets would be as follows:

The current case data for event A would be set to the temporary values associated with the probability change in CS 2. (Since probability changes take precedence over class changes when they occur for the same event within the same change set.)

The current case data for event B would be set equal to the temporary values associated with the class change in CS 3. (Since the probability or class change in the higher numbered change set takes precedence over changes in lower numbered change sets.)

The current case data for event C would be set to the temporary values associated with the class change in CS 1.

The current case data for event D would be set to the base case values for event D, since there were no probability changes or class changes made to event D in any of the marked change sets.

5.2.9 Reports

This option allows you to create reports that reflect the event modifications that currently exist within the data base. There are three report types: Unaffected Events, Affected Events, and All Events (Figure 58). Each of the report types may be sorted by event name, ascending probability, or change sets. In addition, a report may be routed to the console, an attached printer, or a disk file. When a report is routed to the printer or a disk file, the data will be echoed on the console.

5.2.9.1 Exit. This option returns you to the Change Sets screen. To invoke the option, type <E> in the command field and press <Enter>, or press the <Esc> key.

5.2.9.2 Unaffected Events (Base). This option allows you to generate a report of the events that are not affected by any of the change sets that currently exist in the data base. To invoke the option, type <U> in the command field and press <Enter>. The sort selection menu will be presented allowing you to sort the data by event name, ascending probability, or change set (Figure 59).

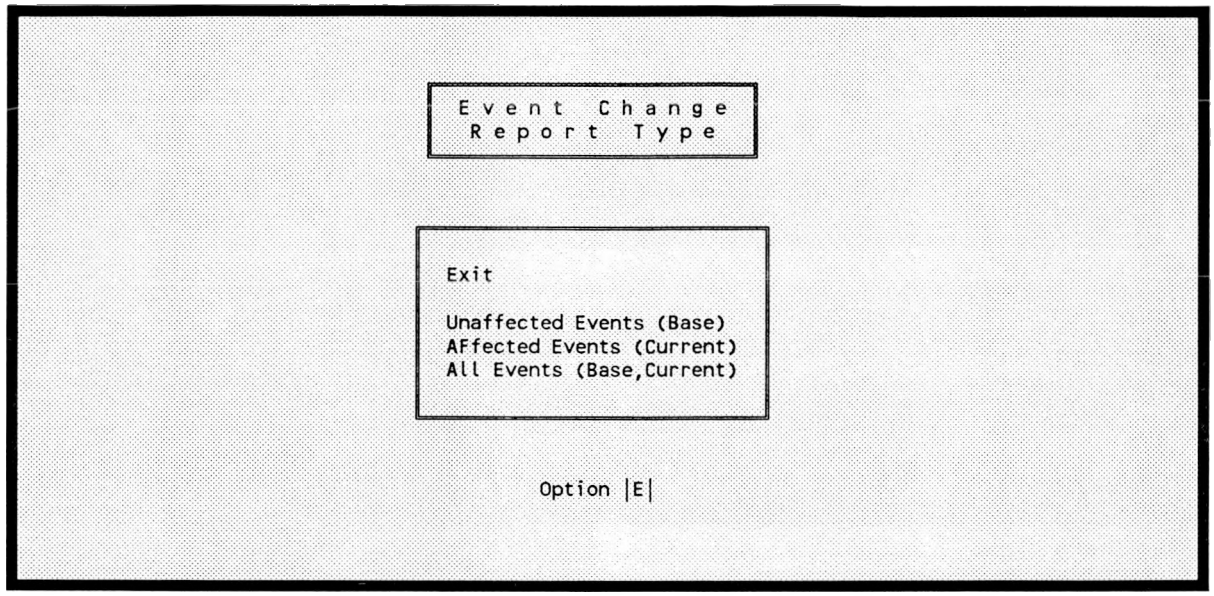


Figure 58. Selecting the event report type.

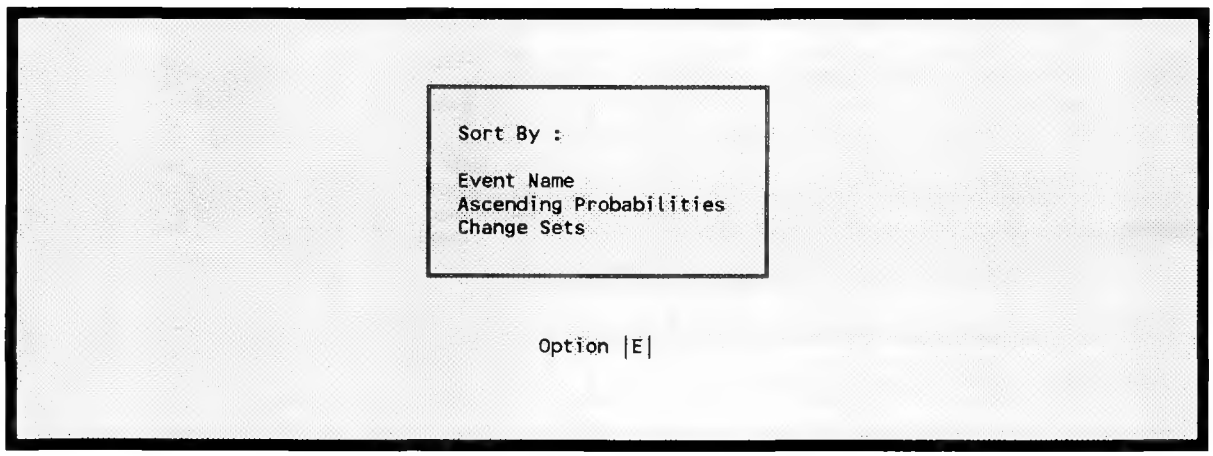


Figure 59. Selecting the sorting order for event reports.

After the sort method has been selected, you are asked to specify the routing of the report (Figure 60).

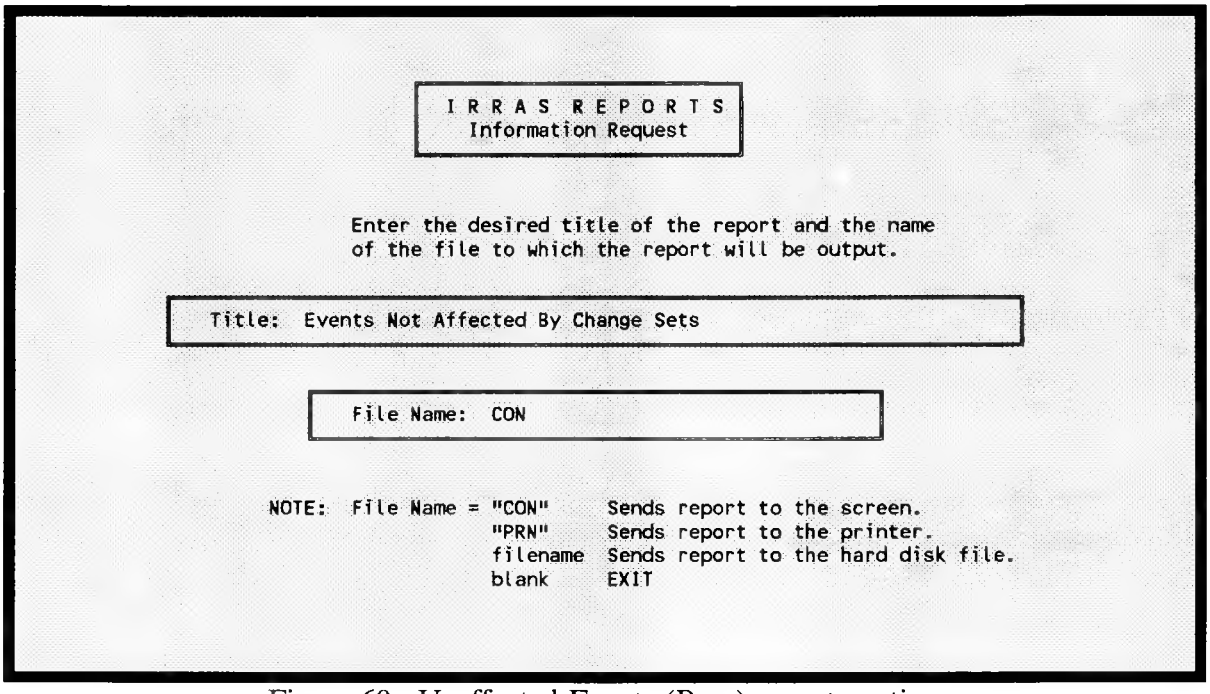


Figure 60. Unaffected Events (Base) report routing.

5.2.9.3 AFfected Events (Current). This option allows you to generate a report of the events that are affected by the change sets that currently exist in the data base. To invoke the option, type <F> in the command field and press <Enter>. The sort selection menu will be presented allowing you to have the data sorted by event name, ascending probability, or change set (Figure 59).

After the sorting method has been selected, you are asked to specify the routing of the report (Figure 61).

5.2.9.4 All Events (Base, Current). This option allows you to generate a report of all of the events in the data base. The report will indicate which events are affected by a change set. To invoke the option, type <A> in the command field and press <Enter>. The sort selection menu will be presented allowing you to have the data sorted by event name, ascending probability, or change set (Figure 59).

After the sorting method has been selected, you are asked to specify the routing of the report (Figure 62).

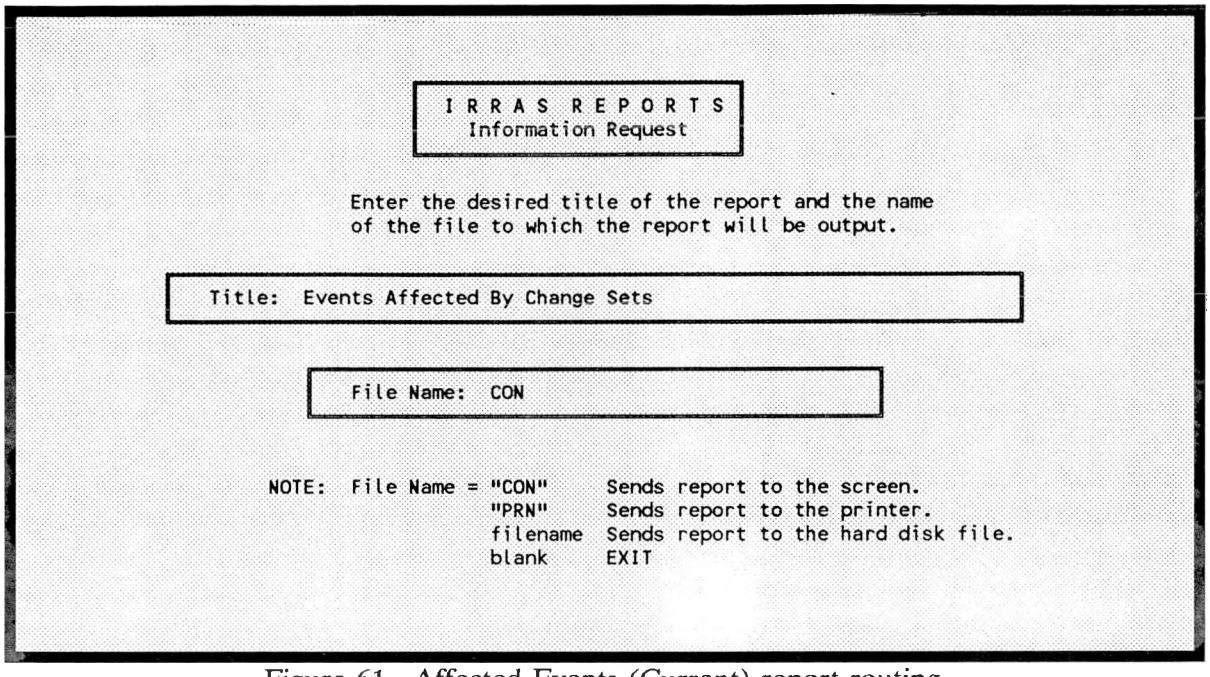


Figure 61. Affected Events (Current) report routing.

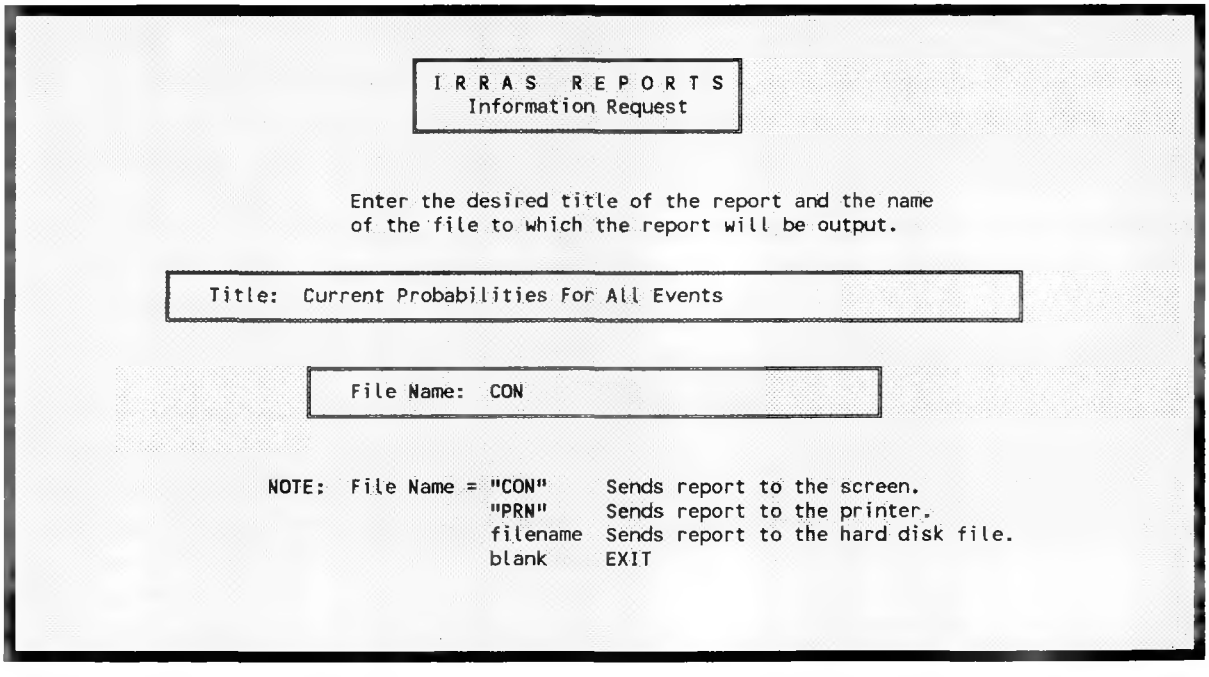


Figure 62. All Events report routing.

5.2.10 Base Case Update

This option allows you to overwrite the base case data values stored in the data base with the current (temporary) data values you have used for event tree analysis. After executing this option, the original base case data is no longer available.

To invoke this option, type <B> (Base Case Update) in the option field, mark the desired change set(s) and press <Enter>. A confirmation screen (Figure 63) will appear to ensure you wish to update the base case values with the temporary data values from the marked change set(s). To terminate the process, type an <N> in the option field and press <Enter>. To initiate the update process, type a <Y> in the option field and press <Enter>. Upon pressing <Enter>, the default mission time is displayed at the bottom of the screen (Figure 64). If you do not wish to change the mission time, press <Enter>.

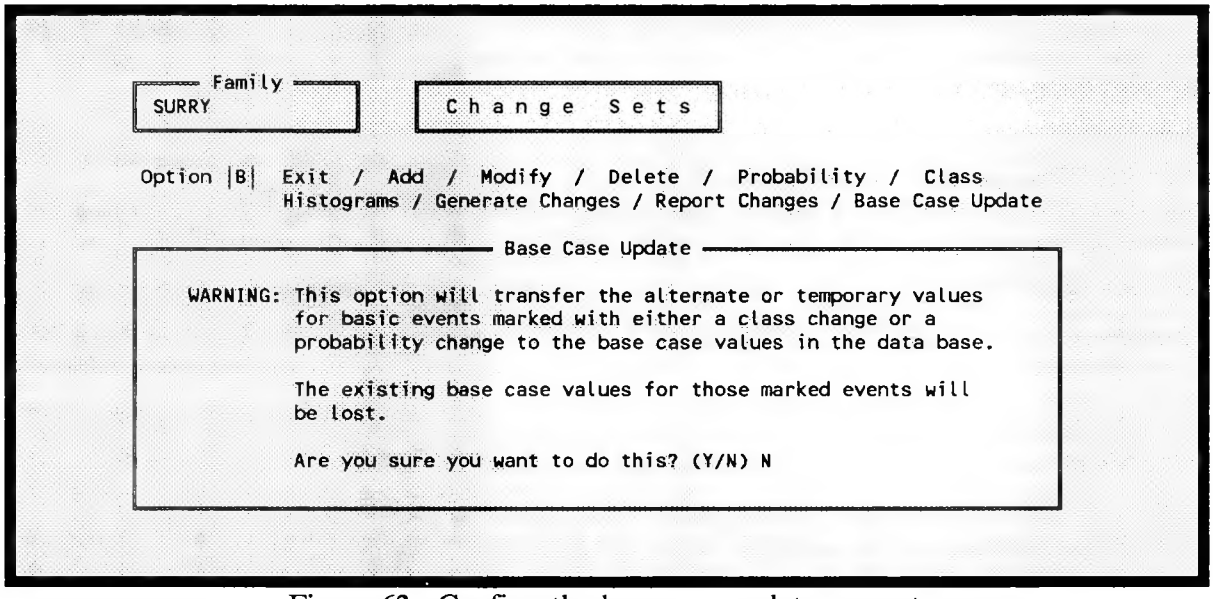


Figure 63. Confirm the base case update request.

WARNING: When you enter a <Y>, the base case will be overwritten.

In order to run a base case update at least one Change Set must be marked. This option transfers the temporary values for the basic events marked with either a probability change or a class change in a change set to the base case values. The existing base case values will be lost. Any event in the change set which does not have either a class change or a probability change associated with it will maintain its existing base case data. Upon completion of the base case update, the message **Base case events have been updated with changed values** will appear at the bottom of the screen.

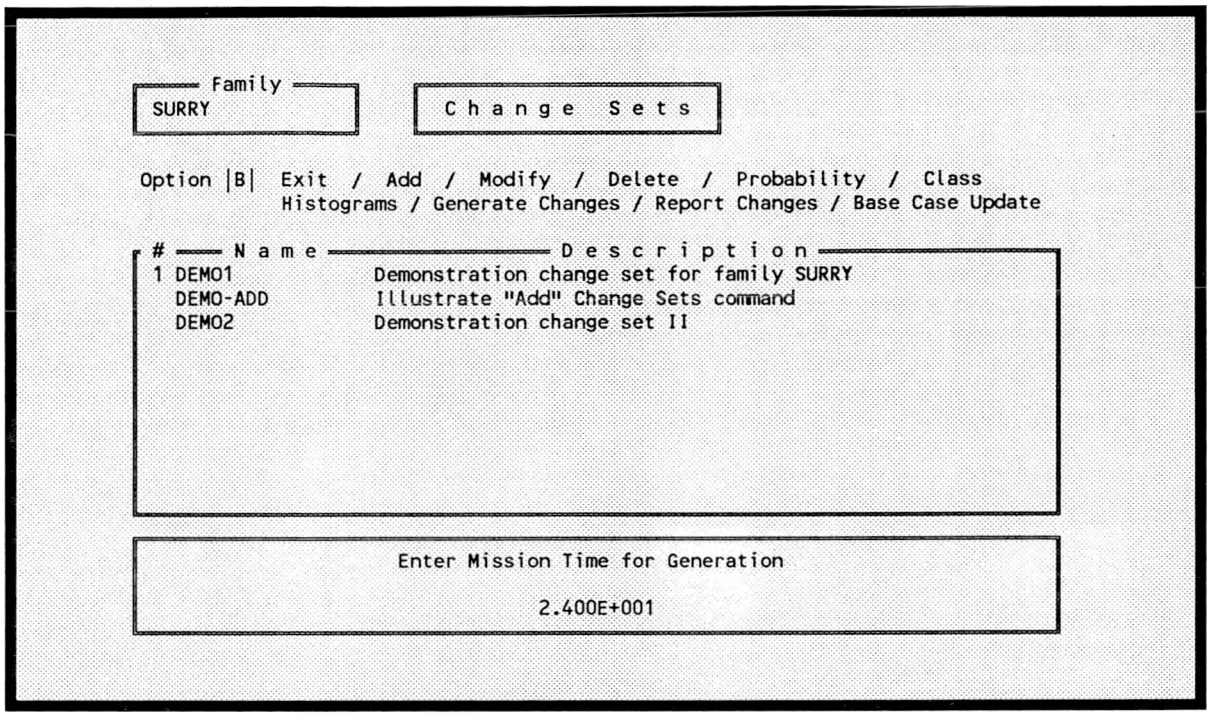


Figure 64. Set mission time for base case update.

If an event in a marked change set has both a class change and a probability change associated with it, the probability change takes precedence and will be used to update the base case values.

If more than one change set has been marked and is being used in the base case update, then the probability and class changes in the highest numbered change set take precedence over changes from lower numbered change sets. For example, if Event A has a probability change associated with it in Change Set 1, and a class change associated with it in Change Set 2, then the class change from Change Set 2 would override the probability change from Change Set 1.

5.3 Analyze Systems

This option provides the means to recalculate system values after events and/or cut sets have been modified. To invoke the option, highlight Analyze Systems or type <A> in the option field, and press <Enter>. Figure 65 shows the main screen for system analysis which lists the systems defined for the current family. The letters c, q, and u (in any combination) may precede a system name and are defined as follows:

c - flags the system as having cut sets that must be recalculated
q - flags the system as having cut sets that must be requantified
u - flags the system as needing uncertainty distributions recalculated

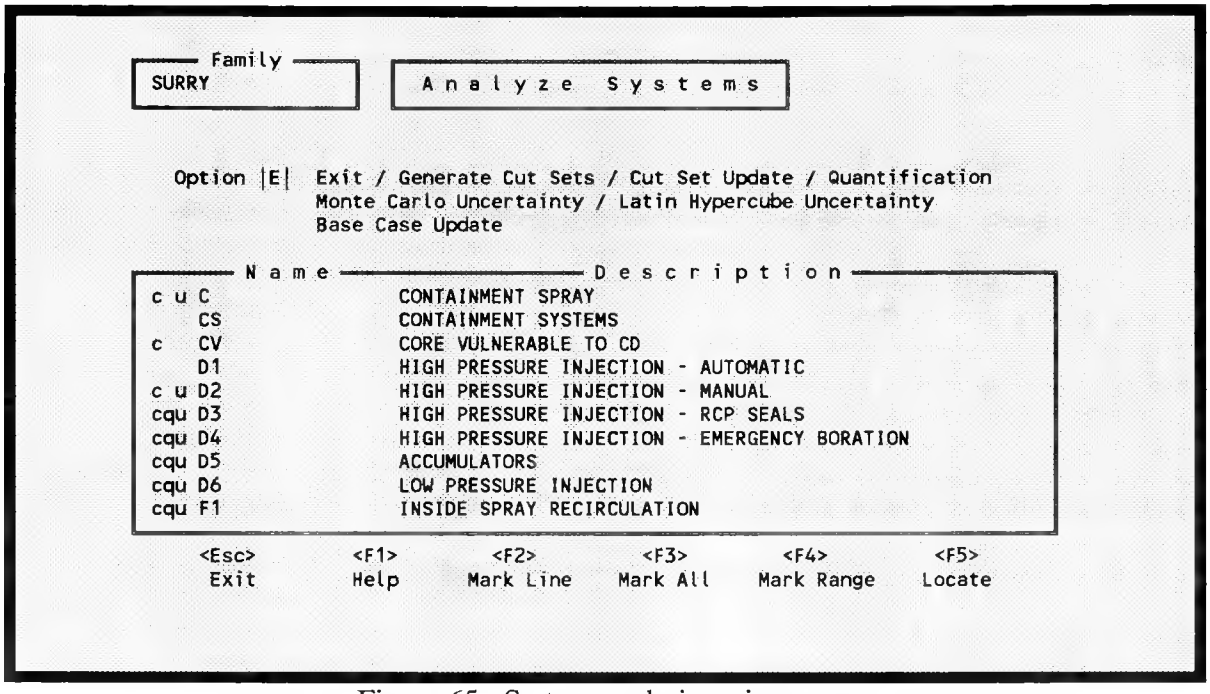


Figure 65. System analysis main menu.

Once these functions have been executed the corresponding letter is removed from the display. The options available from the Analyze Systems screen are Exit, Generate Cut Sets, Cut Set Update, Quantification, Uncertainty Analysis, and Base Case Update. You have the choice of using either the Monte Carlo sampling technique or the Latin Hypercube sampling technique for running the uncertainty analysis process.

5.3.1 Exit

To return to the Fault Tree Analysis menu, type an <E> (Exit) in option field and press <Enter>, or press the <Esc> key.

5.3.2 Generate Cut Sets

This option allows you to generate the cut sets for a selected system based on cut set generation cutoff values. You are given the opportunity to specify several cut set generation cutoff values which will be used to determine if a cut set is to be retained or discarded from the selected system.

You are given the ability to generate cut sets for a selected system, a group of systems, or all systems within the current family. To invoke the Generate Cut Sets for a single selected system, type <G> (Generate Cut Sets) in the option field, highlight the desired system, and press <Enter>. To invoke this process for a group of systems, mark the desired systems using the function keys F2, F3, and F4, type a <G> in the option field, and press <Enter>. To invoke this option for all systems in the current family, clear all marked entries with the F3 key, type <G> in the option field and

press <Enter>. A message **Process all records? (Y/N)** will appear at the bottom of the screen. Type a <Y> to continue the Generate Cut Sets for all of the systems, or type an <N> to terminate the update for all systems.

Whether you are generating cut sets for a single system, a group of systems, or for all systems the Cut Set Generation Cutoff Values screen shown in Figure 66 will be displayed. You may change any of the data fields on this screen. Each field is described below. The default values that appear on this screen may be reset to new values by selecting the Utility Options from the IRRAS main menu and then invoking the Define Constants option.

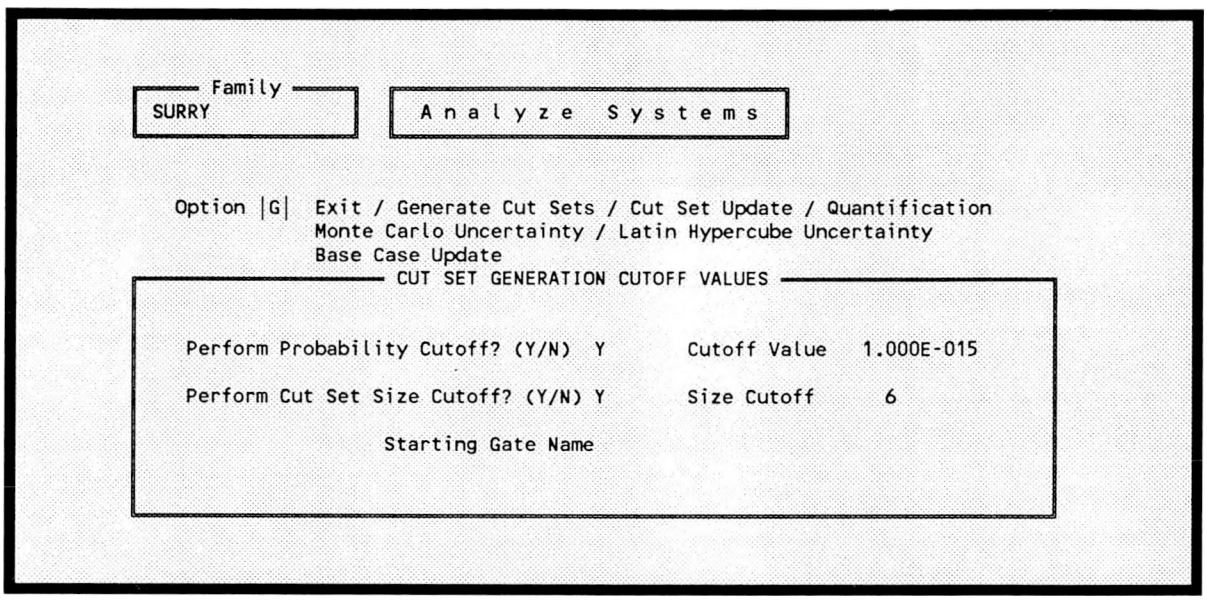


Figure 66. Cut set generation cutoff values.

Perform Probability Cutoff? - If you enter a <Y> then the only cut sets whose product for all of its event probabilities is greater than or equal to the value in the Cutoff Value field will be kept. All other cut sets will be removed.
If you enter an <N>, then the probability for the cut set will not be relevant for determining if the cut set should be retained or discarded.

Perform Cut Set Size Cutoff?- If you enter a <Y>, then only the cut sets whose number of events is less than or equal to the value specified in the Size Cutoff field will be kept in the cut sets for that system. All other cut sets will be removed.
If you enter an <N>, then the number of events in a cut set will be irrelevant for determining if the cut set should be retained or discarded.

Starting Gate Name - If you specify a gate in this field, then this gate will be the gate assumed to be the top gate of the tree. If you do not specify a name, the top gate will be determined by finding the gate which is not referenced by any other gate.

During processing the screen shown in Figure 67 is displayed and updated as the calculations proceed. Upon completion of the cut set generation, the results are displayed as shown in Figure 68.

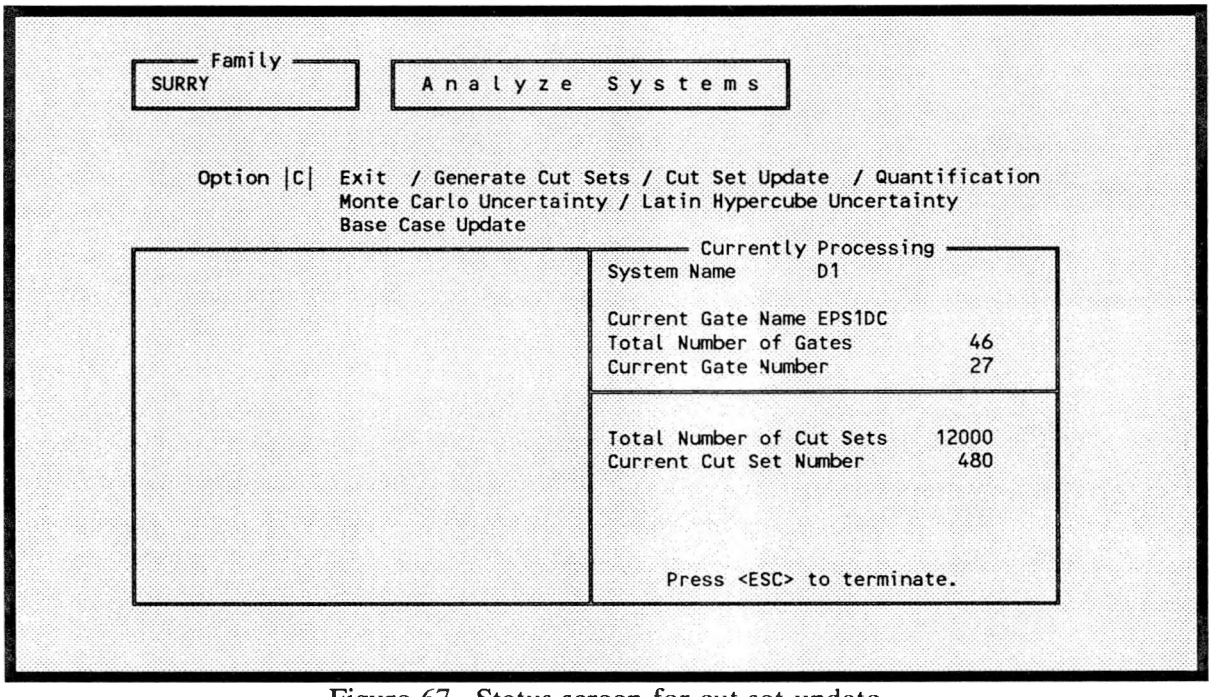


Figure 67. Status screen for cut set update.

There is a limit on the number of cut sets which can be stored for a given system. If the number of cut sets generated by this option exceeds this limit, then a message is displayed indicating that cut sets were truncated beyond what the user specified. The screen showing the numbers for all generated cut sets is displayed. The user is then asked to press the <Enter> key to continue. When the <Enter> key is pressed, a screen showing the numbers for the cut sets which were actually kept is displayed.

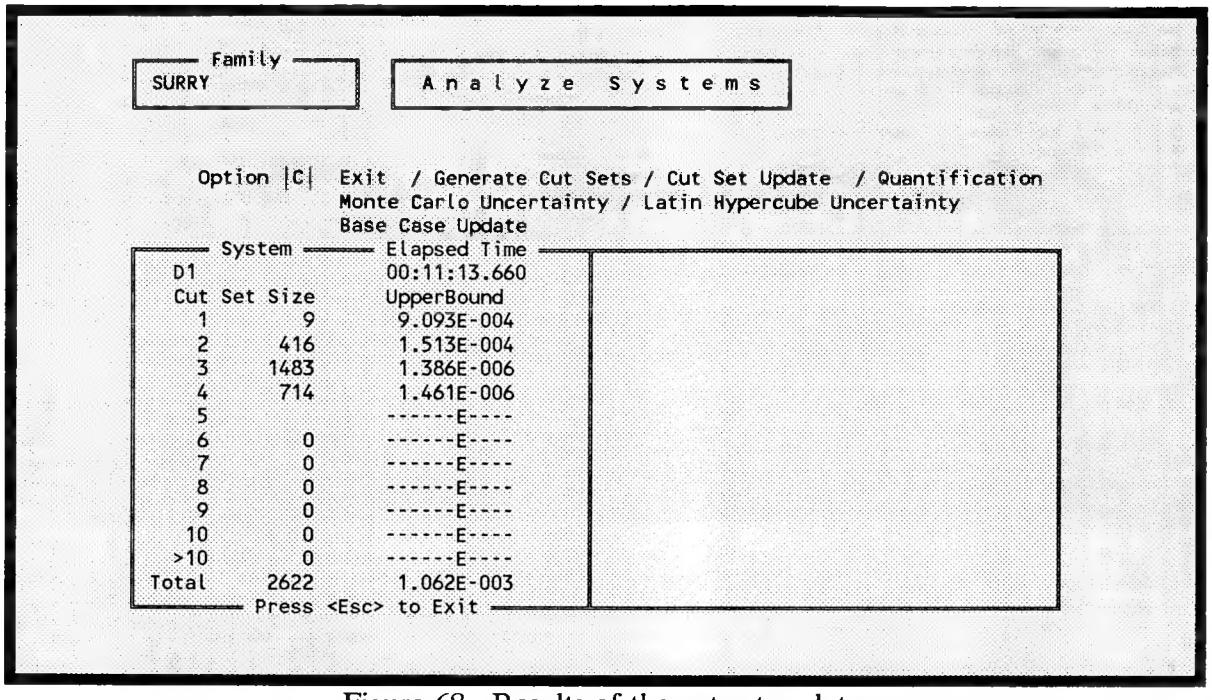


Figure 68. Results of the cut set update.

5.3.3 Cut Set Update

This option will update the alternate cut sets for a selected system based on cut set generation cutoff values. You are given the opportunity to specify several cut set generation cutoff values that will be used to determine if a cut set is to be retained or discarded from the selected system. You are also given the choice of using either the base case cut sets or the alternate case cut sets as the starting set of cut sets to be updated. The updated version of the cut sets will be saved as the new alternate cut sets for the system.

You are given the ability to update the alternate cut sets for a selected system, the alternate cut sets for a group of systems, or the alternate cut sets for all of the systems within the current family. To invoke the Cut Set Update process for a single selected system, type <C> (Cut Set Update) in the option field, highlight the desired system, and press <Enter>. To invoke this process for a group of systems, mark the desired systems using the function keys F2, F3, and F4, type a <C> in the option field and press <Enter>. To invoke this option for all systems in the current family, clear all marked entries with the F3 key, type <C> in the option field and press <Enter>. A message **Process all records? (Y/N)** will appear at the bottom of the screen. Type a <Y> to continue the Cut Set Update for all of the systems, or type an <N> to discontinue the update for all systems.

Whether you are updating alternate cut sets for a single system, a group of systems, or for all systems the Cut Set Generation Cutoff Values screen shown in Figure 69 will be displayed. You may change any of the data fields on this screen. The default values which appear on this screen may be reset to new values by selecting Utility Options on the IRRAS main menu and then invoking

Define Constants option.

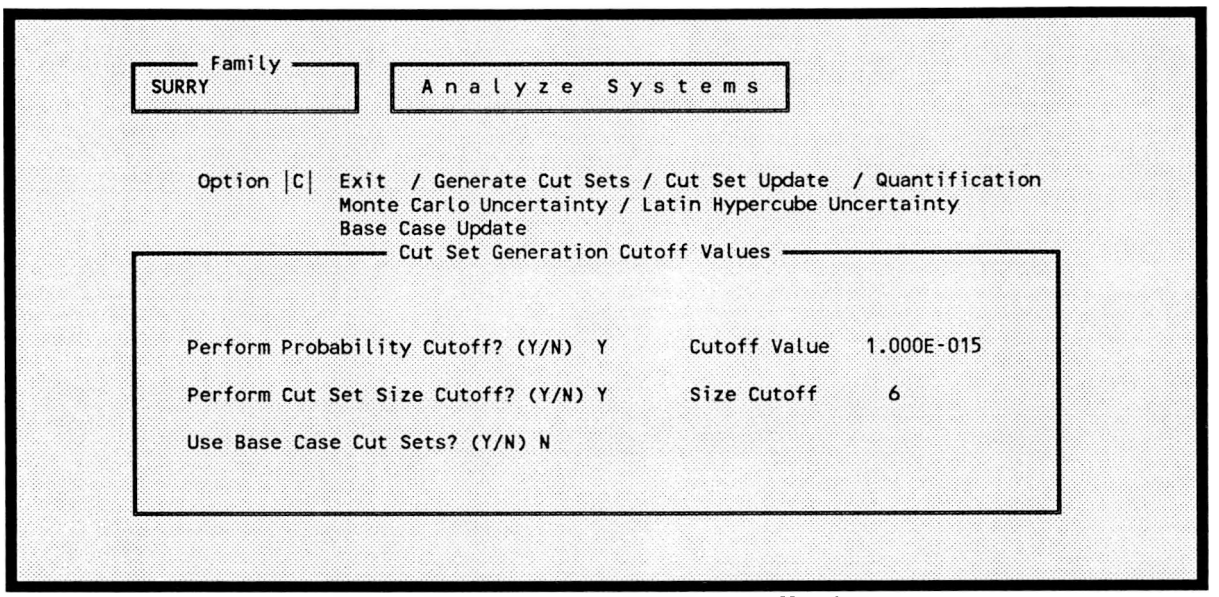


Figure 69. Cut set generation cutoff values.

If you type a <Y> in the Perform Probability Cutoff field, then only the cut sets whose product for all of its event probabilities is greater than or equal to the value in the Cutoff Value field will be kept. All other cut sets will be removed from alternate case cut sets for that system. If you type an <N> in this field, then the probability for the cut set will not be relevant for determining if the cut set should be retained or discarded.

If you type a <Y> in the Perform Cut Set Size Cutoff field, then only the cut sets whose number of events is less than or equal to the value in the Size Cutoff field will be kept in the alternate case cut sets for that system. All other cut sets will be removed. If you type an <N> in this field, then the number of events in a cut set will be irrelevant for determining if the cut set should be retained or discarded.

If you enter a <Y> in the Use Base Case Cut Sets field, then the base case cut sets will be used as the cut sets to be updated and then stored in the alternate case cut sets. However, if an <N> was entered in this field, the alternate cut sets will be used as the cut sets to be updated and then resaved in the alternate case cut sets.

During processing the screen shown in Figure 70 is displayed and updated as the calculations proceed. Upon completion of the cut set update, the results are displayed as shown in Figure 71.

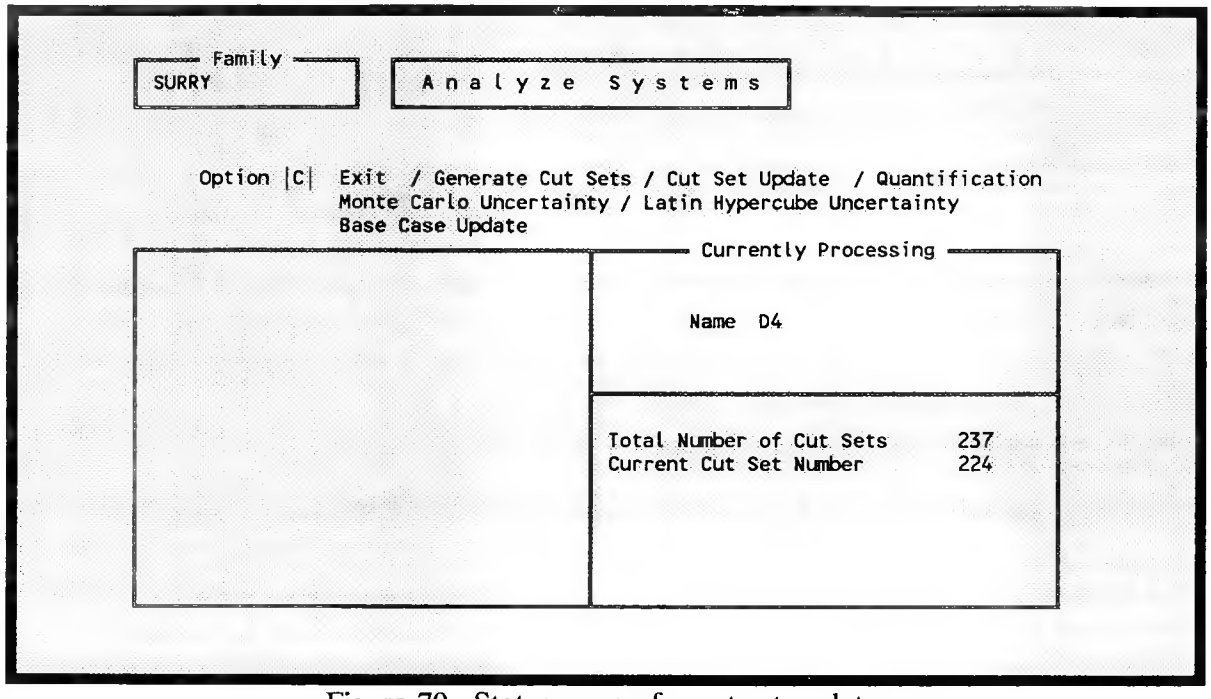


Figure 70. Status screen for cut set update.

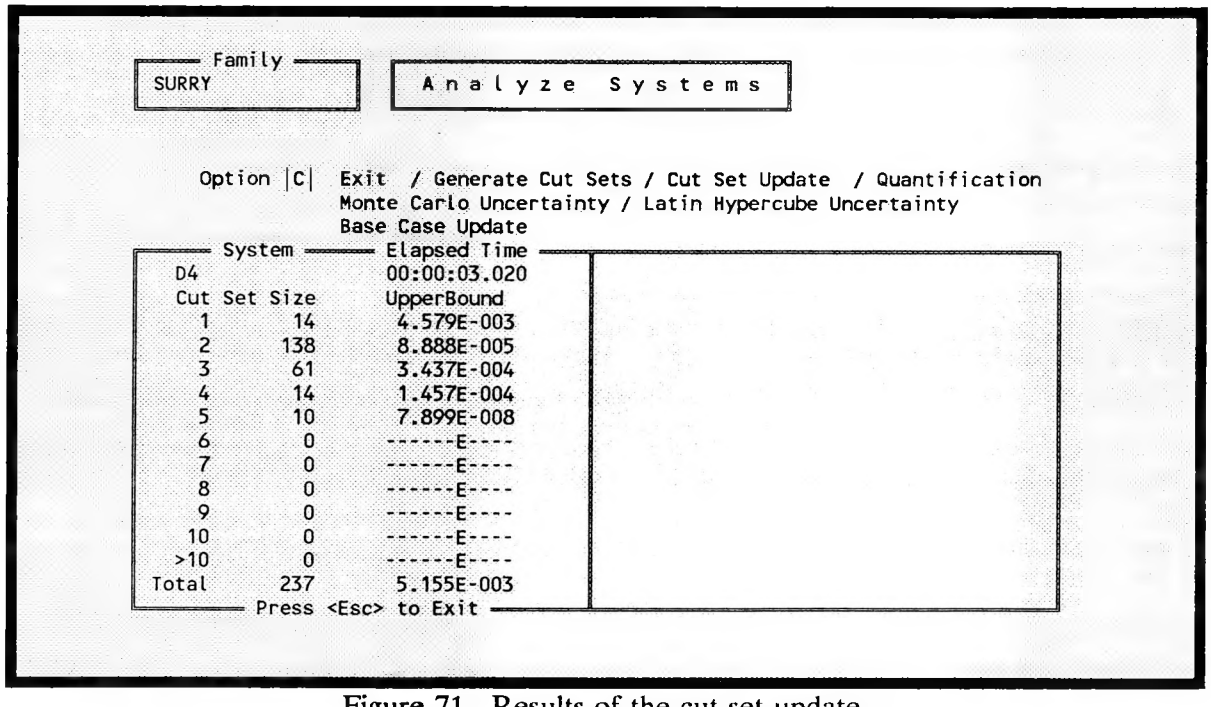


Figure 71. Results of the cut set update.

The cut set update flag 'c' will then be removed from every system on the Analyze Systems screen in which the cut set update process has been performed. If an error of some kind occurs during the update process then the message **Error in Cut Set analysis** will be displayed at the bottom of the screen. Once the cut sets are updated, they are also automatically quantified and the appropriate "q" flag is cleared.

5.3.4 Quantification

The quantification process will calculate a new minimum cut set upper bound for the system cut sets using the current data values (event change sets and alternate case cut sets). The new minimum cut set upper bound is saved with the alternate case cut sets for the selected system.

You are given the ability to requantify the alternate cut sets for a selected system, for a group of systems, or for all of the systems within the current family. To invoke the Quantification process for a single selected system, type <Q> (Quantification) in the option field of the Analyze Systems screen, highlight the desired system, and press <Enter>. To invoke this process for a group of systems, mark the desired systems using the function keys F2, F3, and F4, type a <Q> in the option field and press <Enter>. To invoke this option for all systems in the current family, type <Q> in the option field and press <Enter>. A message **Process all records (Y/N)?** will appear at the bottom of the screen. Type a <Y> to continue the Quantification process for all of the systems, or type an <N> to discontinue this process.

During processing the message **Quantification in progress** appears at the bottom of the screen. If an error occurs then the message **Error quantifying cut sets** will be displayed at the bottom of the screen.

Upon completion of the quantification process, the results are displayed as shown in Figure 72. The requantify flag 'q' will then be removed from every system on the Analyze Systems screen for which the quantification process has been performed.

5.3.5 Uncertainty Analysis

This function allows you to run an uncertainty analysis on a system using one of the two sampling techniques provided. The two sampling techniques are the Monte Carlo simulation technique and the Latin Hypercube simulation technique.

To use the Monte Carlo sampling technique to obtain an uncertainty analysis for a system or a group of systems, you must type an <M> the option field of the Analyze Systems screen and press <Enter>. However, if you wish to use the Latin Hypercube sampling technique, then type an <L> in the option field and press <Enter>.

You are given the option of running an uncertainty analysis on the alternate cut sets for either a single system, for a group of systems, or for all of the systems within the current family. To invoke this process for a single selected system, type <L> or <M> (Latin Hypercube / Monte Carlo) in the option field, highlight the desired system, and press <Enter>. To invoke this process for a group of systems, mark the desired systems using the function keys F2, F3, and F4, type a <L> or <M> in the option field and press <Enter>. To invoke this process for all systems in the current family, type <L> or <M> in the option field and press <Enter>. A message **Process all records?**

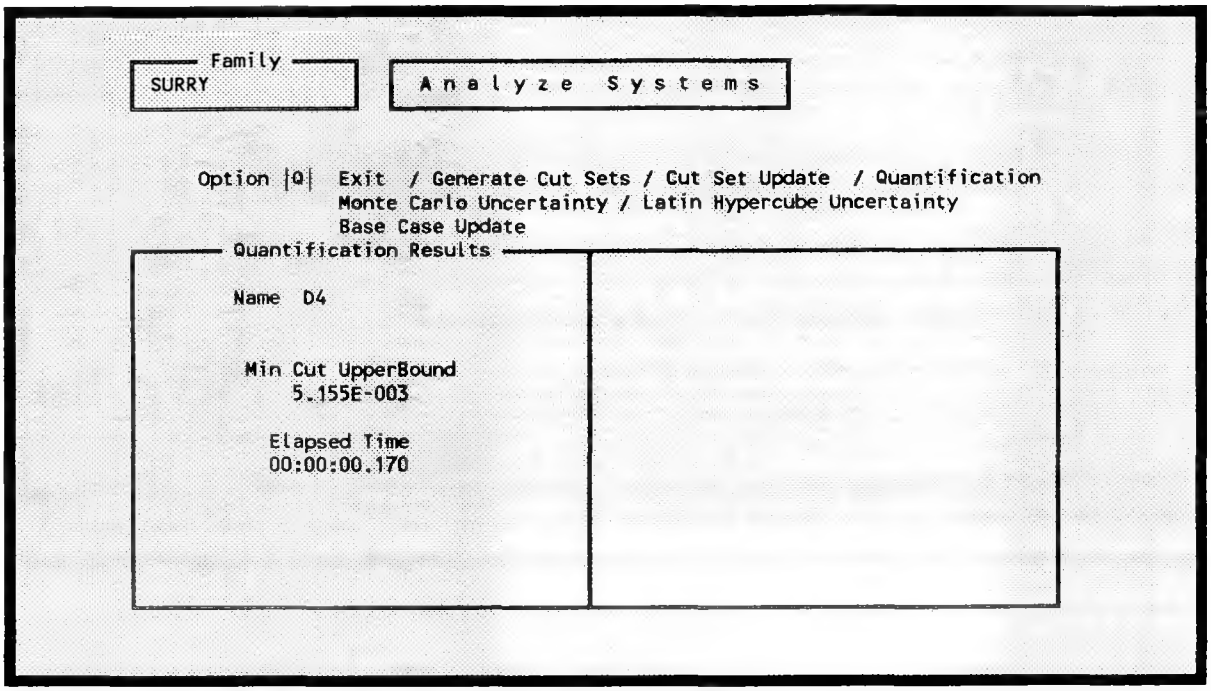


Figure 72. Results of the quantification process.

(Y/N) will appear at the bottom of the screen. Type a <Y> to continue the uncertainty analysis for all of the systems, or type an <N> to discontinue the analysis.

Once the sampling technique for the uncertainty analysis has been selected and the desired system(s) selected, the Uncertainty Calculation Values screen will be displayed (Figure 73 for Monte Carlo sampling and Figure 74 for Latin Hypercube sampling). This screen prompts you to enter the number of samples to be generated during the simulation and the initial value of the seed for the random number generator. There will be a default seed in the field for the random seed. You may use this value or enter a new value for the seed. To obtain a random seed from the system clock, you must enter a zero in this field. There will also be a default value in the field for the number of samples. You may use this value or enter another value. You may change the default values for both the number of samples and the random seed in the Utility Options, Define Constants suboption.

When using the Monte Carlo sampling technique for the uncertainty analysis, if the number of samples entered is less than ten, then the number of samples will be increased to ten before the uncertainty analysis process will continue. Any number of samples greater than or equal to ten will be allowed, but a number of at least 1000 is probably a better value for improving the reliability of the Monte Carlo results.

When using the Latin Hypercube Sampling (LHS) technique, if the number of samples entered is less than twice the total number of unique events in the system, then the number of samples will be increased to two times the total number of unique events before the analysis will continue. The LHS technique gives its best results if the number of samples is at least twice the total number of unique events.

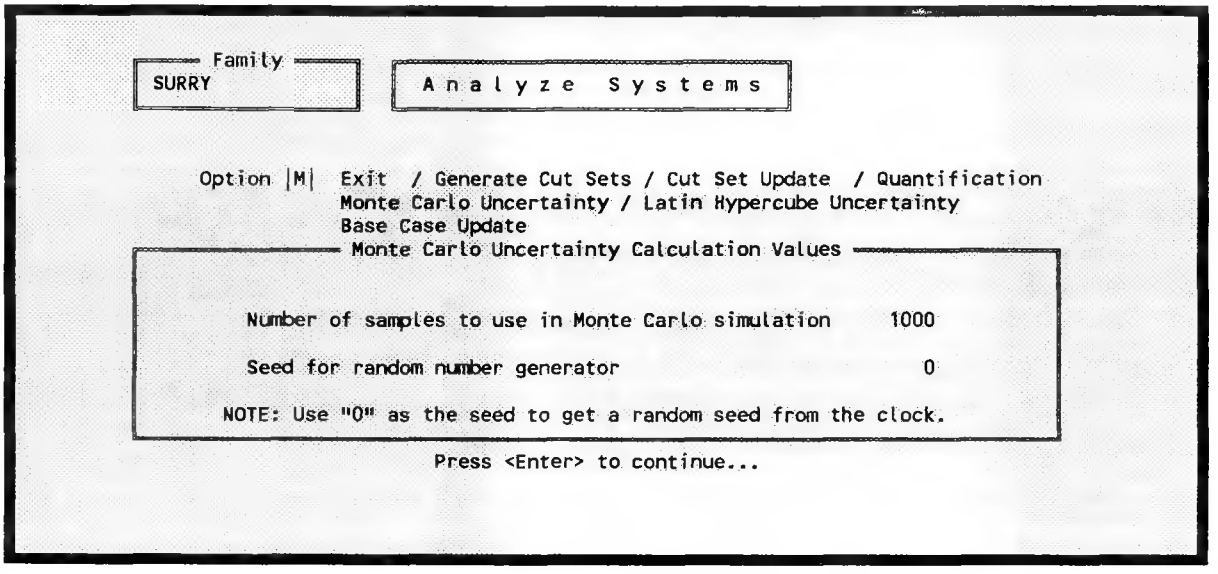


Figure 73. Monte Carlo calculation values.

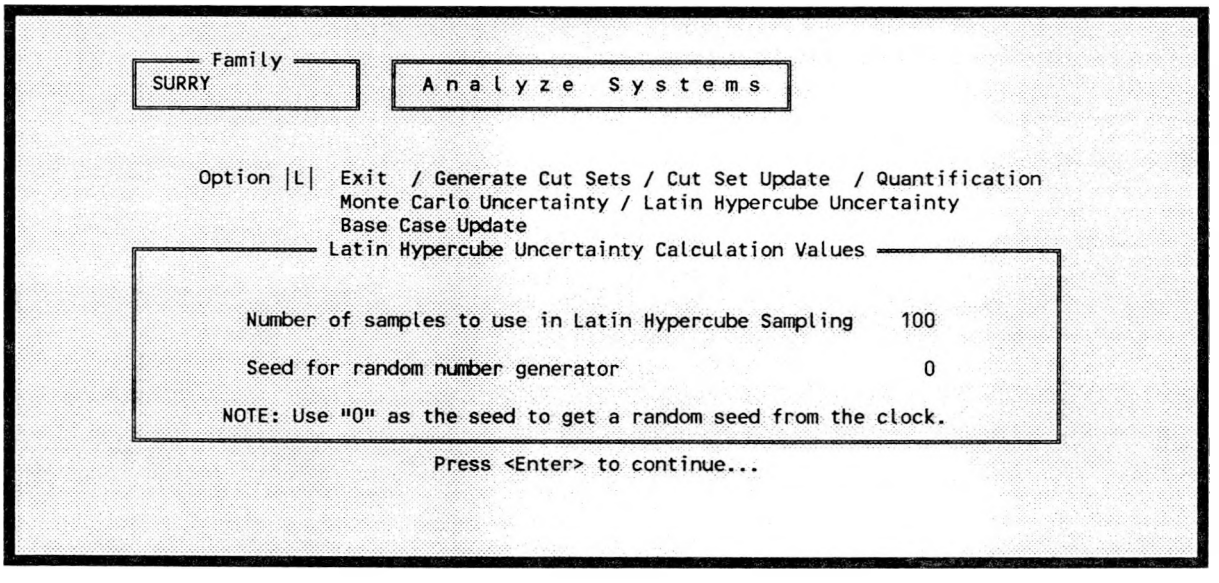


Figure 74. Latin Hypercube calculation values.

Once the number of samples has been accepted and a seed obtained from the system clock (if necessary), checks will be run to ensure the events with the same correlation classes have consistent failure data, uncertainty data, and distribution types. If any events with inconsistencies exist, an error message will be displayed and the uncertainty analysis process will be terminated so that the inconsistent values may be corrected.

If an error of some type occurs during the uncertainty analysis process, the process is terminated and the message **Error in Uncertainty analysis** is displayed at the bottom of the Analyze Systems screen.

If all of the events successfully pass the correlation class checks, then the distribution parameters for the events will be checked to ensure that they are valid. If any of the parameters are invalid, error messages will be displayed and the process will be terminated so the distribution parameters may be corrected.

After both of these checks have been passed, a point estimate will be calculated for the selected system. At this point the samples for each event will be generated using the selected sampling technique, either Monte Carlo Sampling technique or the Latin Hypercube Sampling technique. The uncertainty analysis function provides you with eight different distribution types for both sampling techniques. The distribution types include normal, lognormal, beta, gamma, chi-squared, exponential, uniform and the user-defined histograms.

During processing the current status screen will be displayed and updated as the samples are generated. Figure 75 and Figure 76 illustrate the current status screens for the Monte Carlo and the Latin Hypercube sampling techniques, respectively. When the requested number of samples has been generated or the user has terminated the process of generating the samples by pressing the <Esc> key, statistical information will be calculated using the generated samples. A sample mean, median, and standard deviation will be calculated for the selected system. Coefficients of skewness and kurtosis, and quantile values will also be calculated for the system. This data will be saved in the database for the selected system.

Upon completion of these calculations, the following values will be displayed on the Uncertainty Results screen for viewing: the system name, random seed used, the number of samples generated in this process, the total number of events and cut sets in the system being processed, the point estimate, the mean, the median, the 5th and 95th percentile values, the minimum and maximum generated sample values, the standard deviation, the skewness and kurtosis, and the time involved to perform the analysis. Figure 77 and Figure 78 illustrate the Uncertainty Results screens for the Monte Carlo and the Latin Hypercube sampling techniques, respectively.

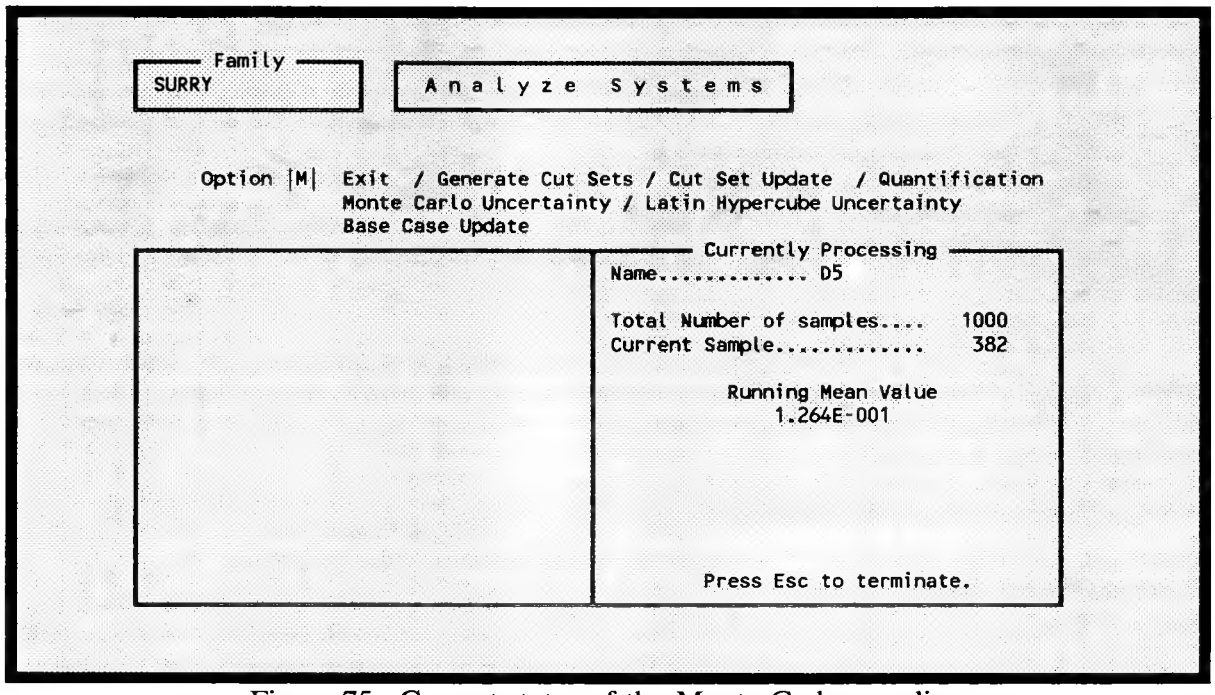


Figure 75. Current status of the Monte Carlo sampling.

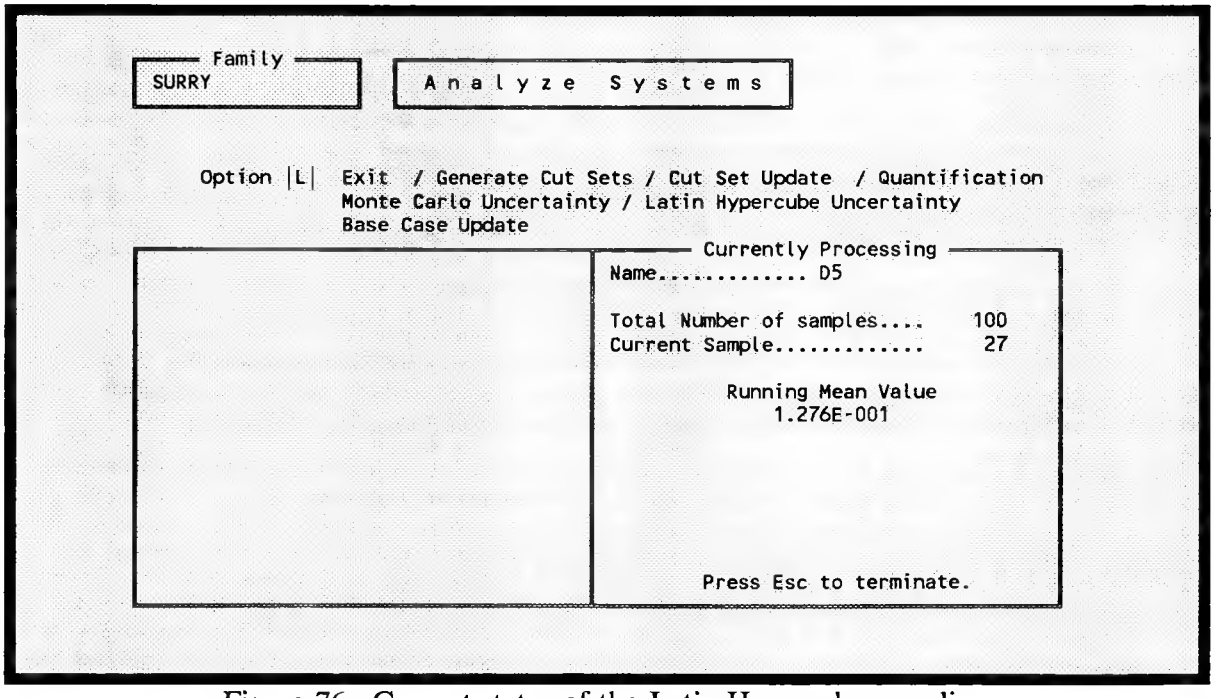


Figure 76. Current status of the Latin Hypercube sampling.

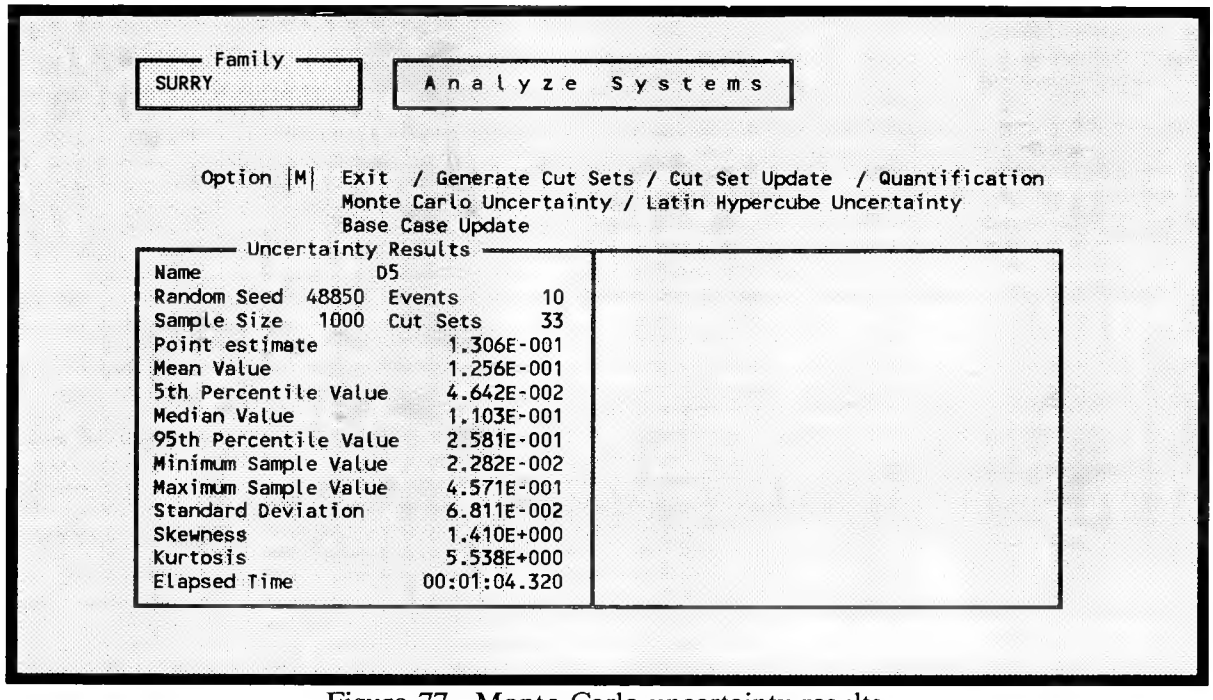


Figure 77. Monte Carlo uncertainty results.

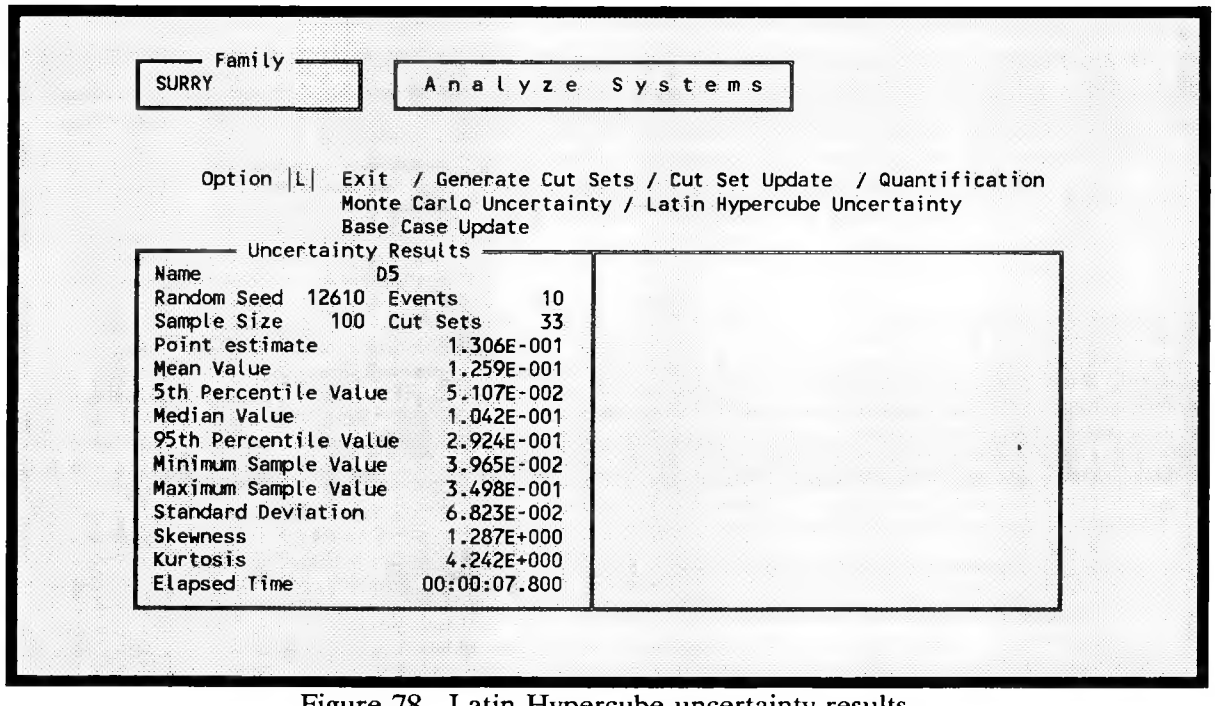


Figure 78. Latin Hypercube uncertainty results.

If only one system was selected (highlighted) for the uncertainty analysis process, then you will need to press <Enter> to return to the Analyze Systems screen from the Uncertainty Results screen. However, if more than one system is being processed, the Uncertainty Results screen will be displayed for each system, and when all of the selected systems have been processed, you will automatically be returned to the Analyze Systems screen.

5.3.6 Base Case Update

This option allows you to overwrite all base case (original) data with the current case data. The base case cut sets will be set to the alternate case cut sets; the base case uncertainty data will be set to the current case uncertainty data; and the base case quantile values will be set equal to the quantile values for the current case. The base case minimum cut set upper bound will be initialized to the current case minimum cut set upper bound. **WARNING: The original base case data will be lost if this option is executed!**

The base case update may be performed on a single system, a group of systems, or on all of the systems in the current family. To activate this option for a single system, type a <B> (Base Case Update) in the option field, highlight the desired system, and press <Enter>. To perform a base case update on a group of systems, mark the desired systems using the F2, F3, or F4 keys, type a <B> in the option field and press <Enter>. To perform this option on all systems in the current family, type a <B> in the option field and press <Enter>. A message **Process all records? (Y/N)** will appear at the bottom of the screen. Type a <Y> to continue the base case update for all of the systems, or type an <N> to discontinue the update for all systems.

A warning screen (Figure 79) will then be displayed asking for a (Y/N) confirmation prior to performing the update. To terminate the update, type an <N> in the option field or press the <Esc> key. To initiate the base case update, type a <Y> in the option field. This will cause the current case data to overwrite the base case data. Upon completion of this process, a message **Base case update complete** will be displayed at the bottom of the screen.

5.4 Display Results

To display the results of your system analysis, highlight Display Results or type <D> on the Fault Tree Analysis screen and press <Enter>. The Display System Results screen will be displayed showing a list of the systems contained in the data base (Figure 80). The following options are available: Exit, Cut Sets, Importance, and Uncertainty. In addition, the following function keys may be used:

<Esc>	Returns to the previous screen.
<F1>	Displays a general help screen.
<F5>	Locates a specific system. When you invoke this option, a screen similar to the one shown in Figure 81 will be displayed. Enter the system name you wish to locate and press <Enter>. If the system exists, it will be highlighted on the display.

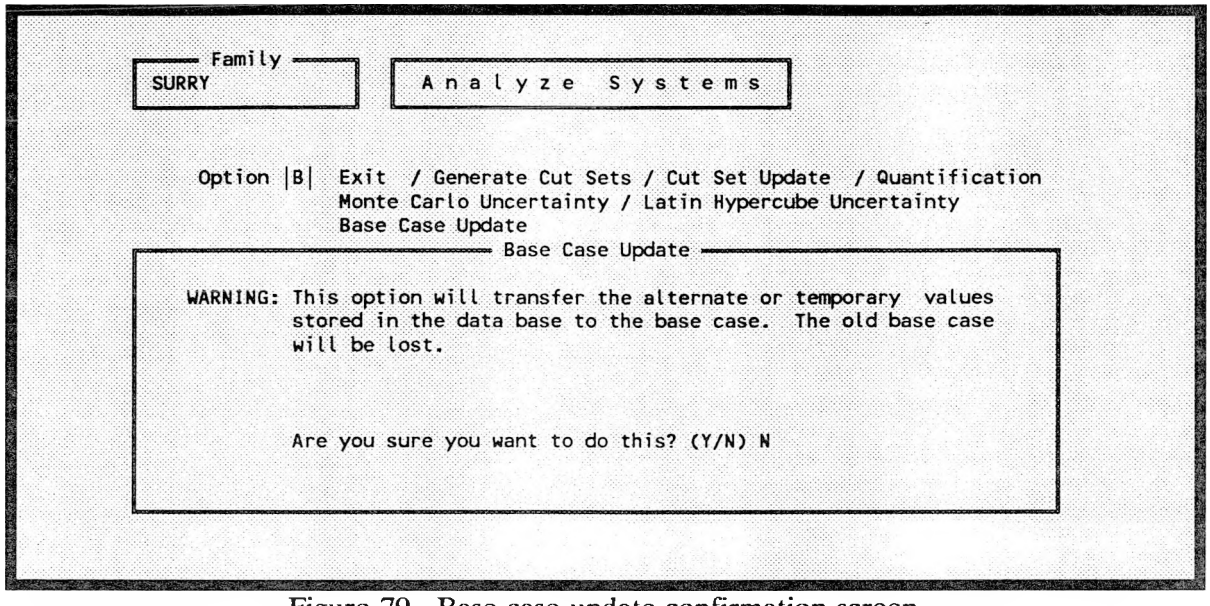


Figure 79. Base case update confirmation screen.

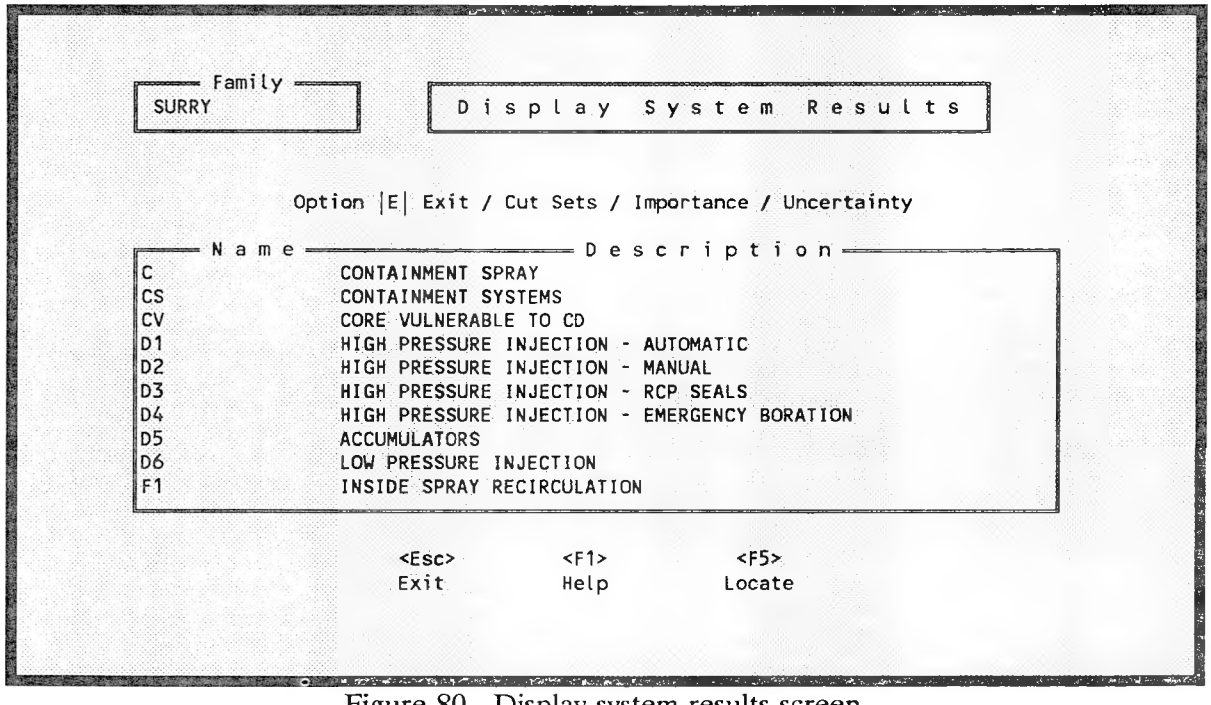


Figure 80. Display system results screen.

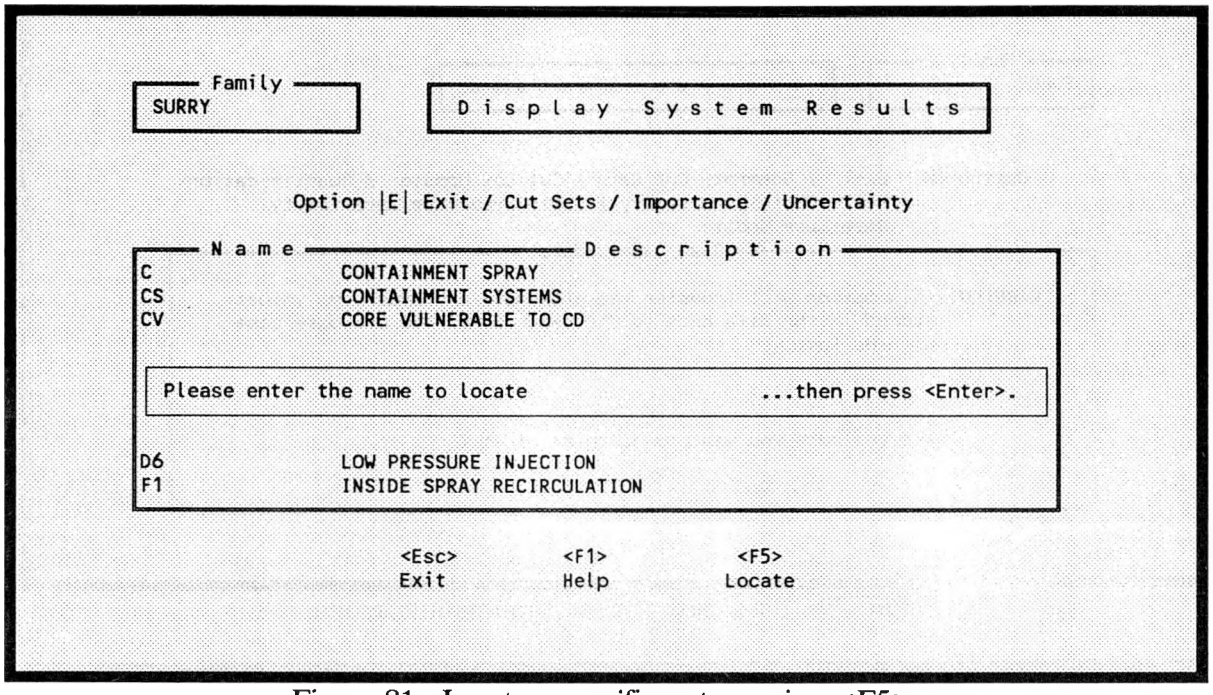


Figure 81. Locate a specific system using <F5>.

5.4.1 Exit

This option terminates the process and returns to the Fault Tree Analysis screen. To invoke the option, type <E> in the option field and press <Enter>, or press the <Esc> key.

5.4.2 Cut Sets

This option displays the system cut sets (Figure 82), their percent of contribution to the system, frequency, and the event names that make up the cut sets. The system minimum upper bound, the number of cut sets that make up the system, the current partition upper bound, the percentage that the partition contributes to the system, and the number of cut sets in the partition are displayed at the bottom of the screen.

5.4.2.1 Exit. This option terminates the process and returns to the previous screen. To invoke this option, type <E> and press <Enter>, or press the <Esc> key.

5.4.2.2 Partition. The partition option allows you to redefine a system as a subset of the original cut sets. This is accomplished by defining a set of events to be used to determine whether a cut set belongs to a partition. The functions available to perform this task are: Exit, Include, Exclude, Complement, Reset, and View Events.

To invoke this option, type <P>, highlight a system, and press <Enter>. This will bring up the screen shown in Figure 83.

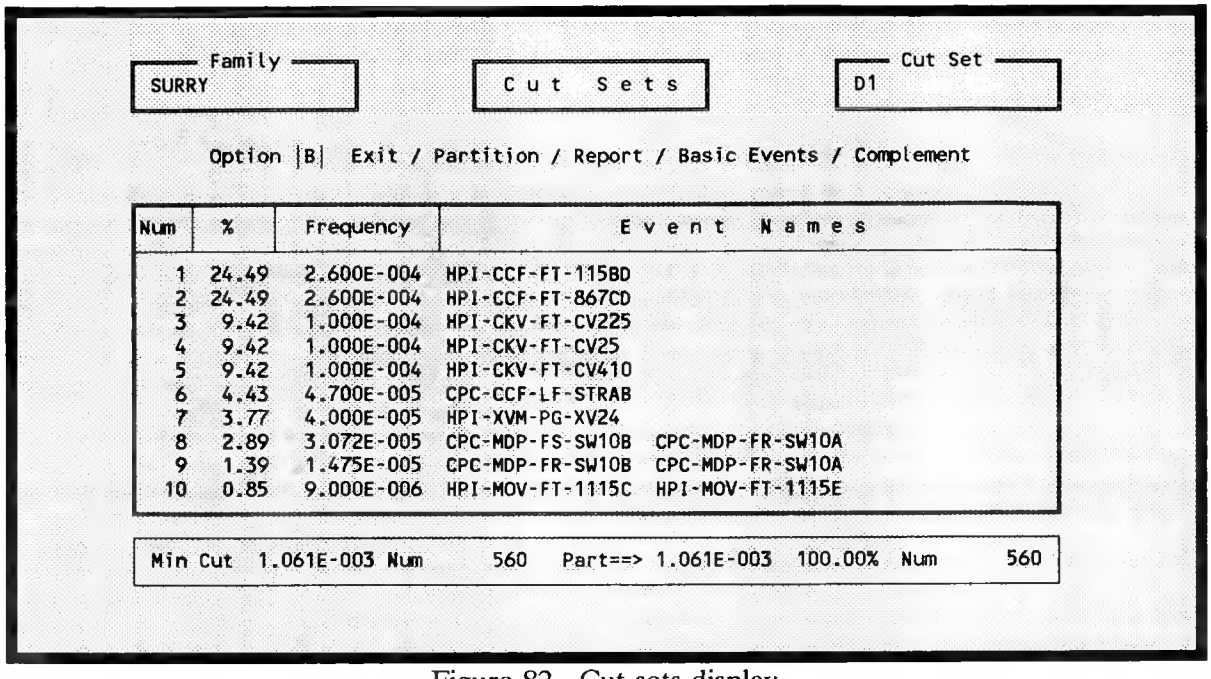


Figure 82. Cut sets display.

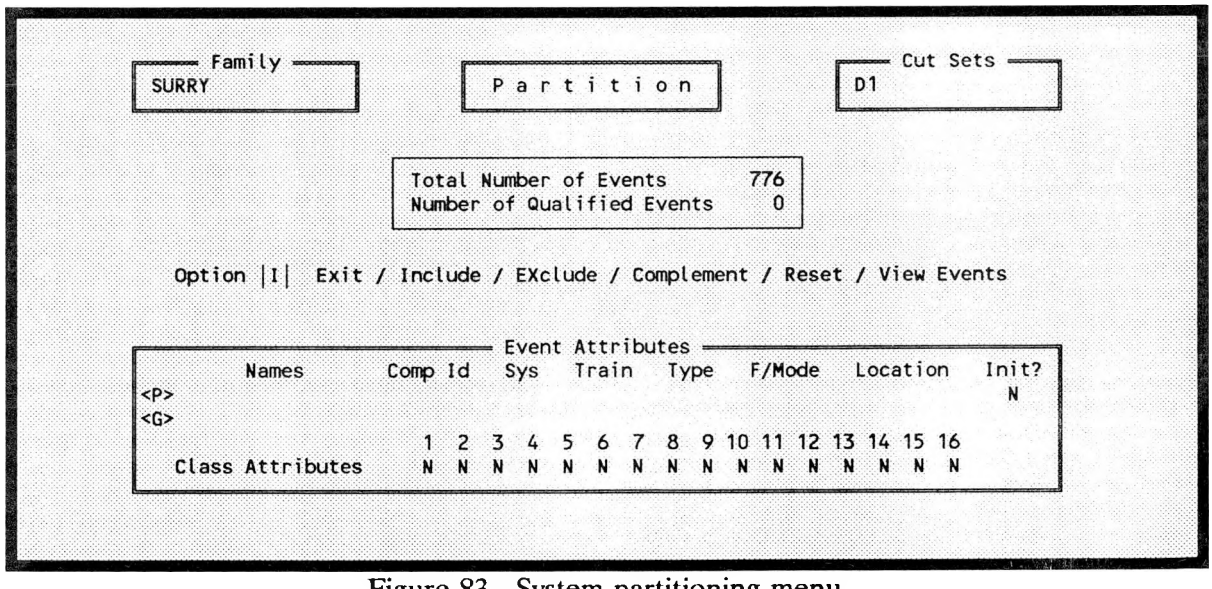


Figure 83. System partitioning menu.

Exit: This option terminates the process and returns to the previous screen. To invoke this option, type <E> and press <Enter>, or press <Esc>.

Include: To establish a partition via this option, type <I> in the option field, then fill in the entry fields that are to be used to qualify the events that may be used in the new partition and press <Enter>. The application proceeds to qualify the events and when complete will update the Number of Qualified Events field that appears at the top of the screen. In this case, qualified events are those events which contain the included attributes. Returning to the Cut Sets screen via the Exit option, you will see that the system cut set list contains only those cut sets that are made up of qualified events. Figure 84 was the result of specifying the event name "HPI-CKV-FT-CV410" for the "Include" option. If the system cut sets do not contain any of the qualified events, then the message **No cutsets qualify** is displayed at the bottom of the screen.

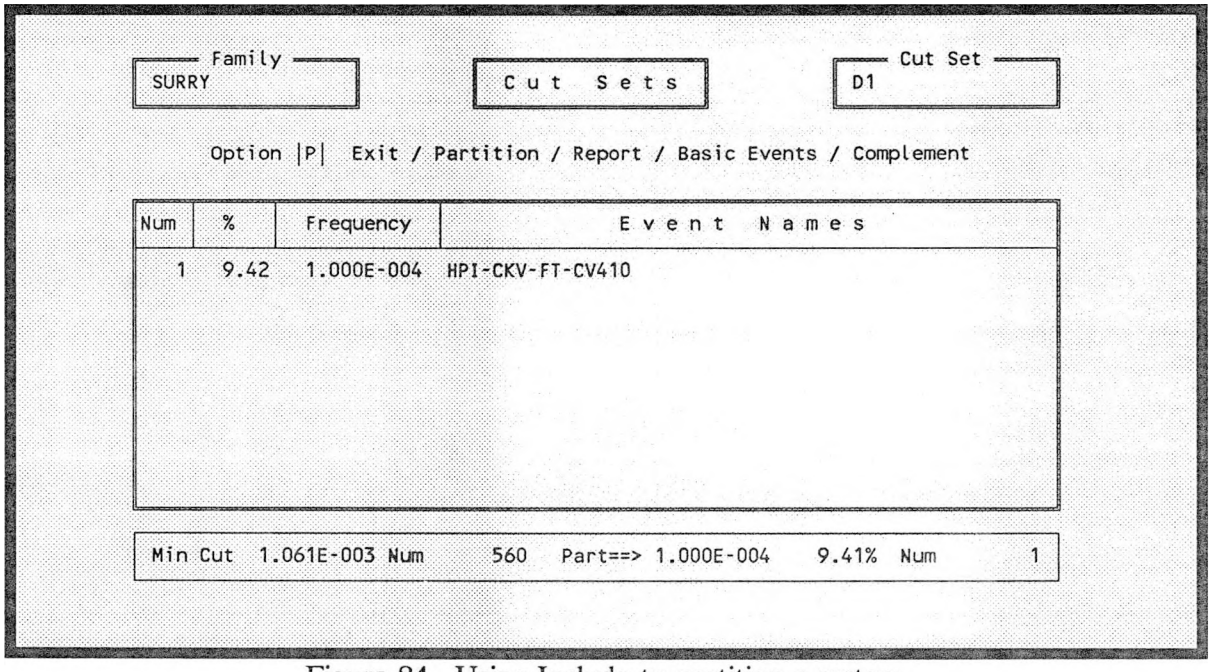


Figure 84. Using Include to partition a system.

EXclude: To establish a partition via this option, type <X> in the option field, then fill in the entry fields on the screen that are to be used to remove events from the list of qualified events. The application proceeds to remove the events. When complete, the Number of Qualified Events field that appears at the top of the screen will be updated accordingly. Returning to the Cut Sets screen via the Exit option you will see that the system cut set list contains only those cut sets that are made up of qualified events. Figure 85 was the result of specifying the event name "HPI-CKV-FT-CV410" for the "EXclude" option. If the system cut sets do not contain any of the qualified events, then the message **No cutsets qualify** is displayed at the bottom of the screen.

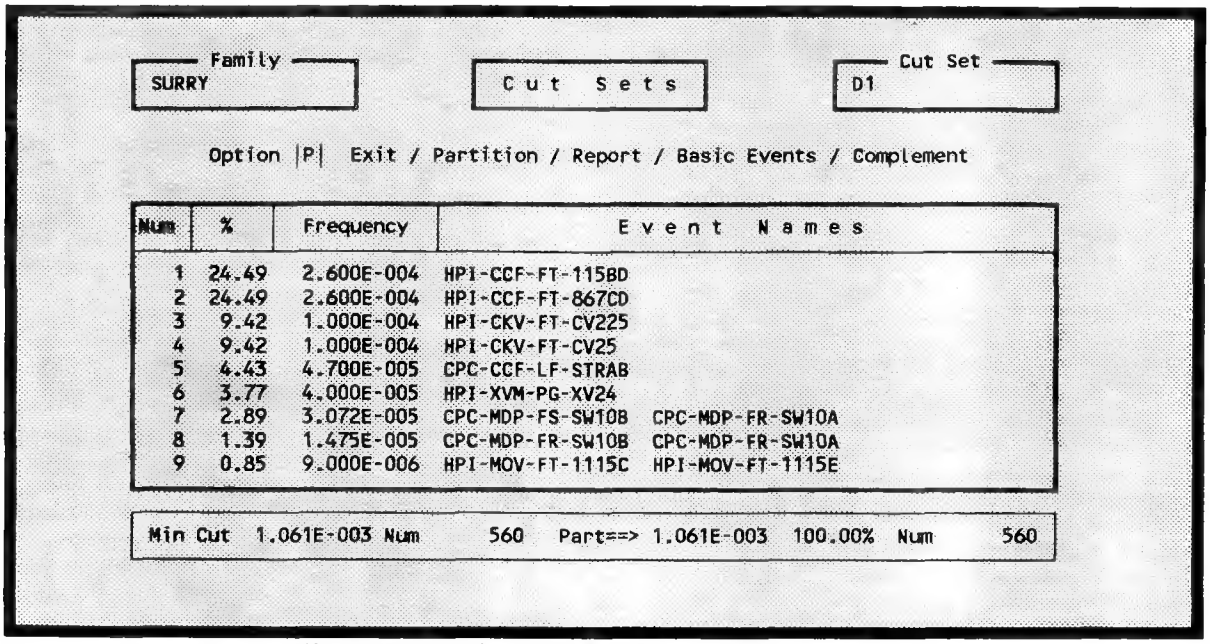


Figure 85. Using EXclude to partition a system.

Complement: To establish a partition via this option, type <C> in the option field, and press <Enter>. This causes all currently qualified events to be disqualified, and all unqualified events to become the set of qualified events. The Number of Qualified Events field at the top of the screen will change accordingly. Returning to the Cut Sets screen via the Exit option you will see that the system cut set list contains only those cut sets that are made up of qualified events. If the system cut sets do not contain any of the qualified events then the message **No cutsets qualify** is displayed at the bottom of the screen.

Reset: This option sets all family events to qualified. This, of course, removes all partitioning from the current system cut sets. To activate this option, type <R> in the option field and press <Enter>. (Assume the partition shown in Figure 84). The original cut set list is the result, as shown in Figure 82.

View Events: This option displays the list of family events and allows you to mark those events that are to be considered qualified events (Figure 86). To activate this option, type <V> in the option field and press <Enter>. Using <F2>, <F3>, or <F4> keys, mark the events that are considered qualified and press <Enter>. You will be returned to the Partition screen where the number of qualified events will be updated accordingly (Figure 87). If the system cut sets do not contain any of the qualified events, then the message **No cutsets qualify** is displayed at the bottom of the screen.

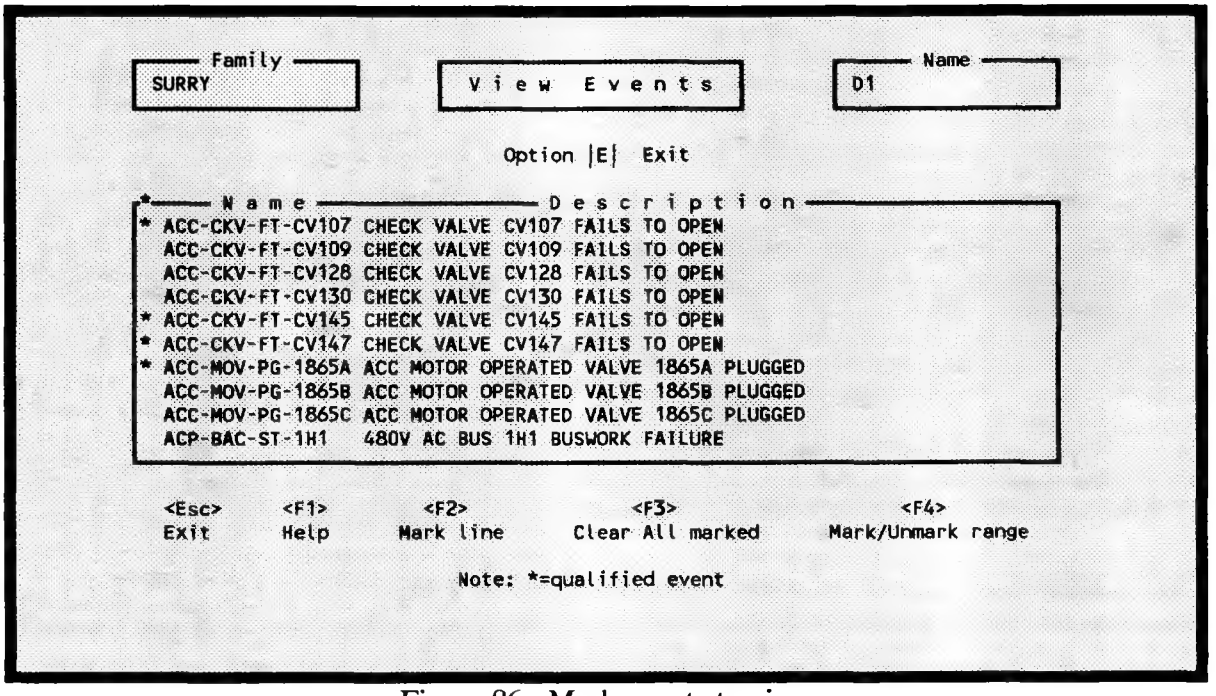


Figure 86. Mark events to view.

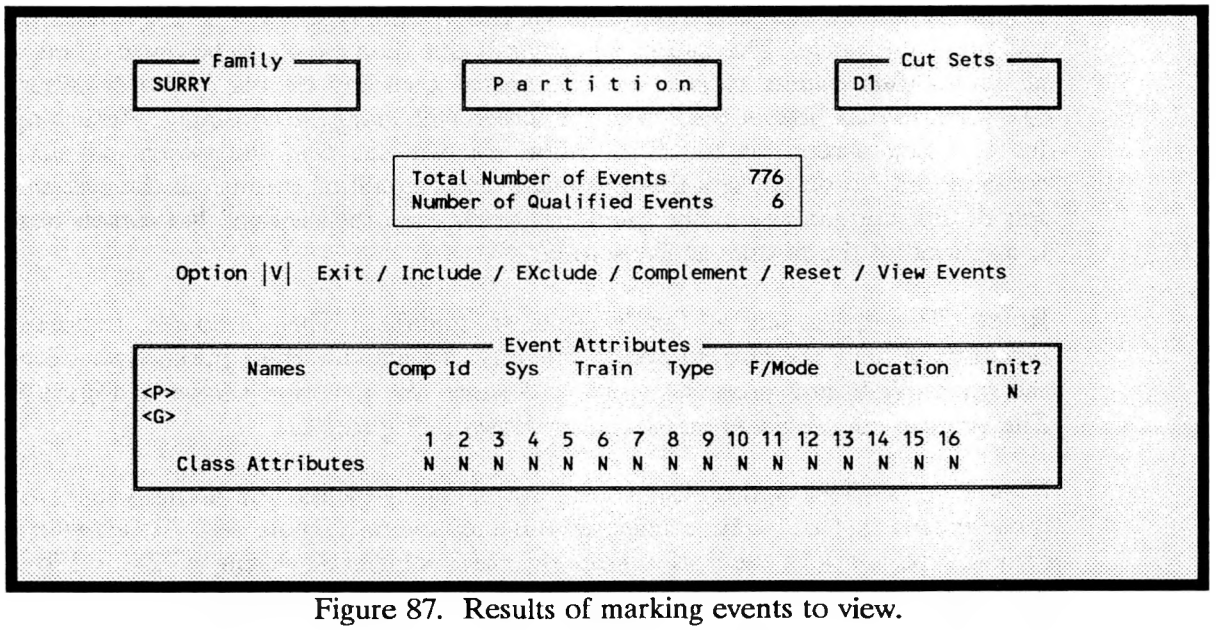


Figure 87. Results of marking events to view.

5.4.2.3 Report. The Report option allows you to generate a report of the data that is displayed on the screen. The report may be displayed on the console, sent to an attached printer, or saved in a disk file for later processing (Figure 88). To invoke this option, type <R> in the option field, and press <Enter>. Upon pressing <Enter>, the Information Request screen is displayed (Figure 88). This screen shows a default title and file name. You may change these defaults to meet your needs.

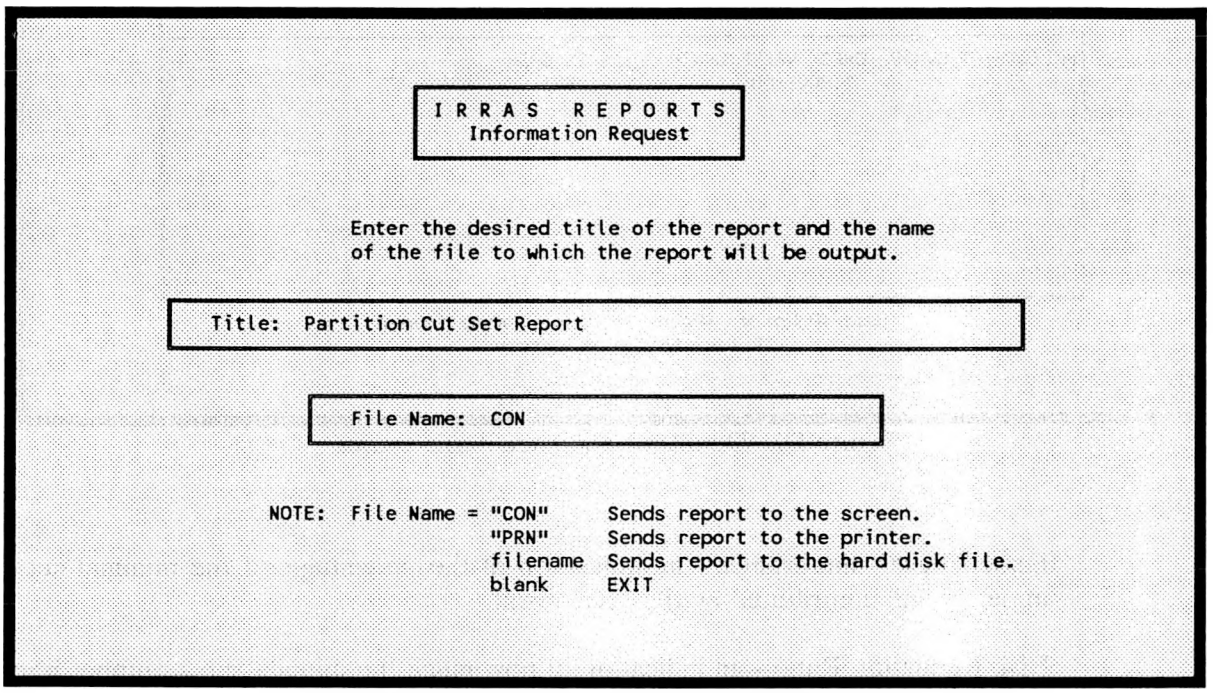


Figure 88. Partition report type selection.

5.4.2.4 Basic Events. The Basic Event option provides the following detailed information about the events that make up a cut set: name, description, probability, component ID, system, component type, failure mode, and location (Figure 89). To invoke this option, type <B> in the option field, highlight a cut set, and press <Enter>.

5.4.2.5 Complement. The Complement option operates on the current system partition. Its function is to set all currently qualified cut sets to unqualified. This allows you to split a system into two partitions and then switch between the two partitions to view the results. To invoke this option, type <C> in the option field, and press <Enter>. (Assume the partition shown in Figure 84). The resulting display is shown in Figure 85.

5.4.3 Importance

This option calculates and displays the following three important measures for each event in the system:

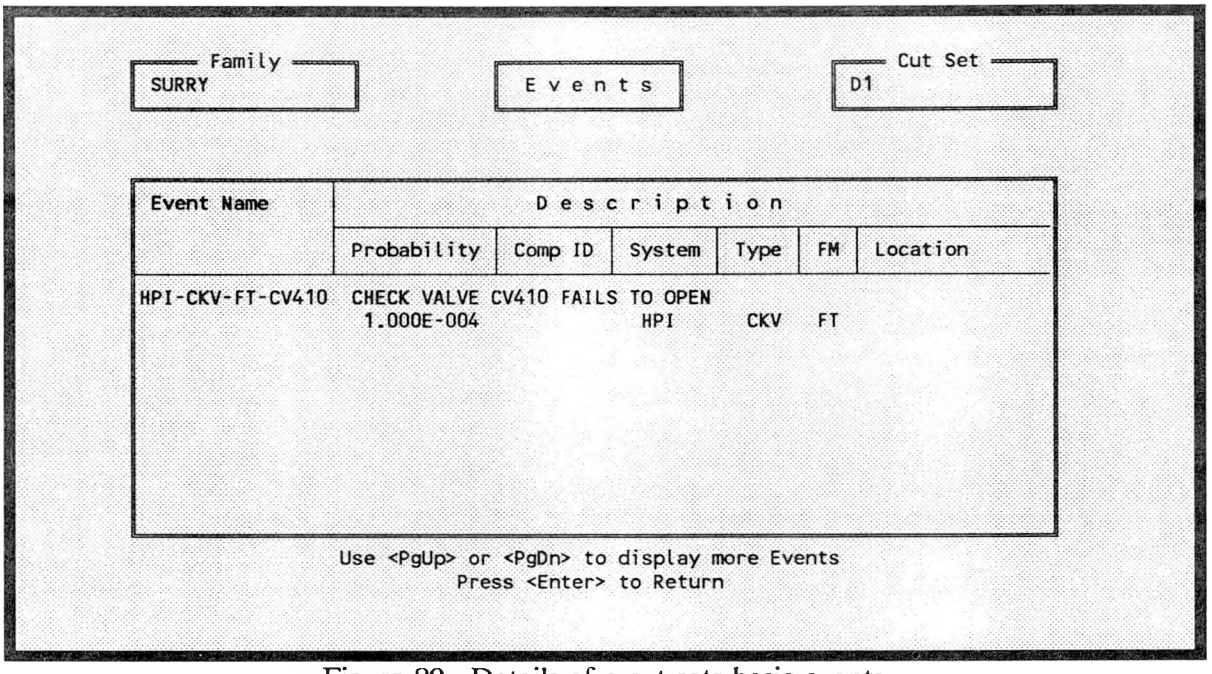


Figure 89. Details of a cut sets basic events.

- Fussell-Vesely importance - an indication of the percentage of the minimal cut set upper bound contributed by the basic event.

- Risk Reduction Ratio - an indication of how much the minimal cut set upper bound would decrease if the basic event was made perfect (never fail).

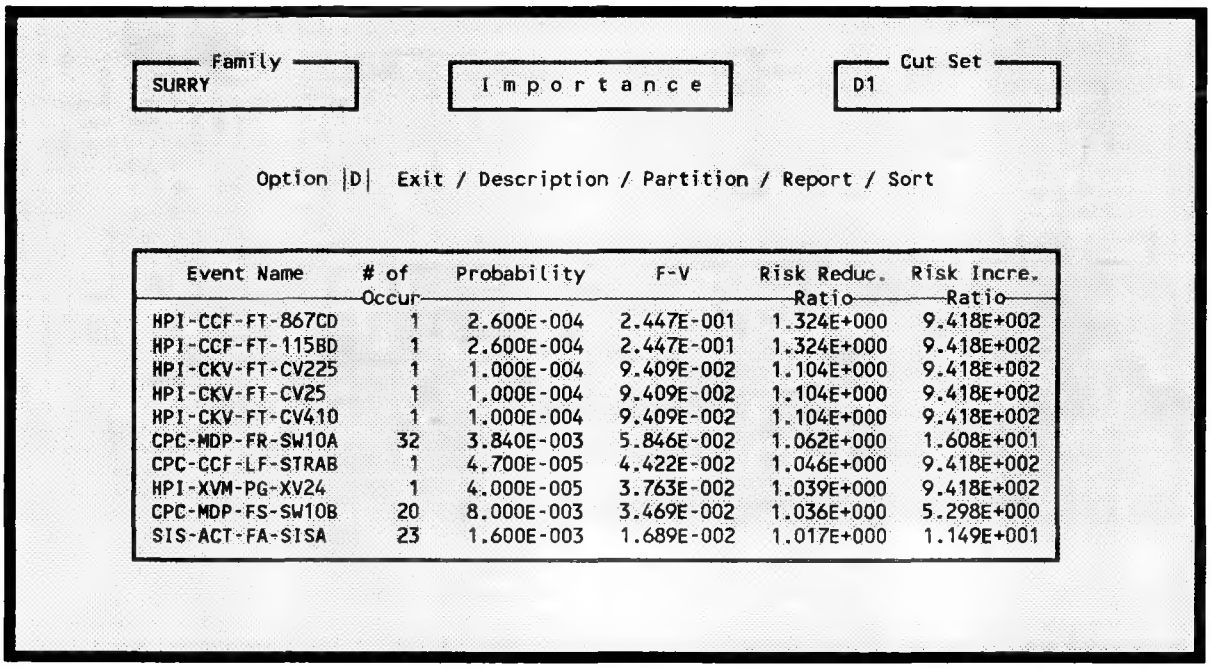
- Risk Increase Ratio - an indication of how much the minimal cut set upper bound would increase if the basic event was always failed.

If the Intervals flag is set in the Constants Menu, the Birnbaum measure (the partial derivative), the Risk Reduction interval, and the Risk Increase Interval will be displayed.

To invoke this option, type <I> in the option field, highlight a system (or you may process all records by not specifying a system), and press <Enter>. By default, when the importance data is first displayed it is sorted, high to low, on Fussell-Vesely (Figure 90).

5.4.3.1 Exit. Returns you to the previous screen.

5.4.3.2 Description. Displays the full description for the highlighted event on the bottom of the screen. To invoke this option, enter a <D>, highlight the desired event, and press <Enter>. If no event is highlighted, the message **An event must be selected first...** is displayed.



Event Name	# of Occur	Probability	F-V	Risk Reduc. Ratio	Risk Incre. Ratio
HPI-CCF-FT-867CD	1	2.600E-004	2.447E-001	1.324E+000	9.418E+002
HPI-CCF-FT-115BD	1	2.600E-004	2.447E-001	1.324E+000	9.418E+002
HPI-CKV-FT-CV225	1	1.000E-004	9.409E-002	1.104E+000	9.418E+002
HPI-CKV-FT-CV25	1	1.000E-004	9.409E-002	1.104E+000	9.418E+002
HPI-CKV-FT-CV410	1	1.000E-004	9.409E-002	1.104E+000	9.418E+002
CPC-MDP-FR-SW10A	32	3.840E-003	5.846E-002	1.062E+000	1.608E+001
CPC-CCF-LF-STRAB	1	4.700E-005	4.422E-002	1.046E+000	9.418E+002
HPI-XVM-PG-XV24	1	4.000E-005	3.763E-002	1.039E+000	9.418E+002
CPC-MDP-FS-SW10B	20	8.000E-003	3.469E-002	1.036E+000	5.298E+000
SIS-ACT-FA-SISA	23	1.600E-003	1.689E-002	1.017E+000	1.149E+001

Figure 90. Initial display of importance measures.

5.4.3.3 Partition. This option invokes the same process as described in Section 5.4.2.2, except the effect is to limit which events are displayed/reported.

5.4.3.4 Report. This option invokes the same process as described in Section 5.4.2.3.

5.4.3.5 Sort.When you invoke this option, Figure 91 will be displayed. As shown, the data can be sorted by the following: Name, Occurrence, Probability, F-V, Reduction, and Increase.

5.4.4 Uncertainty

The Uncertainty option displays the distribution and confidence limits of a system for both base and current data values. This data was calculated using either the Latin Hypercube simulation technique or the Monte Carlo simulation technique. To invoke this option, type <U> (Uncertainty) in the option field of the Display System Results screen, highlight the desired system, and press <Enter>. Figure 92 shows the base and current case uncertainty data for the highlighted system.

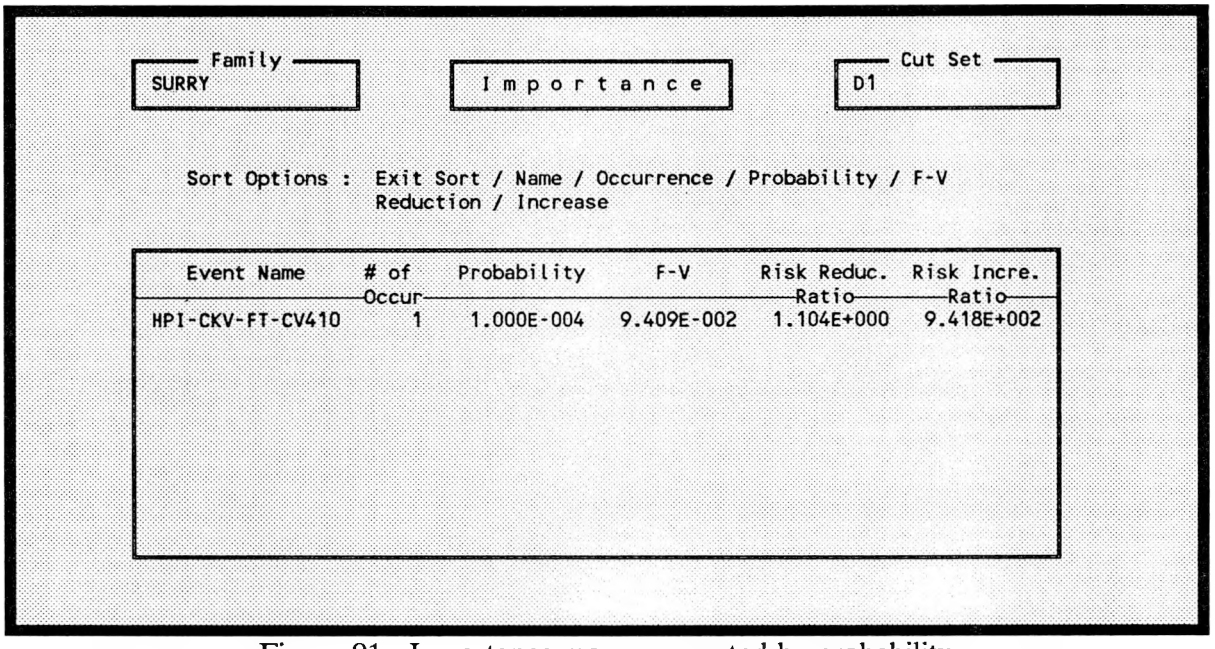


Figure 91. Importance measures sorted by probability.

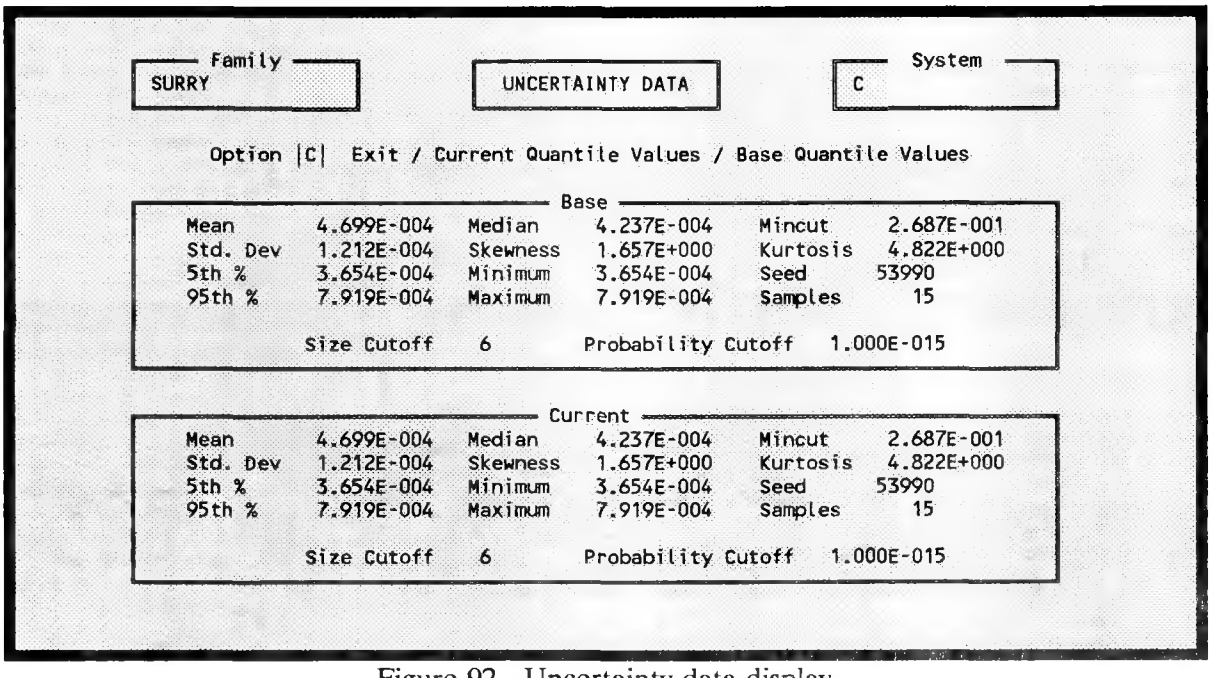


Figure 92. Uncertainty data display.

From this screen you may either return to the System Display screen or view the quantile values associated with the current case data or the base case data. To return to the System Display screen, type an <E> (Exit) in the option field and press <Enter>, or press the <Esc> key. To view the quantile values for the current case, type a <C> in the option field and press <Enter>. A screen showing the quantile values will appear (Figure 93). To return to the previous screen press <Enter>. If you wish to view base case quantile values, type a <B> in the option field and press <Enter>.

Distribution Quantile Level (in per cent)	95% Confidence Interval On Quantile Level in % (+/-)	Quantile Value	CURRENT CASE 95% Confidence Interval on Quantile Lower Bound	Upper Bound
0.5	6.9	3.6546E-004	3.6546E-004	3.6546E-004
1.0	8.4	3.6546E-004	3.6546E-004	3.6546E-004
2.5	11.2	3.6546E-004	3.6546E-004	3.7003E-004
5.0	14.4	3.6546E-004	3.6546E-004	3.7021E-004
10.0	18.5	3.7003E-004	3.6546E-004	3.9247E-004
20.0	23.6	3.9247E-004	3.6546E-004	4.2324E-004
25.0	25.2	3.9247E-004	3.6546E-004	4.2375E-004
30.0	26.5	3.9301E-004	3.7003E-004	4.2375E-004
40.0	28.1	4.2324E-004	3.7021E-004	4.6749E-004
50.0	28.6	4.2375E-004	3.9247E-004	4.9533E-004
60.0	28.1	4.6749E-004	4.0875E-004	4.9592E-004
70.0	26.5	4.9265E-004	4.2375E-004	6.9206E-004
75.0	25.2	4.9533E-004	4.2375E-004	7.9197E-004
80.0	23.6	4.9592E-004	4.6644E-004	7.9197E-004
90.0	18.5	6.9206E-004	4.9533E-004	7.9197E-004
95.0	14.4	7.9197E-004	4.9592E-004	7.9197E-004
97.5	11.2	7.9197E-004	6.9206E-004	7.9197E-004
99.0	8.4	7.9197E-004	7.9197E-004	7.9197E-004
99.5	6.9	7.9197E-004	7.9197E-004	7.9197E-004

Figure 93. Quantile values display.

5.5 Cut Set Editor

The cut set editor provides you with the means to edit the base case/alternate system cut sets. Base case cut sets are, generally, the cut sets that represent the data in its original form. If you have performed a base case update this may not be true. Alternate cut sets represent data that was modified during previous cut set editor sessions.

Any event name entered during cut set editing may be preceded by a "/" to indicate that it is to be treated as a complemented event. The probability of a complemented event is 1 - the failure probability.

To invoke this option, highlight Cut Set Editor or type <C> in the option field and press <Enter>. Figure 94 shows the Cut Set Editor screen indicating the system names and descriptions. Whether the system has associated base case cut sets and/or alternate cut sets is indicated by the letter B and A preceding the system name. To edit the base case cut set, select <B>, highlight a

system showing a letter B, and press <Enter>. Likewise to edit an alternate cut set select <A>, highlight a system showing a letter A, and press <Enter>. If a system name is not flagged with a B or A it may still be edited.

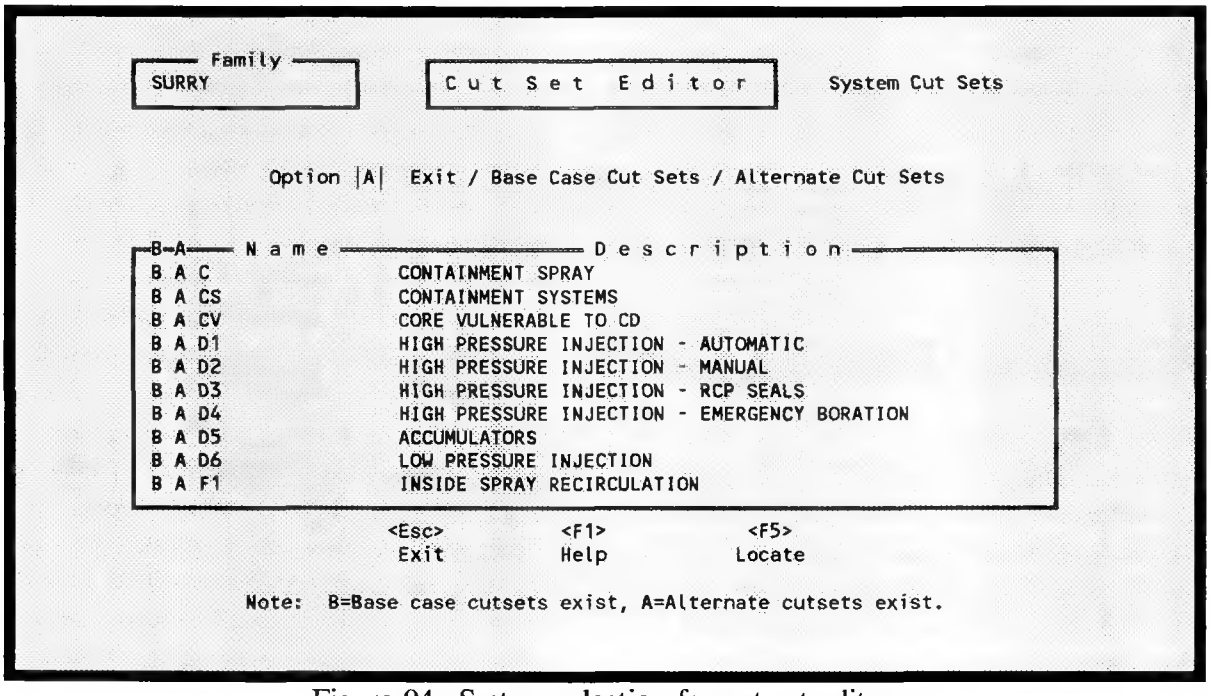


Figure 94. System selection for cut set editor.

In any case the screen shown in Figure 95 is displayed. This screen shows 14 editing options which are activated by a single key stroke. The 14 options include: Exit, Add, Modify, Delete, Locate, Next, Previous, Search, Options, Insert Events, Replace Events, Copy Cut Sets and Replace Events, Undo Delete, and Find and Delete Cut Sets. The Add, Modify, and Delete functions will perform their function on either the entire cut set or on a single event in a cut set depending upon where the cursor is positioned at the time the key to activate the function is pressed. If the cursor is in the first column of the screen, then the function will be performed on the entire cut set. However, if the cursor is in one of the other four columns, then the function will be performed on the event where the cursor is positioned.

To move the cursor about the editing window, use the keyboard cursor pad. The arrow keys move one field in each respective direction. The <Home> key places the cursor in the upper right corner of the window. The <End> key moves the cursor to the bottom left. The <PgUp> key moves the window up one page (12 lines). The <PgDn> key moves the window down one page. <Ctrl-PgUp> and <Ctrl-PgDn> moves to the top and bottom of the file. Pressing the function key <F1> toggles between two cut set editor screens. One screen shows the editing options and the other shows the available cursor movements.

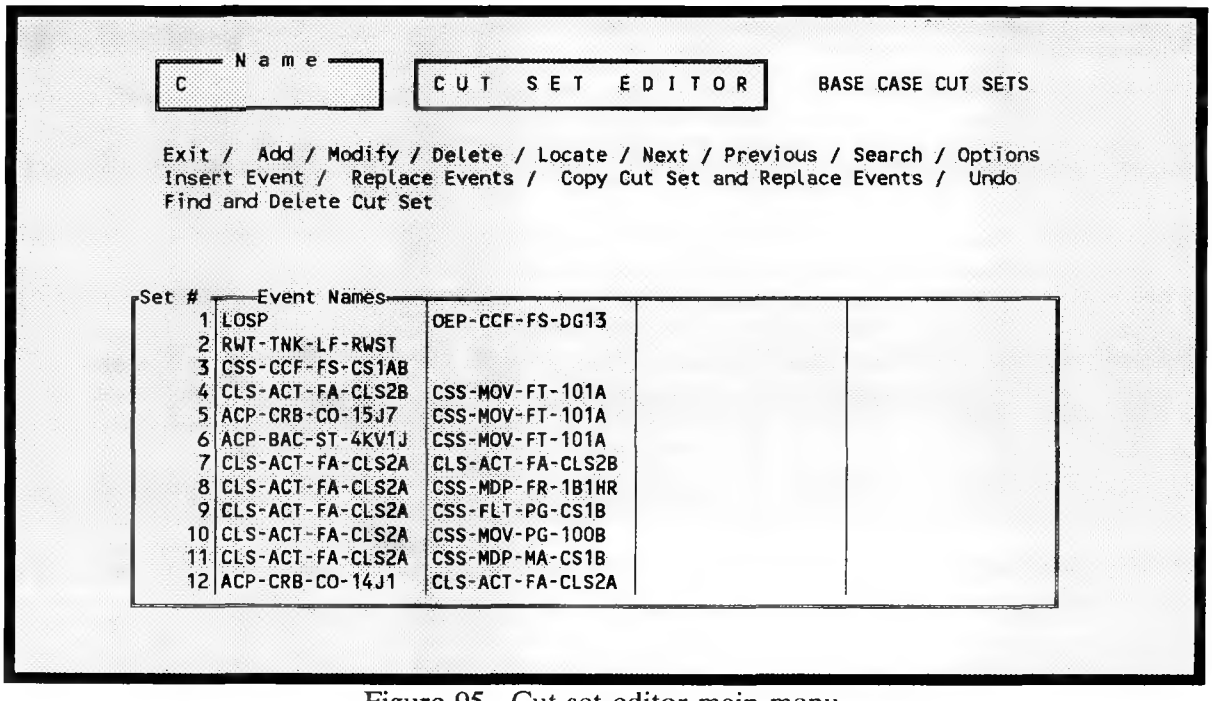


Figure 95. Cut set editor main menu.

5.5.1 Exit

This option returns you to the Cut Set Editor screen (Figure 94). After pressing <E> (Exit) you are asked if the changes are to be saved or discarded (Figure 96). If the changes are saved, the sequence and plant frequencies must be recalculated to reflect the new cut set configurations.

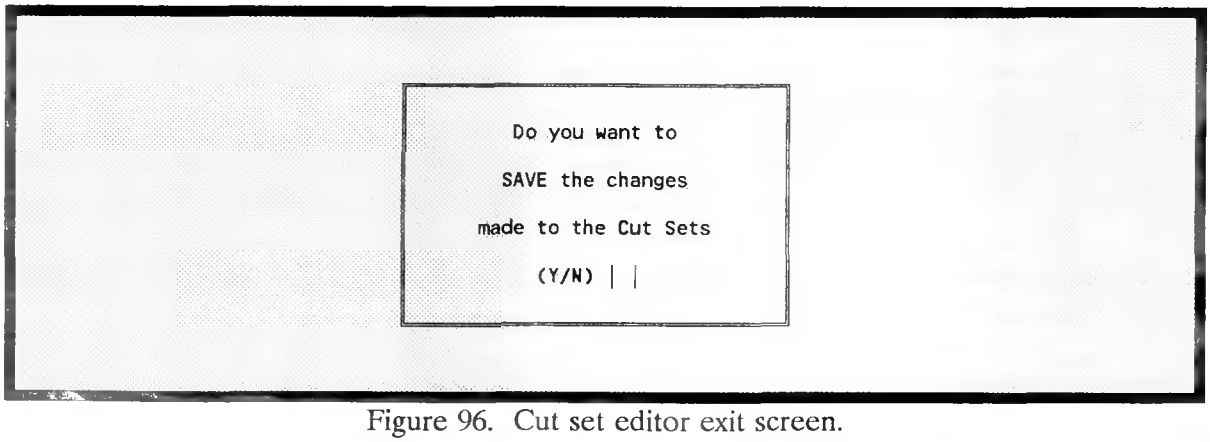


Figure 96. Cut set editor exit screen.

5.5.2 Add

This option allows you to add a cut set to a system or an event to a cut set. To add a new cut set, move the cursor into the set number column and press <A>. The cut set display is cleared, and the cursor is placed in the event name column (Figure 97). The event names, that make up the cut set may be entered using the <Tab> key to move between fields, and the <Enter> key to end the addition. The window is then updated and the cursor is positioned on the new cut set (Figure 98). The <Insert> key also invokes the Add option.

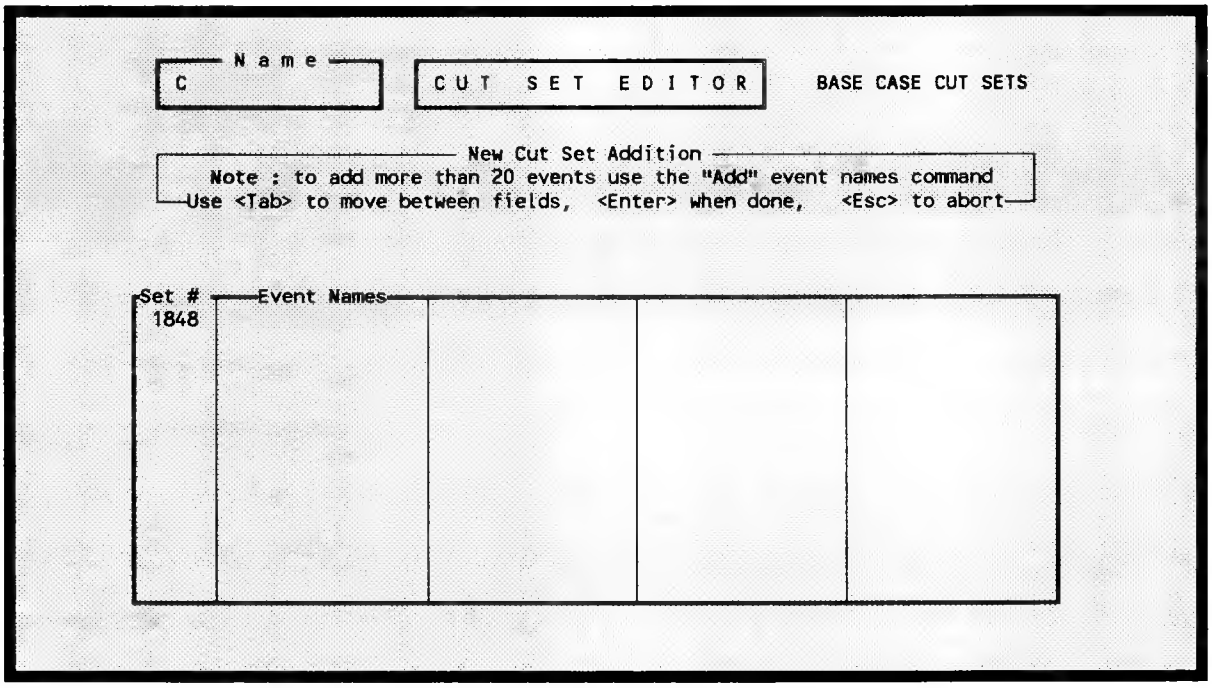


Figure 97. Adding a new cut set.

To add an event to a cut set place the cursor in the row of the cut set you wish the event to be in, press <A> to invoke the Add command, and enter the event name. Figure 99 shows the editor screen ready to add an event name. Figure 100 shows the results of adding a new event.

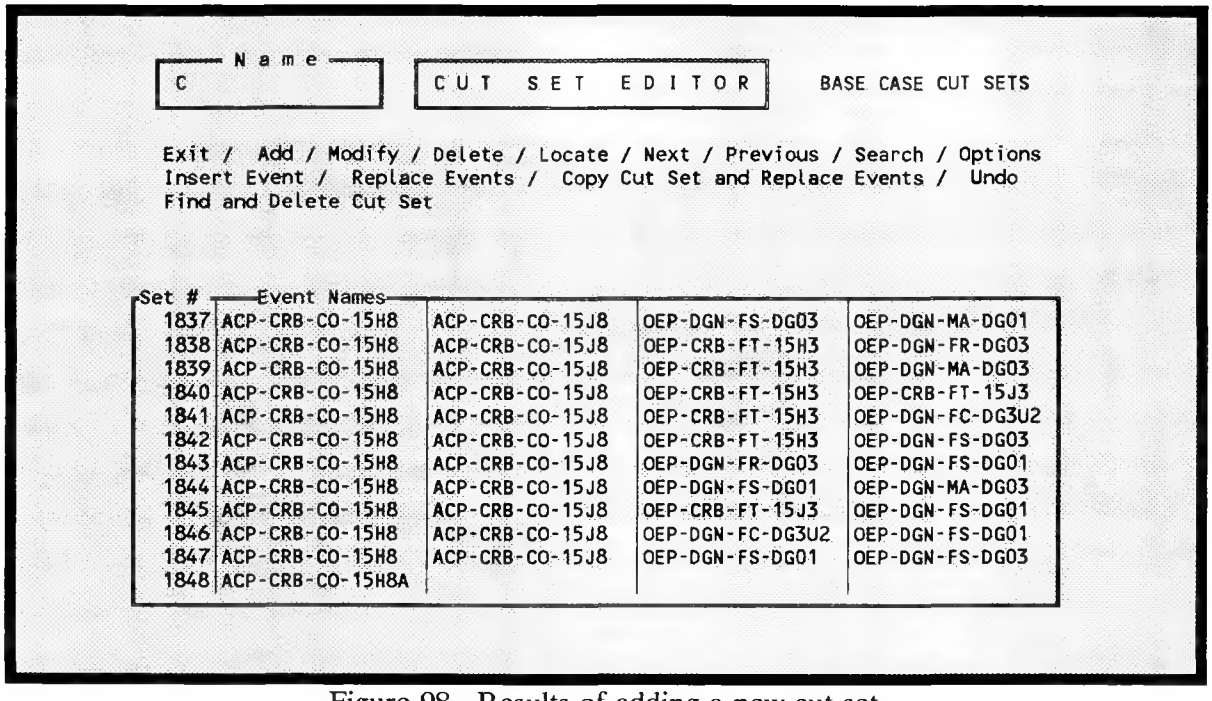


Figure 98. Results of adding a new cut set.

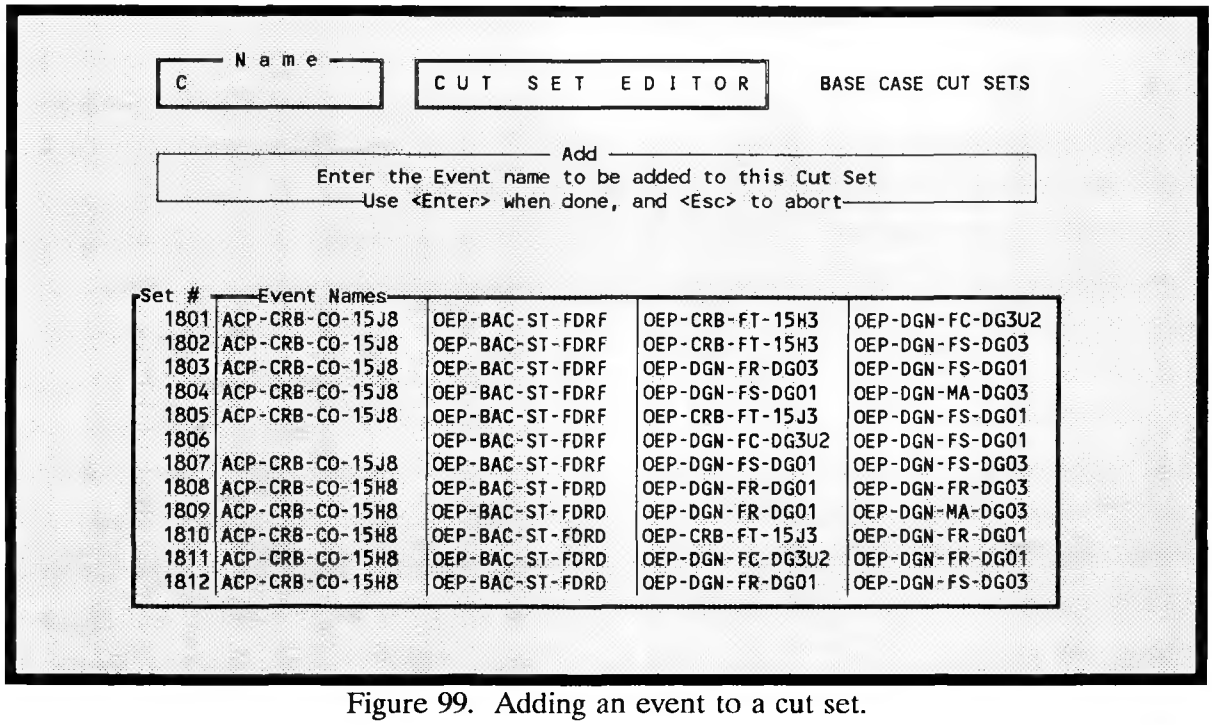


Figure 99. Adding an event to a cut set.

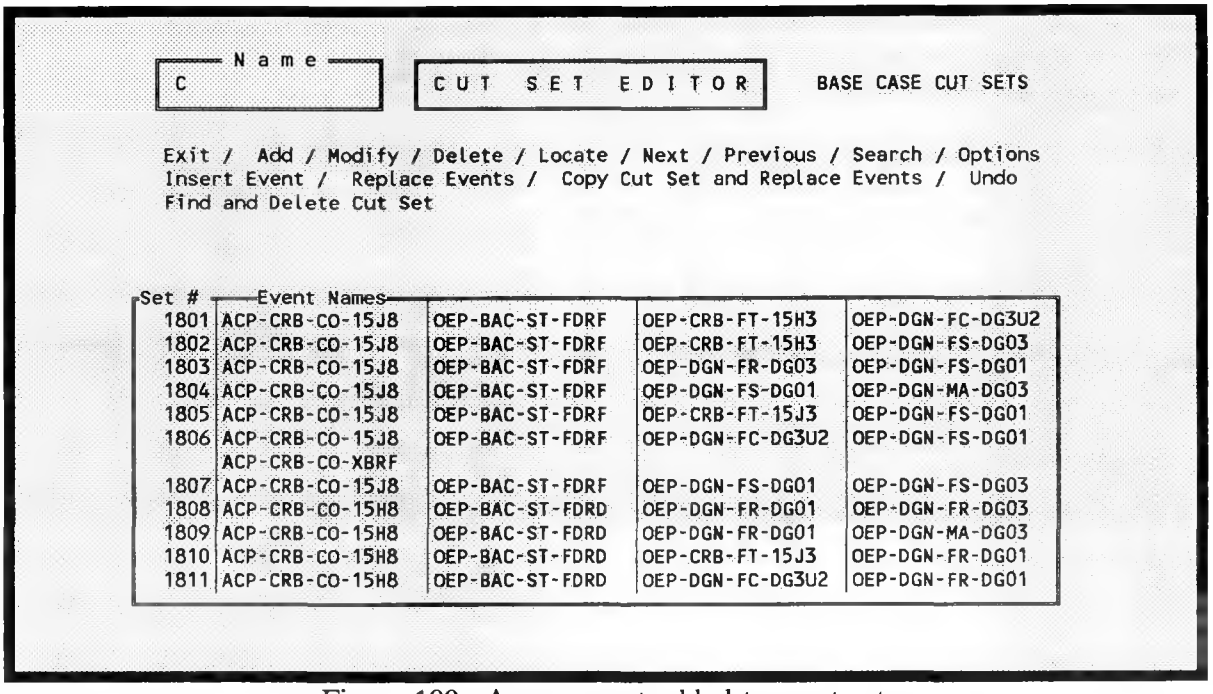


Figure 100. A new event added to a cut set.

5.5.3 Modify

To modify events of an entire cut set, place the cursor in the first column of the screen and press the <M> key. This will display a screen containing the first 20 events of the cut set to be modified (Figure 101). After making modifications to the events of the cut set, press <Enter> to save the modifications or press <Esc> to abort the modification process.

To change a single event in a cut set, position the cursor on the desired event and press the <M> key. This will display the Change Event Name Screen (Figure 102) to allow you to modify the current event. When modifying an event, you may use all of the alphanumeric keys, in addition to the <Ins> and <Del> keys.

5.5.4 Delete

This option allows you to delete an entire cut set (Figure 103) or an individual event (Figure 104). Placing the cursor on a cut set number and pressing <D> causes the entire cut set to be deleted. If the cursor is placed on an event name, the event at that location only is deleted from the cut set.

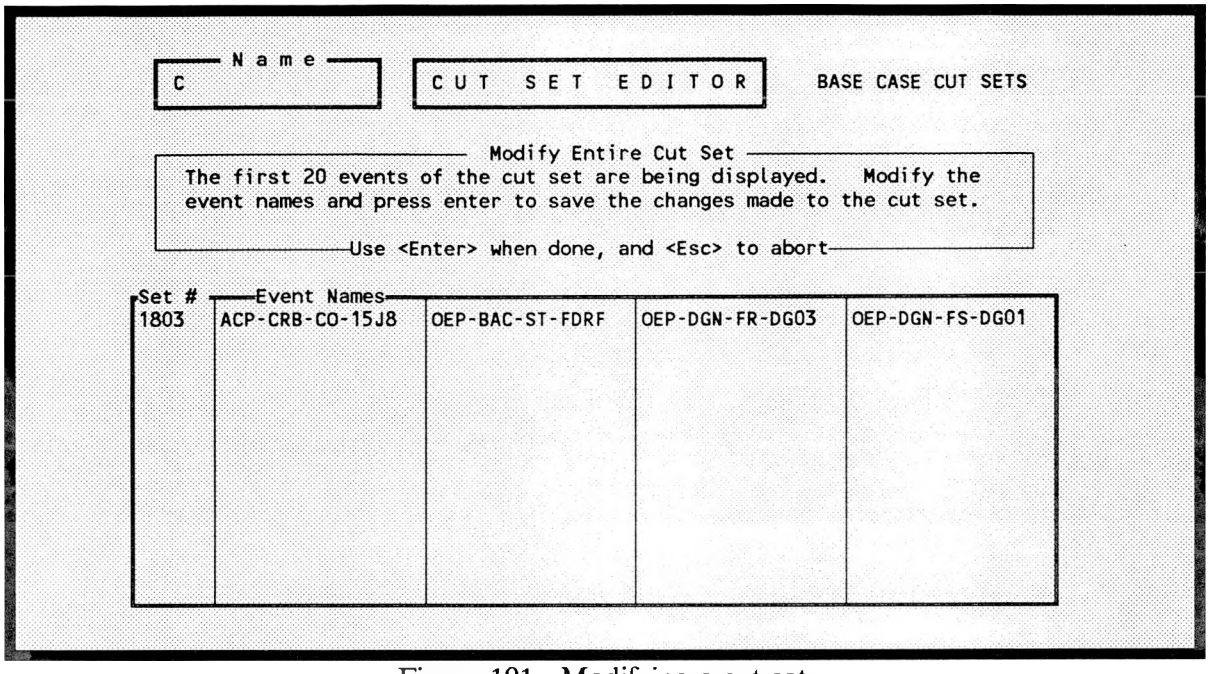


Figure 101. Modifying a cut set.

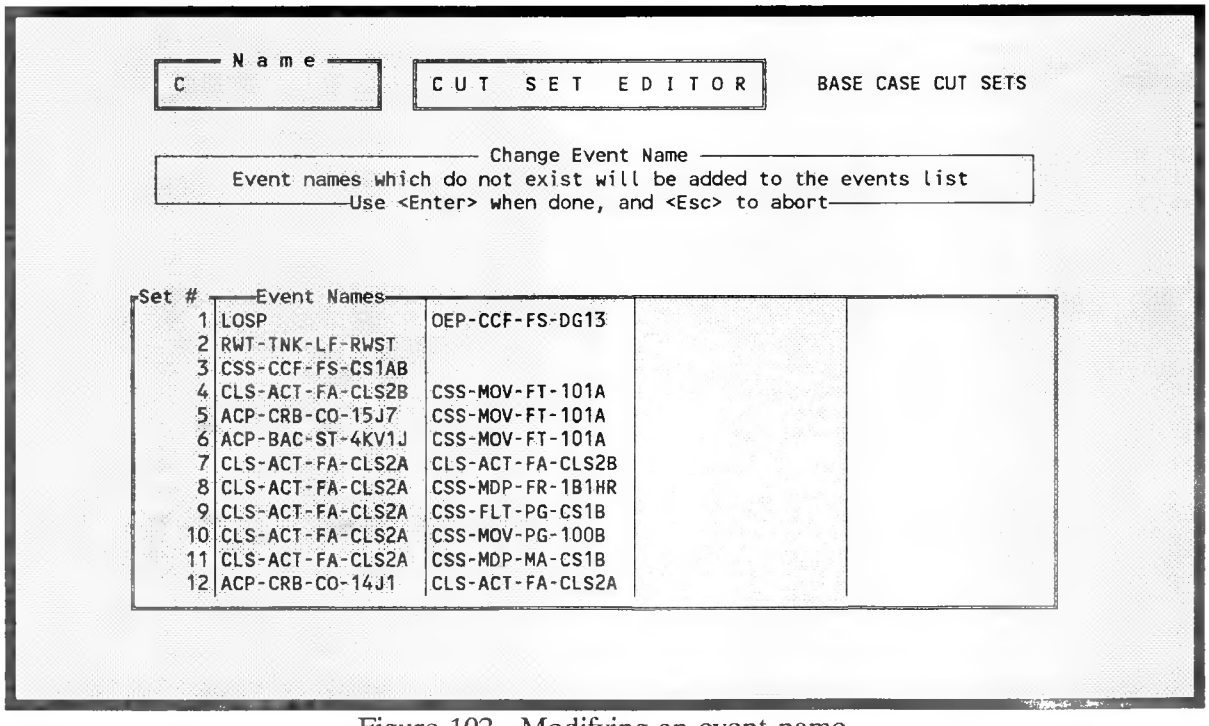


Figure 102. Modifying an event name.

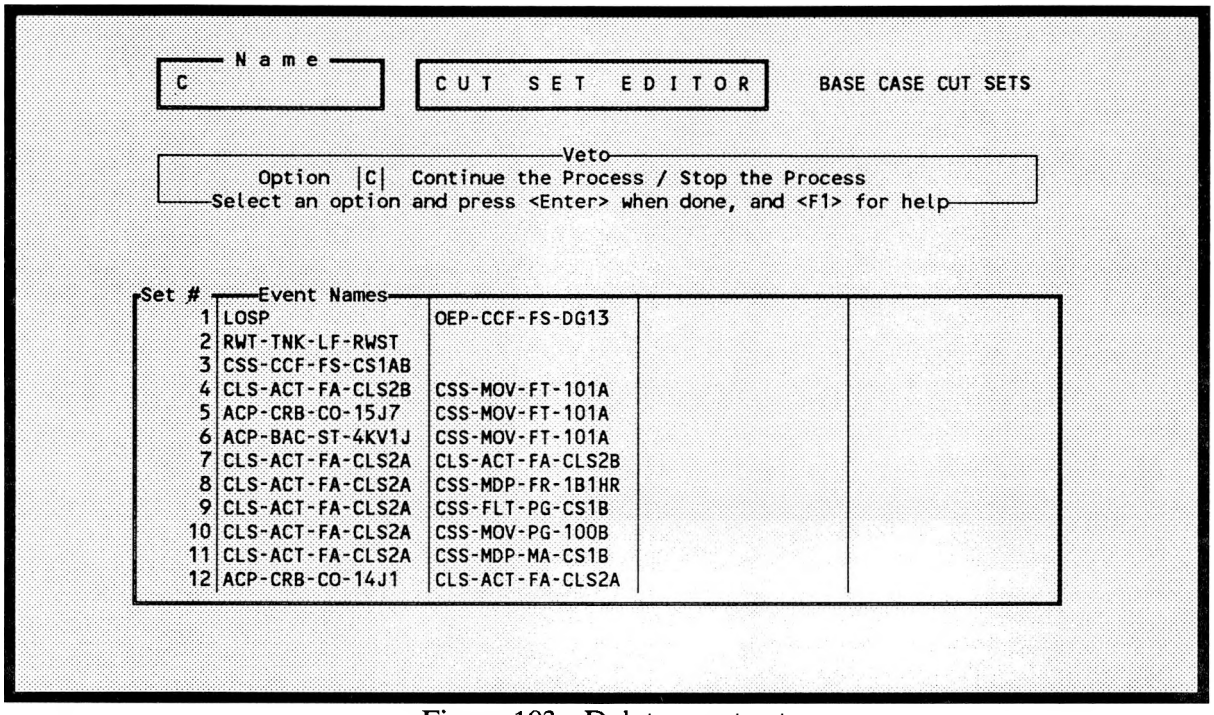


Figure 103. Delete a cut set.

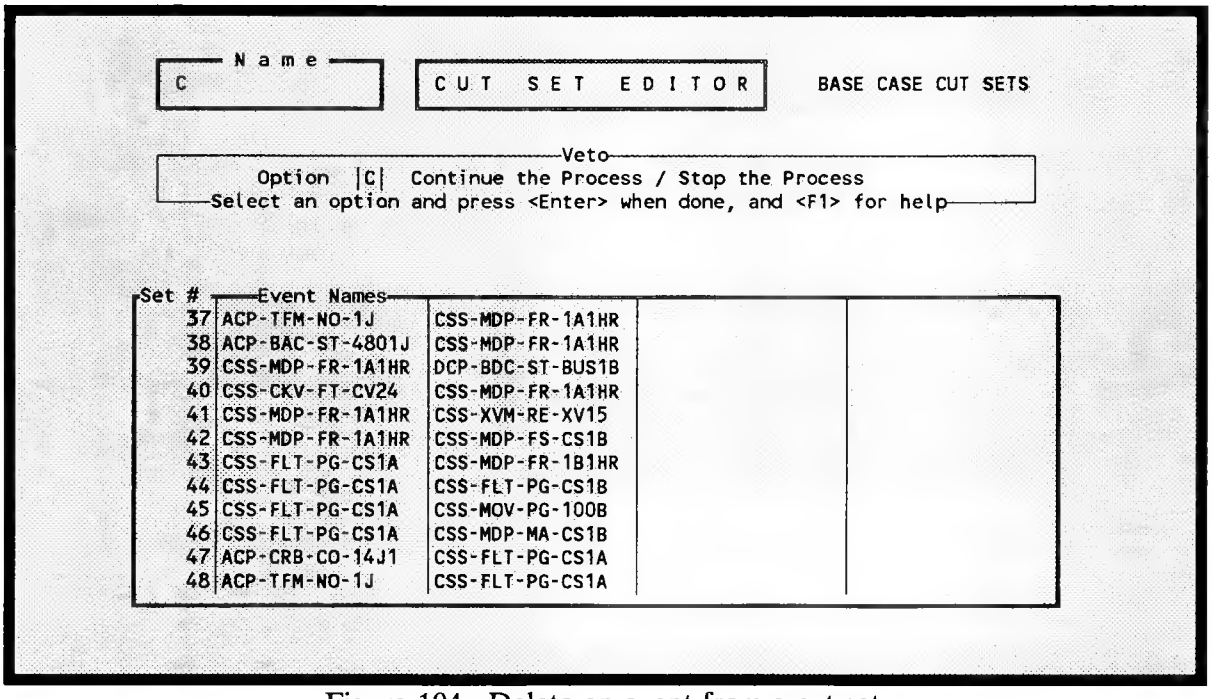


Figure 104. Delete an event from a cut set.

When the delete option is invoked the option list on the display is replaced by a veto menu. For deletions, the Veto option is always turned on unless you specifically turn it off. The veto options function as follows:

Stop. Typing <S> aborts the delete operation for the highlighted cut set or event.

Continue the process. Typing <C> and pressing <Enter> results in deleting a cut set or event.

5.5.5 Locate

The locate option allows you to search the list of all existing events and the list of all the newly added events for events that meet the desired search criteria. Events that meet the desired search criteria are considered to be qualified events. You are then able to locate the first occurrence of one of these qualified events from the current set of cut sets.

To invoke this option, press the <L> key. This will display the locate menu (Figure 105). From this screen, the following four options are available: Exit, Locate, Next, and Previous. The number of unique events that exist in the current set of cut sets is listed on this screen, along with the number of currently qualified events.

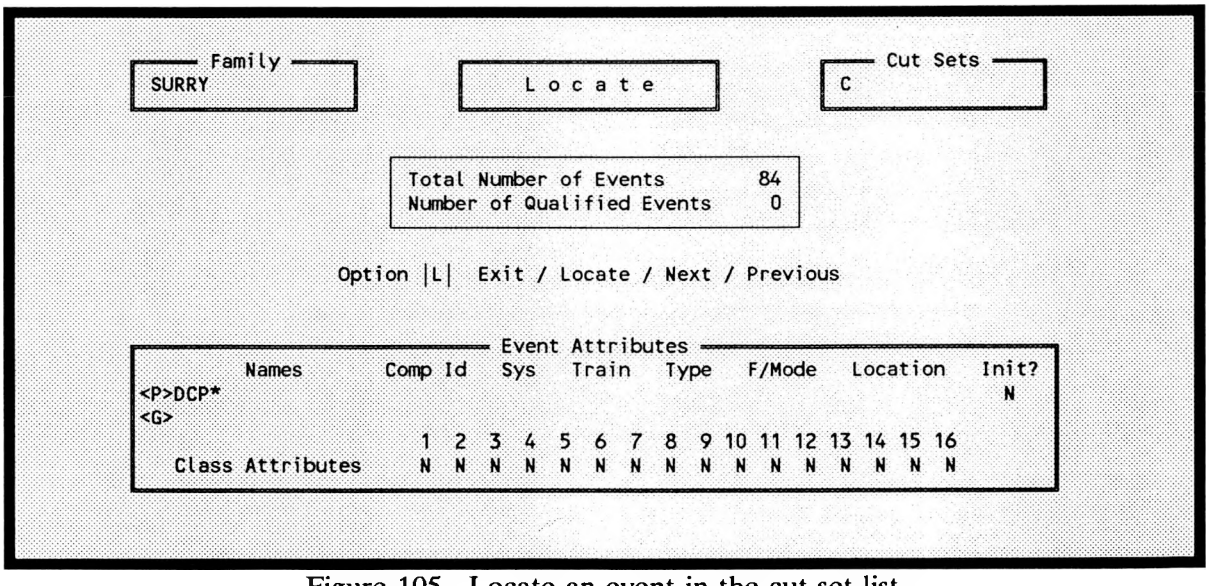


Figure 105. Locate an event in the cut set list.

5.5.5.1 Exit. If the locate function has been performed and an event name exists in the name field of this screen, then upon entering an <E> in the option field, the cursor will be placed on the first occurrence of that event name within the current set of cut sets. If the event does not exist within the current cut sets, then a message stating the event was not found will be displayed.

If the locate function has not been performed then entering an <E> in the option field will simply terminate the locate function. This may also be terminated by pressing the <Esc> key.

5.5.5.2 Locate. This option searches the list of all existing events and the list of all newly added events for events which meet the desired search criteria. This option allows wild card search characters for the two name fields on the screen. A question mark (?) matches any single character in its specified position, and an asterisk (*) matches a character string of any length. This option will use any of the filled event attribute fields on the screen as search criteria. Any events which meet the selected search criteria are considered to be qualified events. The number of currently qualified events will then be updated on the screen. The first qualified event will be displayed on the screen (Figure 106).

NOTE: It is possible for an event to be a qualified event and still not exist in the current set of cut sets.

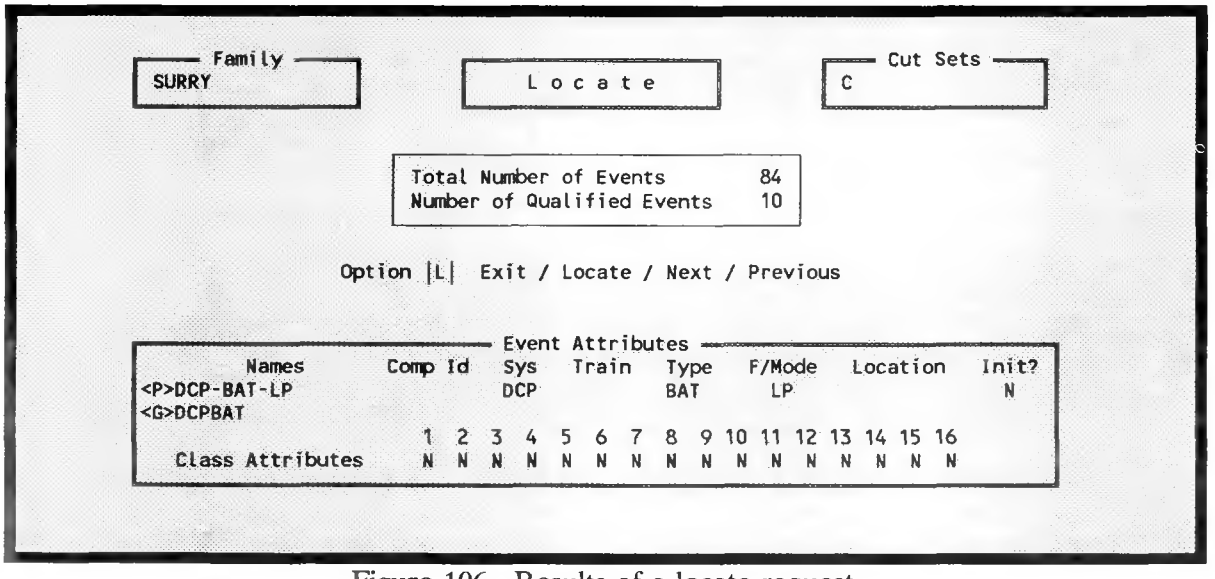


Figure 106. Results of a locate request.

5.5.5.3 Next. This option will display the next qualified event from the list of qualified events.

5.5.5.4 Previous. This option will display the previous qualified event from the list of qualified events.

5.5.6 Next

This option allows you to go to the next occurrence of the event name that was specified in the locate option. To invoke the option, type <N>.

5.5.7 Previous

This option allows you to go back to the previous occurrence of the event name specified in the locate option. To invoke the option, type <P>.

5.5.8 Search

This option provides a fast locate feature for a single event name. As each letter of the event name is typed the cut set list is scanned for the first occurrence of the letter. To invoke the option, type <S> which will replace the option list with the search request on the screen display (Figure 107). The search starts with the top cut set of the current display. Type the desired event name and press <Enter>. The cursor will be positioned on the first occurrence of the requested event. At this point <N> (Next) and <P> (Previous) will allow you to move through the cut set list positioning the cursor on the next or previous occurrence of the requested event name.

5.5.9 Options

The Options command provides the capability of setting Cut Set Editor defaults. To invoke this option, type <O> which will replace the normal option list with the "default" option list on the screen display (Figure 108). The default options are

- Range - This option sets the maximum number of cut sets that will be searched for the specified string. Range is used by the Replace, Insert, Copy and Replace, and Find and Delete commands. By default, Range is set to 9999.

- Veto - Veto tells each operation to ask again if you wish to modify the cut set data. By default, this is turned off.

- Veto Delete - Functions the same as Veto. However, it applies only to the Delete command. By default, this is turned on.

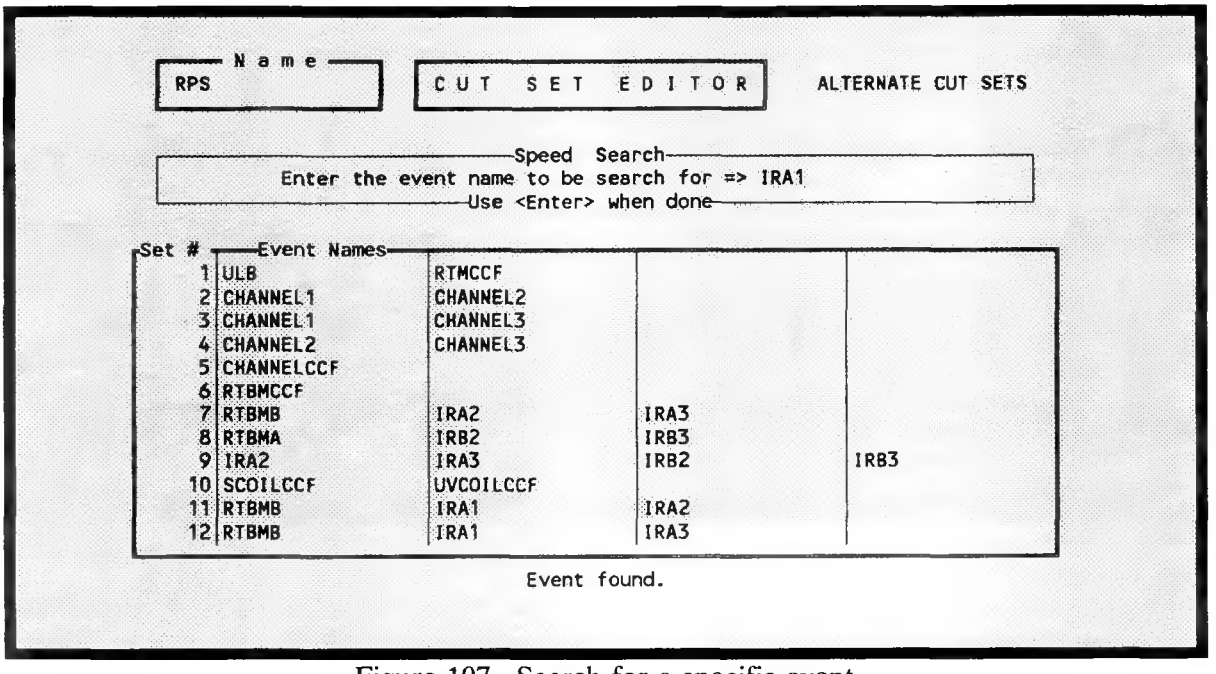


Figure 107. Search for a specific event.

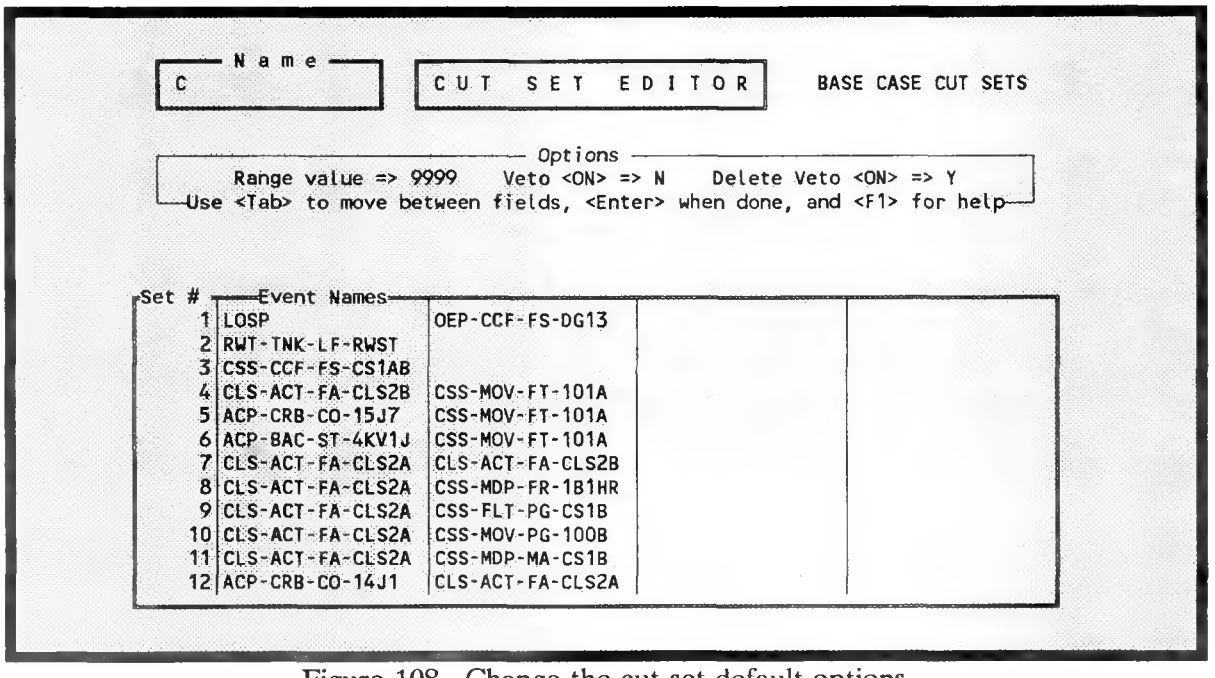


Figure 108. Change the cut set default options.

5.5.10 Insert Event

This option allows you to execute a global insertion of an event. You specify a search string which can consist of up to five event names and the name of the event to be inserted. In all cut sets containing the "search string" the event to be inserted will be added. The search starts with the cut set at the top of the current display. To invoke this option, type <I> which will replace the option list on the screen with the Find/Insert request as shown in Figure 109.

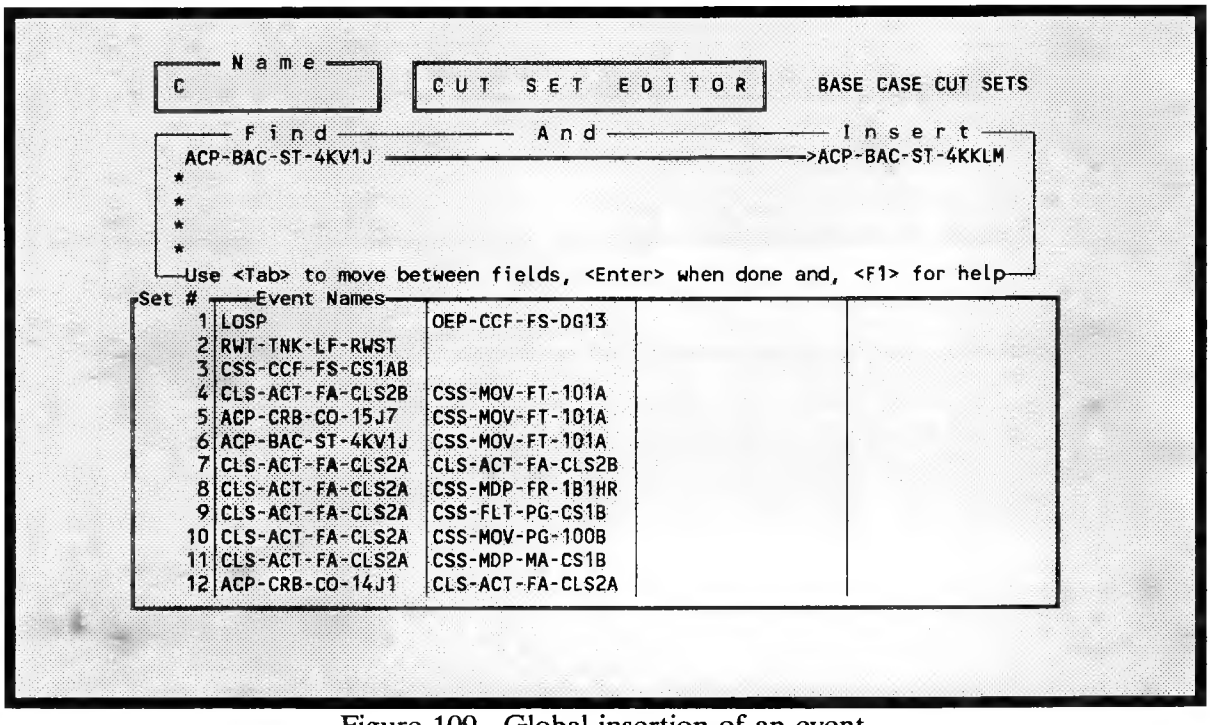


Figure 109. Global insertion of an event.

5.5.11 Replace Events

This option allows you to specify a search string and replace every occurrence of that string with a specified event name. The search string may consist of up to five event names. The replacement is a global function in that all occurrences of the search string will be replaced by the specified event name. The replacement event name may be left blank, which will delete all occurrences of the search string from the cut set list. The search starts with the cut set at the top of the current display. To invoke the option, type <R> which will replace the option list on the screen with the Find/Replace request (Figure 110).

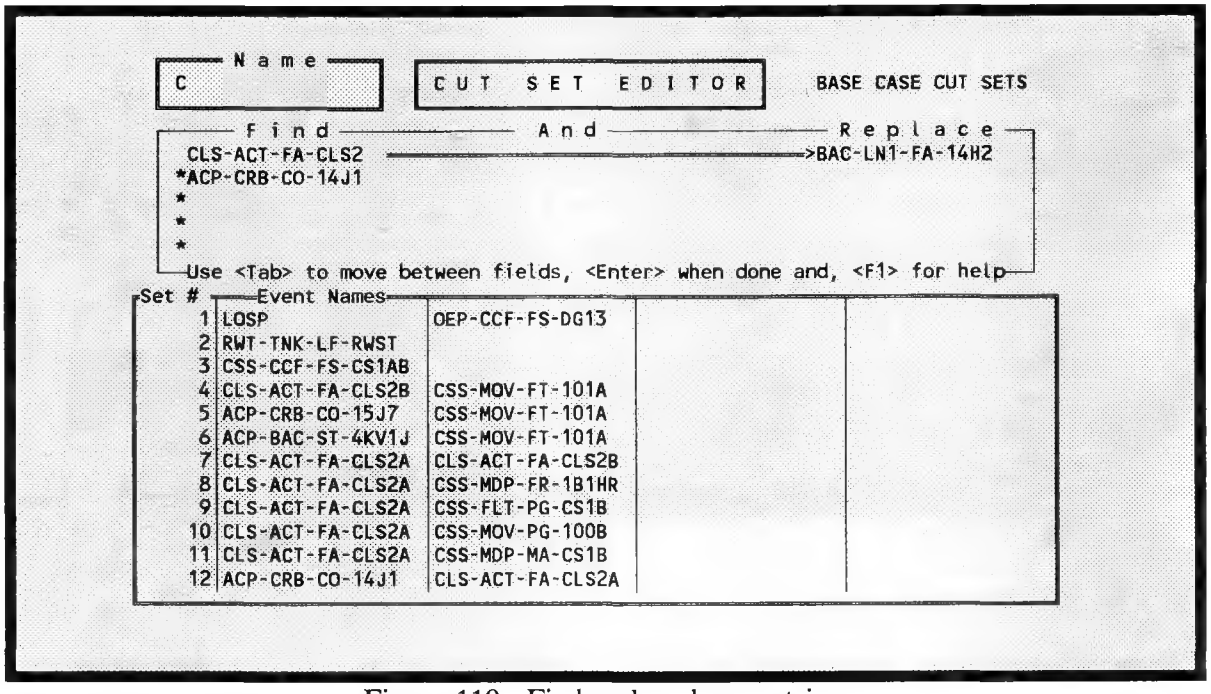


Figure 110. Find and replace a string.

5.5.12 Copy Cut Set and Replace Events

This option allows you to search for cut sets containing a specific string, copy the cut sets (minus the events specified in the search string), and add a specific event to the new cut set. You may specify up to five event names as a search string. If the event name to be added is left blank, the process is terminated. The search starts with the cut set at the top of the current display. To invoke this option, type <C> which will replace the option list on the display with the Copy/Replace request (Figure 111).

5.5.13 Undo

This option allows you to recover the last item deleted. The item may be an entire cut set or a single event. A deletion may be undone only if the Undo Delete command is used immediately after the deletion has occurred. To invoke the option, type <U>.

5.5.14 Find and Delete Cut Set

This option allows you to delete all cut sets that contain a specified string. You may specify up to five event names as a search string. The search begins at the cut set at the top of the current display. To invoke this option, type <F> which will replace the option list with the find and delete request (Figure 112).

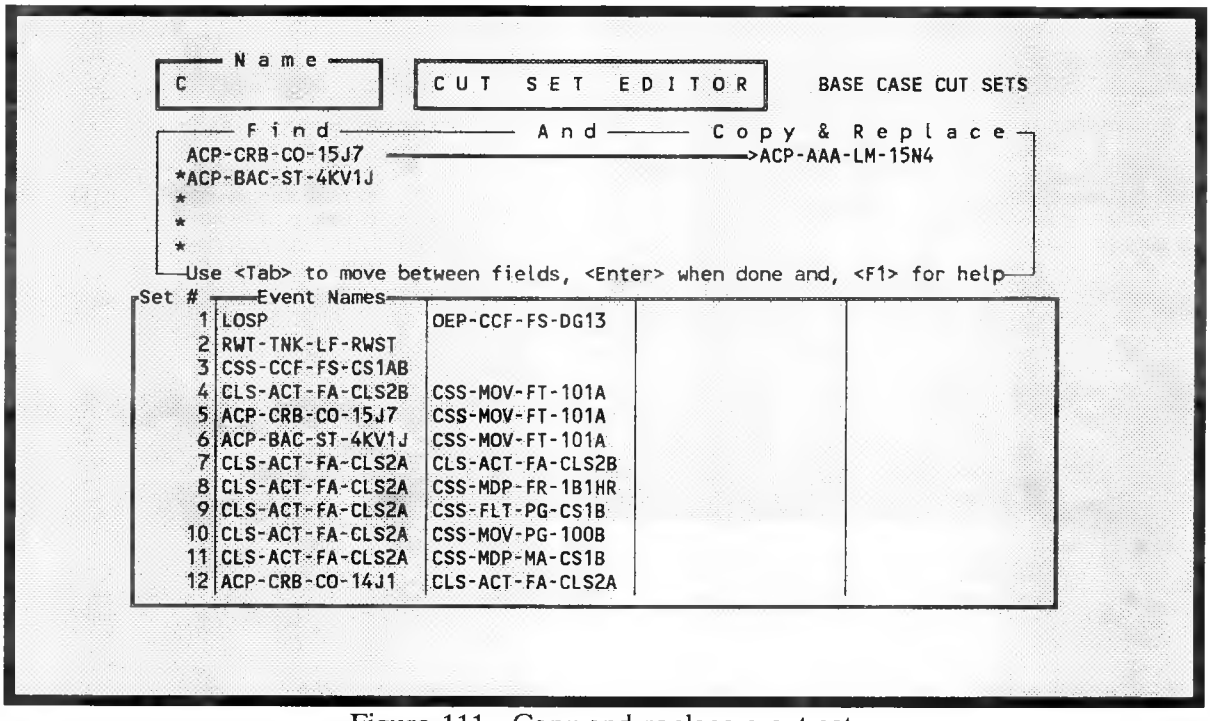


Figure 111. Copy and replace a cut set.

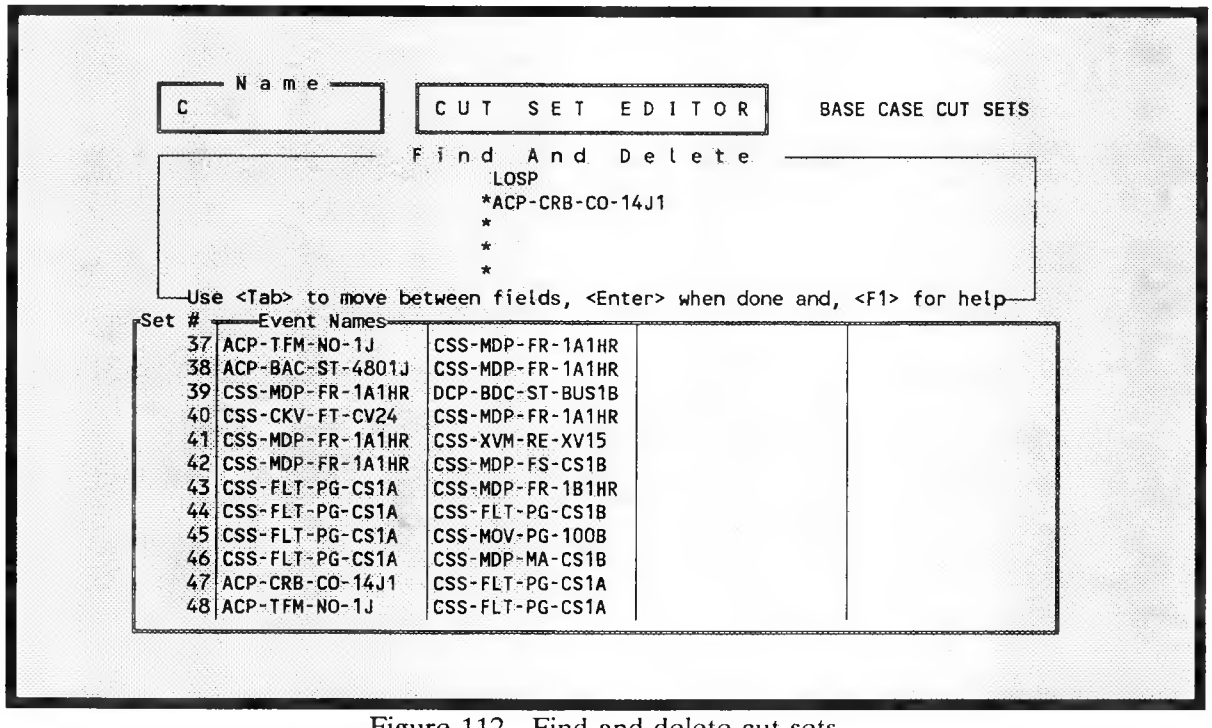


Figure 112. Find and delete cut sets.

5.6 Logic Editor

This option allows you to modify the logic of a system or subsystem. When you invoke this option, Figure 113 will be displayed. You may toggle the display to list systems or subsystems (see Section 5.6.3). Three options are available: Exit, Logic Editor, and Sub-System. In addition, the following function keys are available:

<Esc> Returns to the previous screen.
<F1> Displays a general help screen.
<F5> Locates a specific system. When you invoke this option, a screen similar to the one shown in Figure 114 will be displayed. Enter the system name you wish to locate and press <Enter>. If the system exists, it will be highlighted on the display.

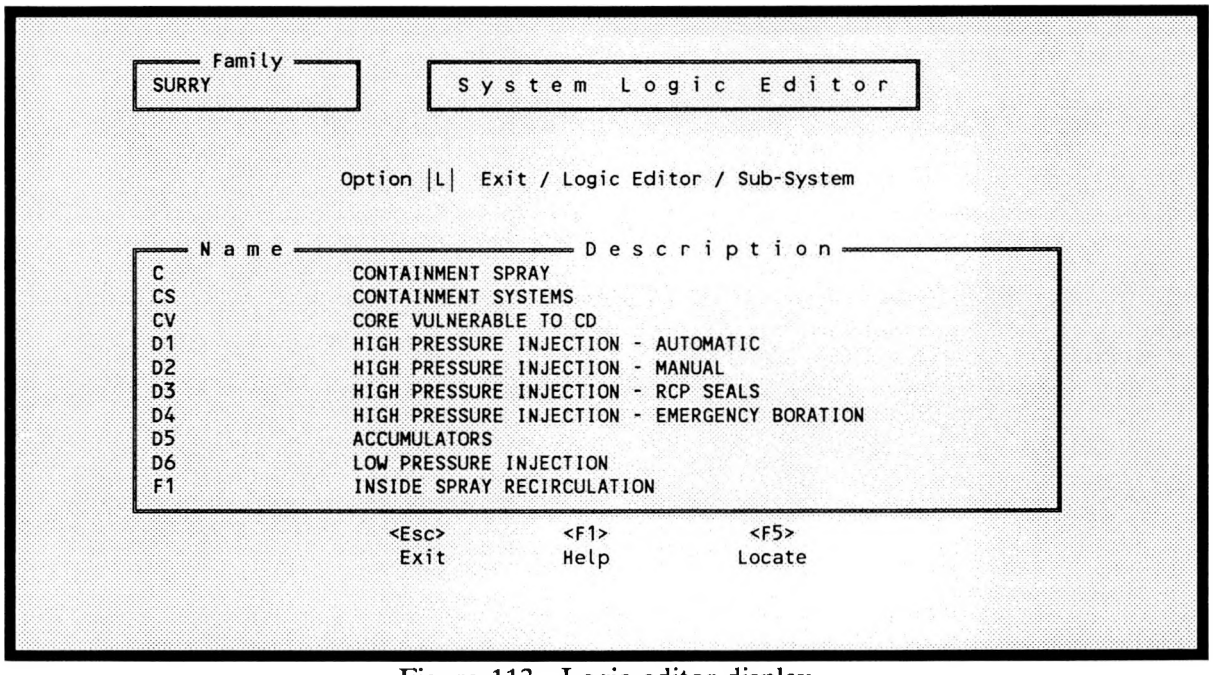


Figure 113. Logic editor display.

5.6.1 Exit

This option terminates the process and returns you to the Fault Tree Analysis screen (Figure 31). To invoke this option, enter an <E> in the option field and press <Enter>, or press the <Esc> key.

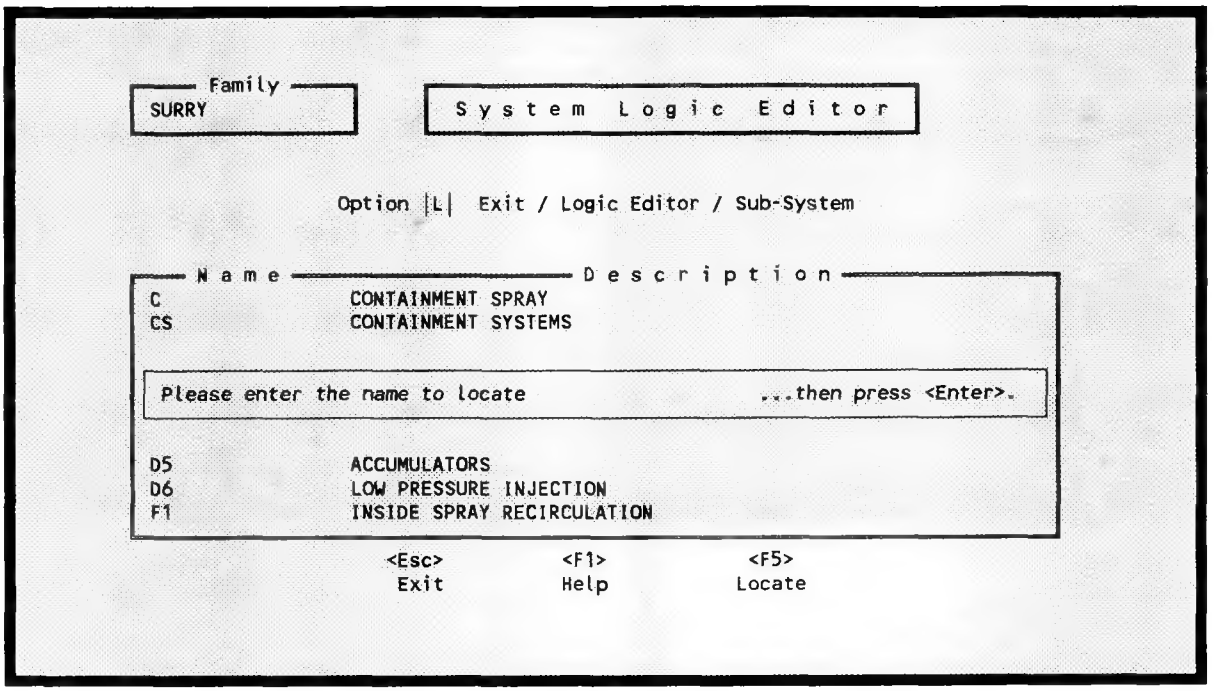


Figure 114. Locate system/subsystem using <F5>.

5.6.2 Logic Editor

To invoke this option, enter an <L> in the option field, highlight the desired system, and press <Enter>. If you do not highlight a system, the message **A record must be highlighted first** will be displayed. After highlighting a system and pressing <Enter>, Figure 115 will be displayed. All gates, types and inputs contained in the selected system or subsystem will be displayed. Thirteen editing options are available. Each option will be discussed in the following paragraphs.

5.6.2.1 Exit. This option terminates the process and returns you to the System Logic Editor screen. To invoke this option, type an <E> and press <Enter>, or press the <Esc> key.

5.6.2.2 Add. This option allows you to enter a new gate name or input into the selected system or subsystem. To invoke this option, enter an <A> while positioned in the gate name column or at the desired input row or column. When you invoke this option, Figure 116 will be displayed.

On this screen, you enter the following fields:

Gate Name - Enter the new gate name. If you enter a name that already exists, the message **Duplicate gate names are not allowed** is displayed. You are returned to the gate name prompt to re-enter a valid name.

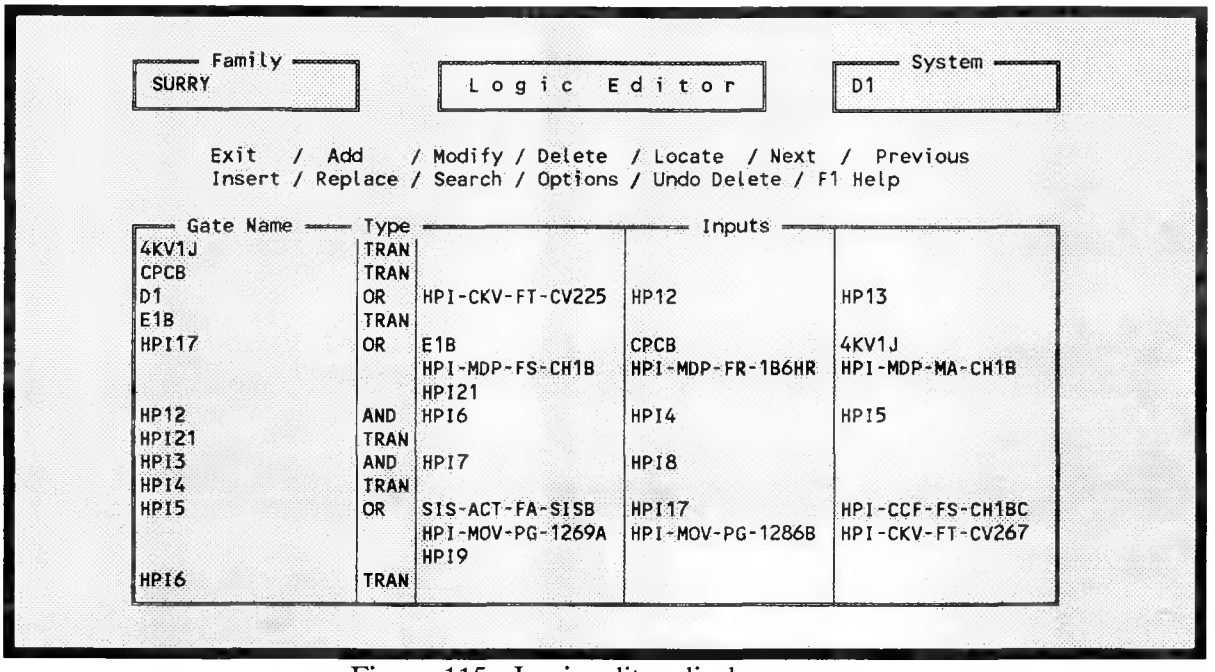


Figure 115. Logic editor display screen.

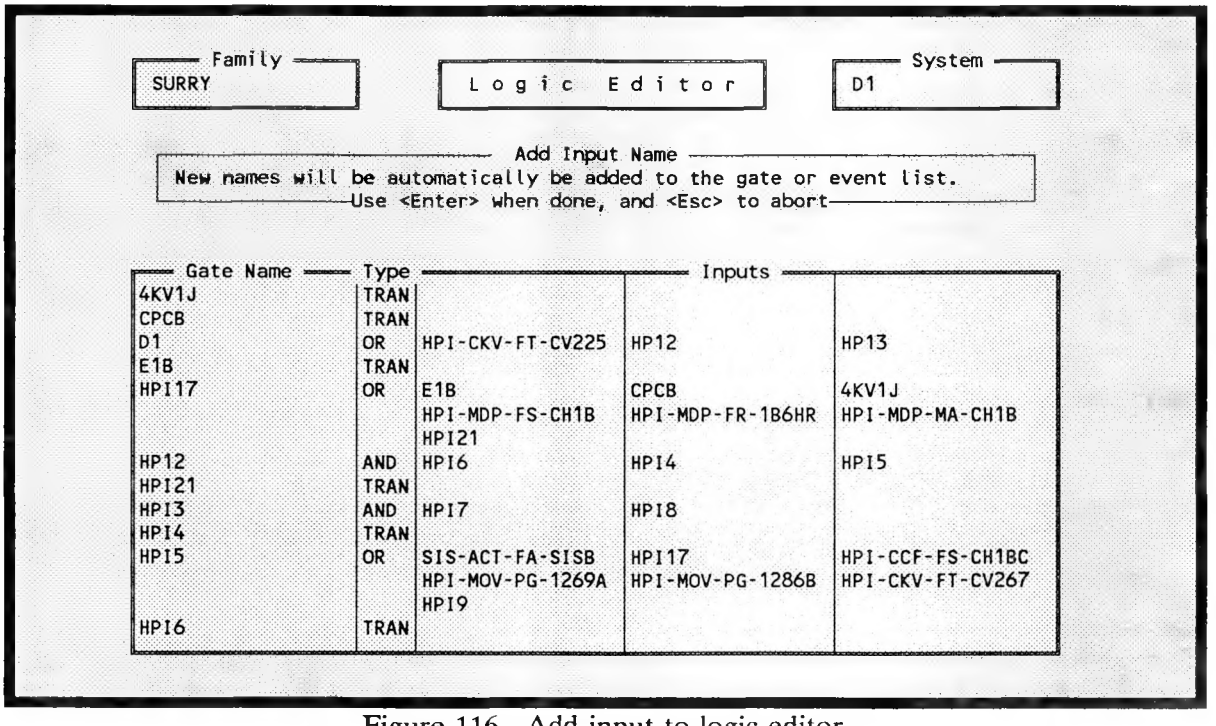


Figure 116. Add input to logic editor.

Type - Enter the gate type. Valid gate types include AND, OR, and TRAN.

Inputs - Enter any inputs (event names) for the new gate. After you enter an input, a window will be displayed asking you to identify the input as a <G> (gate), <E> (event), or <A> (to abort the process). Press <Enter> to terminate the process.
If you are adding input to an existing gate, position the cursor at the desired location and press <A>. A blank highlight line will appear. Enter the input name and press <Enter>. The new input will appear on the screen.

5.6.2.3 Modify. This option allows you to modify any of the data displayed on the screen. To invoke this option, highlight the data you wish to update using the arrow or tab keys, and type an <M>. When you invoke this option, Figure 117 will be displayed. Use the insert, delete, or arrow keys to modify the highlighted text. You may only modify the highlighted text. Press <Enter> to exit and save the changes, or press the <Esc> key to exit without saving the changes.

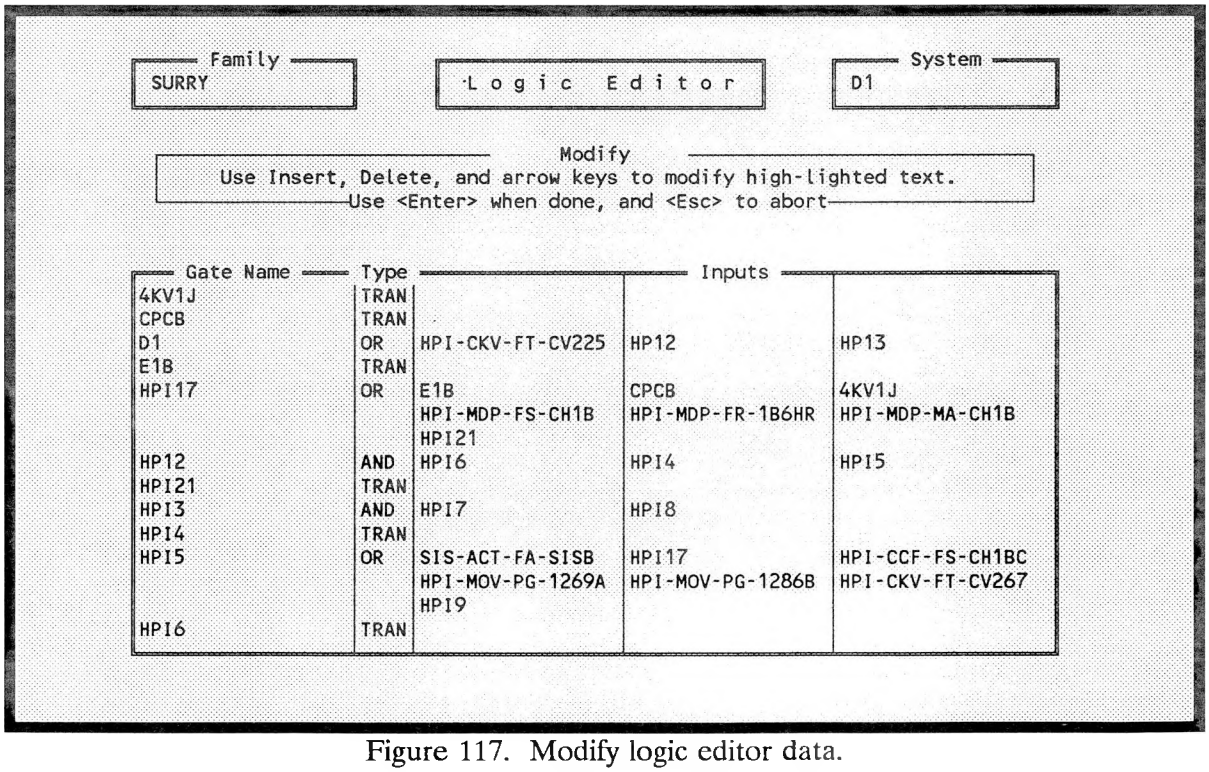
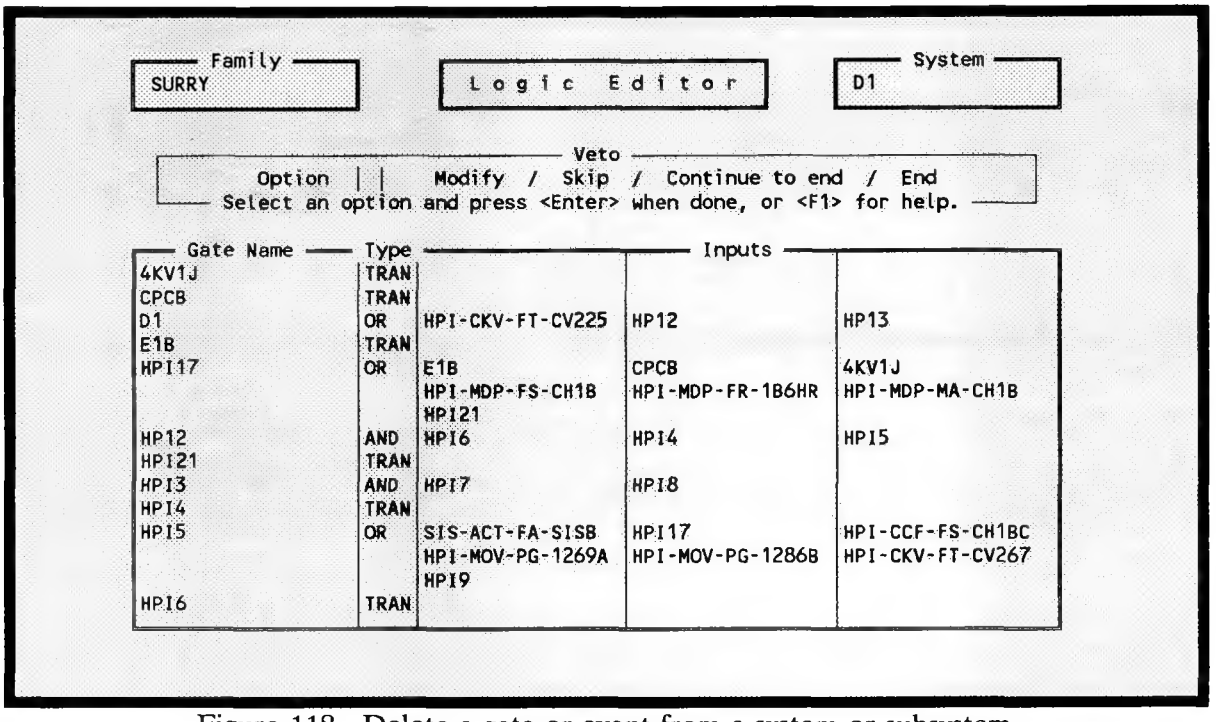


Figure 117. Modify logic editor data.

5.6.2.4 Delete. This option allows you to delete any of the data displayed on the screen. To invoke this option, highlight the text you wish to delete using the arrow or tab keys and type a <D>. When you invoke this option, Figure 118 will be displayed. The following options are available:



Gate Name	Type	Inputs		
4KV1J	TRAN			
CPCB	TRAN			
D1	OR	HPI-CKV-FT-CV225	HP12	HP13
E1B	TRAN			
HPI17	OR	E1B	CPCB	4KV1J
		HPI-MDP-FS-CH1B	HPI-MDP-FR-1B6HR	HPI-MDP-MA-CH1B
		HPI21		
HP12	AND	HPI6	HPI4	HP15
HPI21	TRAN			
HPI3	AND	HPI7	HPI8	
HPI4	TRAN			
HPI5	OR	SIS-ACT-FA-SISB	HPI17	HPI-CCF-FS-CH1BC
		HPI-MOV-PG-1269A	HPI-MOV-PG-1286B	HPI-CKV-FT-CV267
		HPI9		
HPI6	TRAN			

Figure 118. Delete a gate or event from a system or subsystem.

Modify	-	Deletes the current event or gate name but first prompts you with the veto options.
Skip	-	Skips the selected delete.
Continue to end	-	Deletes without asking if you wish to delete.
End	-	Terminates the delete process.

5.6.2.5 Locate. This option allows you to locate a specified gate or event. When you invoke this option, Figure 119 will appear at the top of the screen prompting you to enter the name you wish to locate. The input is case-sensitive, so you must enter the name exactly as it appears. Enter the gate or event name and press <Enter>. If found, the entered name or event will be highlighted and the message **Name Found** will be displayed at the bottom of the screen. If the event or name is not located, the message **Not found** will be displayed.

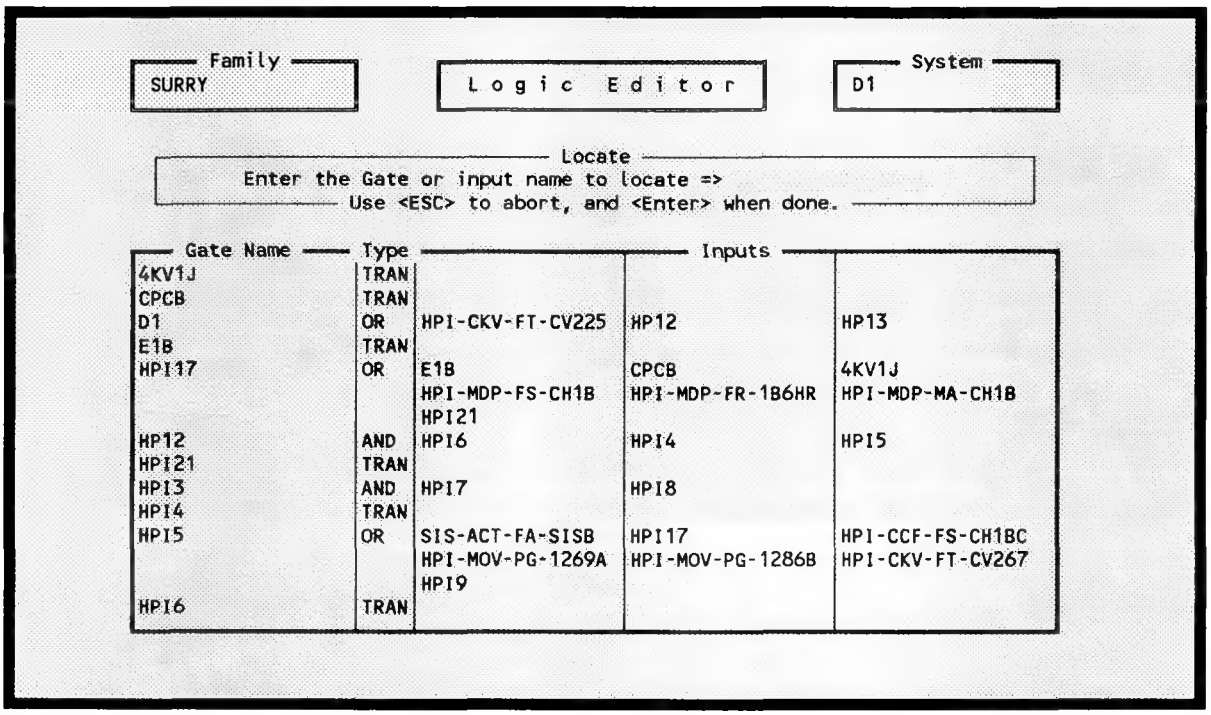


Figure 119. Locate a specified gate or event.

5.6.2.6 Next. This option highlights the next record in the display.

5.6.2.7 Previous. This option locates the previous record in the display.

5.6.2.8 Insert. This option allows you to insert a gate or event name. When you invoke this option, Figure 120 is displayed. This option uses two names: the find and the insert/replace name. The find name is the name to be matched. It may contain any number of "*" or "?" characters. These wild card characters have the same meaning as they do in DOS file names. The insert field cannot contain any wild card characters, and will be used exactly as typed.

5.6.2.9 Replace. This option allows you to replace a gate or event name. When you invoke this option, Figure 121 is displayed. This option uses two names: the find name and the replace name. The find name is the name to be matched. It may contain any number of wild card characters. The 'replace with' field cannot contain any wild card specifications.

5.6.2.10 Search. This option allows you to perform a speed search. When you invoke this option, Figure 122 will be displayed. Enter the name to be located. As you start entering characters, the search will begin. If no record is found, the message **Input not found!!** will be displayed, and you will be returned to the Logic Editor Display.

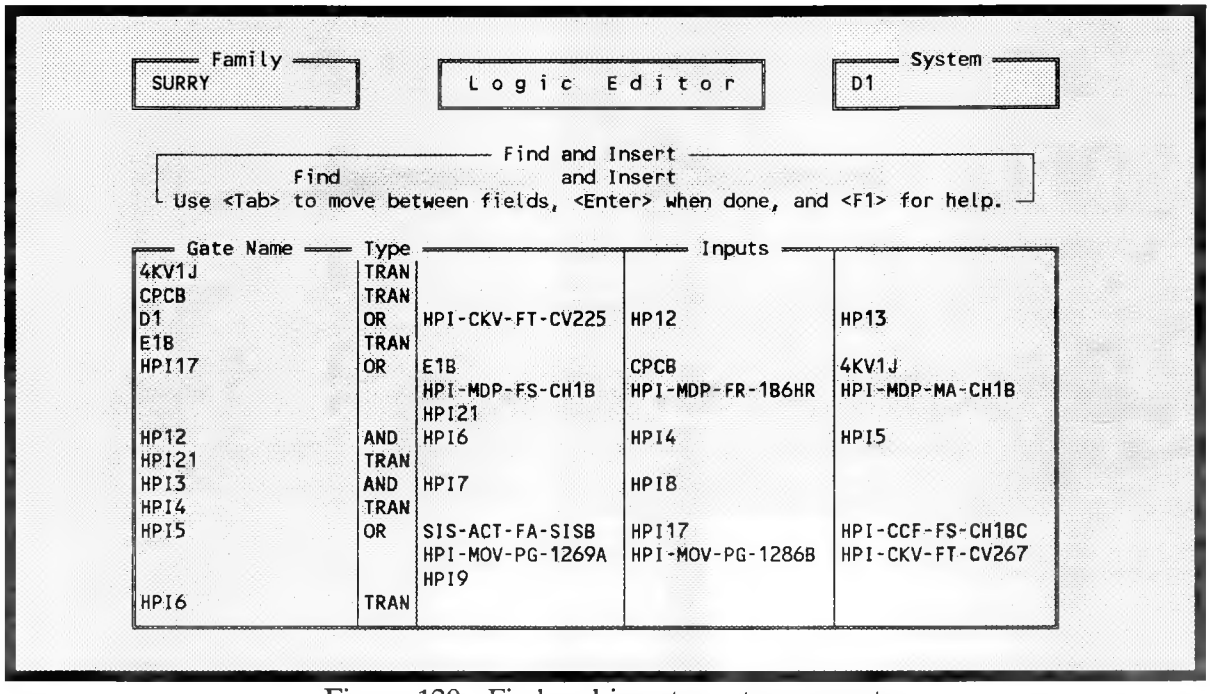


Figure 120. Find and insert a gate or event.

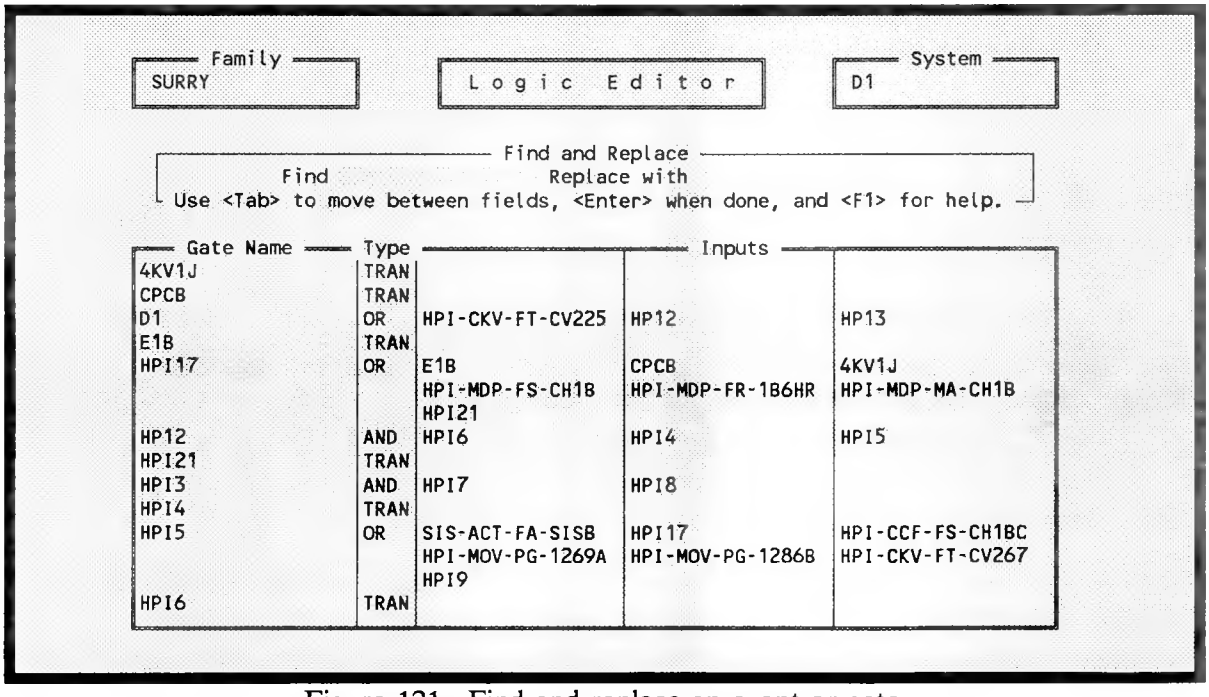


Figure 121. Find and replace an event or gate.

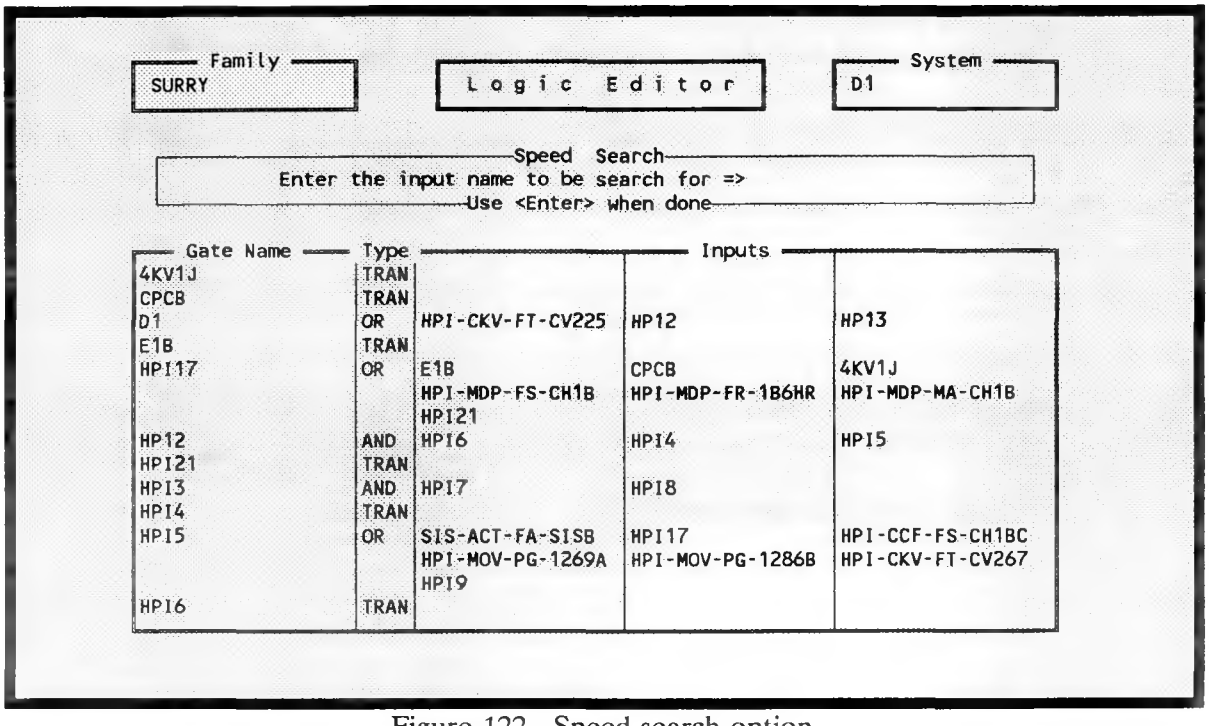


Figure 122. Speed search option.

5.6.2.11 Options. This option allows you to set the veto options. When you invoke this option, Figure 123 will be displayed. The following options may be set:

Veto - Veto tells each operation to ask again if you wish to modify the data. By default this is turned off.

Delete Veto - Functions the same as Veto. However, it applies only to the Delete command. By default this is turned on.

Help - Activates the on-line general help messages. When this is turned off, the help messages will not appear.

5.6.2.12 Undo Delete. This option allows you to retrieve your last delete. If you have accidentally deleted an event or gate, you may invoke this option to retrieve it. Only your last deletion may be retrieved.

5.6.2.13 F1 Help. This option displays the cursor movements that allow you to easily move through the Logic Editor Display (see Figure 124). To move the cursor about the editing window, use the keyboard cursor pad. The arrow keys move one field in each respective direction. The <Home> key places the cursor in the upper right corner of the window. The <End> key moves the cursor to the bottom left. The <PgUp> key moves the window up one page (12 lines). The <PgDn> key moves the window down one page (12 lines). The <Ctrl-PgUp> and <Ctrl-PgDn>

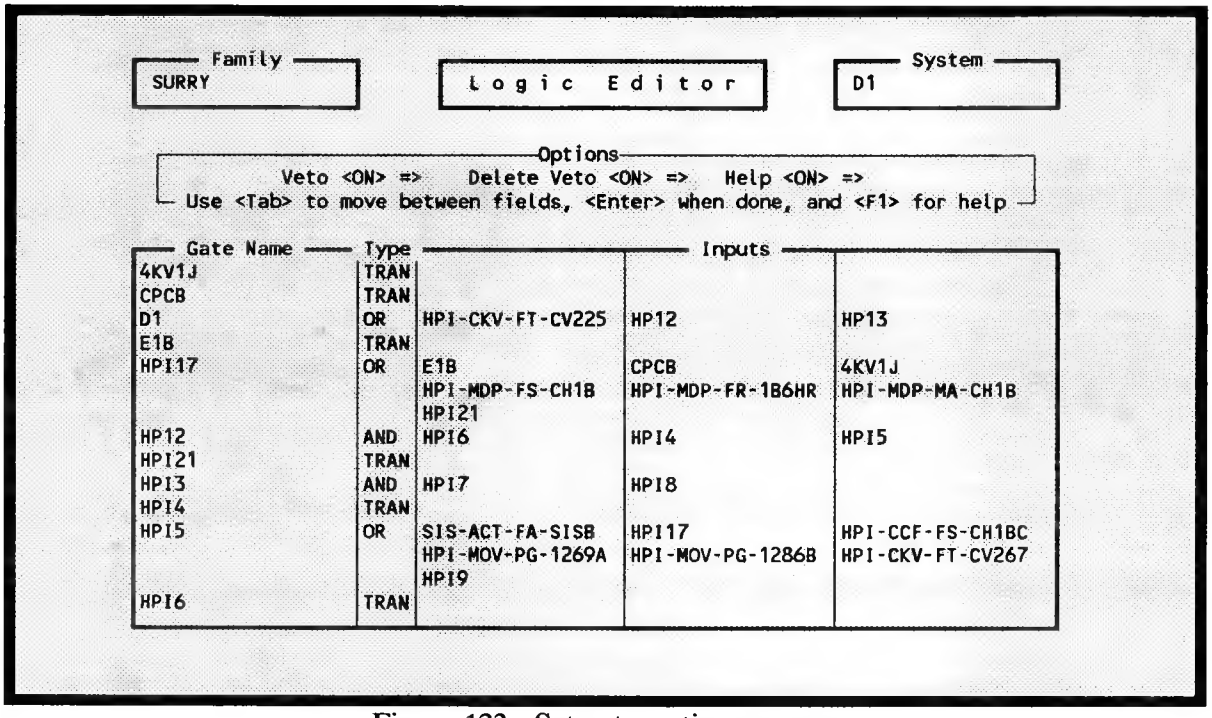


Figure 123. Set veto options screen.

keys move to the top and bottom of the file, respectively. Pressing the <F1> key toggles between two cut set editor screens. One screen shows the editing options and other shows the cursor movements.

NOTE: When you press the <Esc> key to terminate the Logic Display, Figure 125 is displayed.

5.6.3 Sub-System

Toggles the System Logic editor display to list systems or subsystems on the screen. To invoke this option, enter an <S> in the option field, and press <Enter>. To toggle back to the previous display, simply enter an <S> in the option field and press <Enter>.

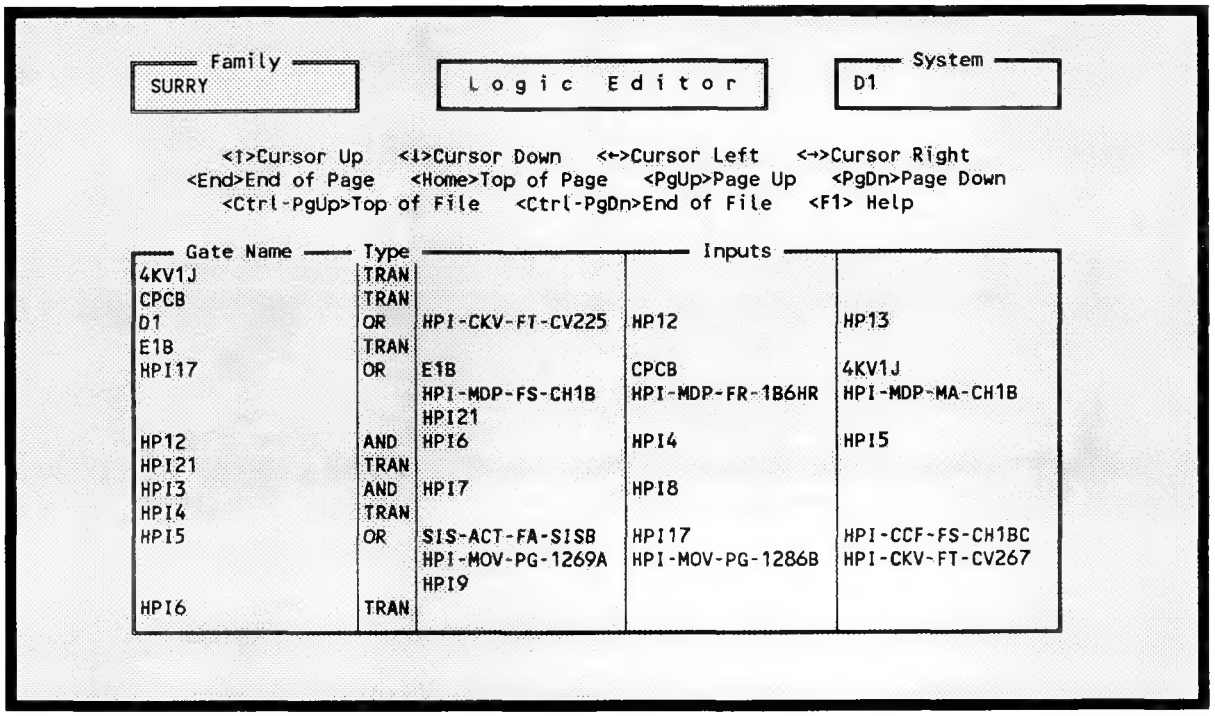


Figure 124. Cursor movements help display.

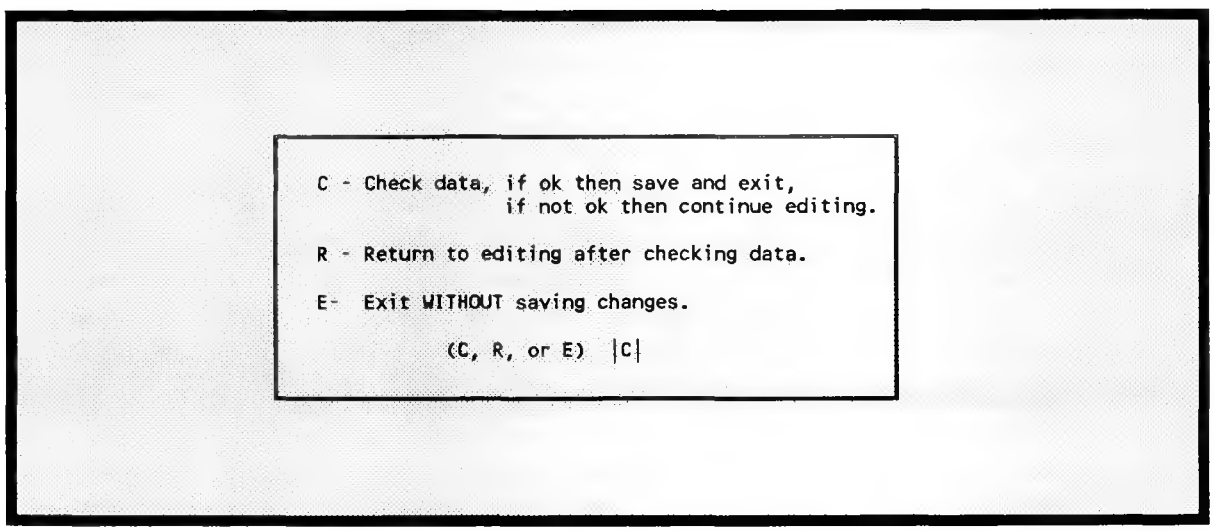


Figure 125. Save/abort changes screen.

6.0 CREATE EVENT TREES

This option allows you to graphically build and edit event trees and output them to several hard copy hardware devices. To select this option, highlight the "CREATE Event Trees" option on the IRRAS main menu or enter a <C> and press <Enter>. When you invoke this option, Figure 126 will be displayed. As shown, the following option are displayed:

Exit	Returns you to the IRRAS main menu.
Create Event Trees	Allows you to build and edit the event tree diagrams.
Link Event Trees	Allows you to define linkage rules and generate sequence logic.
Plot Trees (HP)	Allows you to plot HP graphics files or generate HPGL formatted files.
Rasterize Event Tree	Allows you to "rasterize" a selected event tree diagram. This process is used to prepare and format the diagram for printing on a laser output device.
eXtract Event Trees	Allows you to extract event trees, clear extracted event trees, and display extracted event trees.
Define Plotter Pens	Allows you to assign colors to your plotter pens.

Each of these options is discussed in the following paragraphs.

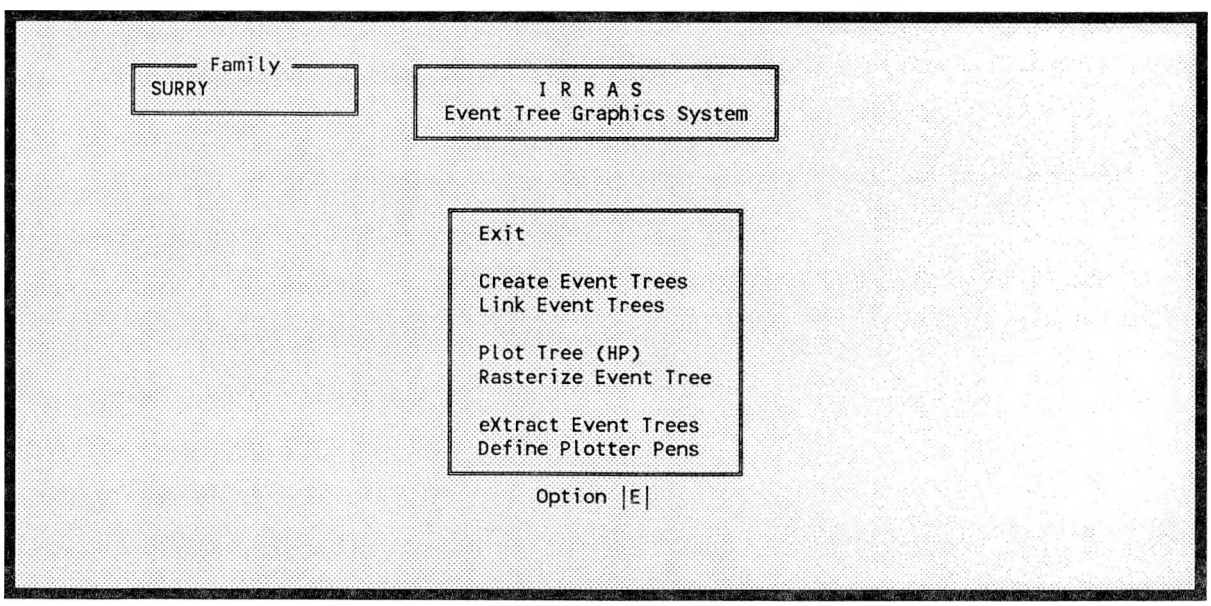


Figure 126. Event tree graphics system menu.

6.1 Exit

This option terminates the event tree option and returns you to the IRRAS main menu. To invoke this option, highlight the Exit option and press <Enter>.

6.2 Create Event Trees

This option allows you to construct or edit an event tree diagram. You may start building the diagram from scratch or from an existing file to generate or modify logic. When this option is selected, Figure 127 is displayed. The editing commands are shown in the left column, while the rest of the screen is the drawing surface. Many of the commands listed in the editing column have additional pop-up menus associated with them. The cursor is used to position pop-up menus and select menu options.

To invoke any of the editing commands (using a mouse), position the cursor over the desired editing command on the active menu. The active menu is the last menu you pulled up or moved. When the editing command box is highlighted (a white line outlines the box), press the left mouse button. The command is now invoked. Each editing command is described in the following paragraphs.

6.2.1 EXIT

This option terminates the editing session and returns you to the previous screen (Figure 126). To invoke this option, position the cursor over the EXIT box and press the left mouse button or <Enter>.

6.2.2 MOVE (←→)

The move command, which is represented by ←→, allows you to position the editing command menu anywhere on the screen. When you invoke this command, a white outline surrounds the entire editing column. Drag the cursor to position the outline at the desired location and press the left mouse button or <Enter>. The menu will be displayed at the new location.

6.2.3 Show

This command clears the screen and re-displays the currently defined diagram.

6.2.4 EDIT

This command allows you to make changes to the event tree. When you invoke this option, an additional pop-up menu is displayed (Figure 128). As shown, five options are available: EDIT, Add, Del, Copy, and Pass.

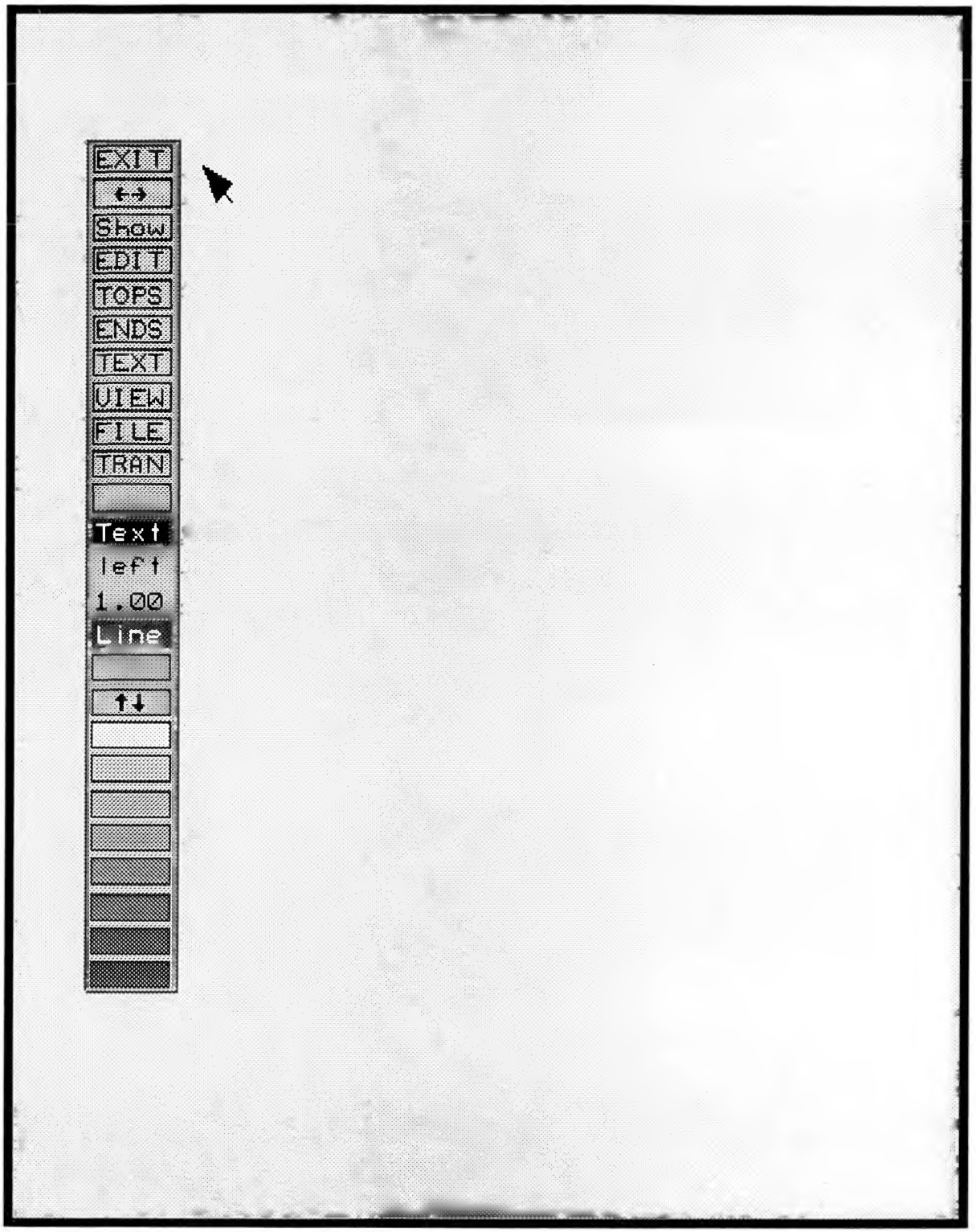


Figure 127. Create event tree editing commands.

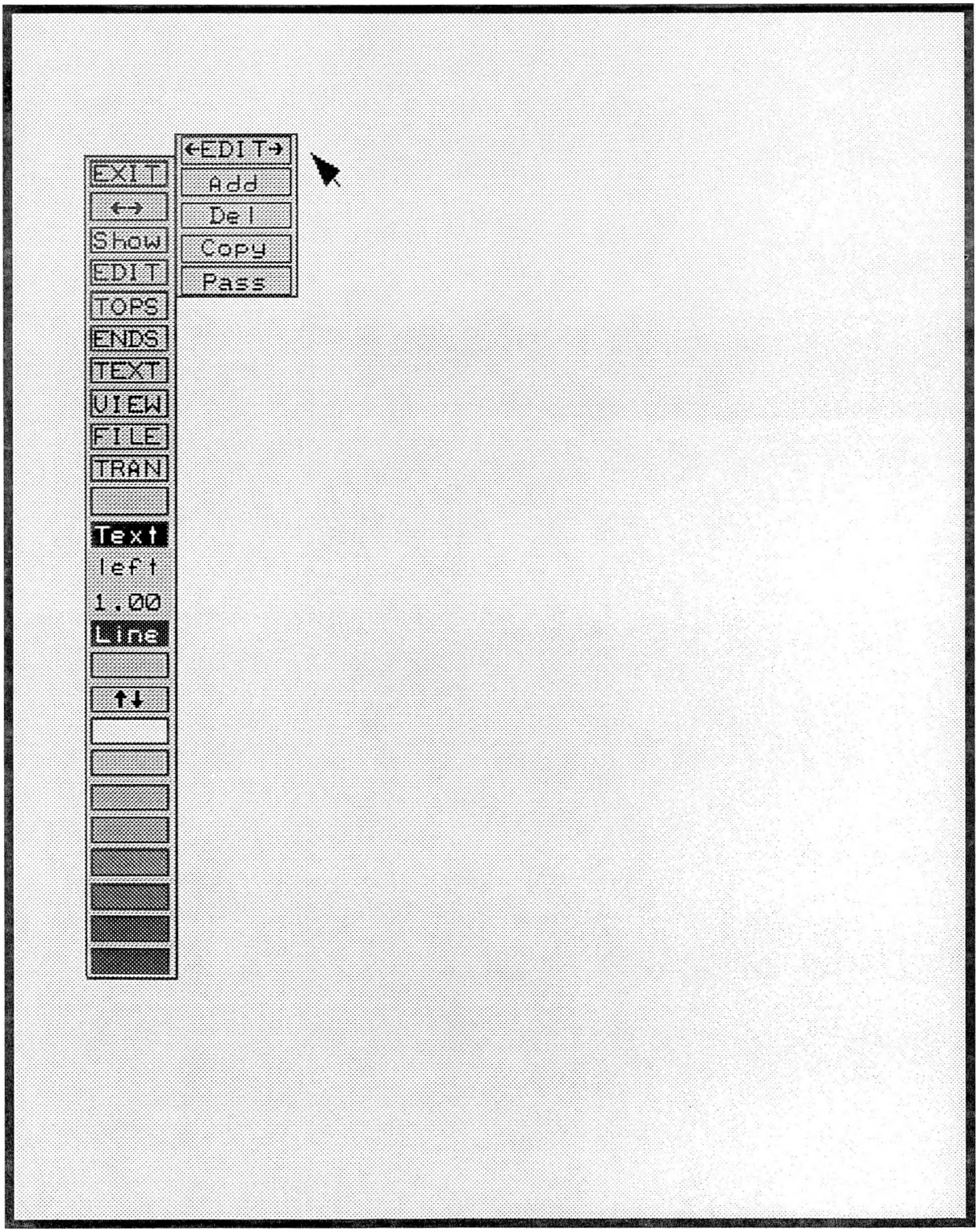


Figure 128. Event tree EDIT pop-up menu.

6.2.4.1 ←EDIT→. This option allows you to move the pop-up menu to a new location on the screen. To invoke this option, position the cursor on the ←EDIT→ box and press the left mouse button. An outline will appear. Move the outline to the new location on the screen and press the left mouse button. The menu will be moved to the new location.

6.2.4.2 Add. This option allows you to add a branch to the event tree. When you invoke this option, you will be prompted to **Pick the intersecting point of the new branch.** The cursor will change from a filled cursor arrow to an 'empty' cursor arrow. Position the cursor over the place where the new branch is to be added and press the left mouse button. A small box will appear. Next, you will be prompted to **Pick the vertical position of the new branch.** The vertical position determines whether the new branch will be added above or below the existing branch. Position the cursor to the desired vertical position and press the left mouse button. The diagram is redrawn with the new branch added. The prompt to **Pick the intersecting point of the new branch** will return. At this point you can select another location to add a branch or press the right mouse button to terminate the add process.

6.2.4.3 Del. This option allows you to delete branches from the tree. When you invoke this option, you will be prompted to **Pick the branch to be deleted.** Position the cursor on the branch to be deleted and press the left mouse button. The selected branch will be highlighted and the message **Delete highlighted branch? Left = YES, Right = NO** will be displayed. If the highlighted branch should be deleted, press the left mouse button; if not, press the right mouse button. If you responded yes, the diagram will be redrawn to reflect the deletion. In either case, the prompt **Pick the branch to be deleted** will return. At this point you may select another branch to delete, or press the right mouse button to terminate the deletion process.

6.2.4.4 Copy. This option allows you to copy existing branches of the tree to new locations. When you invoke this option, you will be prompted to **Pick beginning of the branch to copy.** Position the cursor at the start of the branch to be copied and press the left mouse button. Next, you will be prompted to **Pick copy location.** There are three ways to use the copy command. In each case you select the existing branch to be copied. Then you may either place the cursor over the start of a pass, at the start of a branch and replace the existing branch, or place the cursor at the start of a branch and add the copied logic to the branch. Depending on the copying method you use, you will be prompted with **Replace = left button, Add = Right button.** If this branch is a replacement for an existing branch, press the left mouse button. If this branch is an addition, press the right mouse button. If this branch is an addition, you will be prompted to **Pick vertical location of the start of new sub-tree.** Pick the new location and press the left mouse button.

6.2.4.5 Pass. This option allows you to change a branch to a pass. When you invoke this option you will be prompted to **Pick the branch that is to be made a pass.** Position the cursor on the branch to be converted and press the left mouse button. The entire branch is highlighted and you will be prompted with **Make highlight branch a pass? Left = YES, Right = NO.** If this is the branch you wish to change into a pass press the left mouse button; otherwise, press the right mouse button. If you respond yes, the branch is converted to a pass. If you respond no, the process is terminated. In either case, the prompt **Pick the branch that is to be made a pass** will return. At this point you may select another branch, or press the right mouse button to terminate this procedure.

6.2.5 TOPS

This option allows you to make changes to the top events. When you invoke this option, an additional pop-up menu will be displayed (Figure 129). As shown, five options are available: TOPS, Add, Del, Edit and Name?.

6.2.5.1 ←TOPS→. This option allows you to move the pop-up menu to a new location on the screen. To invoke this option, position the cursor on the ←TOPS→ box and press the left mouse button. An outline will appear. Move the outline to the new location and press the left mouse button. The menu will be moved to the new location.

6.2.5.2 Add. This option allows you to add a new event. For example, an event tree might have the existing events 1, 2, 3, and 4. A new event is needed between events 2 and 3. You select this event and will be prompted to **Pick the event that will follow the new event.** The cursor will change from an arrow to a cross hair. Position the cross hair at the desired event (in this example, we would pick event 3) and press the left mouse button. The prompt **Enter new event name:** will be displayed. Enter the event name (up to 16 characters are allowed) and press <Enter>. The diagram will be redrawn and displayed showing the newly added event and the event list will be updated.

6.2.5.3 Del. This option allows you to delete an event. To delete an event all branch points that logically fall below the event must be converted to passes. When you invoke this option you will be prompted to **Pick the event that is to be deleted.** The cursor will change from an arrow to a cross hair. Position the cursor on the event to be deleted and press the left mouse button. If the branch points have not been converted to passes, the message **The event picked is currently being used in the tree** will be displayed. If you want to delete the event you must go back and convert the branch points using the PASS option under the EDIT command. When the deletion is successful, the tree will be updated and redisplayed.

6.2.5.4 Edit. This option allows you to change an event name. When you invoke this option you will be prompted to **Pick the event name to be edited.** The cursor changes from an arrow to a cross hair. Position the cursor on the event in the diagram or the event name displayed at the top to be renamed and press the left mouse button. The prompt **Enter new event name:** will be displayed. Enter the new name (up to 16 characters are allowed) and press <Enter>. The event name will be changed at the top of the diagram.

6.2.5.5 Name?. To conserve space on the diagram, only the first 5 characters of the event name are displayed on the diagram. Use this option to display the complete event name (all 16 characters). When you invoke this option you will be prompted to **Pick an event name.** The cursor will change from an arrow to a cross hair. Position the cursor on the desired event name at the top of the diagram and press the left mouse button. The entire event name will be displayed on the prompt line at the bottom of the screen. The cross hair will remain so you may select additional event names to display or press the right mouse button to terminate the process.

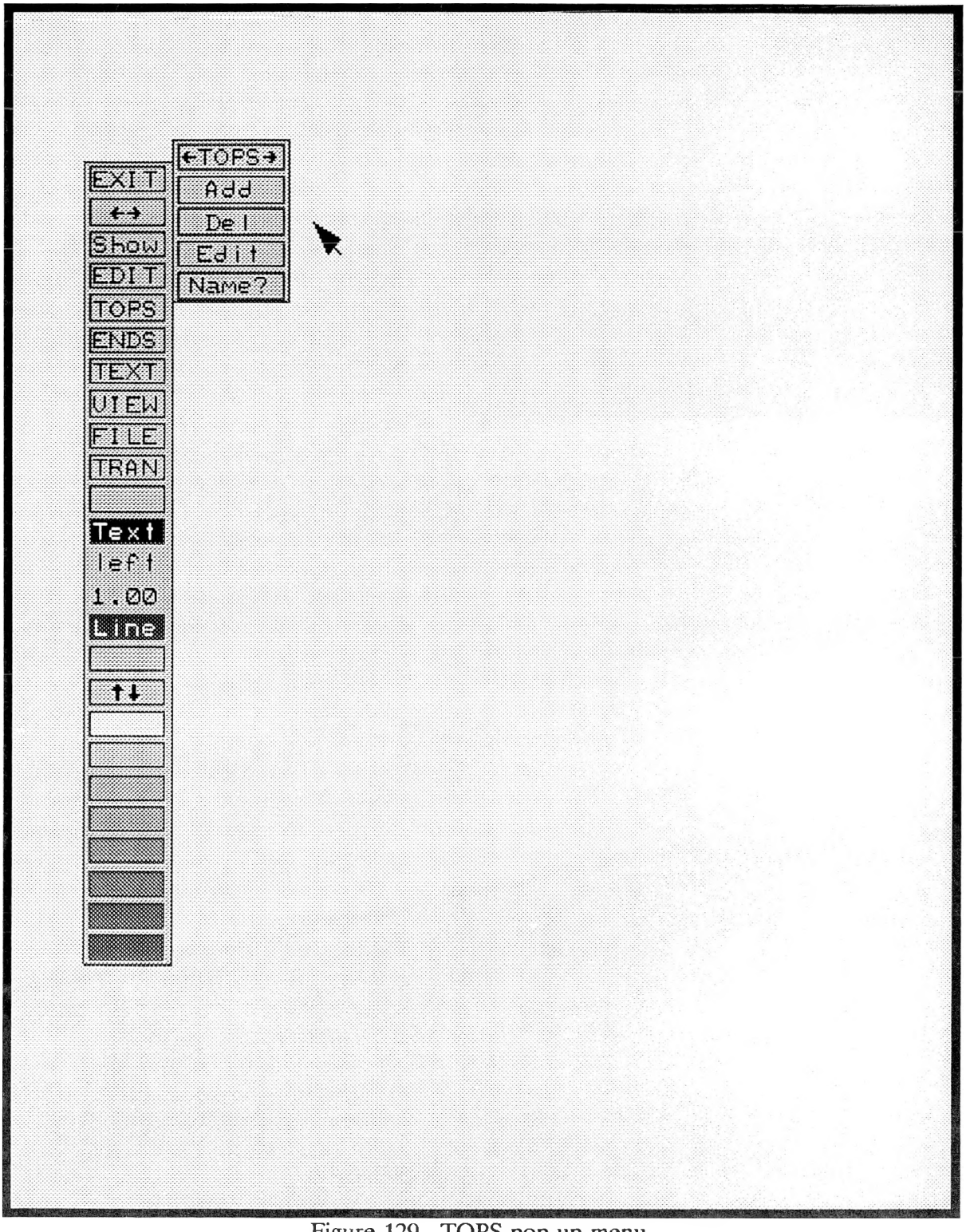


Figure 129. TOPS pop-up menu.

6.2.6 ENDS

At the end of each sequence is a unique number and some textual information. This information includes the sequence name, end state name, and two other fields used for user defined information. Each sequence must have a sequence name. All other information is optional. When a branch (sequence) is added, the names or "ends" are given defaults. Each default equates to the empty screen. Also a display option is given to each end. This allows you to turn on or off the information. Usually you will have the text turned off while building your event tree. Each list or column of information has a header. The header may be placed at any horizontal location. Display information is associated with each header. Individual sequences and/or column information may be turned off or on. Sequence and header information, along with the display and placement attributes, are modified through the ENDS command. When you invoke this command, an additional pop-up menu is displayed (Figure 130). As shown, four options are available: ENDS, End States, Edit Header, and Place Header.

6.2.6.1 ←ENDS→. This option allows you to move the pop-up menu to a new location on the screen. To invoke this option, position the cursor on the ←ENDS→ box and press the left mouse button. An outline will appear. Move the outline to the new location and press the left mouse button. The menu will be moved to the new location.

6.2.6.2 End States. This option allows you to display information about the end state. When you invoke this option you will be prompted to **Pick the leaf corresponding to the desired endstate information.** The cursor is placed on the tree at the end of the sequences. The cursor will only move in the vertical direction allowing you to pick only leaf branches. Position the cursor at the desired end state and press the left mouse button. A window will appear in the middle of the screen that displays the sequence names, end state names, and the data contained in the two user-defined fields for the selected end state. Next, you will be prompted to **Pick the box to be edited.** Position the cross hair over the box to be edited and press the left mouse button. If you choose to edit the sequence names or end state names you will be prompted to **Enter Text:**. Enter the desired name and press <Enter>. If a name already exists, it will be overwritten with the new name you entered.

The two remaining fields are toggle switches. The toggles allow you to specify whether or not to display the item.

To terminate this process, press the right mouse button. The window will disappear and you will be returned to the **Pick the leaf corresponding to the desired endstate information** prompt. At this point, you may select another end state or press the right mouse button to terminate the process.

6.2.6.3 Edit Header. This option allows you to edit header information. When you invoke this option, a window appears near the top of the screen. This window contains sequence names, end state names, and two user defined fields contained in the header. Next, you will be prompted to **Pick the box to be edited.** Position the cross hair over the box to be edited and press the left mouse button. If you selected to edit sequence names or end state names you will be prompted to **Enter text:**. Enter the desired text and press <Enter>. If the box contained data, it will be replaced by the text you just entered. To terminate this process, press the right mouse button.

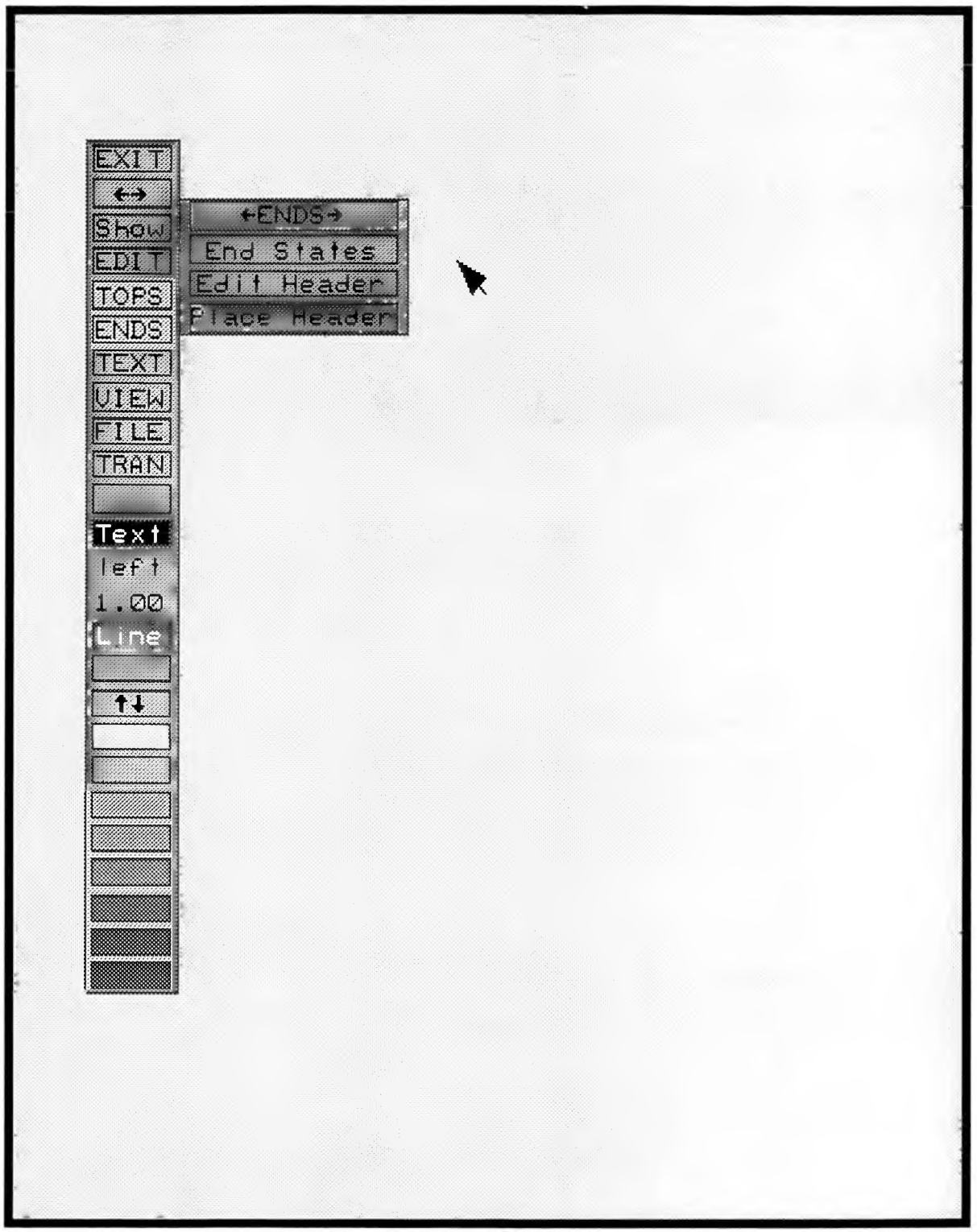


Figure 130. ENDS pop-up menu.

6.2.6.4 Place Header. This option allows you to move a header to another location on the screen. When you invoke this option you will be prompted to **Pick the header that is to be relocated.** Position the cross hair on the desired header to be moved contained in the listing on the right side of the screen or on the title to the left of the status/tops line at the top of the screen and press the left mouse button. You will be prompted to **Pick the placement point for the header.** Position the cursor on the desired location and press the left mouse button. The headers will be moved to the new location. The prompt **Pick the header that is to be relocated** will return. At this point, you may select another header to relocate or press the right mouse button to terminate the process.

6.2.7 TEXT

This option allows you to add text to the diagram at any location, in any size and color. When you invoke this command, an additional pop-up menu is displayed (Figure 131). As shown, seven options are available: TEXT, FONT, Write, Move, Copy, Erase, and EDIT.

6.2.7.1 ←TEXT→. This option allows you to move the pop-up menu to a new location on the screen. To invoke this option, position the cursor on the ←TEXT→ box and press the left mouse button. An outline will appear. Move the outline to the new location and press the left mouse button. The menu will be moved to the new location.

6.2.7.2 FONT. This option allows you to select the font type for the text. When you select this option an additional pop-up menu will be displayed (Figure 132). Select the desired font by positioning the cursor over the font and pressing the left mouse button. You must select a font (or cancel) in order to continue. All new text will be displayed in the selected font. Remember, you are changing the default font type using this option. No existing text will be changed to this new font type. To change existing text, select the TEXT option, the EDIT suboption, and invoke the FONT command. You may then mark existing text to be changed to the default font.

6.2.7.3 Write. This option allows you to write text at any location on the screen. When you invoke this option you will be prompted to **Pick text placement location.** Position the cursor at the desired location and press the left mouse button. A window will appear in the top left corner of the screen. Enter the desired text. When complete, press <Esc>. If the show text option is turned on (See VIEW option), the newly added text will be displayed on the screen. Next, you will be prompted to **Pick next text placement location:**. At this point you may select another location to write text or press the right mouse button to terminate the process.

6.2.7.4 Move. This option allows you to move the selected text to a new location on the screen. When you invoke this option you will be prompted to **Pick region to be moved - press CANCEL to quit.** You select the region by marking the opposite corners of the text to be moved. Position the cross hair at the text you want to move and press the left mouse button. A small dot appears. Drag the cursor across the desired text until the box totally surrounds the text. Press the left mouse button again. The message **Pick reference point - press CANCEL to quit** will be displayed. The reference point is used to give you some indication of the position of the text being moved relative to the box. Position the cross hair at the location where you want the selected text

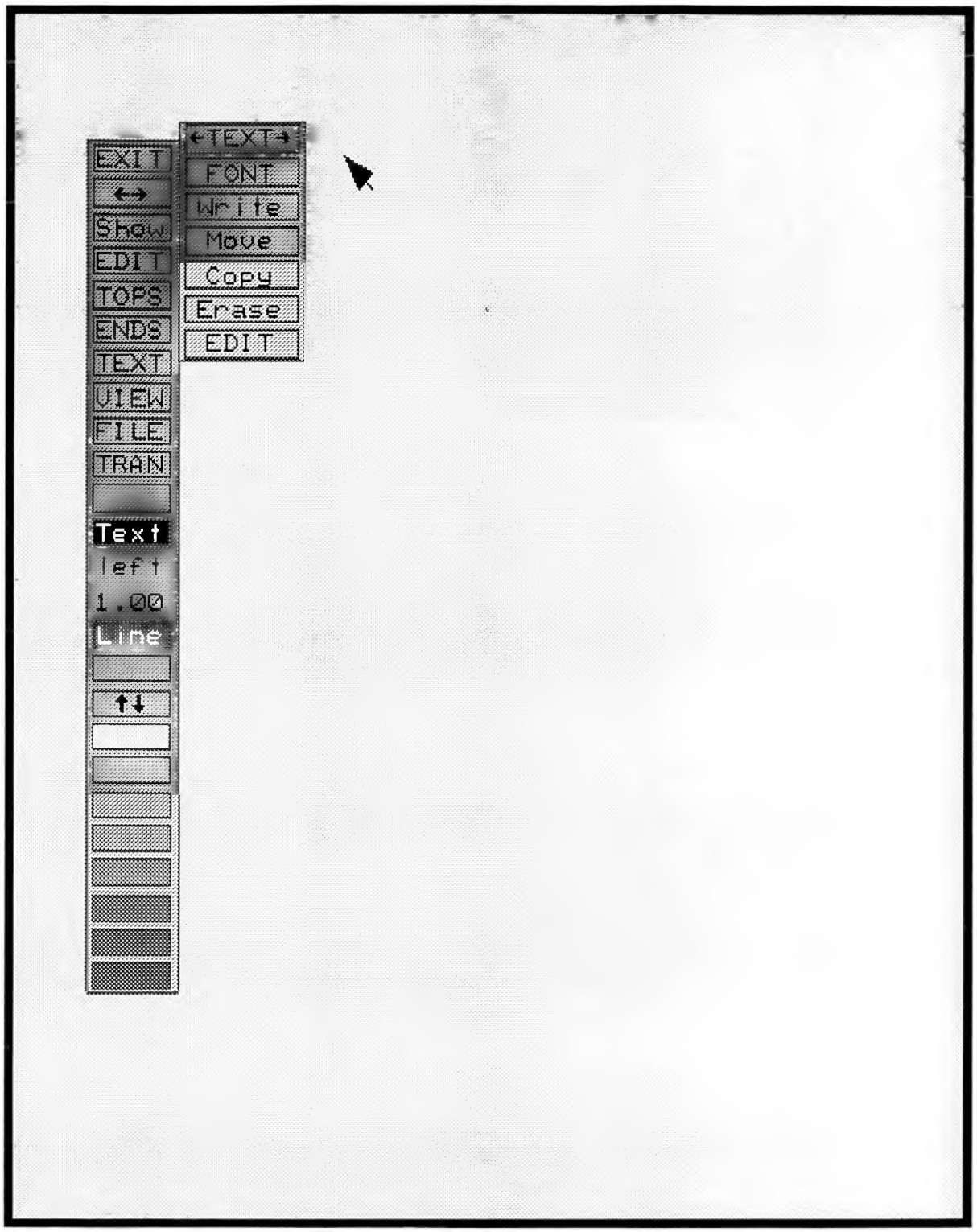


Figure 131. TEXT pop-up menu.

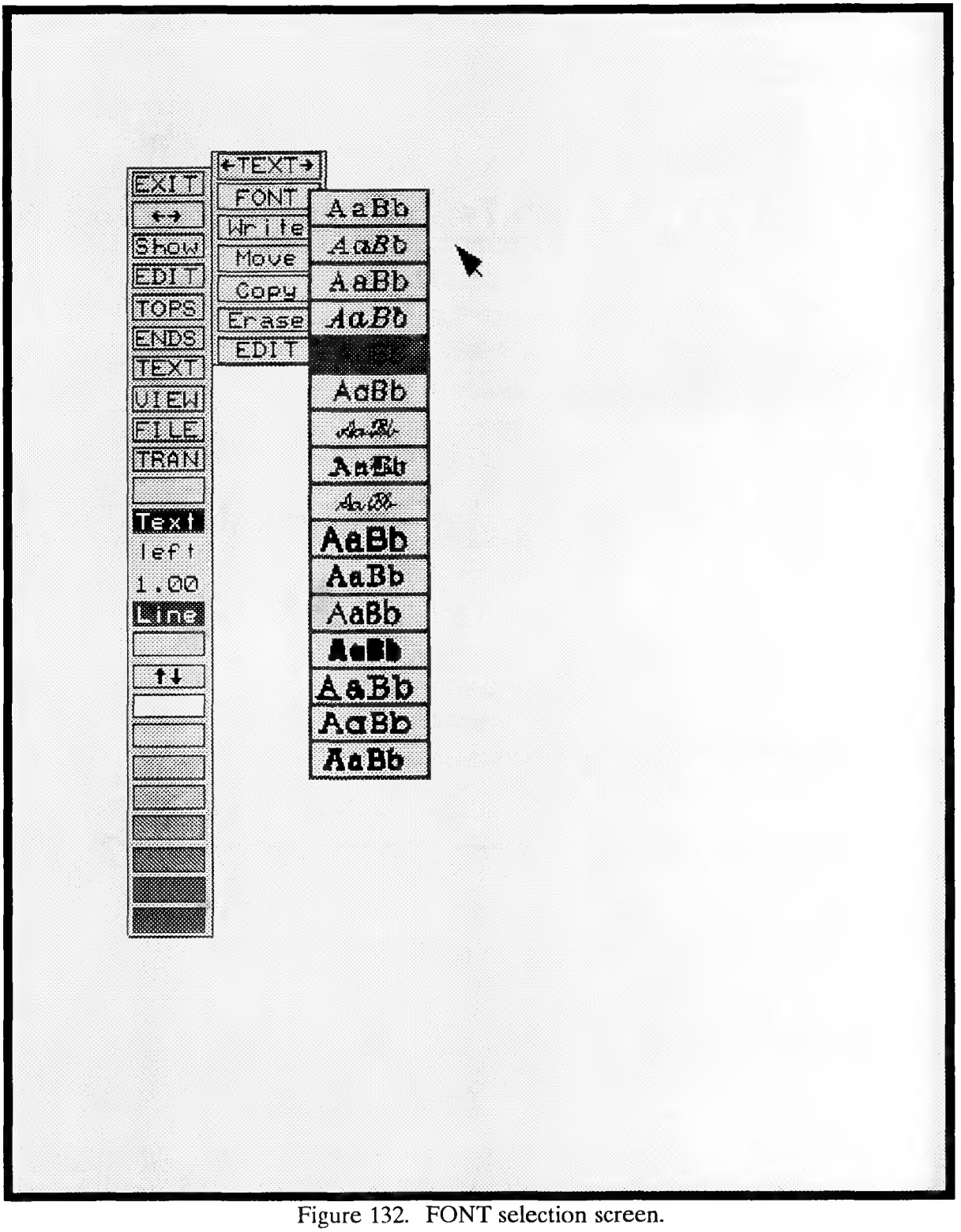


Figure 132. FONT selection screen.

to be moved to. Next, you will be prompted to **Pick placement point - press CANCEL to reselect.** Use the mouse to move the box to the exact position where you want the box to appear. When you are satisfied with the new position press the left mouse button. The selected text will be moved to the new location. The prompt **Pick placement point - press CANCEL to reselect** will be displayed again. At this point you may select another location to move the text, or press the right mouse button or <Esc> key to terminate the process.

6.2.7.5 Copy. This option allows you to copy the selected text to a new location on the screen. When you invoke this option you will be prompted to **Pick region to be copied - press CANCEL to quit.** You select the region by marking the opposite corners of the text to be copied. Position the cross hair at the text you want to copy and press the left mouse button. A small dot appears. Drag the cursor across the desired text until the box totally surrounds the text. Press the left mouse button again. The message **Pick reference point - press CANCEL to quit** will be displayed. The reference point is used to give you some indication of the position of the object being copied relative to the box. Position the cross hair at the location where you want the selected region to be copied to. Next, you will be prompted to **Pick placement point - press CANCEL to reselect.** Use the mouse to move the box to the exact position where you want the text to appear. When you are satisfied with the new position press the left mouse button. The selected text will be moved to the new location. The prompt **Pick placement point - press CANCEL to reselect** will be displayed again. At this point you may select another location to copy the text to, or press the right mouse button or <Esc> key to terminate the process.

6.2.7.6 Erase. This option allows you to delete selected text. When you invoke this option you will be prompted to **Pick region to be deleted.** You select the region by marking the opposite corners of the text to be deleted. Position the cross hair at the text you want to move and press the left mouse button. A small dot appears. Drag the cursor across the desired text until the box totally surrounds the text. Press the left mouse button again. The message **Delete this region? left = YES, Right = NO** will be displayed. If this is the text to be deleted, press the left mouse button; otherwise press the right button. Next, you will be prompted to **Pick next region to be deleted.** At this point you may select more text to delete or press the right mouse button or <Esc> key to terminate the process.

NOTE: If the text is not deleted, check the size of the outline box used to mark the region. It must be large enough to encompass all the text desired; otherwise, no text will be deleted.

6.2.7.7 EDIT. This option allows you to edit text and set various attributes of the text including color, size, font, and justification. When you invoke this option, an additional pop-up menu will be displayed (Figure 133).

6.2.7.7.1 ←EDIT TXT→--This option allows you to move the pop-up menu to a new location on the screen. To invoke this option, position the cursor on the ←EDIT TXT→ box and press the left mouse button. An outline will appear. Move the outline to the new location and press the left mouse button. The menu will be moved to the new location.

6.2.7.7.2 Text--This option allows you to edit any of the text contained in the

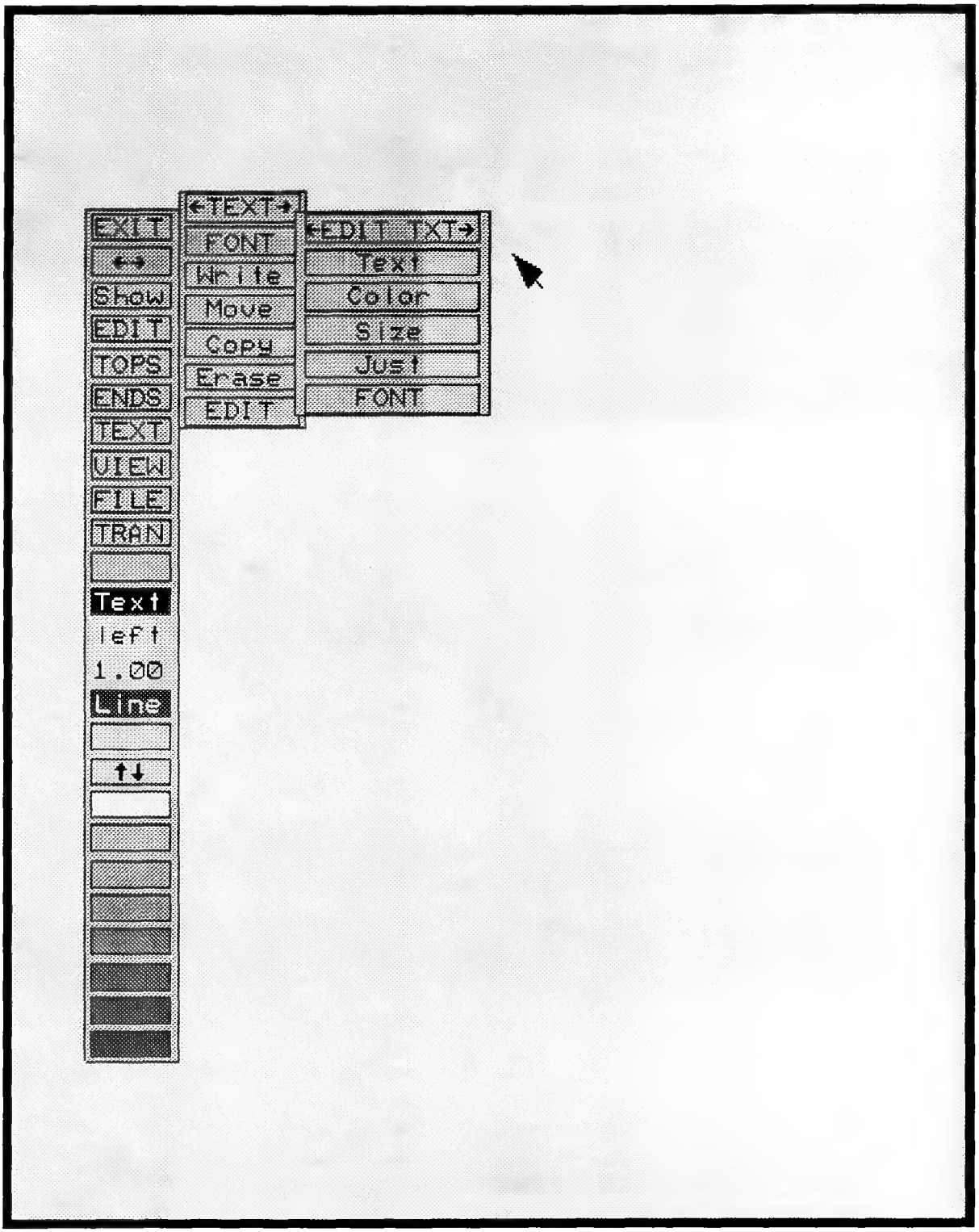


Figure 133. EDIT pop up menu.

displayed diagram. When you select this option you will be prompted to **Box text to be edited.** You select the text to be edited by boxing the opposite corners of the text region. Position the cross hair at the beginning of the text you wish to modify and press the left mouse button. A small dot will appear. Drag the cursor over the text until the outline surrounds the text you wish to modify. When the text is completely surrounded, press the left mouse button. A window will appear displaying the selected text. To modify the text, simply type over the existing text. Use the <Ins> and <Del> keys to add and delete characters as necessary. In addition, you may use the Backspace and End keys. The Backspace key deletes the character to the left of the cursor and moves the rest of the characters to the left one space. The End key positions the cursor at the end of the current line. When complete, press <Esc>. You will be prompted to **Pick next text to be edited.** At this point you may select additional text to edit or press the right mouse button to terminate the process.

6.2.7.7.3 Color--This option allows you to change the color of selected text in your event tree diagram. When you invoke this option you will be prompted to **Box the text to be changed.** Position the cursor at the beginning of the text you wish to change and press the left mouse button. A small dot will appear. Drag the cursor over the text until the outline box surrounds all the desired text. Press the left mouse button. Next, you will be prompted to **Pick the new text color from the color bar.** To select a color, position the cursor over the desired color and press the left mouse button. The text will immediately change to the new color. The prompt **Box next region to be changed** will be displayed. At this point you may select more text to change or press the right mouse button to terminate the process.

6.2.7.7.4 Size--This option allows you to specify the height of selected text in your diagram. When you invoke this option, you will be prompted to **Box the text to be changed.** Position the cross hair at the beginning of the text you wish to change and press the left mouse button. A small dot will appear. Drag the cursor over the text until the outline surrounds all the desired text. When all the desired text is surrounded, press the left mouse button. Next, the prompt **Enter the new text size >** will be displayed. At this prompt enter the desired text size and press <Enter>. You may enter a value of .001 to 9.0. The selected text will be displayed in the new size. Next, you will be prompted to **Box next region to be changed.** At this point you may select more text to be changed or press the right mouse button to terminate this process.

6.2.7.7.5 Just--This option allows you to justify selected portions of the text in your diagram. Justification is where the text will be placed offset from the placement point. When you invoke this option you will be prompted to **Box the text to be changed.** Position the cursor at the beginning of the text to be changed and press the left mouse button. A small dot will appear. Drag the cursor over the text until the outline completely surrounds it. When the desired text is completely surrounded press the left mouse button. You will be prompted to **Enter text justification - ('L'=Left, 'R'=Right, 'C'=Center) >.** Enter the desired justification and press <Enter>. The prompt **Box next region to be changed** will be displayed. At this point you may select additional text to modify or press the right mouse button to terminate this process. See Section 6.2.12 for a compete discussion on setting the justification.

6.2.7.7.6 FONT-- This option allows you to select the font type for selected text. When you select this option an additional pop-up menu will be displayed (Figure 134). Select the desired font type by positioning the cursor over the font and pressing the left mouse button. You

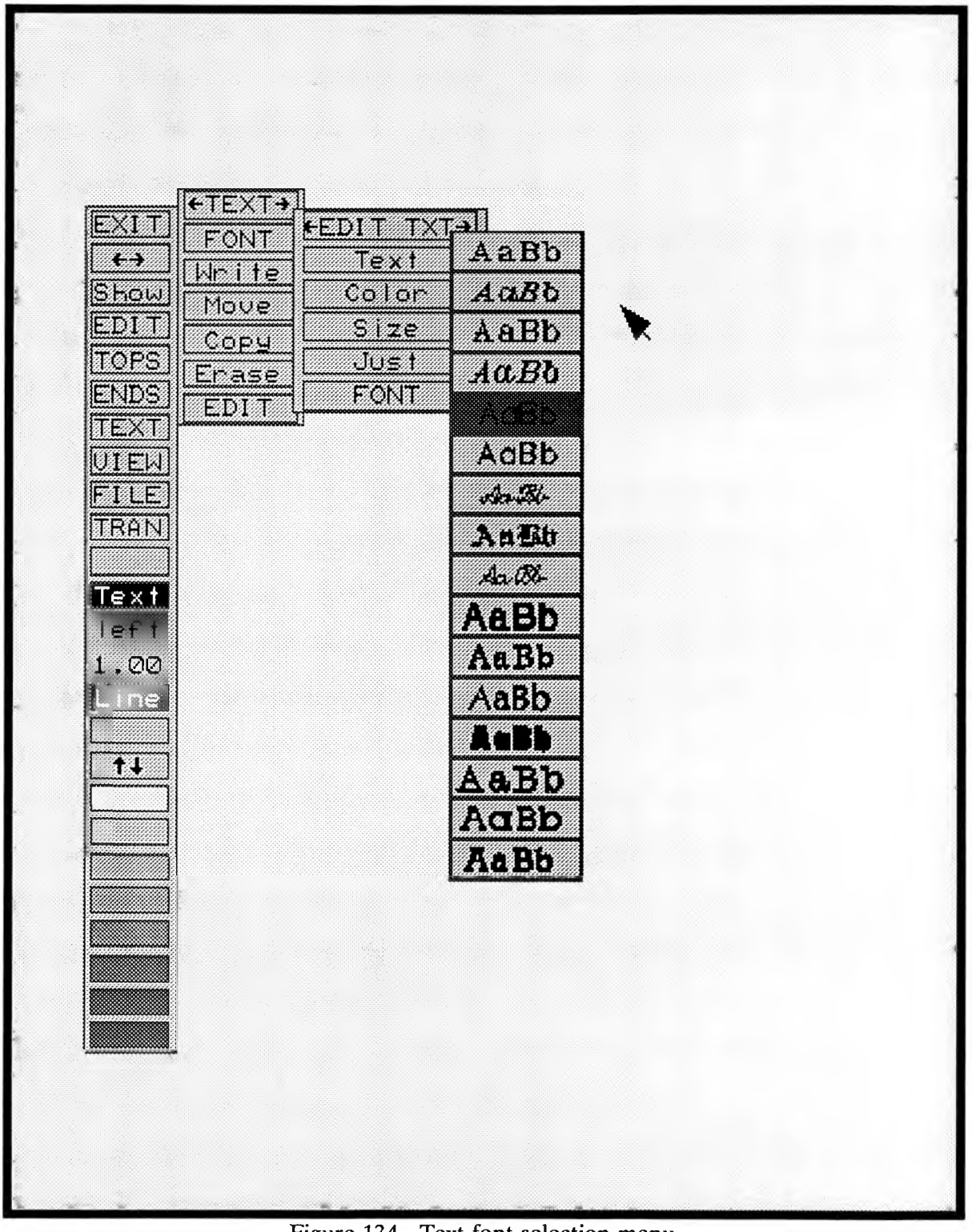


Figure 134. Text font selection menu.

must select a font (or cancel) in order to continue. Next, you will be prompted to **Box the text to be changed**. Position the cursor over the text to be changed and press the left mouse button. A small dot will appear. Drag the cursor over the text to be modified. When the box completely surrounds the desired text, press the left mouse button. The selected text will be displayed in the new font type. Next, you will be prompted to **Box next region to be changed**. At this point you may select more text or press the right mouse button to terminate the process.

6.2.8 VIEW

This option allows you to change the position and size of the displayed diagram. You may move the drawing up, down, right, left, zoom in, zoom out, or restore the drawing to its original size and/or position. You may also toggle to display/not display text and turn on and off the grid. When you select this option, Figure 135 will be displayed. The VIEW submenu consists of the following options:

- down arrow: Invoking this option allows you to shift the diagram downward. To invoke this option, position the cursor in the down arrow box and press the left mouse button <Enter>. The message **Pick a new bottom edge** will be displayed. Move the cross hair to the position which is to become the new bottom of the display and press the left mouse button or <Enter>. The diagram will adjust accordingly. At this point, you can select a new bottom edge or terminate the function by pressing the right mouse button or <Esc>. The above mentioned message will remain on the screen until you terminate the process.

- up arrow: Invoking this option allows you to shift the diagram upward. To invoke this option, position the cursor in the up arrow box and press the left mouse button or <Enter>. The message **Pick a new top edge** will be displayed. Move the cross hair to the position which is to become the new top edge of the display and press the left mouse button or <Enter>. The diagram will shift accordingly. At this point, you may select a new top edge or terminate the process by pressing the right mouse button or pressing <Esc>. The above mentioned message will remain on the screen until you terminate the process.

- right arrow: Invoking this option allows you to shift the diagram to the right. To invoke this option, position the cursor in the right arrow box and press <Enter>. The message **Pick a new right edge** will appear on the screen. Move the cross hair to the position which is to become the new right edge of the display and press <Enter>. The diagram will shift accordingly. At this point, you may select a new right edge or press the right mouse button to terminate the process. The above mentioned message will remain on the screen until you terminate the process.

- left arrow: Invoking this option allows you to shift the diagram to the left. To invoke this option, position the cursor in the left arrow box and press the left mouse button or <Enter>. The message **Pick a new left edge** will be displayed. Move the cursor to the position which is to become the new left edge of the display and press the left mouse button or <Enter>. At this point, you may select a new left edge or press the right mouse button or <Esc> to terminate the process.

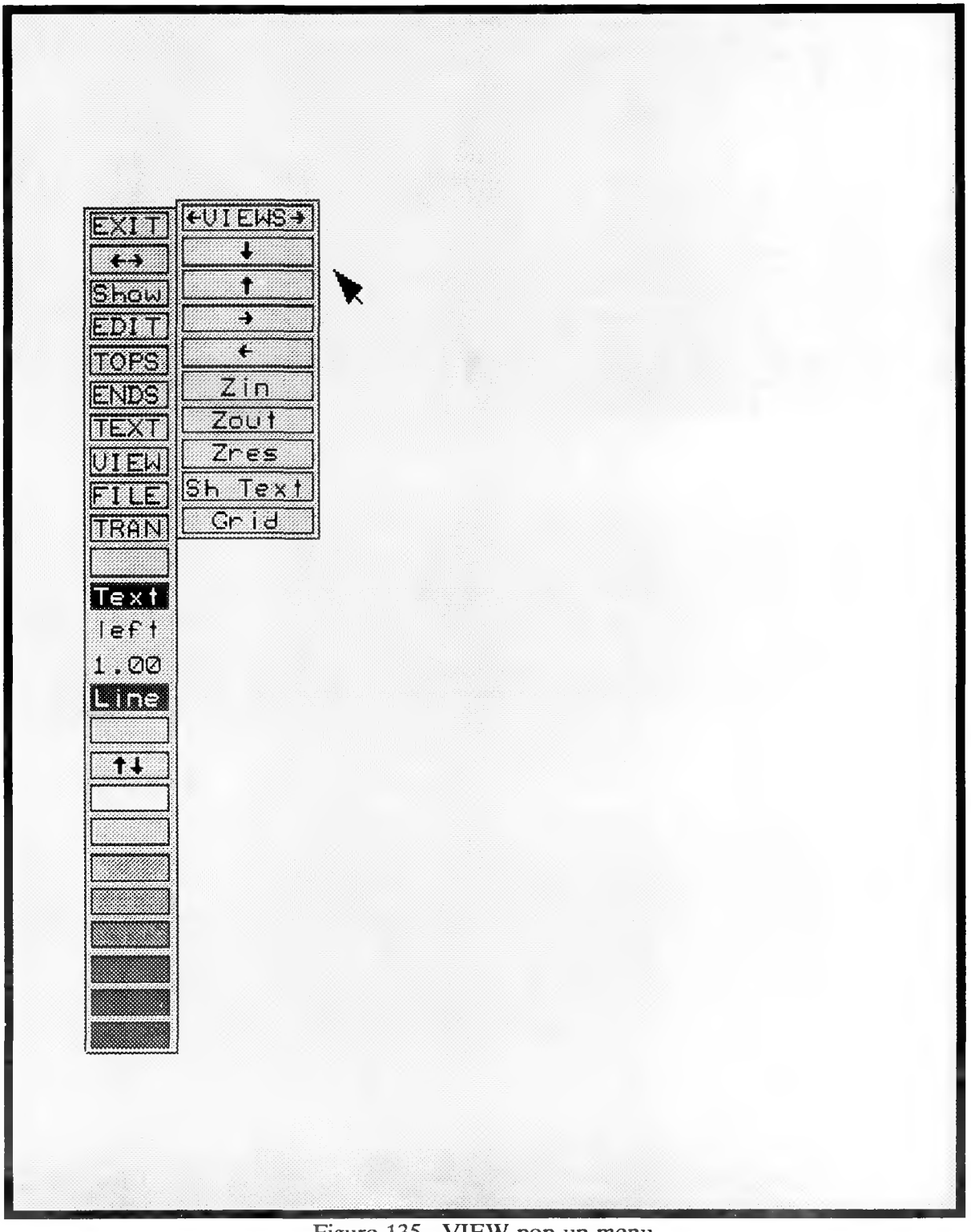


Figure 135. VIEW pop-up menu.

- Zoom in: Invoking this option allows you to fill the screen with a small portion of the original display (magnifies the selected portion of the screen). To invoke this option, position the cursor in the Zin (zoom in) box and press the left mouse button or <Enter>. The message **Pick first corner** will be displayed. Move the cursor at the start of the diagram to be enlarged and press the left mouse button. A small dot appears. Next, you will be prompted to **Pick next corner.** Drag the cursor across the desired area until it is completely surrounded by the outline box. Press the left mouse button. The portion of the original display enclosed by the box will now fill the entire screen. The display can be restored to its original size by invoking the Zres (zoom restore) option.

- Zoom out: Invoking this option allows you to shrink the screen by approximately 50%. To invoke this option, position the cursor in the Zout (zoom out) box and press the left mouse button or <Enter>. The entire display will be reduced, while the drawing space is increased. To restore the display to its original size, invoke the Zres option.

- Zoom Restore: This option restores any display created by zoom in or zoom out to the original display size or to the last saved file. To invoke this option, position the cursor in the Zres box and press the left mouse button or <Enter>.

- Sh Text: This option allows you to toggle the display the text setting from Sh Text to No Text. Sh Text displays all defined text. No Text does not display the text.

- GRID: This option displays a grid behind your diagram to allow you to line up symbols and text. This is a toggle switch. To turn the grid on, position the cursor in the GRID option box and press the left mouse button or <Enter>. To turn the grid off, repeat the same steps.

6.2.9 FILE

This option allows you to perform various file manipulation functions including loading, saving, listing and creating event tree files. When you invoke this option, an additional pop-up menu will be displayed (Figure 136). Each of these pop-up commands is discussed in the following paragraphs.

6.2.9.1 ←FILE→. This option allows you to move the pop-up menu to a new location on the screen. To invoke this option, position the cursor on the ←FILE→ box and press the left mouse button. An outline will appear. Move the outline to the new location and press the left mouse button. The menu will be moved to the new location.

6.2.9.2 Load. This is one of the options that can be used to load a file. When you invoke this option, you will be prompted to **Enter file name >**. At this prompt, enter the file name and press <Enter>. You must know the name of the file before initiating this option. The LIST

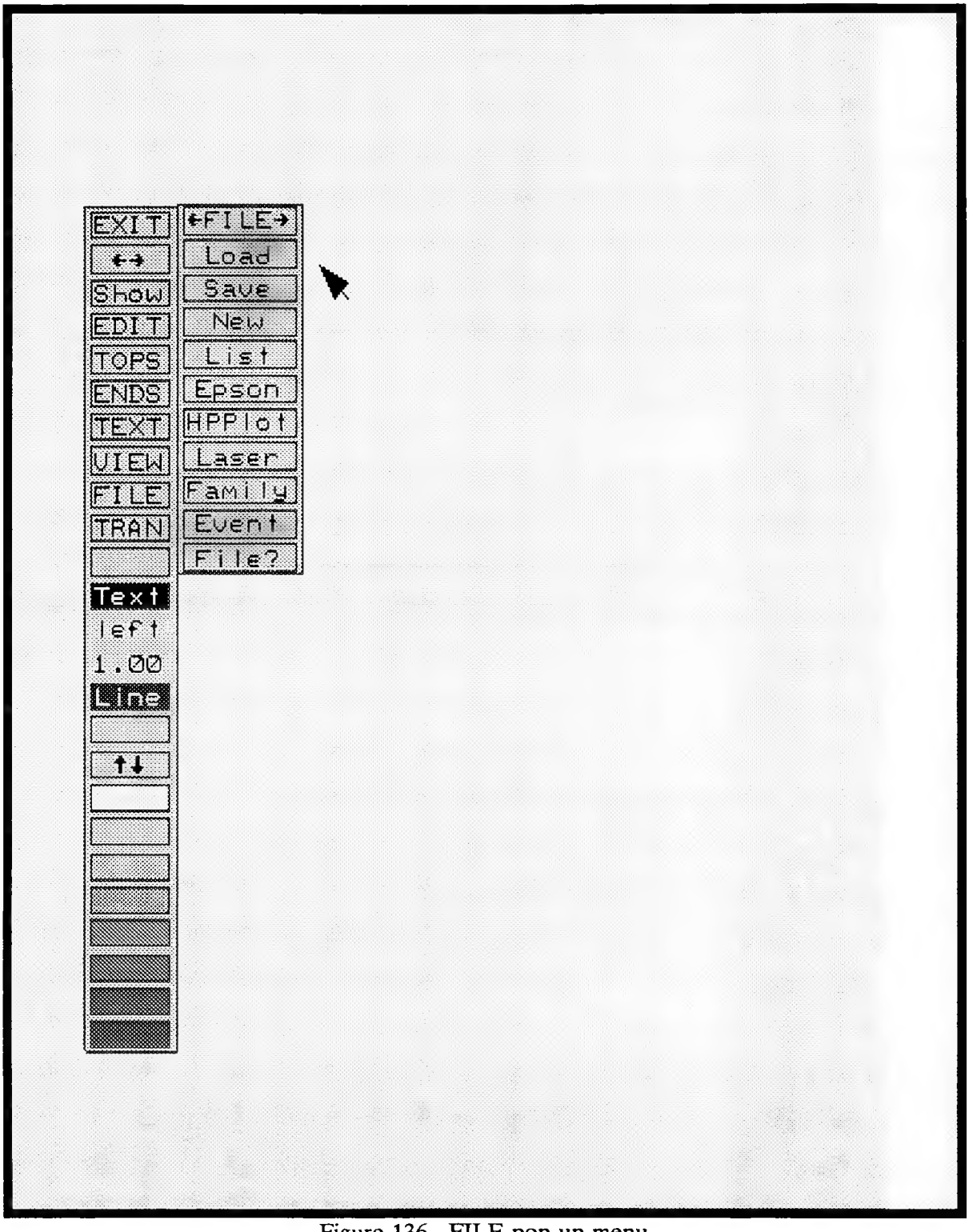


Figure 136. FILE pop-up menu.

command also allows you to load a file, but in addition it will display all available files.

6.2.9.3 Save. This option allows you to save the current file. When you invoke this command you will be prompted to **Enter file name or CR for file *current file name*.** At this point you may enter a new file name or choose the default file name provided by pressing <Enter>. The file is then written to disk. If you enter a new file name, do not provide an extension. The extension ".ETG" is provided by IRRAS.

6.2.9.4 New. This option allows you to create a new event tree (file). When this command is invoked you will be prompted to **Enter Initiating Event or Top Name.** Enter the event or name and press <Enter>. You will then be asked **Is this an Initiating Event.** Respond with a Y or N. You will then be prompted to **Enter Event Name #1.** Enter an event name and press <Enter>. This prompt will repeat (with the event number increasing each time) until you press <Enter> without entering a name. The newly created event tree will then be displayed on the screen. The default form of an event tree will contain a success/fail branch at the first event and a don't care or pass extending through the ending event.

6.2.9.5 List. This is one of the two options used to load an event tree diagram. When you invoke this option, an additional pop-up menu will be displayed listing the files available. You will be prompted to **Pick the file to load.** To select a file to be loaded, position the cursor on the desired file name and press the left mouse button. The selected diagram will be displayed on the screen. You may now proceed with other editing functions.

6.2.9.6 Epson. This option formats the current diagram for an Epson printer and sends it to the attached local Epson printer.

6.2.9.7 HPPlot. This option formats the current diagram for an HP plotter and writes it to a file, which can be printed at your convenience using the Plot Tree (HP) option.

6.2.9.8 Laser. This option formats the current diagram for a laser printer and sends it to the local laser printer to be printed.

6.2.9.9 Family. This option allows you to view and change the name of the family corresponding to the current diagram. The default family name is provided. When you invoke this option you will be prompted to **Type in the New Name or <Return> for *family name*>.** Enter a new file name if desired, or press <Enter> to accept the default family.

6.2.9.10 Event. This option allows you to view and change the event tree file name. The current file name for the event tree is provided. When you invoke this option, you will be prompted to **Type in the New Name or <Return> for *current file name* >.** Enter a new file name and press <Enter> or leave blank and press <Enter> to keep the current file name.

6.2.9.11 File?. This option allows you to view the current file name. When this option is invoked the current file name is displayed at the bottom left corner of the screen. If no file name is assigned to the current diagram, the default file name of **NONAME.ETG** will be displayed.

6.2.10 TRANS

This option allows you to add, delete, and modify transfer file names as well as transfer to and from files which are added as transfers. When you invoke this option, an additional pop-up menu will be displayed (Figure 137). Each pop-up option is discussed in the following paragraphs.

6.2.10.1 Add. The add option allows you to place a transfer file name in the diagram. This transfer file name can then be selected and you can transfer back and forth between the two event tree diagrams or any number of diagrams (files) that are included in the transfer list. When you invoke this option you will be prompted to **Pick the leaf where the transfer is to be placed.** The cursor will move vertically along the end of the event branches. Position the cursor on the desired transfer point and press the left mouse button. The prompt **Enter transfer file name** will be displayed. Enter the appropriate file name and press <Enter>. A "T" is placed after the selected sequence number and the entered file name is placed in the corresponding end state slot. The prompt **Pick the leaf where the transfer is to be placed** will return. At this point you may select another transfer point or press the right mouse button to terminate the process.

6.2.10.2 Delete. This option allows you to delete transfer file names from the diagram. When you invoke this option you will be prompted to **Pick the leaf corresponding to the transfer to be deleted.** Position the cursor on the leaf branch where a transfer has been previously added and press the left mouse button. The "T" will be deleted and the corresponding sequence name will be removed from the transfer list. You will be returned to the previous prompt. At this point you may select another transfer point to delete or press the right mouse button to terminate the process.

6.2.10.3 Modify. This option allows you to change the transfer file name. When you invoke this option you will be prompted to **Pick the leaf corresponding to the transfer to be edited.** Position the cursor on the transfer leaf and press the left mouse button. The prompt **Type in the New Name or <Return> for *current transfer file name* >**. Enter the new transfer file name or press <Enter> to retain the existing file name.

6.2.10.4 Tran→. This option allows you to work with multiple files simultaneously. When you invoke this option you will be prompted to **Pick the leaf corresponding to the desired transfer file name.** The selected file is then loaded into the system. This option will allow you to transfer back and forth to various files.

6.2.10.5 ←Tran. After a transfer to another file has been made, you use this option to return to the previous file. When you invoke this option you will be prompted to **Pick the file to transfer to.** A pop-up window will appear showing you a list of available transfer files. Select a file by positioning the cursor on the desired file and pressing left mouse button.

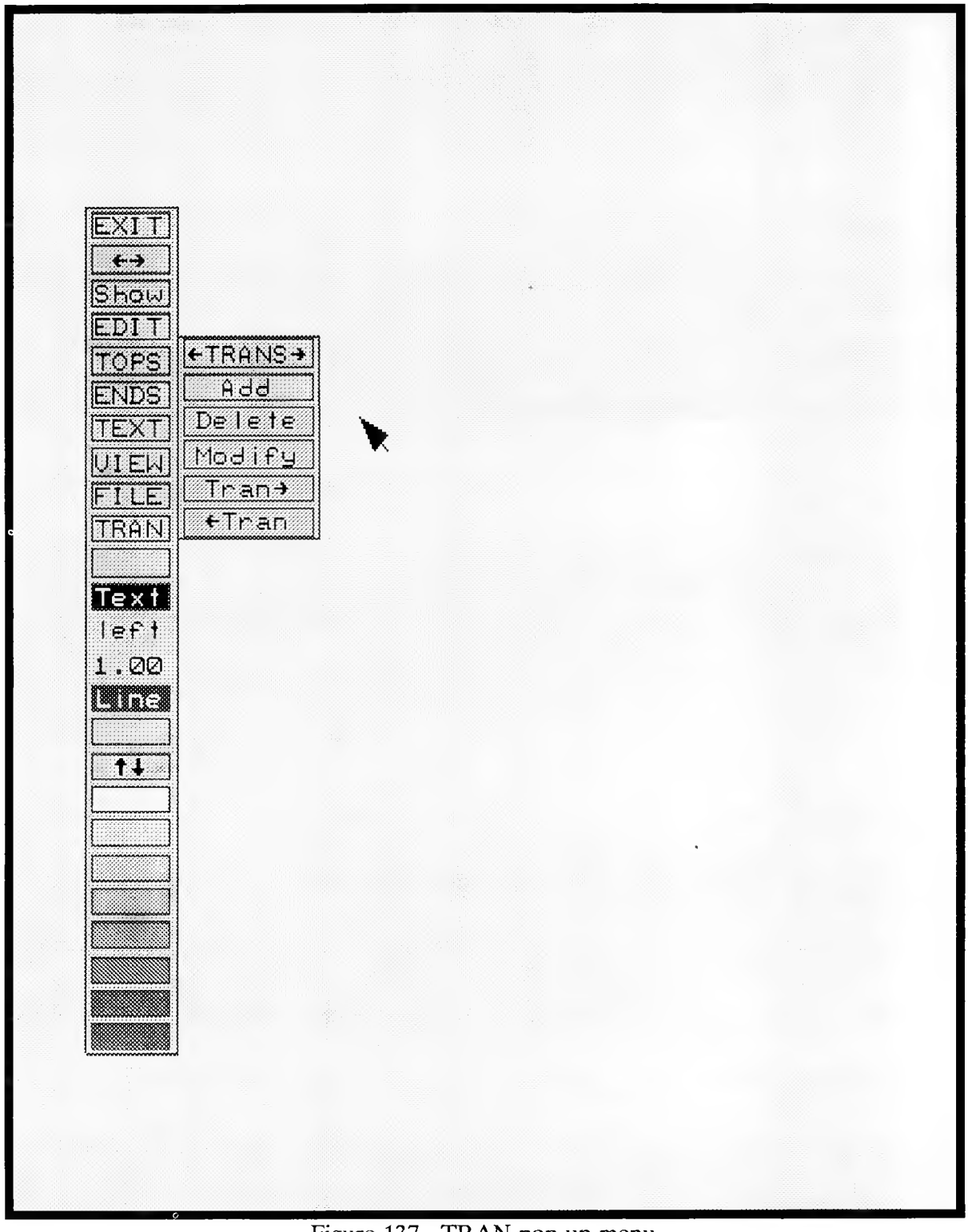


Figure 137. TRAN pop-up menu.

6.2.11 Text

This option allows you to set a default color for the text in your diagram. To invoke this option, position the cursor over the Text box and press the left mouse button. You will be prompted to **Pick a new color from the color bar.** Position the cursor on the desired color and press the left mouse button. (**NOTE:** The ↑↓ is active. Use this option to display additional color selections.) The Text box will change to the selected color. All text created in your diagram from now on will be displayed in this new color. Any existing test in your diagram will retain the old color. To change the color of the existing text you must invoke the TEXT option and select the EDIT suboption and invoke the Color command (see Section 6.2.7).

6.2.12 cntr/left/rght

This option allows you to set the justification for your diagram. Justification is where the text will be placed offset from the placement point. This works as a toggle switch. To change justification, position the cursor over the cntr (left or rght) box and press the left mouse button. You will see the box change from cntr to rght (right). Press the left mouse button again and the box will change from rght to left.

Left justification means the text will be anchored at the left bottom corner, or the text will flow to the right of where it was placed. Center justification means the text will be centered about the placement point. Right justification means the text will be placed to the left of the placement point. Set the toggle switch for the desired justification.

6.2.13 Text Size

This option allows you to set a default text size for your diagrams. Text sizes range from .001 to 9.0. For the purpose of writing general text in event trees, a text size of about 0.5 is appropriate. The size looks too small on the screen, but it is good for sending to a laser printer. When you invoke this option you are prompted to **Enter new text size >**. Enter the desired size and press <Enter>. The Text Size box will reflect the current default setting. Remember, here you are setting the default text sizes. You may always change the text size for selected text by invoking the TEXT option, selecting the EDIT suboption, and invoking the Size command (see Section 6.2.7).

6.2.14 Line

This option allows you to select a color for the lines in your diagram. When you invoke this option you will be prompted to **Pick a new color from the color bar.** Position the cursor over the desired color and press the left mouse button. The Line box will change to reflect the newly selected color. (Remember, you may use the scroll feature to display additional colors). All new lines generated in your diagram will be this default color.

6.2.15 ↑↓ (Color)

This option allows you to scroll the color bar to display the additional color selections available. Position the cursor on the scroll box (↑↓) and press the left mouse button or <Enter> key. The next series of colors will be displayed.

NOTE: When you try to exit the Create Event Trees option without saving your changes, you will be prompted with **ARE YOU SURE? Enter "Y" to Quit anyway.** At this point you may enter a <Y> to quit without saving or press <Enter> to terminate the exit procedure.

6.3 Link Event Trees

This option allows you to define linkage rules and generate sequence logic. When you invoke this option, Figure 138 will be displayed. As shown, three options are available: Exit, Generate Sequences, and Link Editor. In addition, the following special function keys are available:

<Esc> Returns you to the Event Tree Graphics System Menu (Figure 126).

<F1> Displays on-line help messages.

<F2> Marks a file for further processing. When you mark a file, an asterisk will appear in front of the file name.

<F3> Marks all the displayed files for further processing.

<F4> Allows you to mark a range of files for further processing.

<F5> Allows you to locate a specific file for further processing. When you invoke this function, Figure 139 will be displayed. Enter the file name to locate and press <Enter>. The specified file will be highlighted. If the file name does not exist, an error message will be displayed, and you will be returned to the previous screen.

To move around the Link Event Tree screen (Figure 138), use the <PgUp>, <PgDn> and arrow keys.

6.3.1 Exit

This option returns you to the Event Tree Graphics System menu (Figure 126). To invoke this option, enter an <E> in the option field and press <Enter>, or press the <Esc> key.

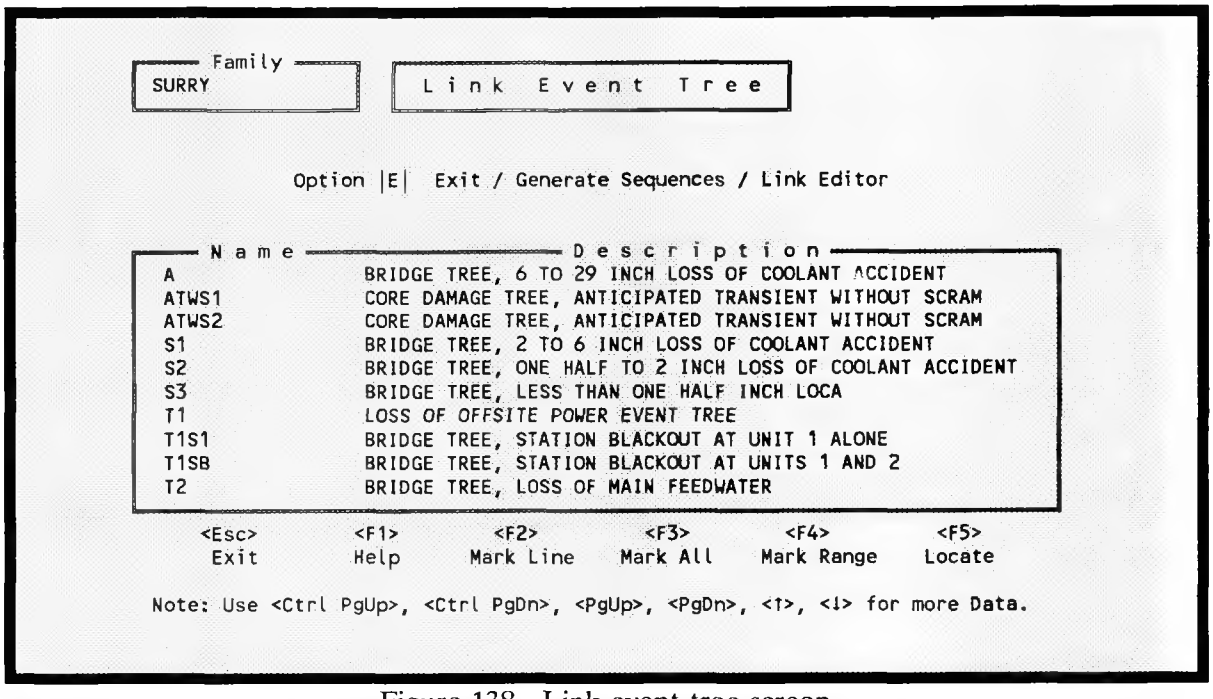


Figure 138. Link event tree screen.

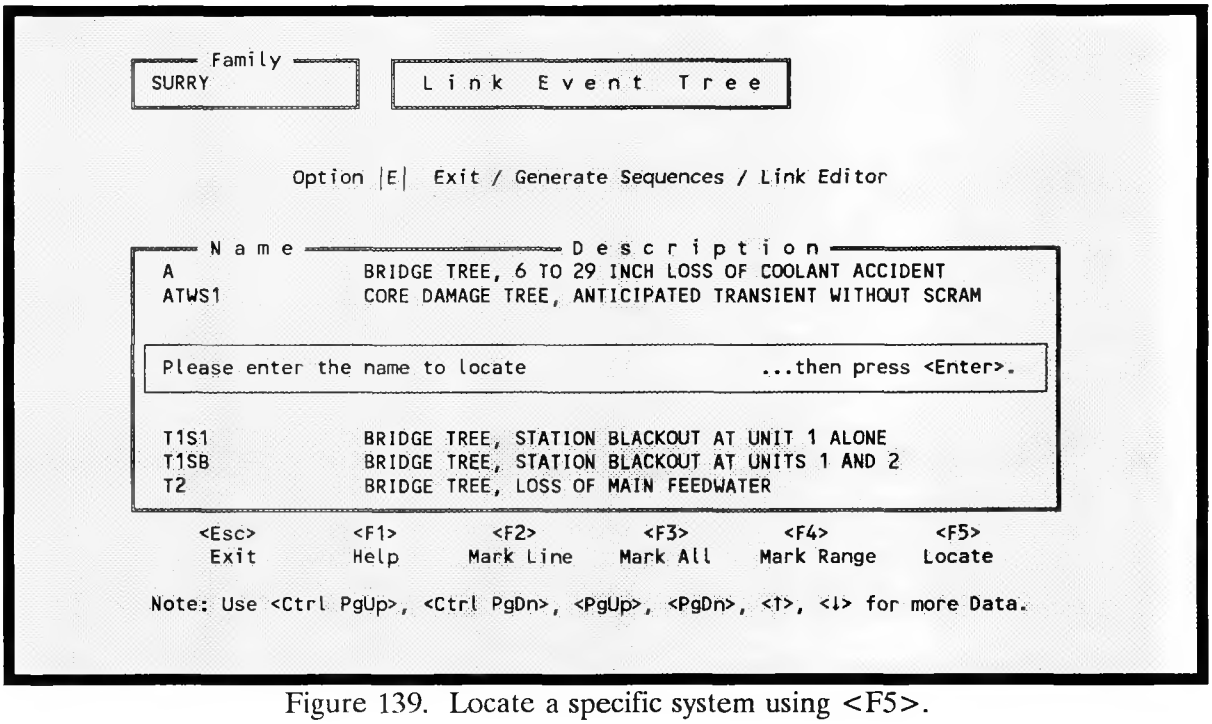


Figure 139. Locate a specific system using <F5>.

6.3.2 Generate Sequences

This option allows you to generate sequence logic for event trees. During sequence generation the sequence logic is created as specified in the event tree logic, and then the linkage rules are applied. To invoke this option for a single selected event tree, enter a <G> in the option field, highlight the desired event tree, and press <Enter>. To invoke this process for a group of event trees, mark the desired event trees using the function keys F2, F3, and F4, enter a <G> in the option field, and press <Enter>. To invoke this option for all event trees in the current family, clear all marked entries, type a <G> in the option field, and press <Enter>. A message **Process all records? (Y/N)** will appear at the bottom of the screen. Type a <Y> to generate sequences for all of the event trees, or type an <N> to terminate the sequence generation process.

In all three cases, after pressing <Enter>, Figure 140 will be displayed. On this screen you must enter a file name where the report is written. The following options are provided:

CON	-	Sends the report to the screen.
PRN	-	Sends the report to the printer.
filename	-	Sends the report to the specified hard disk file name. A default name is provided, which can be changed by simply typing over the default name.
blank	-	No report is generated, but the sequences are generated.
<Esc>	-	Terminates the process without generating the sequences.

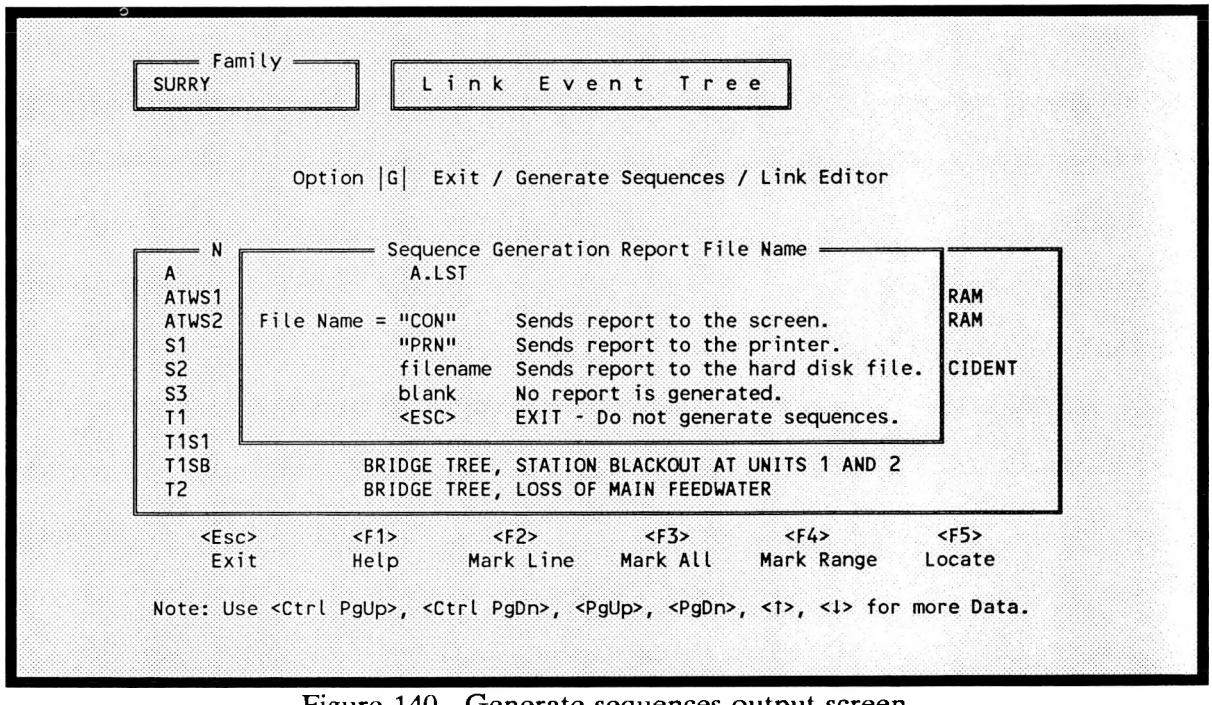


Figure 140. Generate sequences output screen.

The Sequence Generation report contains the listing of the sequences' names, the systems that make up the sequences, any substitutions of systems (based on the linkage rules), and any transfers to other event trees.

After sequence generation begins, the first message displayed is **Reading Logic for event tree: <event tree name>.** As each sequence in that event tree is generated, the message **Processing sequence: <sequence name>** is displayed. If there are any transfers in the event tree, the reading logic message will be displayed again, but this time with the name of the event tree being transferred to. When all the sequences for the event tree have been created, the message **Deleting old/unused sequences for <event tree name>** will appear. At this time all the sequences for the event tree that are no longer valid will be removed.

6.3.3 Link Editor

This option allows you to specify linkage rules for an event tree. A linkage rule is a special case, an exception, or substitution to the normal sequence generation. During sequence generation the sequence logic is created as specified in the event tree logic, and then the linkage rules are applied. For example, event tree A contains a sequence named SEQ-1. According to the strict logic of the event tree, the systems that make up SEQ-1's logic are SYS-1, SYS-2, SYS-3, and SYS-4. A linkage rule would enable you to replace all occurrences of SYS-4 in any sequence in the event tree with SYS-5. Or, you may only want to replace SYS-4 with SYS-5 if and only if SYS-2 and SYS-3 are also present in the sequence logic.

To invoke this option for a single selected event tree, enter an <L> in the option field, highlight the desired event tree, and press <Enter>. To invoke this process for a group of event trees, mark the desired event trees using the function keys F2, F3, and F4, type an <L> in the option field, and press <Enter>. To invoke this option for all event trees in the current family, clear all marked entries, type an <L> in the option field, and press <Enter>. A message **Process all records? (Y/N)** will appear at the bottom of the screen. Type a <Y> to edit the linkage rules for all of the event trees, or type an <N> to terminate the editing process.

In each case, when you press <Enter>, Figure 141 will be displayed showing the rules (if any) for the event tree shown in the upper right hand corner. The message **Reading in tops and systems names** will be displayed. A top is a system that is used in the selected event tree. Then the message **Reading in rules** will be displayed. The rules (if any) for the event tree will then be shown. The first # column is the rule number or the order in which the rules will be applied. Rule 2 takes precedence over rule 1 and rule n takes precedence over rule n-1. The second and third columns are the conditional columns. If a top or system must exist before a substitution can take place, those tops will be named here. There is no limit on the number of conditional tops for a rule. The fourth or replaced top column contains the tops to be substituted and the fifth column contains the tops/systems to use in place of the replaced tops. The following options are available: Exit, Add, Insert, Copy, Delete, and Restore.

6.3.3.1 Exit. This option returns you to the Link Event Tree menu. To invoke this option type an <E> and press <Enter>, or press the <Esc> key. Figure 142 will be displayed asking you if you want to save the rules and then exit. To save the rules in the data base, type a <Y>, and press <Enter>. To exit without saving the rules, type a <N> and press <Enter>.

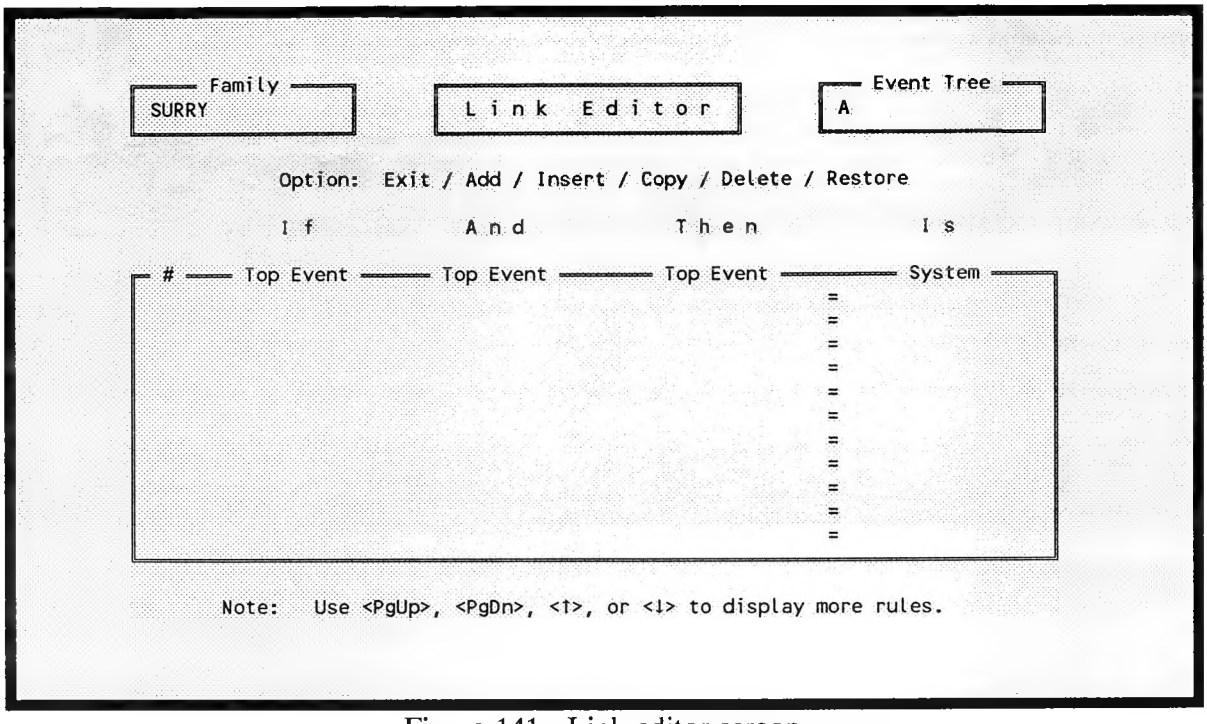


Figure 141. Link editor screen.

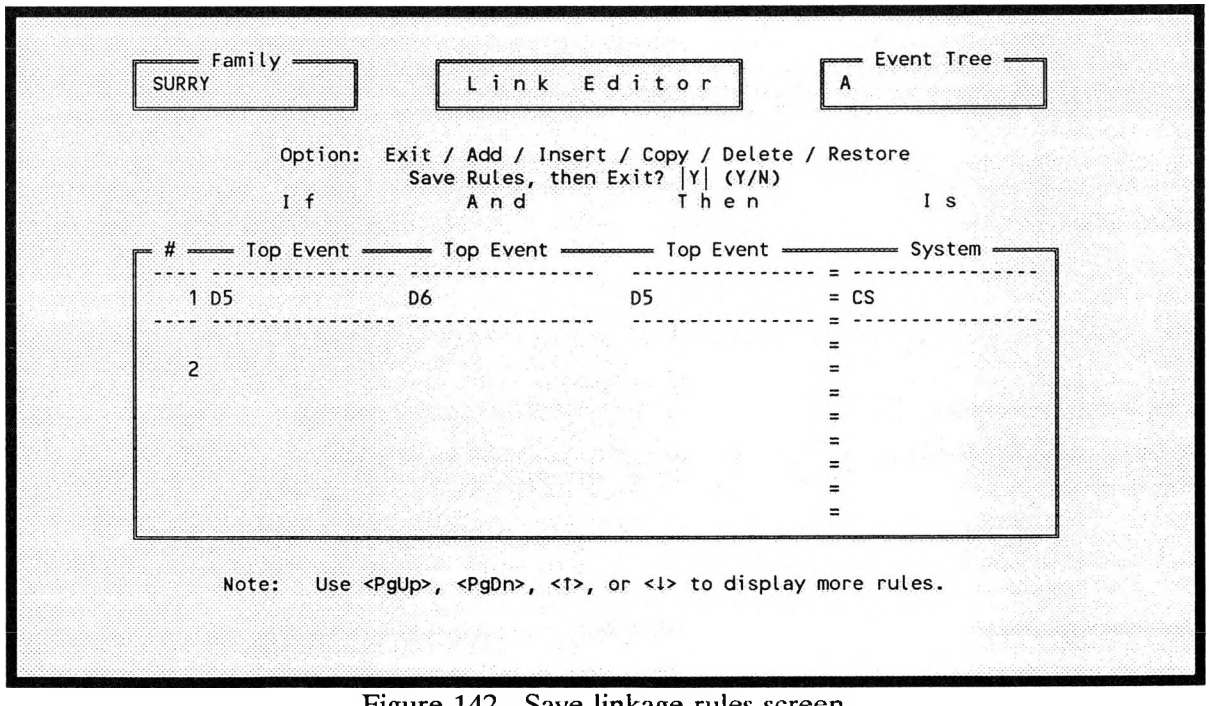


Figure 142. Save linkage rules screen.

6.3.3.2 Add. This option allows you to add a new rule or modify an existing rule if the cursor is in the first column, or add/modify a top or system if the cursor is in any other column. To add a rule, move the cursor to the first column and type an <A>. A default rule number will appear in the first column. Press <Enter> and the cursor will be moved to the second column. A line of dashes will appear above the rule that is being added. This is to assist in keeping the rules separated. To add a conditional top, type <A>, enter the name of the conditional top, and type <Enter>. If the name you entered is not a top for this event tree, the message **Name not found...** is displayed. A list of all the tops for this event tree is displayed in a help form on the right side of menu. To select one the tops from the help form, type <F1>, move the cursor to the top to be added, and press <Enter> (see Figure 143). All conditional tops and replaced tops are added in this same way. The replacement top is added in much the same way with some differences. When you type <A>, the list of all systems in the family is displayed in a help form on the left hand side of the form (see Figure 144). Any system in the family can be entered here, and the message **Name not found...** will be displayed if the name entered is not a system. To modify a rule, position the cursor over the top/system to be changed, type <A>, and enter the new top/system name just as you do on an add.

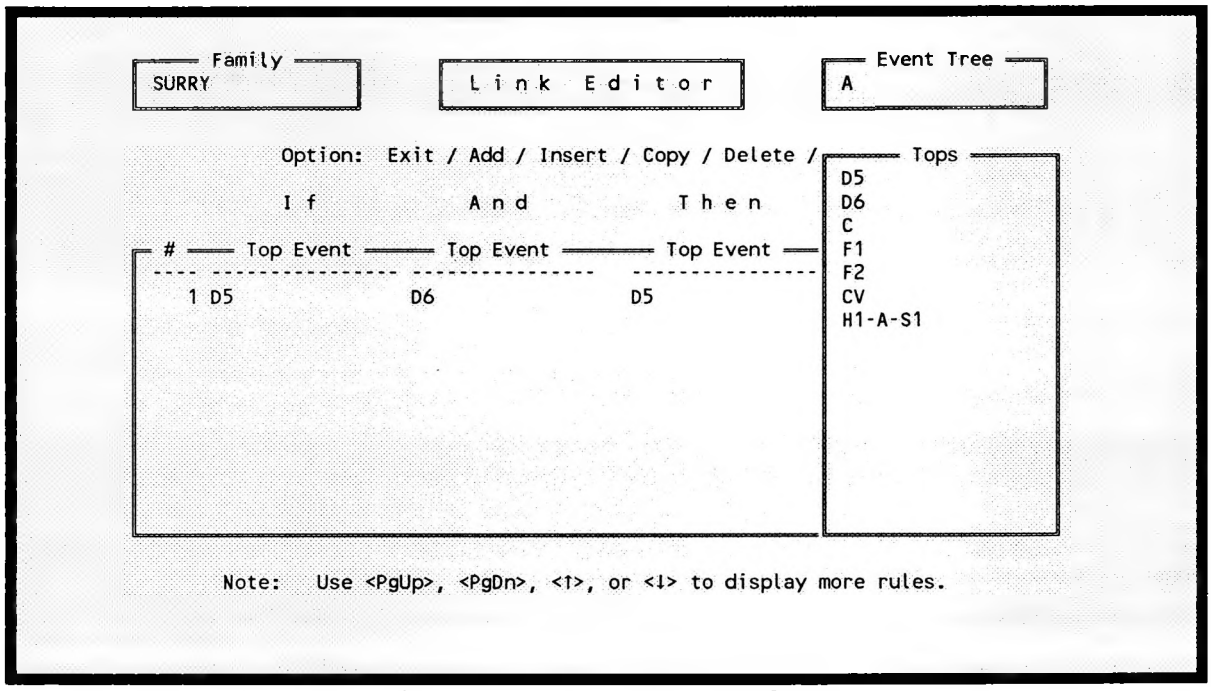


Figure 143. Tops listing help form.

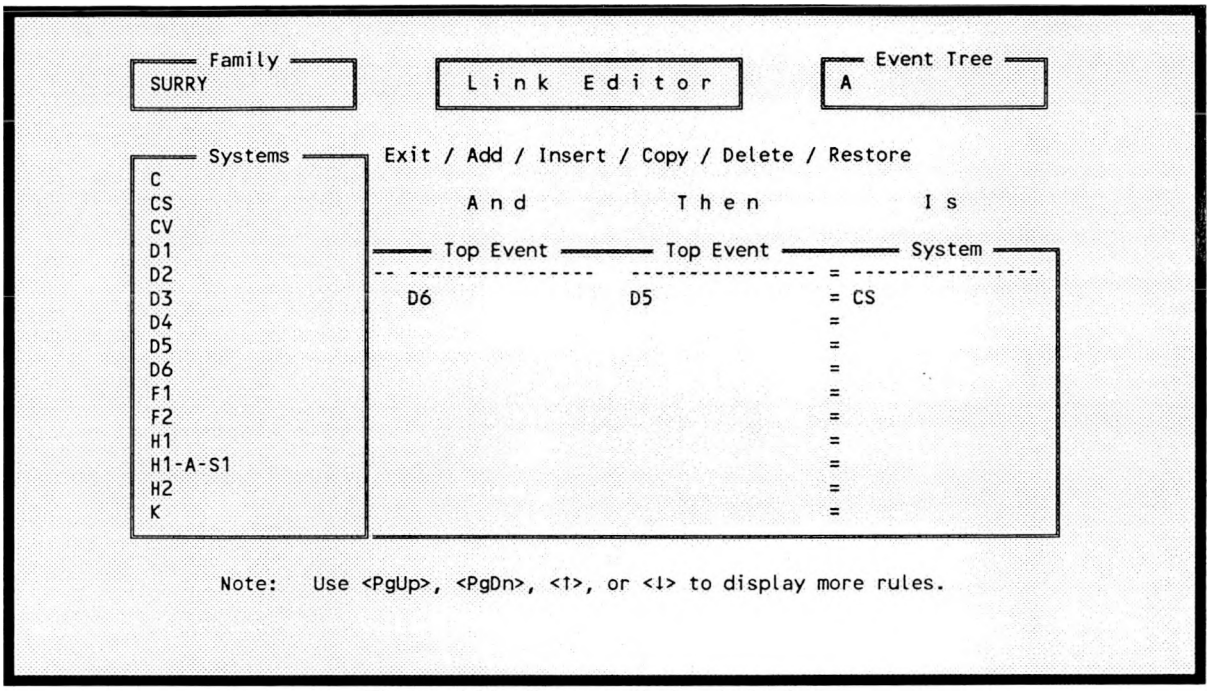


Figure 144. Systems listing help form.

6.3.3.3 Insert. This option adds one blank line after the line containing the cursor, regardless of the column the cursor is in.

6.3.3.4 Copy. This option copies one rule after another. Figure 145 contains the copy menu. The rule number of the rule closest to the cursor will be in the first blank, but you may enter any other existing rule in its place. To copy the desired rule enter an existing rule in the second blank and a copy of the first rule will be placed after the second rule.

6.3.3.5 Delete. This option deletes the entire selected rule if in the first column, or a top or system if in any other column. To delete a rule, place the cursor in the first column of the rule to be deleted and type a <D>. To delete a system or top, place the cursor in the column where the desired system or top is located and type a <D>.

6.3.3.6 Restore. This option restores the last deleted rule if the cursor is in the first column, or a top or system if the cursor is in any other column.

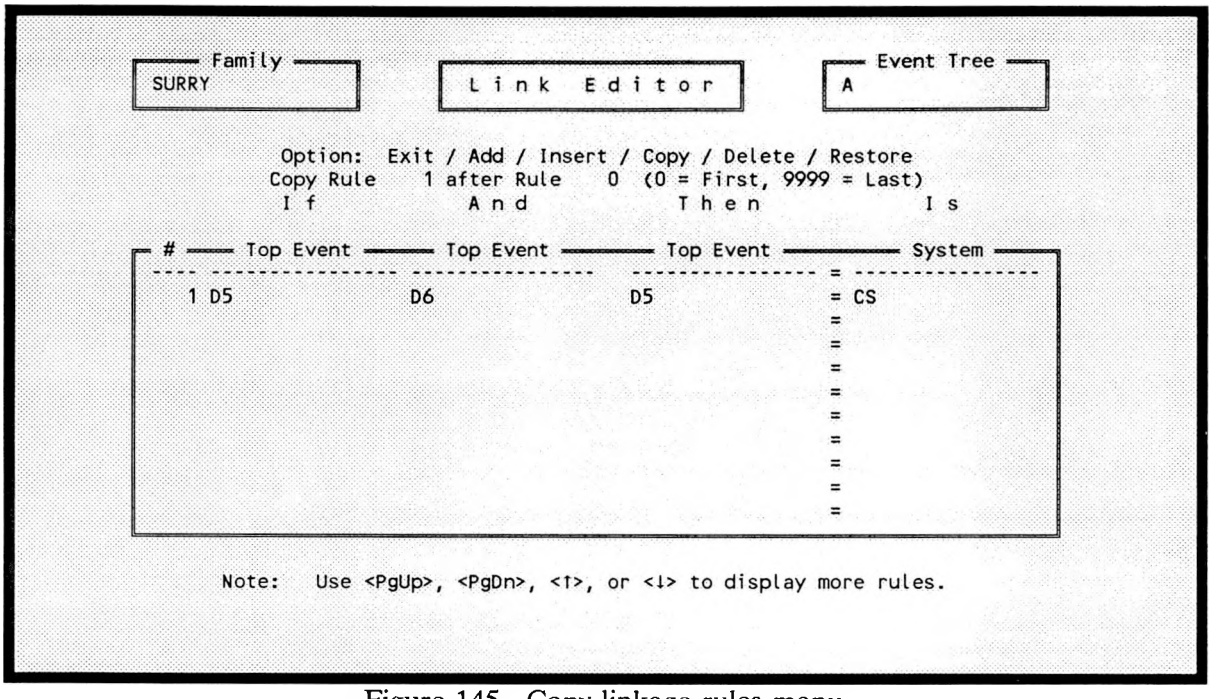


Figure 145. Copy linkage rules menu.

NOTE: **Please note there is a one to one relationship between replaced tops and replacement tops/system. In other words, a group of systems cannot replace one top and group of tops cannot be replaced by one system. An example of a multi-branch failure is shown in Figure 146.**

6.4 Plot Tree (HP)

This option allows you to plot HP graphics files or generate HPGL formatted files. When you invoke this option, Figure 147 will be displayed. All available plot files are displayed. The following options are available:

Exit	-	Returns you to the Event Tree Graphics System menu (Figure 126).
Plotter	-	Sends the specified file to the plotter.
Hpgl	-	Converts the .HPP files.
Delete	-	Deletes the plotter file.

In addition, the following function keys are available:

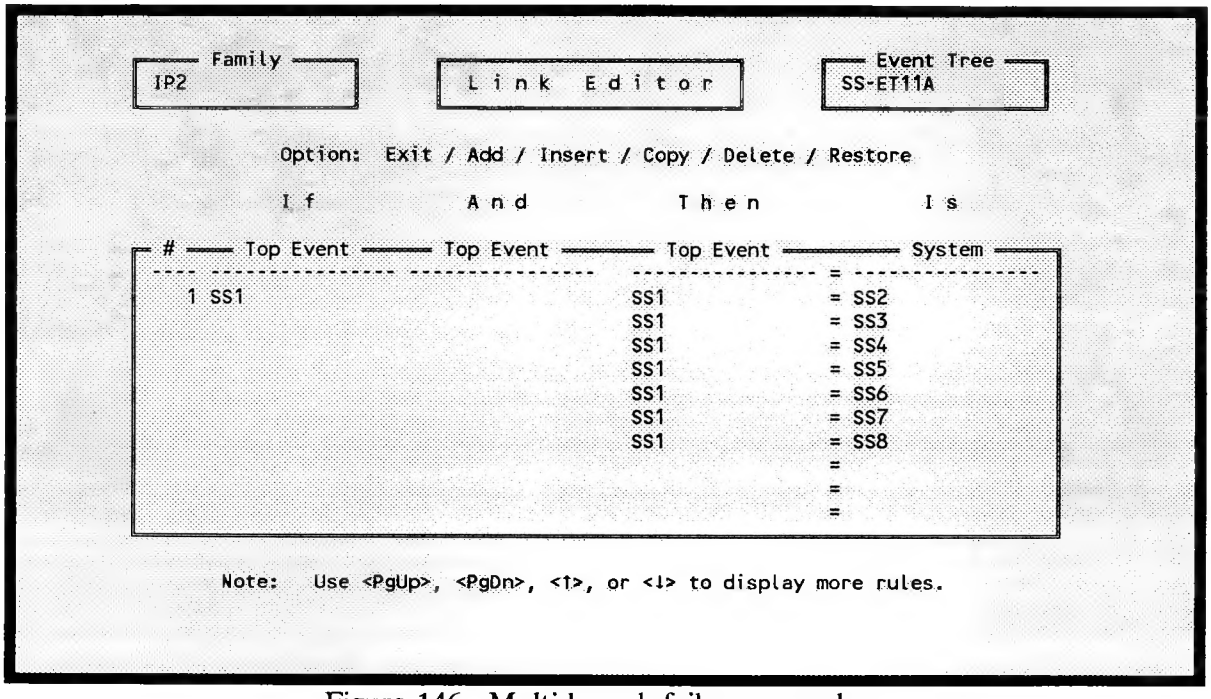


Figure 146. Multi-branch failure example.

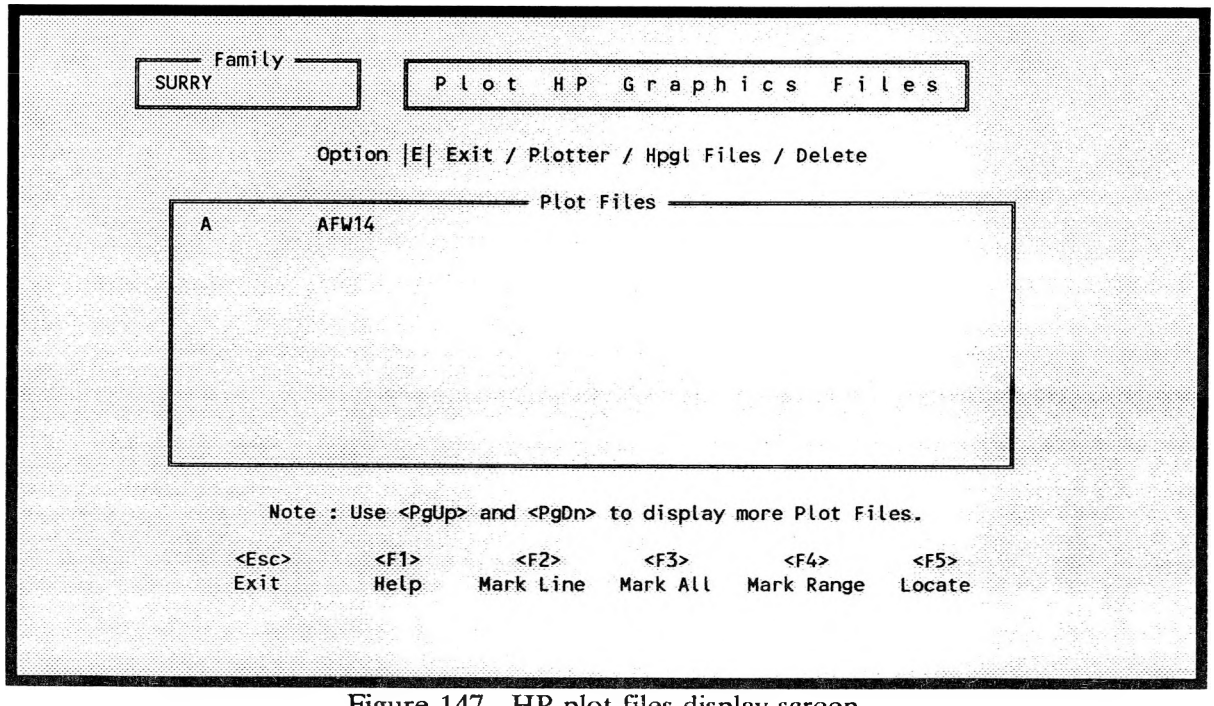


Figure 147. HP plot files display screen.

<Esc> - Returns you to the previous screen.

<F1> - Displays on-line help messages.

<F2> - Marks a line of files for further processing. When you mark a line, an asterisk will appear in front of the first file name.

<F3> - Marks all the displayed files for further processing.

<F4> - Allows you to mark a range of files for further processing.

<F5> - Allows you to locate a specific file for further processing. When you invoke this function, Figure 148 will be displayed. Enter the file name to locate and press <Enter>. The specified file will be highlighted. If the file name does not exist, an error message will be displayed, and you will be returned to the previous screen.

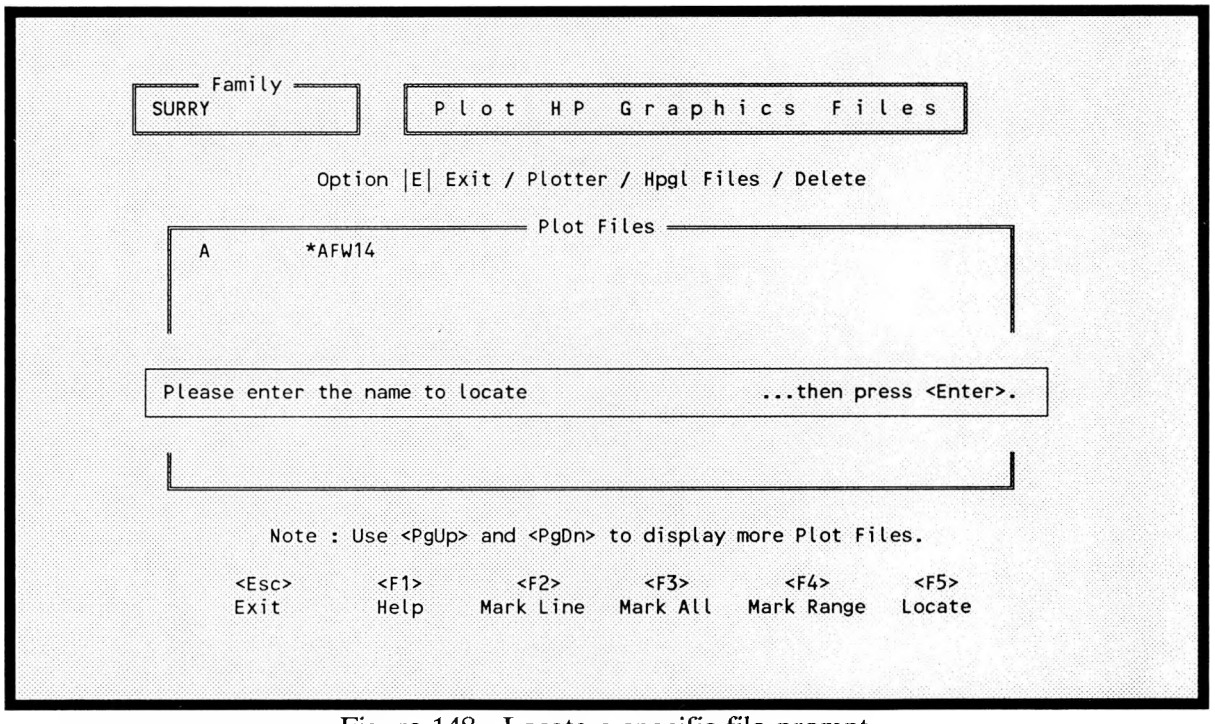


Figure 148. Locate a specific file prompt.

6.4.1 Exit

This option returns you to the previous screen (Figure 147).

6.4.2 Plotter

This option takes the .HPP files generated in the HP Plotter option in the graphics editor (Build) and sends that information (after a conversion) to the HP Pen Plotter (7475). If a plotter is not defined, you will receive the message **Plotter not attached.**

6.4.3 Hpgl Files

This option converts the .HPP files. This allows you to print the files later via batch processing or send the file to a printer which emulates (e.g., plotter cartridge in Wordperfect) the pen plotter.

6.4.4 Delete

This option allows you to delete a plot file from the current directory. To invoke this option enter a <D> in the option field, highlight the file to delete, and press <Enter>. The file will be deleted.

6.5 Rasterize Tree

This option allows you to rasterize event tree diagrams for printing. Obtaining a "laser printed" output of an event tree diagram is done in two steps, First, you must select which drawings to rasterize. Once the drawings have been rasterized, you must exit the program and use the DOS COPY command to send the files to the laser printer. This command is **Copy /b filename.ext.**

When you invoke this option, Figure 149 will be displayed. As shown, two options are available: Exit and Rasterize Event Trees. In addition, the following special function keys are available:

<Esc>	-	Returns you to the previous screen.
<F1>	-	Displays on-line help messages.
<F2>	-	Marks a line of files for further processing. When you mark a line, an asterisk will appear in front of the first file name.
<F3>	-	Marks all the displayed files for further processing.
<F4>	-	Allows you to mark a range of files for further processing.
<F5>	-	Allows you to locate a specific file for further processing. When you invoke this function, Figure 150 will be displayed. Enter the file name to locate and press <Enter>. The specified file will be highlighted.

If the file name does not exist, an error message will be displayed, and you will be returned to the previous screen.

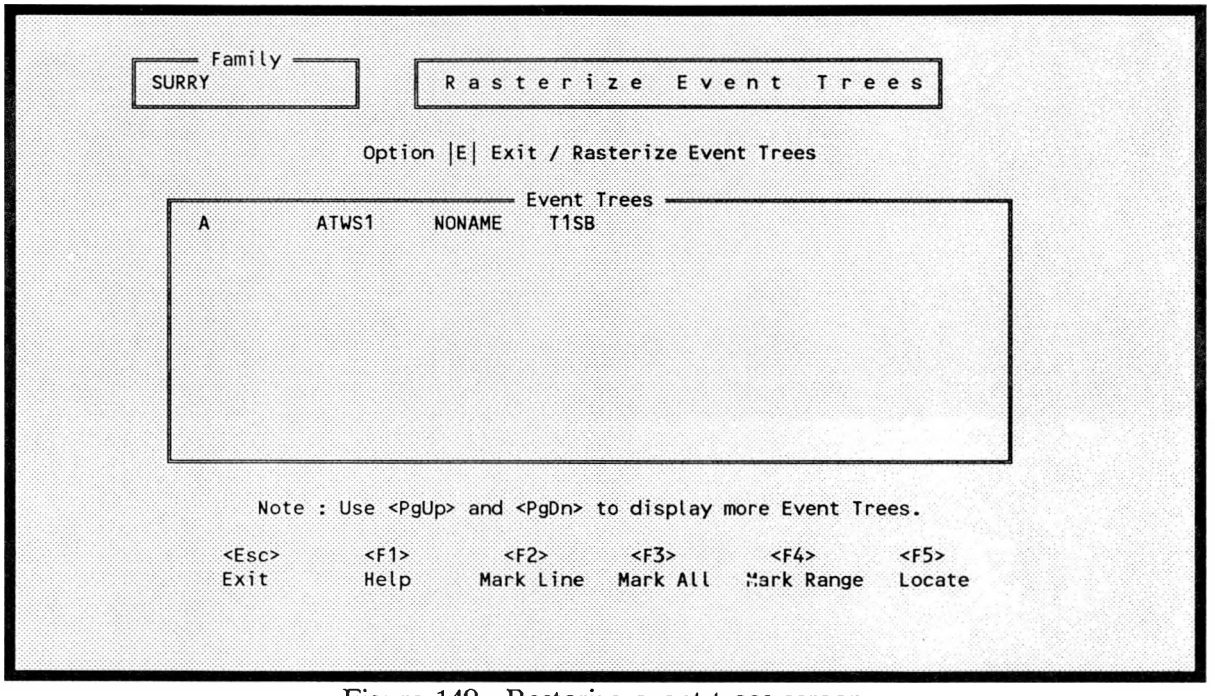


Figure 149. Rasterize event trees screen.

6.5.1 Exit

This option returns you to the Event Tree Graphics System menu (Figure 126). To invoke this option, enter an <E> in the option field and press <Enter>, or press the <Esc> key.

6.5.2 Rasterize Event Trees

This option rasterizes the selected event tree. To invoke this option, enter an <R> in the option field, highlight the file(s) to be rasterized, and press <Enter>. A message will be displayed telling you that the rasterizing is being performed. A percent complete will also be displayed so you can track progress. When complete another message will be displayed notifying you that the raster image has been created.

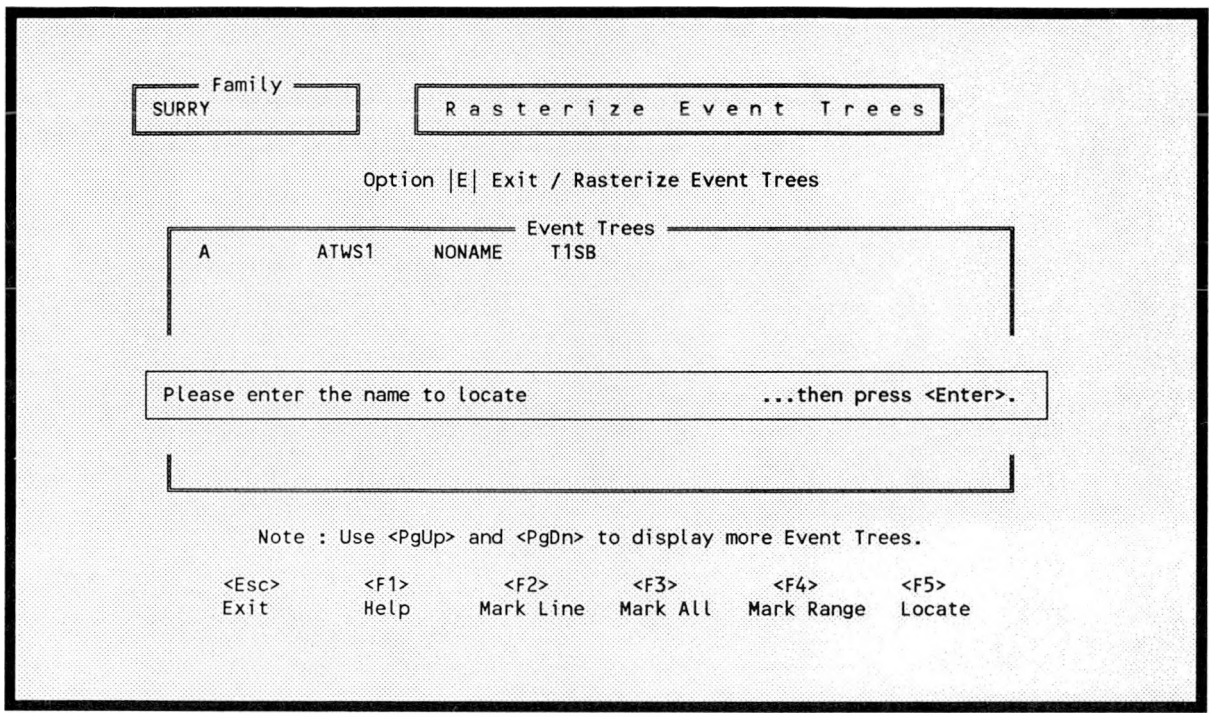


Figure 150. Locate an event tree using the <F5> key.

6.6 eXtract Event Trees

This option allows you to extract event trees from the system. When you invoke this option, Figure 151 will be displayed. On this screen all the event trees residing in the current directory are displayed. Four options are available: Exit, eXtract Trees, Clear Extracted Trees, and Display Extracted Trees. In addition, the following function keys are available:

<Esc> - Returns you to the previous screen.

<F1> - Displays on-line help messages.

<F2> - Marks a line of files for further processing. When you mark a line, an asterisk will appear in front of the first file name.

<F3> - Marks all the displayed files for further processing.

<F4> - Allows you to mark a range of files for further processing.

<F5> - Allows you to locate a specific file for further processing. When you invoke this function, Figure 152 will be displayed. Enter the file name to locate and press <Enter>. The specified file will be highlighted. If the file name does not exist, an error message will be displayed, and you will be returned to the previous screen.

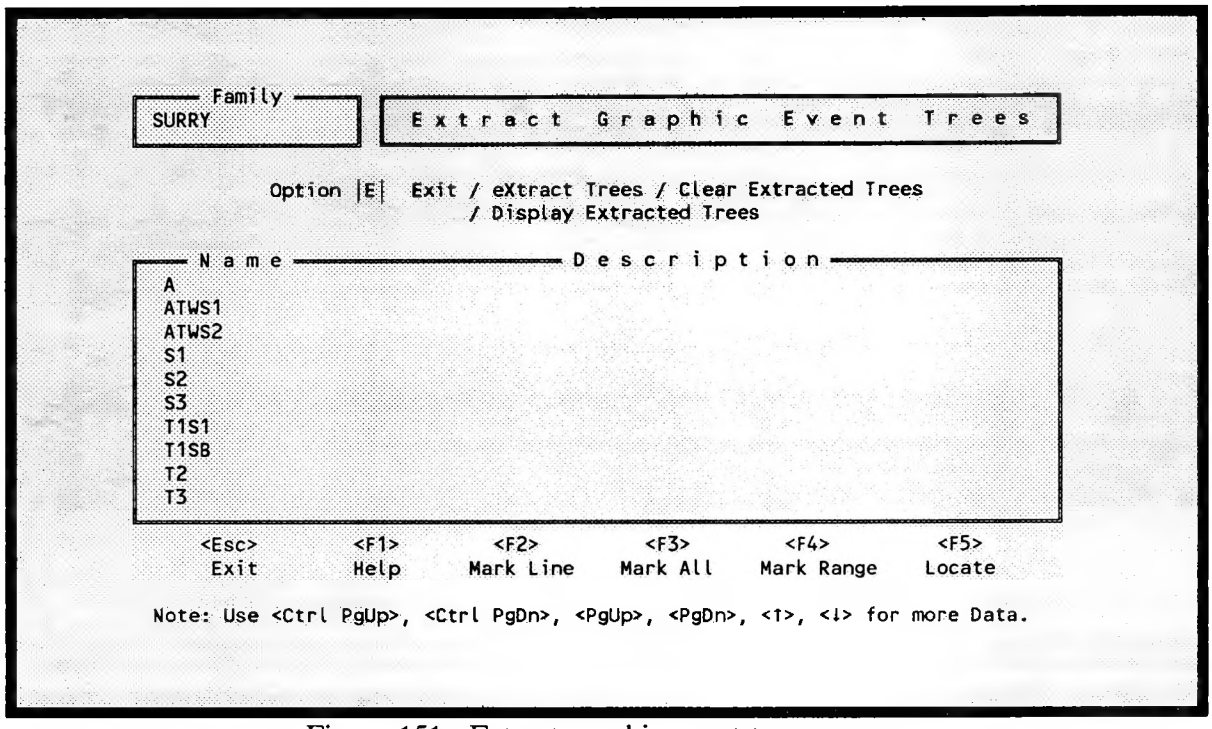


Figure 151. Extract graphic event trees screen.

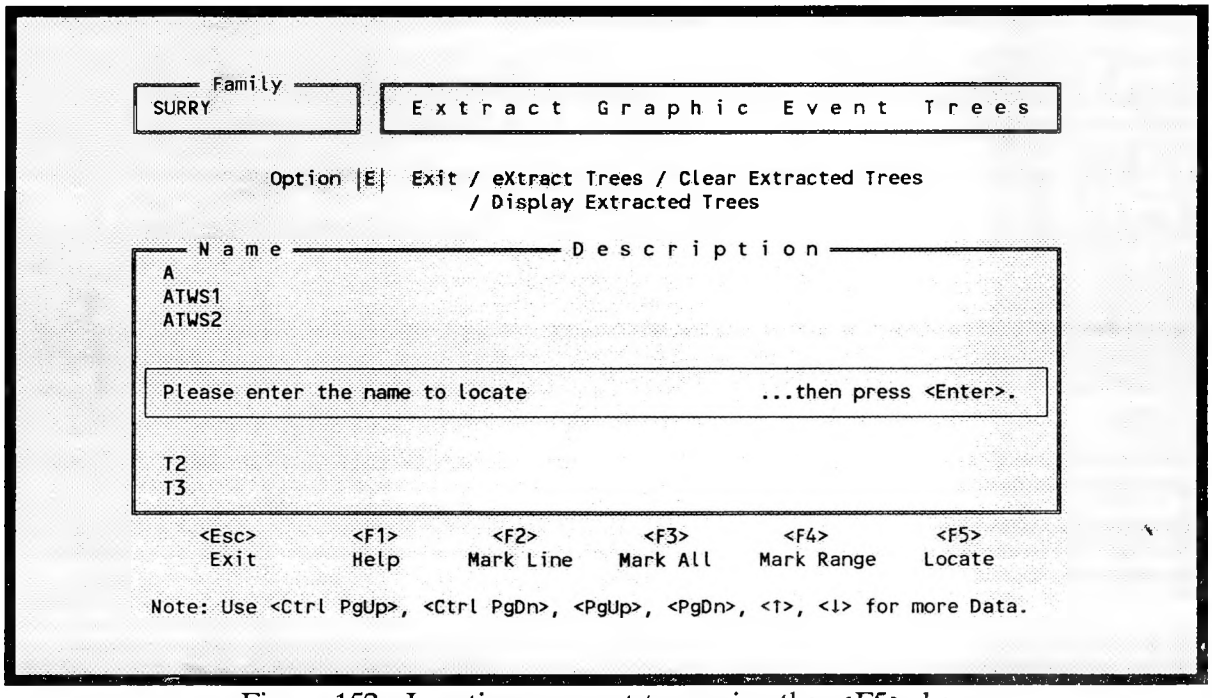


Figure 152. Locating an event tree using the <F5> key.

6.6.1 Exit

This option returns you to the Event Tress Graphics System menu (Figure 126). To invoke this option, enter an <E> in the option field and press <Enter>, or press the <Esc> key.

6.6.2 eXtract Trees

This option allows you to remove specific event trees from the data base. To invoke this option, enter an <X> in the option field, highlight the tree to be extracted or mark the trees to be extracted (using the function keys) and press <Enter>. A message will be displayed notifying you that the tree(s) was successfully extracted.

6.6.3 Clear Extracted Trees

This option allows you to clear all extracted trees from a file. To invoke this option, enter a <C> in the option field, highlight the file to be cleared or mark the files using the function keys, and press <Enter>. A warning screen will appear (Figure 153) telling you that all existing *.ETG files will be deleted. Enter a <Y> to delete or an <N> to terminate the process.

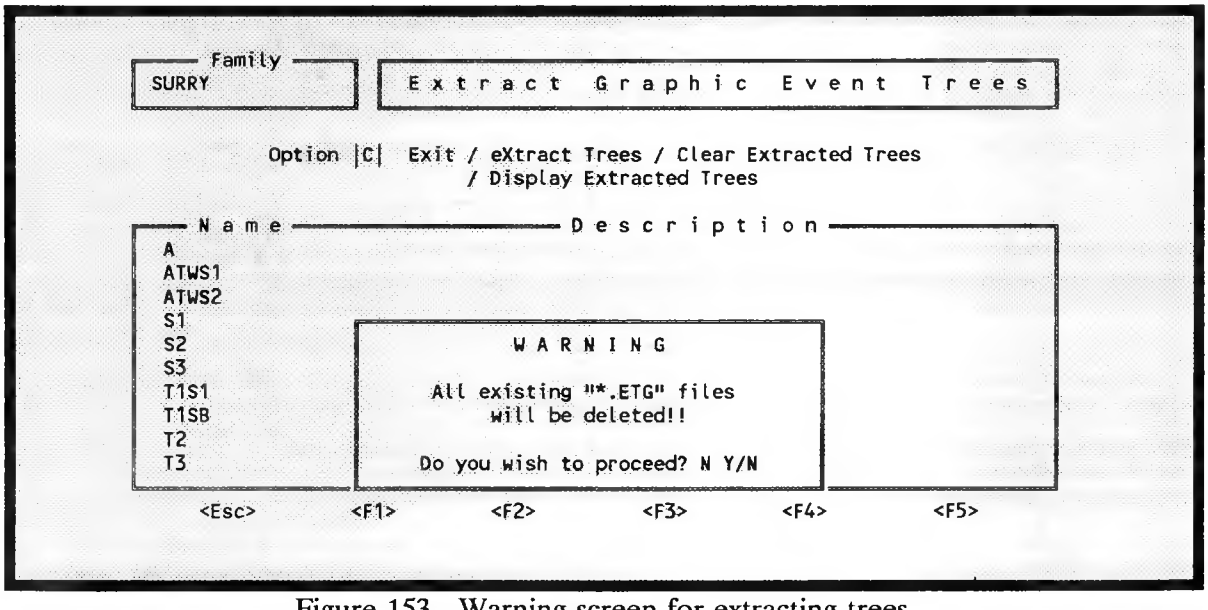


Figure 153. Warning screen for extracting trees.

6.6.4 Display Extracted Trees

This option allows you to display all the extracted trees to date. To invoke this option, enter a <D> in the option field and press <Enter>. A screen similar to the one shown in Figure 154 will be displayed. Press <Enter> to return to the previous screen.

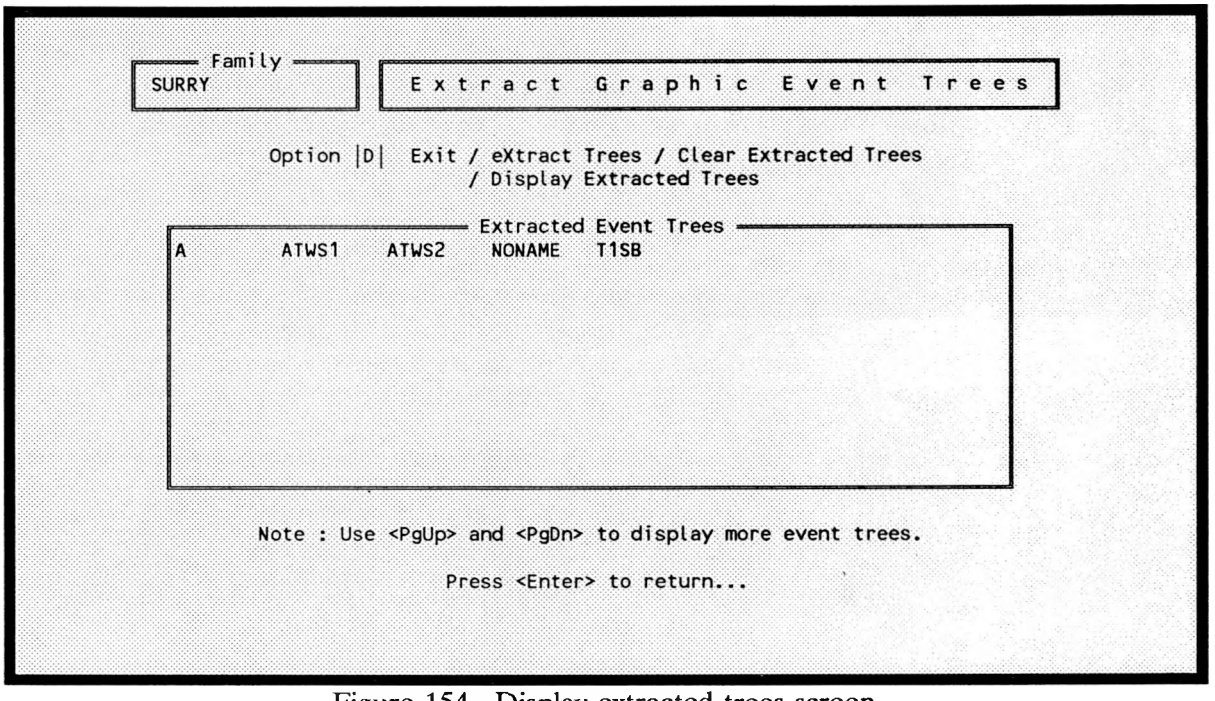


Figure 154. Display extracted trees screen.

6.7 Define Plotter Pens

This option allows you to assign colors to the plotter pens. When you invoke this option, a screen will be displayed showing 16 colors. Select the color to be mapped by positioning the cross hair over the desired color and pressing the left mouse button. You will then be prompted to **Enter number of pen >**. Enter the number of the pen that will contain the previously defined color. Continue this process until all pens have been defined. To terminate the process, position the cursor on the STOP symbol and press the left mouse button.

7.0 ANALYZE SEQUENCES

The Analyze Sequences option consists of the following five options:

1. Modify Event Data includes adding, deleting, and modifying change sets. Change sets contain information about the probability/class changes that are to be applied to basic events during event tree analysis. Within a change set you may modify selected event probabilities, and reset those event probabilities to the base case values. In addition, you may perform a base case update which takes all current basic event data and makes it the new base case data. The original base case data is overwritten in this process. You may also add, modify, or delete user-defined histograms.

2. Analyze Sequences includes updating the cut sets, quantifying the cut sets, running uncertainty analyses, and updating the event tree base case data.

3. Display Results presents the analyses in various report forms.

4. The Cut Set Editor provides the means to modify the event tree cut sets.

5. Link Event Trees allows you to define linkage rules and generate sequence logic.

Keys that you will frequently use are

<Esc>	Escape cancels your last choice and returns you to the previous screen.
<F1>	Help briefly explains the function of a field and may show you examples of data entered.
<F2>	Mark/Unmark tags items for use in the selected option.
<F3>	Clear All Marked events removes the marks (*) from the listed items. If no items are marked, this option will mark all of the items.
<F4>	Mark/Unmark range of items quickly tags large numbers of items for processing.
<F5>	Locate an item. This option will display a blank field in the center of the screen, and a message **Please enter name to locate** will appear. The user should enter the name to be located and then press <Enter>. This feature will place the highlight on the located name. If the required name is not found, then the next name in alphabetical order will be highlighted.

To invoke this option, highlight ANALYZE Sequences and press <Enter>. The event tree analysis main menu is shown in Figure 155. The options available from the event tree analysis main menu are: Exit, Modify Event Data, Analyze Sequences, Display Results, Cut Set Editor, and Link Event Trees. These options and their functions will be discussed in the following paragraphs.

7.1 Exit

The Event Tree Analysis screen appears with Exit as the default choice in the command line (see Figure 155). Press <Enter> to return to the IRRAS main menu.

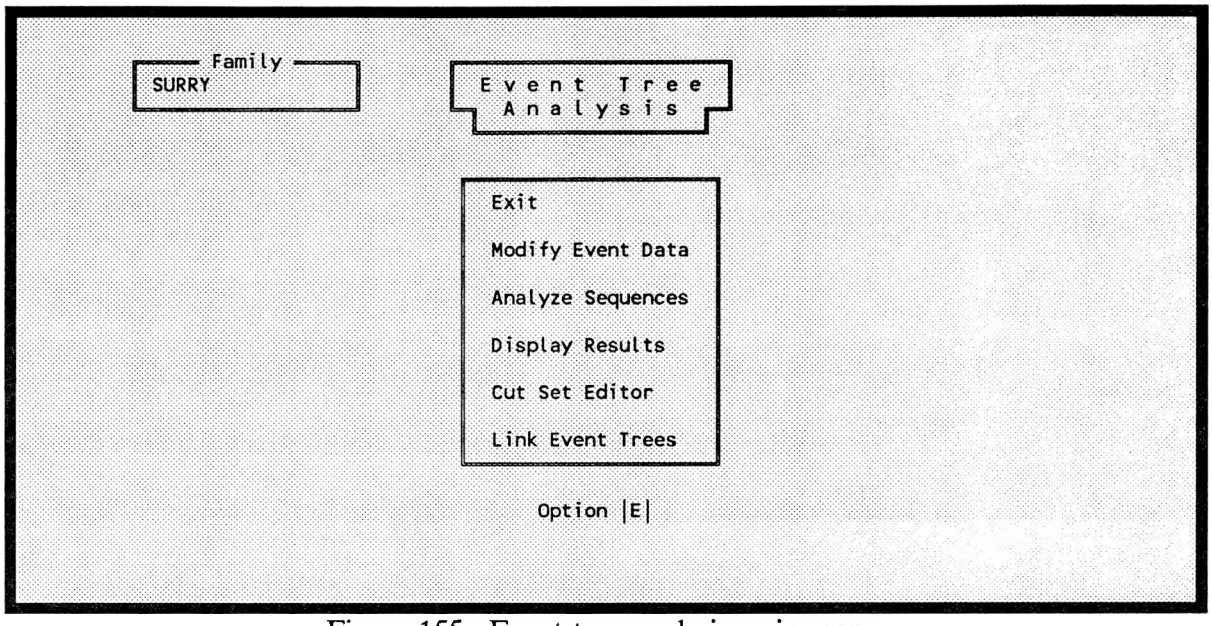


Figure 155. Event tree analysis main menu.

7.2 Modify Event Data

The event data can be manipulated to examine the changes in the probabilities of plant accidents and accident sequence failures based on basic events. Events can be added, modified, and deleted. The probability of events occurring can be recalculated. You may generate change sets to be applied to the basic events for later propagation through the fault tree cut sets. You may update the base case which will replace the present base case data with current data.

From the Modify Event Data option, the following operations may be performed: add, modify, or delete change sets; create and reset individual event probability changes; add a class probability change to a group of events; add, modify, or delete user-defined histograms; update the base case event data with the current case event data; generate new current case event data using the temporary modifications made to the marked change sets; and create reports that reflect the event modifications that currently exist within the data base.

Highlight Modify Event Data or type <M> to select this option and press <Enter>. The Change Sets screen shown in Figure 156 will be displayed. A change set is a set of sensitivity data modifications to be applied to the basic events. Change sets modify the current case basic event failure. A change set consists of probability and/or class changes for a group of basic events.

7.2.1 Exit

Type <E> in the option field and press <Enter>, or press the <Esc> key to return to the Event Tree Analysis screen (Figure 155).

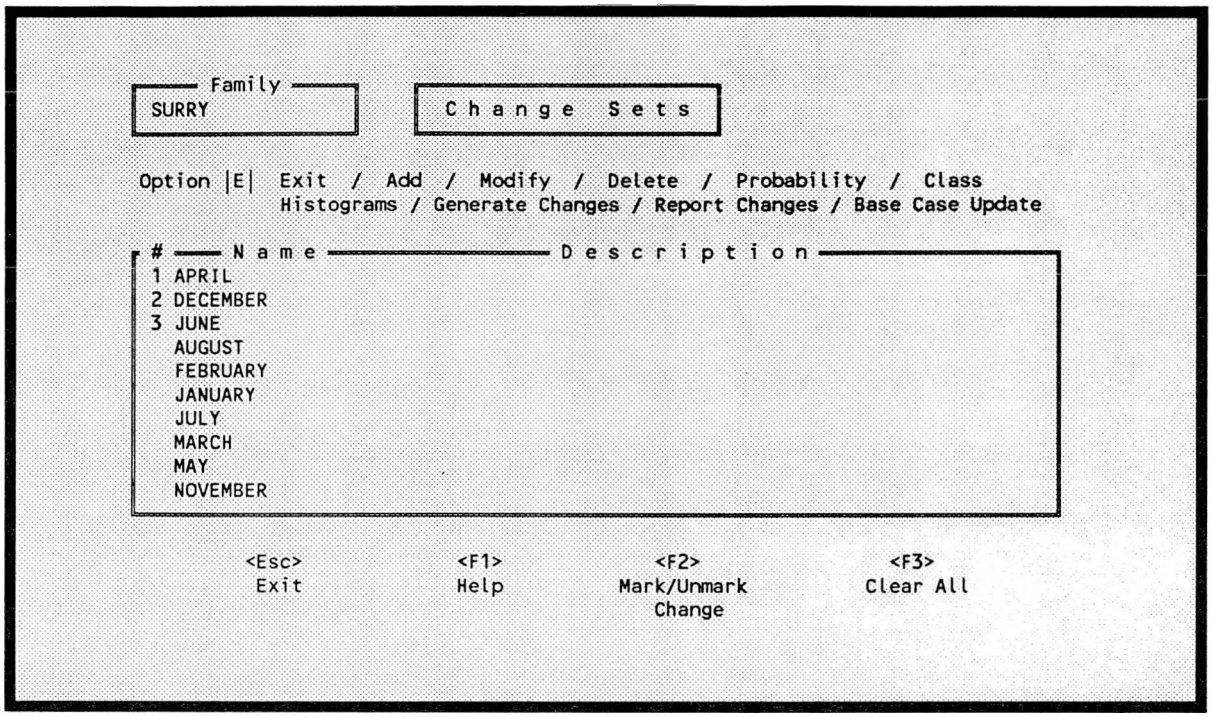


Figure 156. Change sets menu.

7.2.2 Add

The Add function is used to add a change set name and description to the data base. You supply a name (up to 16 characters) and a description (up to 60 characters). The current date is supplied by the system but you may change it if you wish.

To activate the add function, type <A> (Add) in the option field and press <Enter>. The Add Change Set screen shown in Figure 157 will be displayed.

To exit the Add Change Set screen without entering a new change set, press <Esc> or move the cursor to the option field by pressing <Home>, type <E> (Exit), and press <Enter>.

The Add Change Set screen is displayed with the <A> (Add) option as the default entry in the option field. After entering the desired data and pressing <Enter>, the message **New change record added** is displayed at the bottom of the screen and you are returned to the previous screen (Figure 158). If the name you entered already exists, the message **Duplicate change record name - not added** is displayed at the bottom of the screen.

To exit the Add Change Set screen, press <Esc> or move the cursor to the option field by pressing <Home>, type <E> (Exit), and press <Enter>.

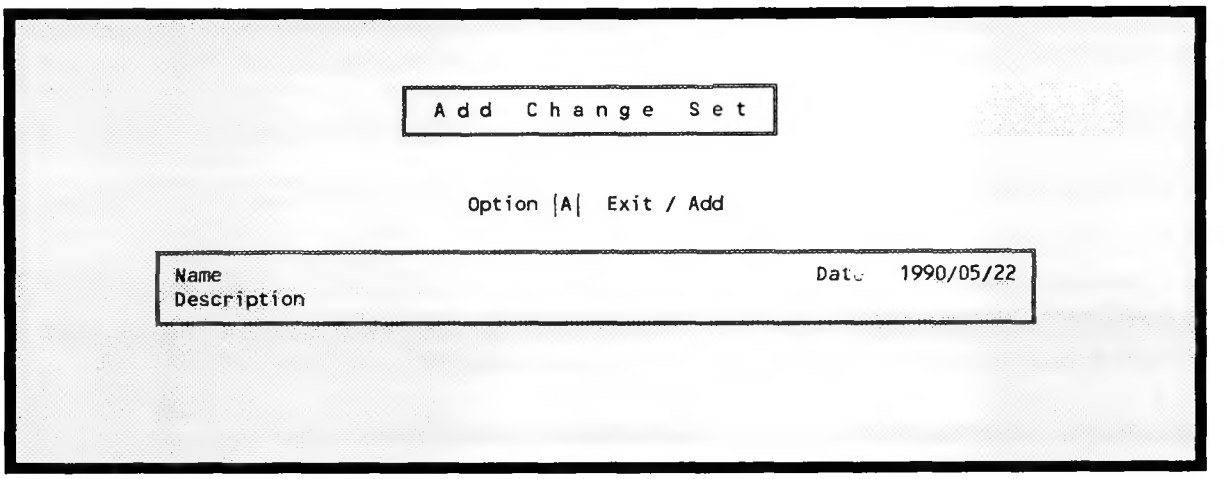


Figure 157. Add a change set.

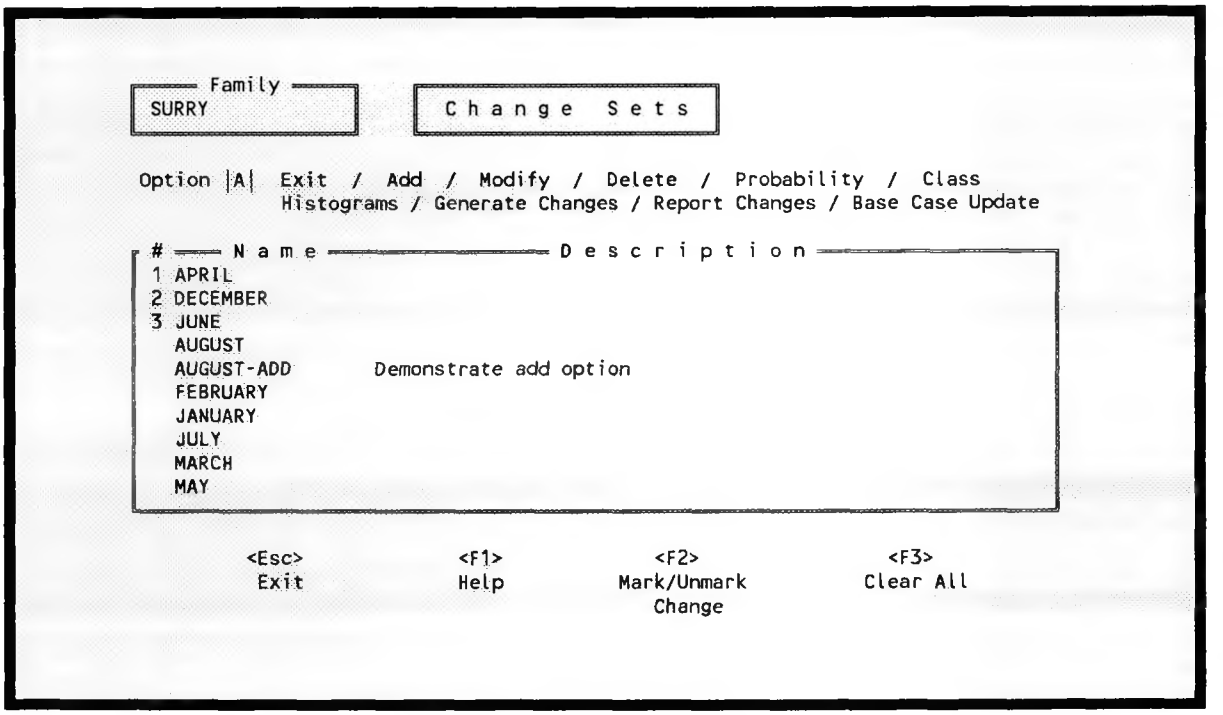


Figure 158. Change set screen after an Add.

7.2.3 Modify

This option allows you to modify the name, description, and/or date for an existing change set. To invoke this function, type <M> in the option field, highlight the change set you want to modify and press <Enter>. The Modify Change Set screen (shown in Figure 159) appears. If you do not indicate the change set you want to modify before pressing <Enter>, a message **Record must be highlighted first** appears.

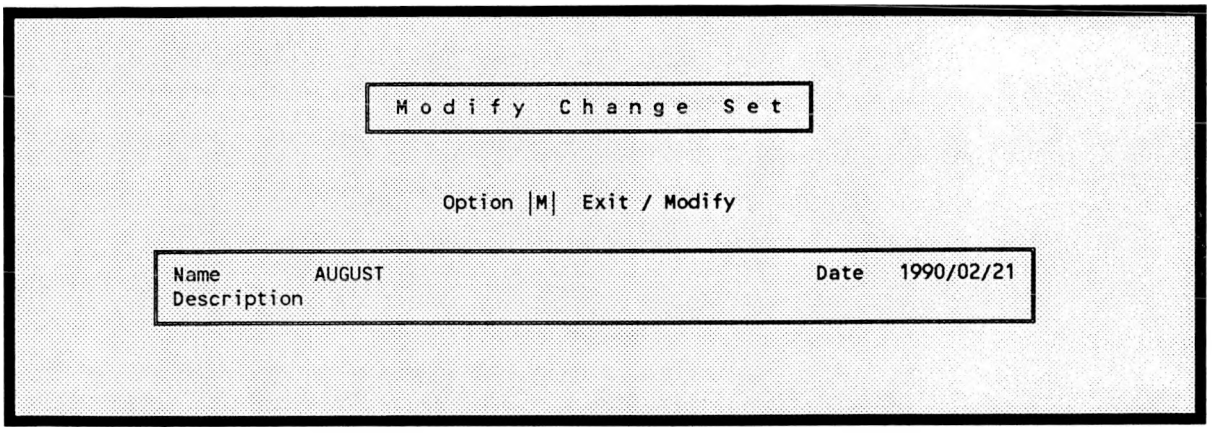


Figure 159. Modify change set.

Edit the name, description, and/or date and press <Enter> to execute the change. A confirmation message, **Record modified**, is displayed. To return to the Change Sets screen without modifying the change set, press <Esc> or move the cursor to the option field by pressing <Home>, type <E> (Exit), and press <Enter>.

7.2.4 Delete

This function is used to remove a change set from the data base. To invoke this function, type <D> in the option field, highlight the change set you wish to delete, and press <Enter>. The Delete Change Set screen (Figure 160) is displayed with a blank option field. Type <D> (Delete) and press <Enter> to remove the change set. You will be returned to the Change Sets screen, and a message **Change record deleted** is displayed. If you have not indicated the change set you want to delete before you press <Enter>, a message **Record must be highlighted first** appears.

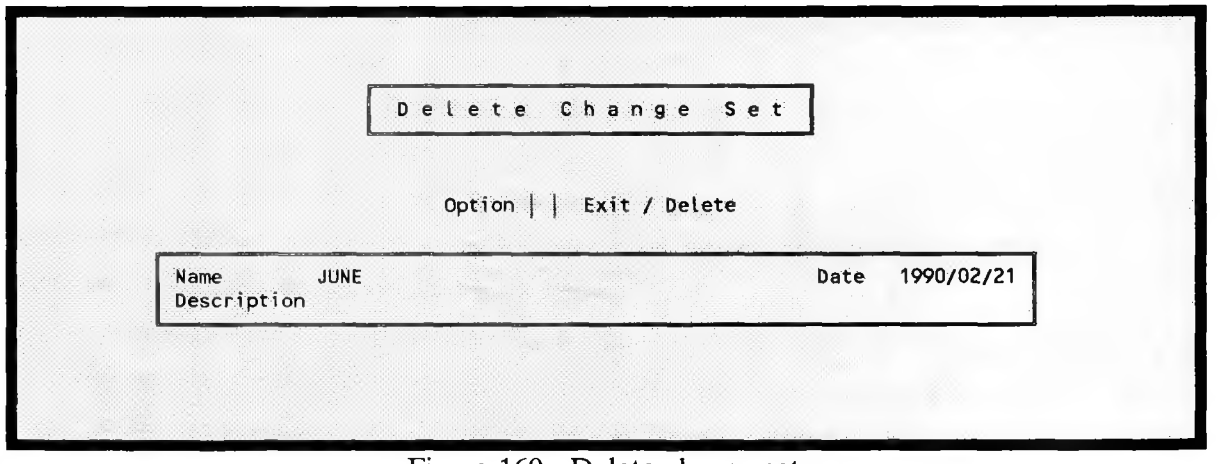


Figure 160. Delete change set.

If the option field is blank and you press <Enter>, you will return to the previous screen (Change Sets). To exit the Delete Change Set screen without deleting a record, press <Esc> or type <E> (Exit) in the option field, and press <Enter>. Either of these actions returns you to the previous screen and cancels the delete option.

7.2.5 Probability

This function allows you the flexibility to experiment with setting different basic event failure and uncertainty data. These data values may be set for a single event or for a specified group of events. The function also provides a reset option to set data values back to the base case values. To invoke this function, type <P> in the option field, highlight a change set, and press <Enter>. If you press <Enter> without highlighting a change set, the message **A line must be highlighted** will be displayed. If you receive this message, highlight an event and press <Enter>. The Select Event screen (Figure 161) appears with <P> (Probability) as the default option. The change set name is shown in the upper right corner in the Change Set box. Three options are available: Exit, Probability, and Reset probability to base.

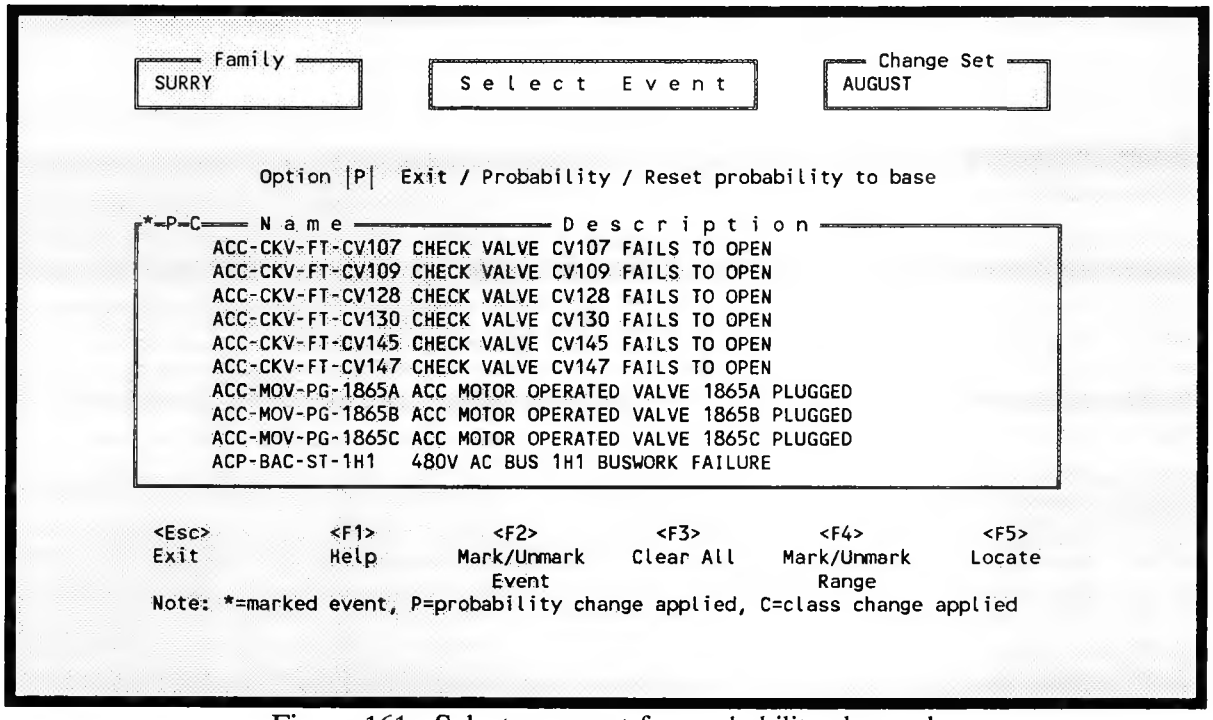


Figure 161. Select an event for probability changed.

7.2.5.1 Exit This function returns you to the Change Sets menu (Figure 156). To invoke this function, type <E> (Exit) in the option field and press <Enter>, or press the <Esc> key.

7.2.5.2 Probability This function allows you to modify the current uncertainty and failure data values. This current data can then be applied to the specified events for use during event tree analysis. The changes applied to basic event data may be for a single event or a group of marked events.

To invoke this function, type <P> (Probability) in the option field, highlight an event or mark a group of events (using F2 and/or F4 function keys) and press <Enter> (Figure 162). If only a single event has been selected then the Event Probability Changes screen (for a single event) will be displayed (Figure 163). The display is divided into three data areas: Event Attributes, Uncertainty Data, and Failure Data. The Event Attributes data display is for information only; no changes may be made to the data fields in this display. The Uncertainty Data/Failure Data areas display both the base case and current data values. You may change only the current data values.

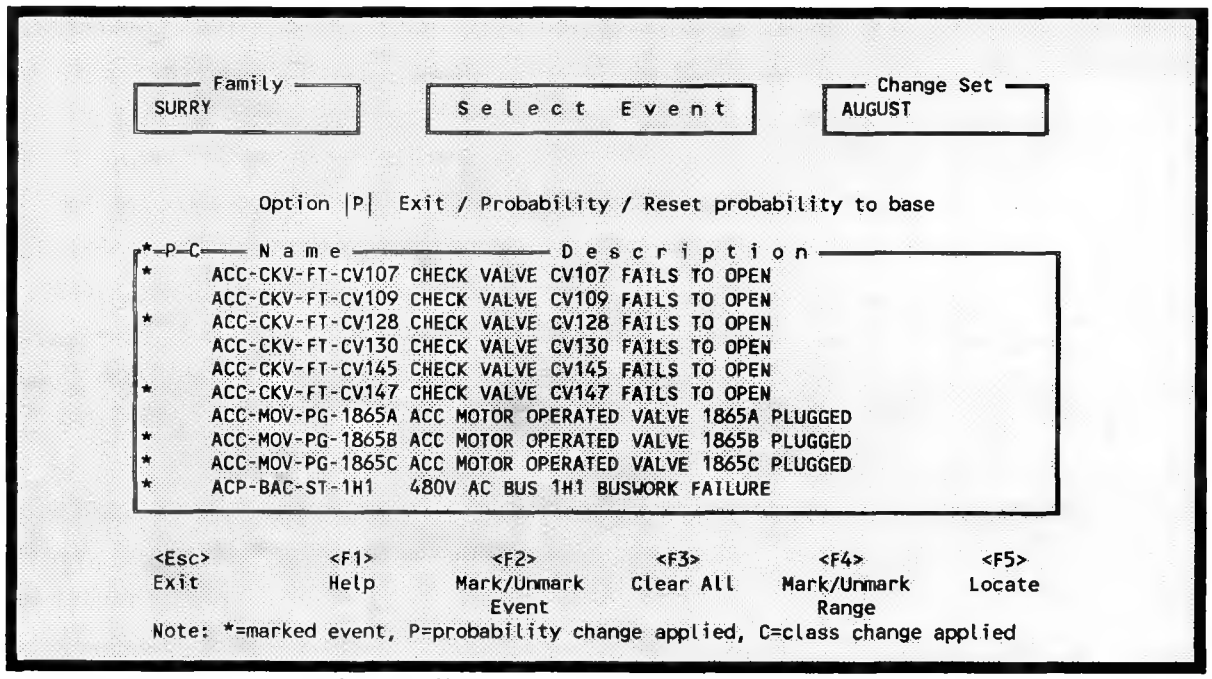


Figure 162. Events marked for modification.

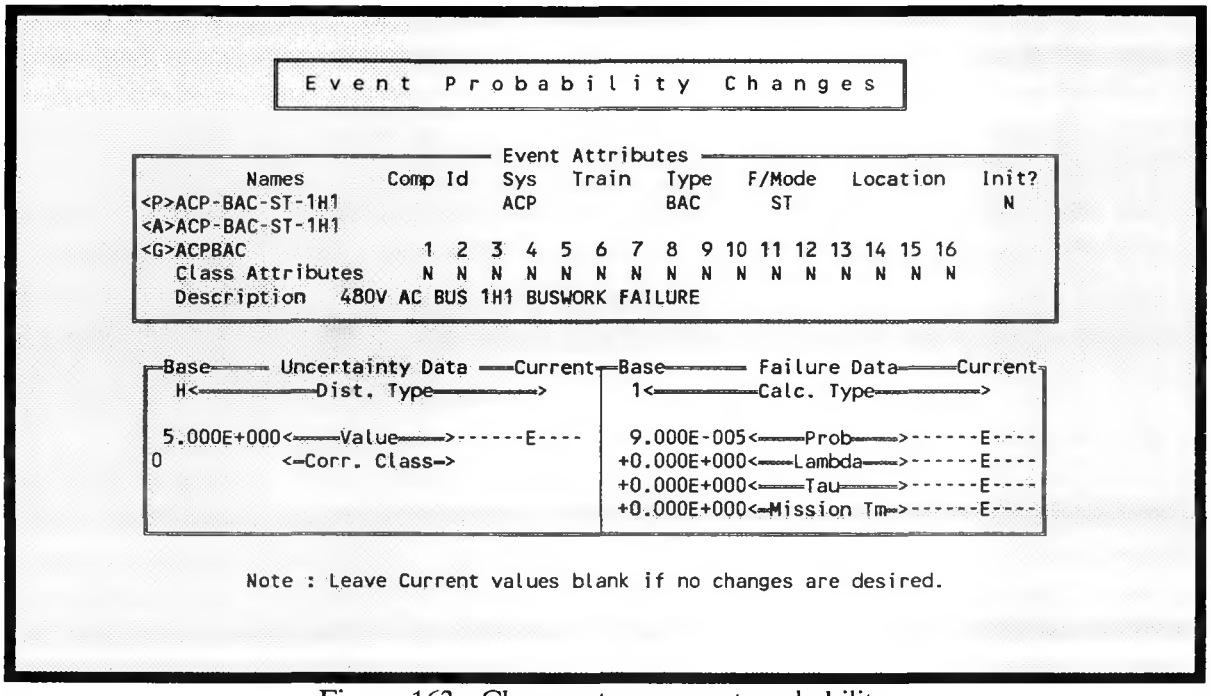


Figure 163. Changes to an event probability.

If a group of events were marked (Figure 162) using the function keys (F2 and F4) shown at the bottom of the screen, and the cursor was in the option field, then upon pressing <Enter> the Events Probability Changes (for a group of events) screen will be displayed (Figure 164). This display is divided into two data areas: Uncertainty Data and Failure Data. As before, both the base case and current data values are shown but you may only change the current values. The changes entered on this screen will be applied to all marked events.

The probability changes made are reflected on the Select Event display by showing a "P" to the left of the effected events. Probability changes have a higher priority than class changes. When both are applied to an event, the probability change will be used during fault tree analysis. This is indicated by flagging the effected events with a "P" and "c" as shown in Figure 165.

On the Event Probability Changes display, help screens are supplied for all data entry fields. Pressing function key F1 when the cursor is in any data entry field will cause the help screen to be displayed. Most of the help forms contain a data entry field at the bottom of the display. This field may be used to enter the desired data value, which will then be transferred into the proper data field upon exiting the help screen. Highlighting an item in the help form list will set the correct value in the data entry field.

Currently, there are seven predefined distribution types available. The predefined distribution types are normal, lognormal, beta, gamma, chi-squared, uniform, and exponential. In addition to these predefined distribution types, the user-defined histograms may be used. The default distribution

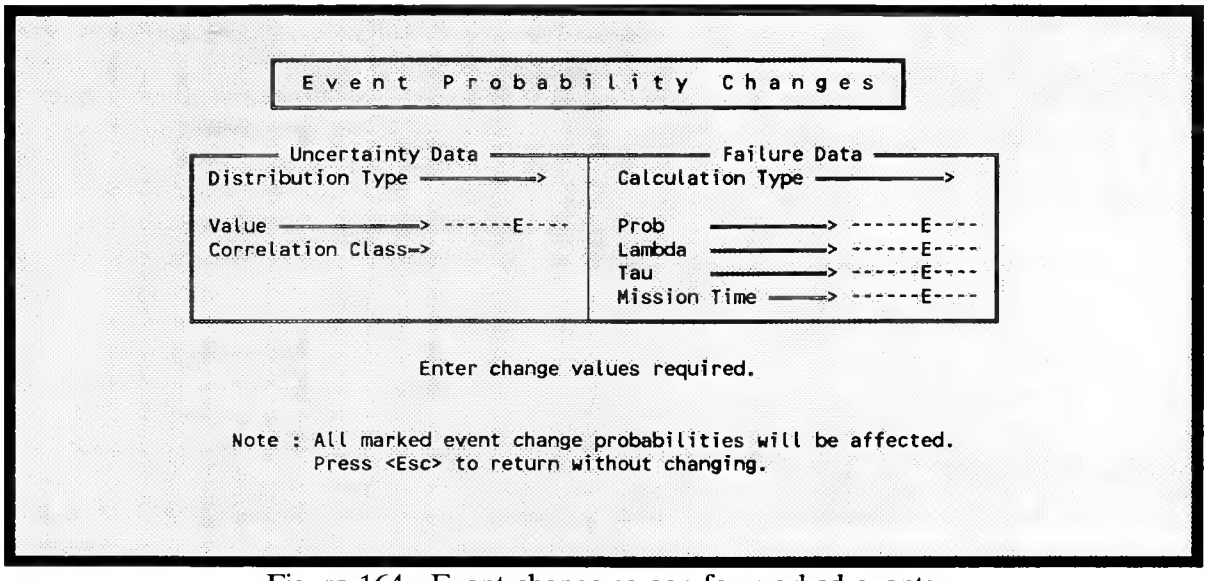


Figure 164. Event change screen for marked events.

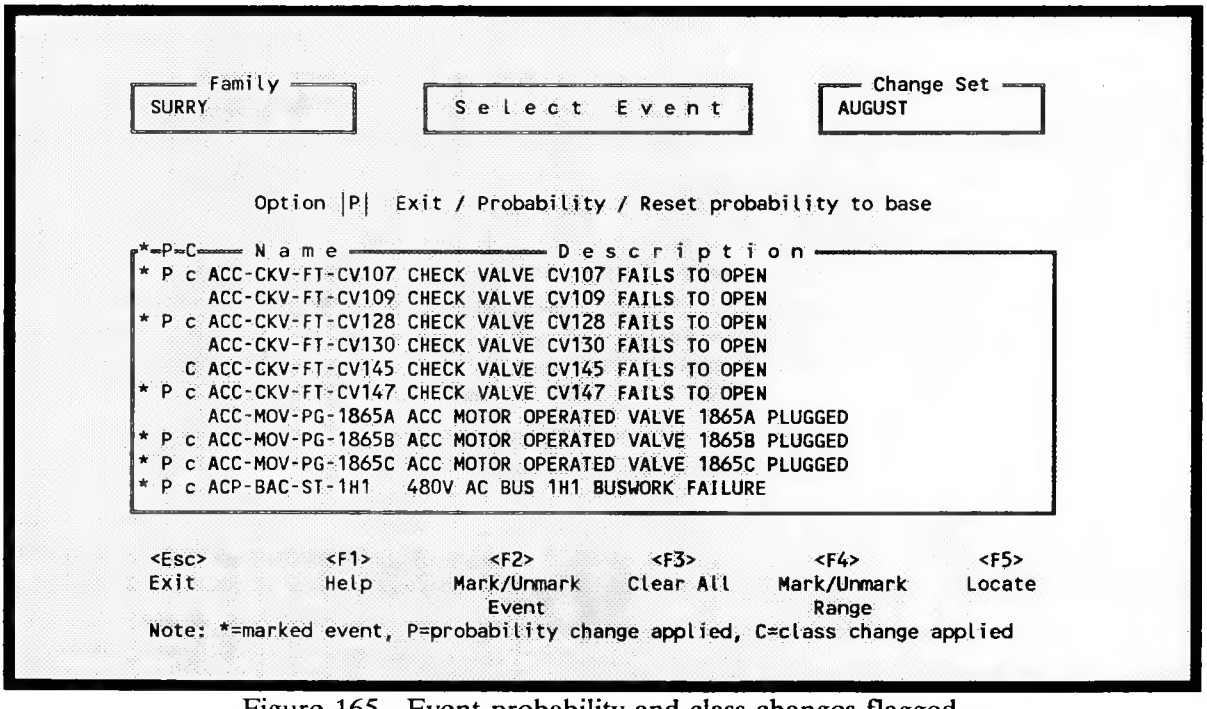


Figure 165. Event probability and class changes flagged.

type is the lognormal. Figure 166 shows the help form associated with the distribution type field on the Event Probability Changes screen. From this help screen, help forms associated with each of the seven predefined distribution types are available. To view these distribution help forms, you must press the <F1> key while the cursor is positioned on the desired distribution type.

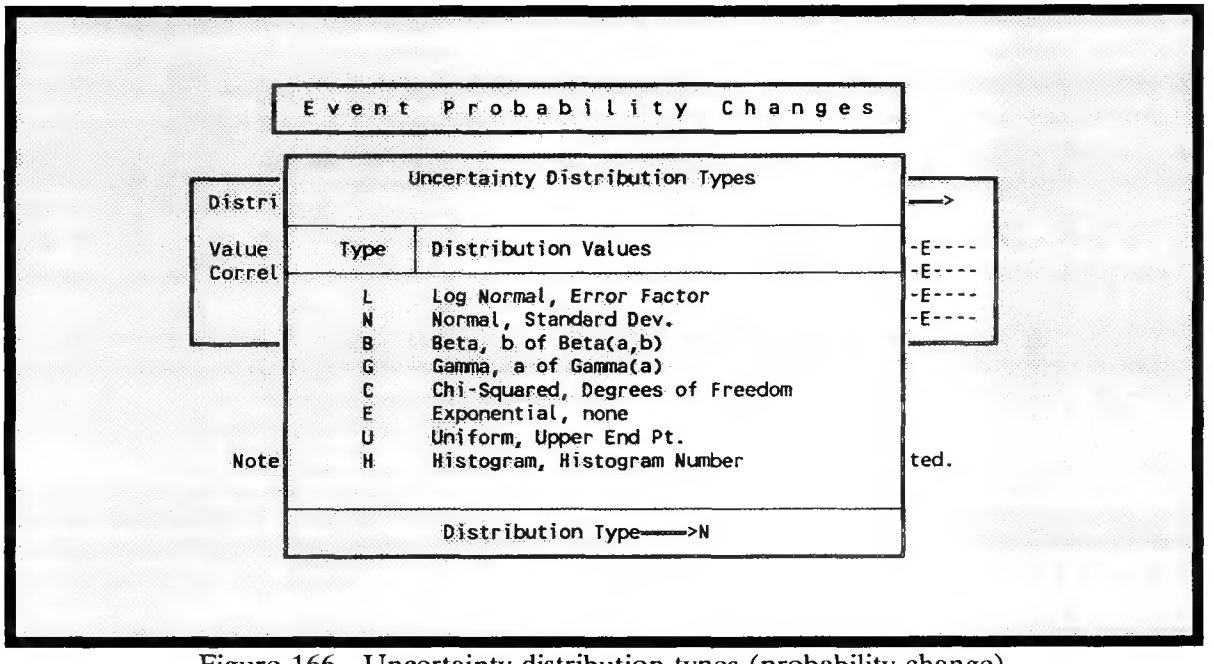


Figure 166. Uncertainty distribution types (probability change).

Correlation classes are used to account for data dependencies among like events in the data base. Correlation classes consist of four character upper-case values. A blank correlation class indicates that there are no data dependencies. When running the uncertainty analyses, the same sample value will be used for all basic events with the same correlation class.

In the Failure Data box the calculation type is a numerical reference to the calculation method to be used. There are eleven types numbered 1 through 9, T, and F. When your cursor is in the Calculation Type field, press <F1> for an explanation of these calculations. The help screen is shown in Figure 167.

The following symbols are used in the equations for calculating failure probability

P = failure probability of the basic event,
p = failure probability,
bp = base case failure probability,
L = failure rate per hour, input as lambda,
t_m = mission time expressed in hours, input as a default, and
T = average time to repair expressed in hours, input as tau.

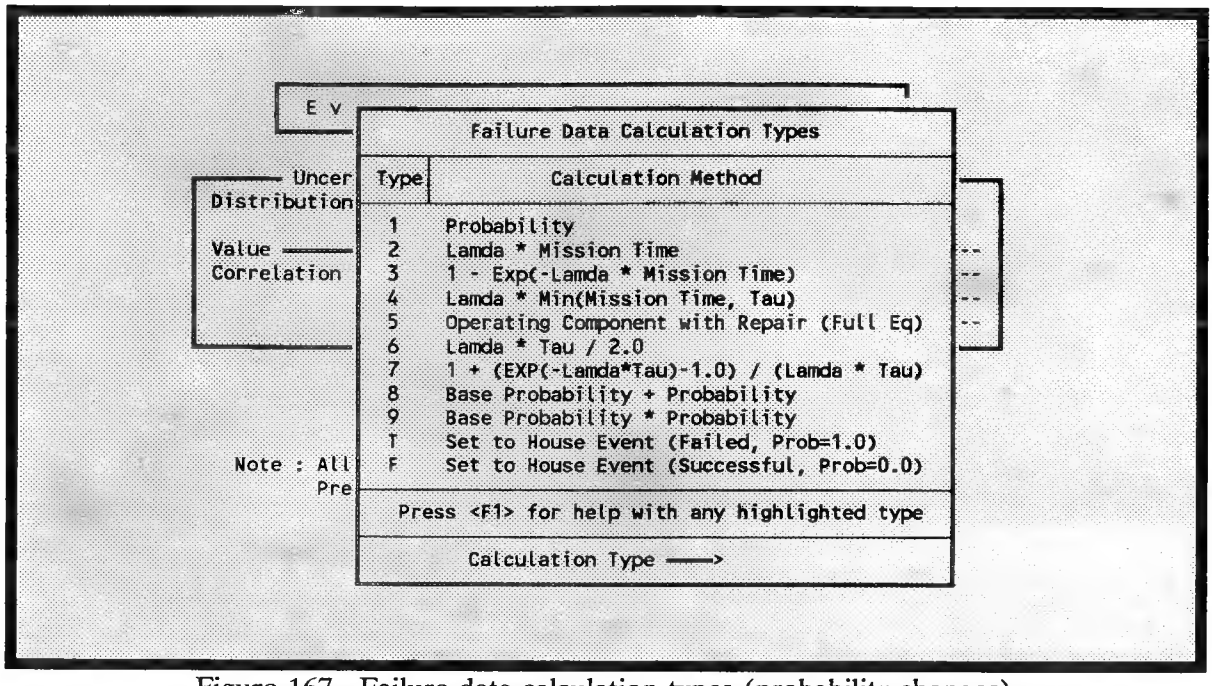


Figure 167. Failure data calculation types (probability changes).

An equation for each calculation type follows:

Calculation Type 1 $P = p$.

Calculation Type 2 $P = L * t_m$.

Calculation Type 3 $P = 1 - \text{Exp}(-L * t_m)$.

Calculation Type 4 $P = L * \text{Min}(t_m, T)$.

Calculation Type 5 $P = ([L * T] / [1 + \{L * T\}]) * (1 - \text{EXP}[-\{(L + 1) / T\} * t_m])$.

Calculation Type 6 $P = L * (T/2)$.

Calculation Type 7 $P = 1 + (\text{EXP}[-L * T] - 1) / (L * T)$.

Calculation Type 8 $P = bp + p$.

Calculation Type 9 $P = bp * p$.

Calculation Type T $P = 1.0$ (House event - failed).

Calculation Type F $P = 0.0$ (house event - successful).

7.2.5.3 Reset Probability to Base. This option allows you to reset the probability changes (not class changes) for a selected event back to the base case values. You may reset probability changes for a single event, a group of events, or all events.

To reset the probability change for a single event, type an <R> (Reset probabilities) in the option field, highlight the desired event name and then press <Enter>. The message **"Reset HIGHLIGHTED probability change? (Y/N)"** is displayed at the bottom of the screen. To reset the probability back to the base case value enter <Y> for yes. To terminate the reset operation enter <N> for no.

To reset the probability changes for a group of events, mark the desired events using the F2 and/or F4 keys, type an <R> in the option field and press <Enter>. The message **"Reset ALL marked probability changes? (Y/N)"** is displayed at the bottom of the screen. Press <Y> to complete the reset operation, or <N> to terminate the reset operation.

To reset all event probabilities to the base case values, clear all existing marks with the F3 key, type an <R> in the option field and press <Enter>. The message **"Reset ALL probability changes? (Y/N)"** is displayed at the bottom of the screen. Press <Y> to perform the reset operation, or <N> to terminate the reset operation.

7.2.6 Class Change

This option allows you to change event data parameters for a specified grouping of events. To invoke this option, enter a <C> in the option field, highlight the desired change set, and press <Enter>. If you do not highlight a change set before pressing <Enter>, the message **A line must be highlighted** will be displayed at the bottom of the screen. The screen display for this option is shown in Figure 168. All data fields in the three data areas are data entry fields. The event class is defined by entering data in the Event Attributes data fields. The more of these fields that are filled in the finer the class definition becomes.

The class changes that you request are reflected on the Select Event display by showing a "C" to the left of the affected events (Figure 169). Probability changes have a higher priority than class changes. When both are applied to an event, the probability change will be used during event tree analysis. This is indicated by flagging the affected events with a "P" and "c" as shown in Figure 169.

On the Class Change display, help screens are supplied for all data entry fields. Pressing function key F1 when the cursor is in any data entry field will cause the help screen to be displayed. Figure 170 and Figure 171 show the help screens for Distribution Type and Calculation Type, respectively. Most of the help forms in this situation contain a data entry field at the bottom of the display. This field may be used to enter the desired data value, which will then be transferred into the proper data field upon exiting the help screen. Highlighting an item in the help form list will set the correct value in the data entry field.

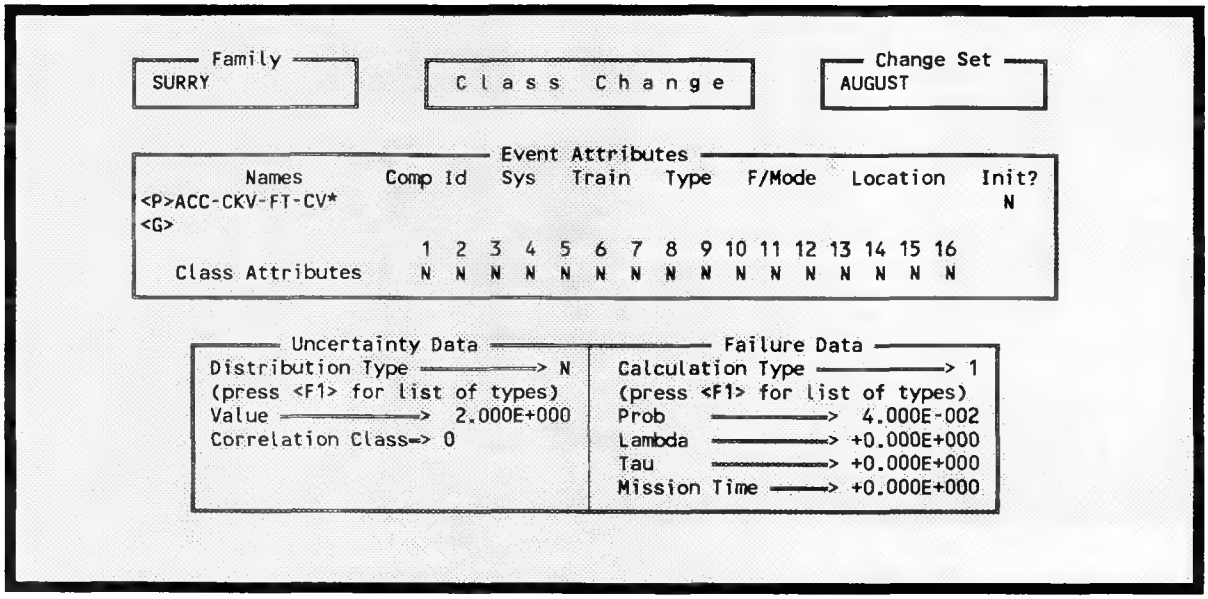


Figure 168. Class change event modify.

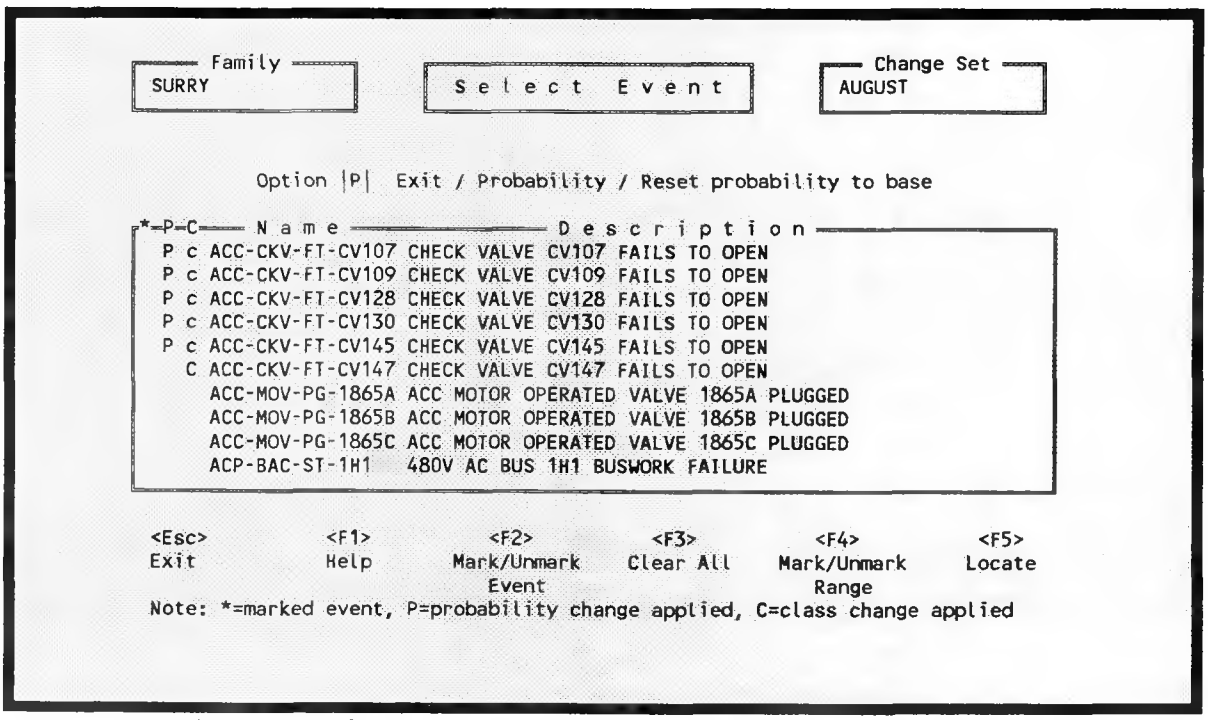


Figure 169. Class and probability changes applied to select events.

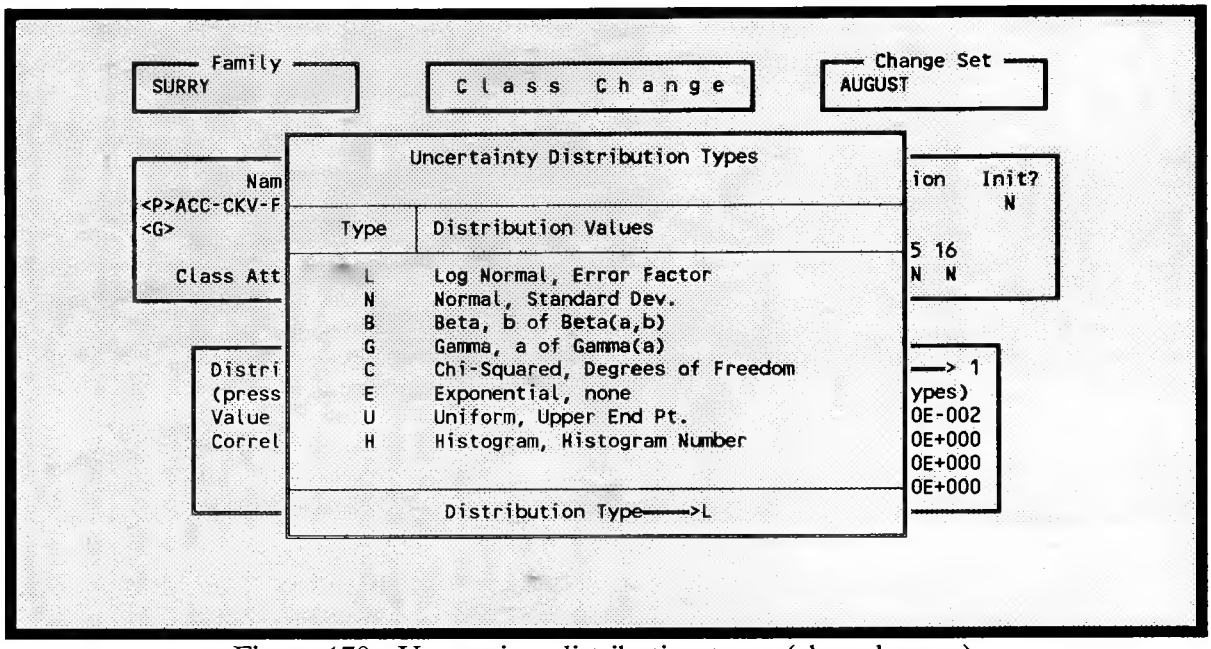


Figure 170. Uncertainty distribution types (class changes).

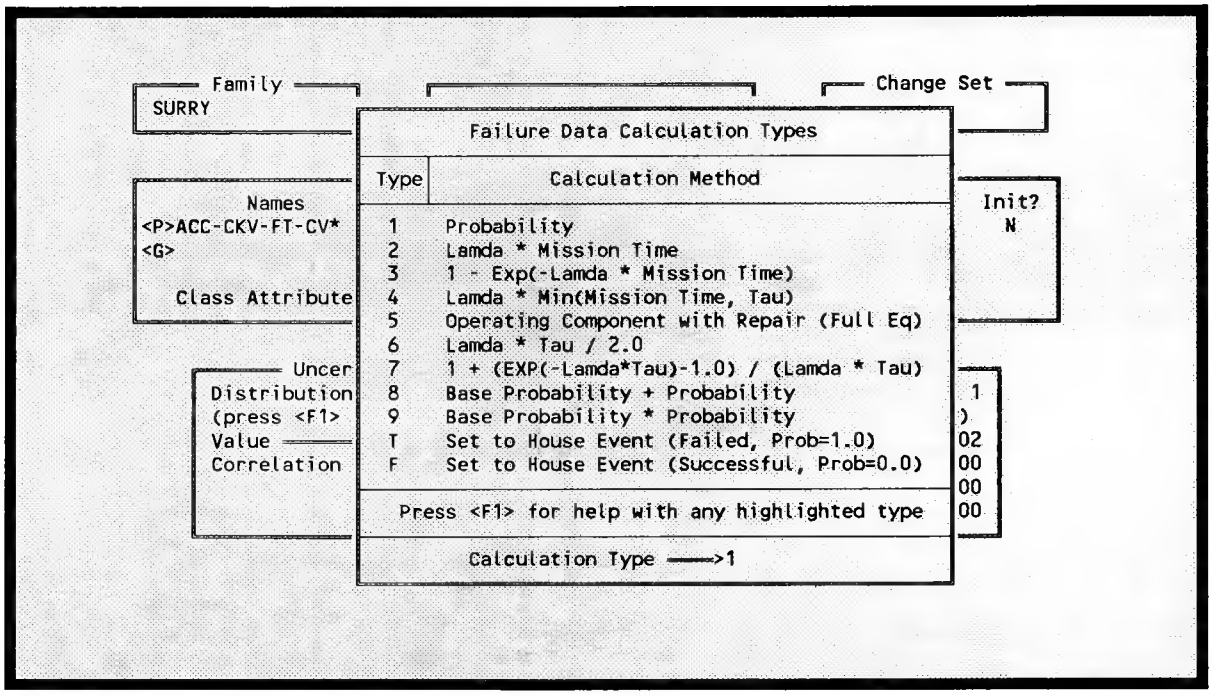


Figure 171. Failure data calculation types (class changes).

Currently, there are seven predefined distribution types available. The predefined distribution types are normal, lognormal, beta, gamma, chi-squared, uniform, and exponential. In addition to these predefined distribution types, the user defined histograms may be used. The default distribution type is the lognormal. Figure 170 shows the help form associated with the distribution type field on the Event Probability Changes screen. From this help screen, help forms associated with each of the seven predefined distribution types are available. To view these distribution help forms, press the <F1> key while the cursor is positioned on the desired distribution type.

Correlation classes are used to account for data dependencies among like events in the data base. Correlation classes consist of four character upper-case values. A blank correlation class indicates that there are no data dependencies. When running the uncertainty analyses, the same sample value will be used for all basic events with the same correlation class.

In the Failure Data box the calculation type is a numerical reference to the calculation method to be used. There are eleven types numbered 1 through 9, T, and F. When your cursor is in the Calculation Type field, press <F1> for an explanation of these calculations. The screen shown in Figure 171 will be displayed.

The following symbols are used in the equations for calculating failure probability

P = failure probability of the basic event,
p = failure probability,
bp = base case failure probability,
L = failure rate per hour, input as lambda,
t_m = mission time expressed in hours, input as a default, and
T = average time to repair expressed in hours, input as tau.

An equation for each calculation type follows:

Calculation Type 1 $P = p$.

Calculation Type 2 $P = L * t_m$.

Calculation Type 3 $P = 1 - \text{Exp}(-L * t_m)$.

Calculation Type 4 $P = L * \text{Min}(t_m, T)$.

Calculation Type 5 $P = ([L * T] / [1 + \{L * T\}]) * (1 - \text{EXP}[-\{(L + 1) / T\} * t_m])$.

Calculation Type 6 $P = L * (T/2)$.

Calculation Type 7 $P = 1 + (\text{EXP}[-L * T] - 1) / (L * T)$.

Calculation Type 8 $P = bp + p$.

Calculation Type 9 P = bp * p.

Calculation Type T P = 1.0 (House event - failed).

Calculation Type F P = 0.0 (house event - successful).

To reset a class change set, enter the class change option and blank out the name fields, and press <Enter>. This will return the event data parameters to the base case values and return you to the Select Event screen.

7.2.7 User-Defined Histograms

This option allows you to create, modify, and delete user-defined histograms. This is a useful option for allowing you to input your own distribution for a variable that can not be expressed with one of the predefined distribution types. The Edit Histograms screen (Figure 172) displays the names of all the currently existing histograms. A unique number is associated with each histogram and is listed on the Edit Histograms screen to the left of the histogram name. The format type is also provided. There are two format types: percentage format and range format. If the histogram was entered in a percent format, a "P" will be displayed in the type field. If the histogram was entered in a range format, an "R" will appear in the type field. To activate this option, type an <H> (Histograms) in the option field of the Change Sets screen and press <Enter>. Figure 172 will be displayed.

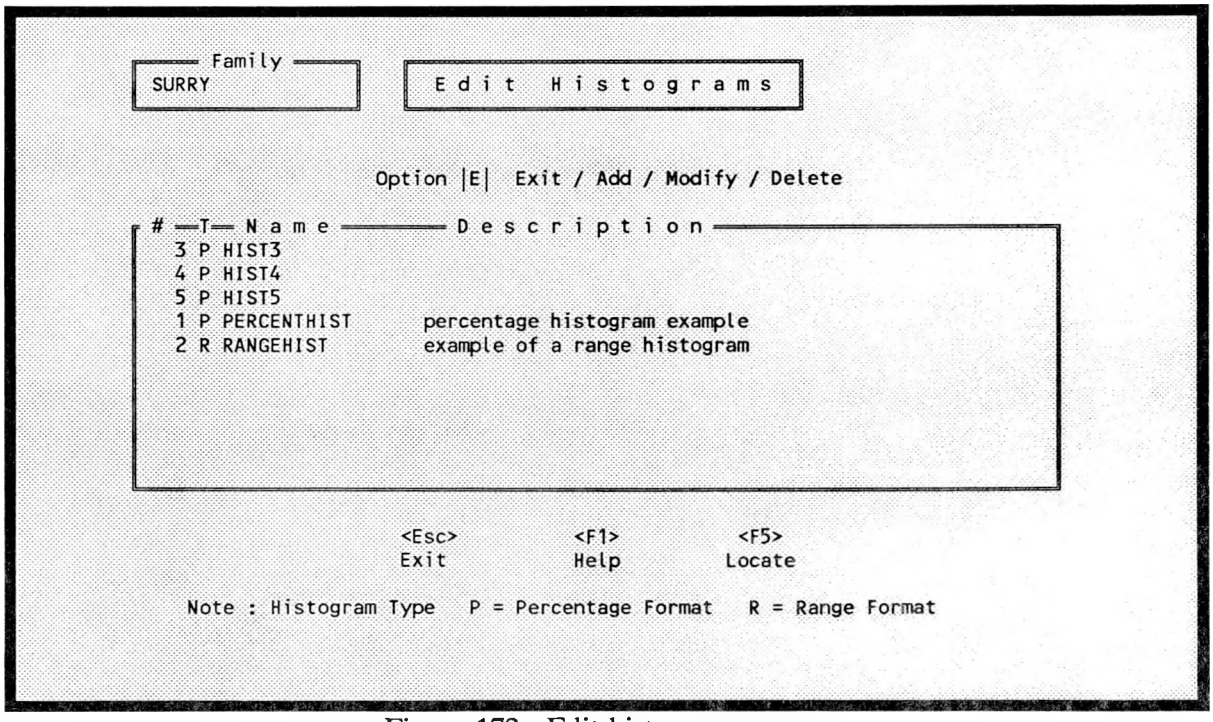


Figure 172. Edit histograms menu.

7.2.7.1 Exit. To return to the Change Sets screen, type an <E> (Exit) in the option field and press <Enter>, or press the <Esc> key.

7.2.7.2 Add Histograms. This option allows you to create a user-defined distribution type. To add a new histogram to the data base, type an <A> (Add) in the option field and press <Enter>. At this point, Figure 173 is displayed and you are given the choice of adding the histogram data in either a percentage format or in a range format.

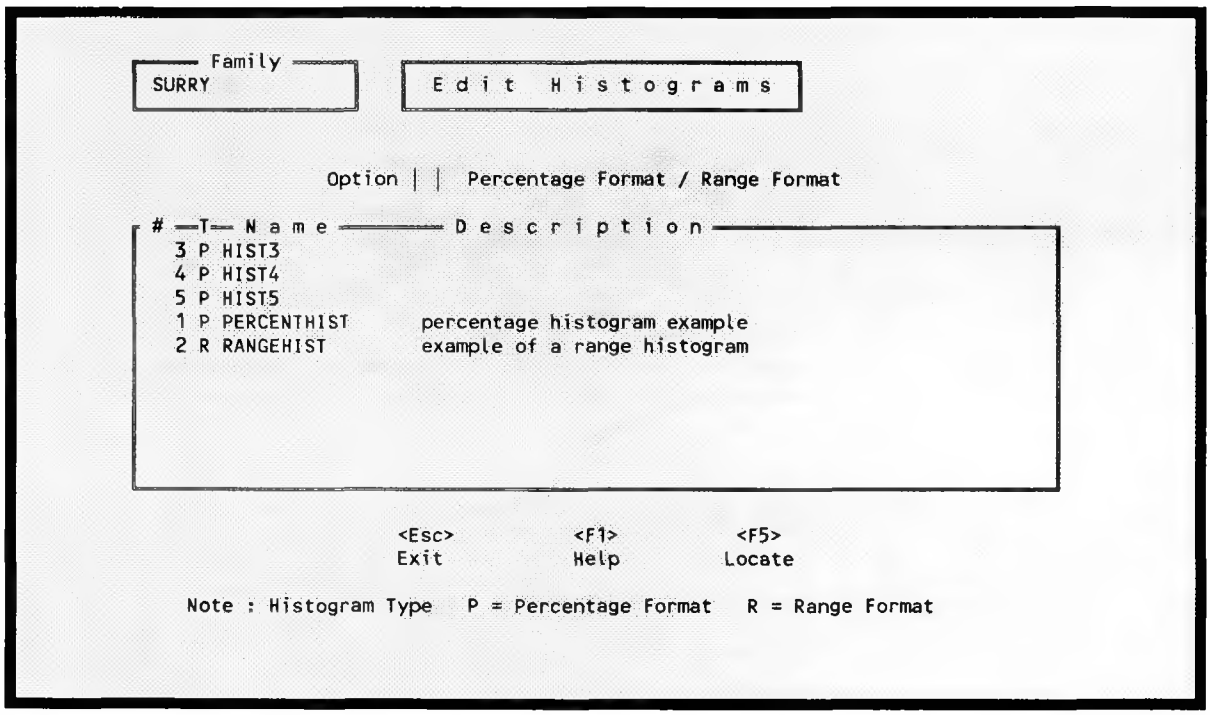


Figure 173. Select percentage or range format for the histogram.

If you wish to add a percentage histogram to the data base, enter a <P> (Percentage) in the option field. Entering a <P> in the option field will cause a Percentage Format Histogram screen to appear. On this screen you should type in a name and a description for the new histogram. Then you should enter in the percentages for the histogram along with the corresponding probabilities. Figure 174 demonstrates how to enter a percentage histogram, given that 15% of the data points have a probability of 0.04, 46% of the data points have a probability of 0.12, 36% of the data points have a probability of 0.02, and the remaining 3% of the data points have a probability of 0.8. The sum of the percentages entered must total 100% in order for the histogram to be accepted as a valid percentage histogram (Figure 175). In the upper right-hand area of the screen is a box that shows the current sum of the percentages which have been input and the remaining percentage needed to reach the 100% total.

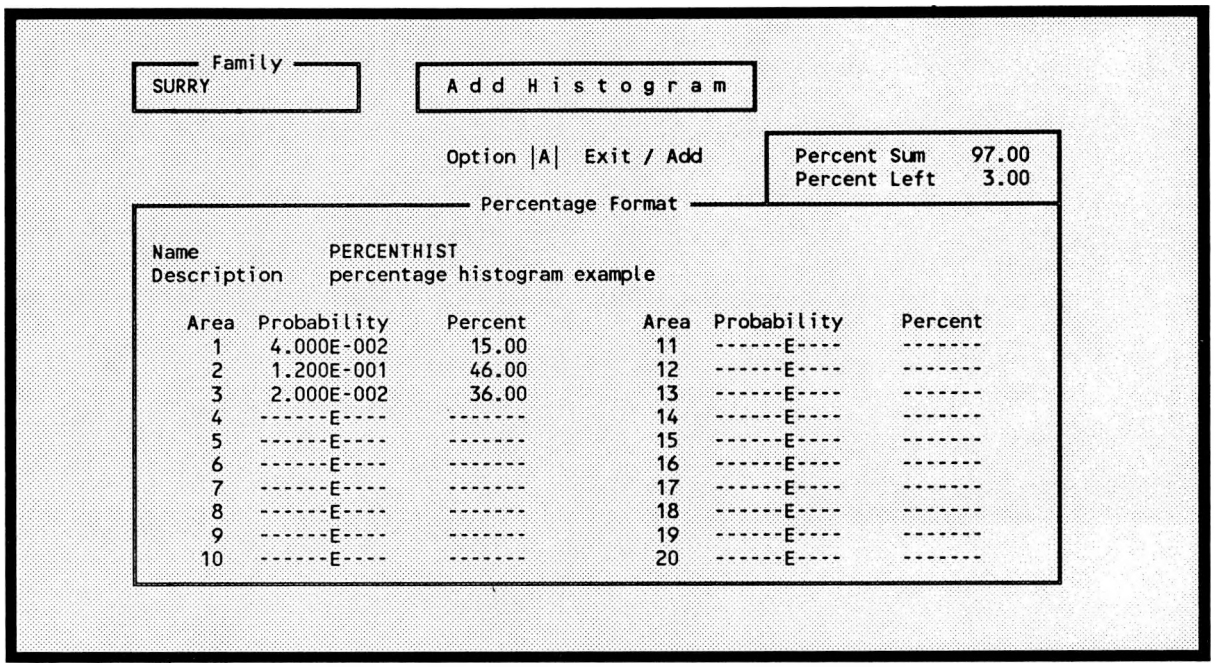


Figure 174. Adding a percentage histogram.

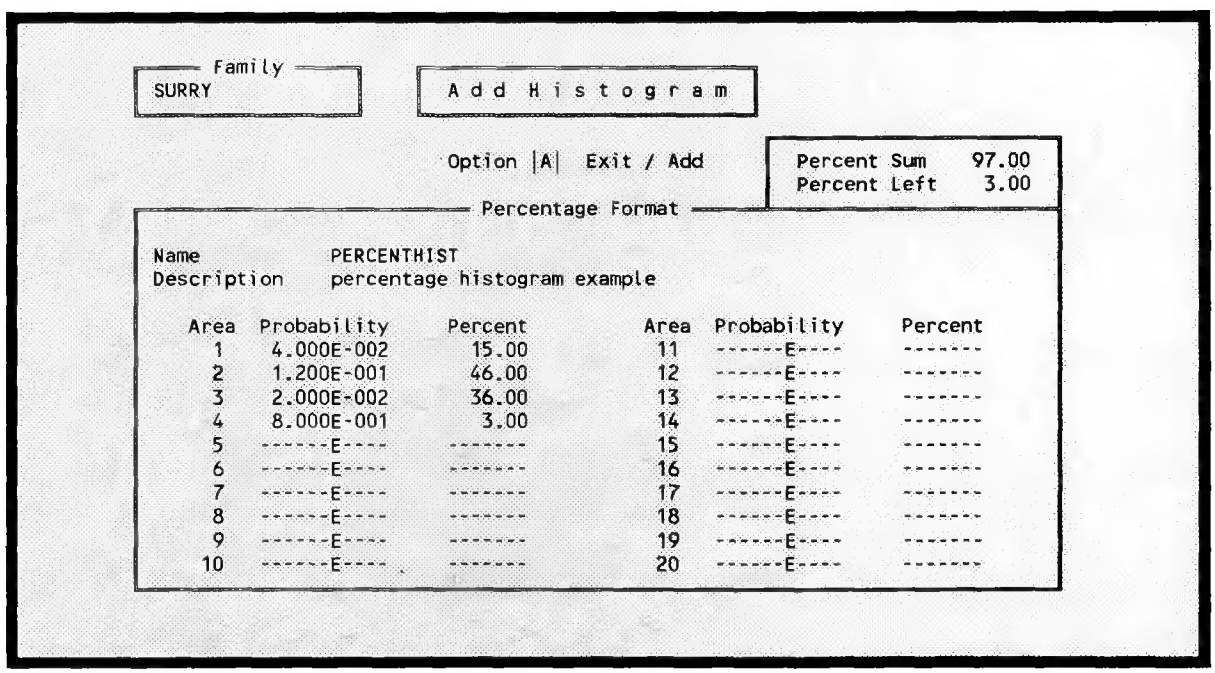


Figure 175. Add the remaining percent to create a valid histogram.

If you wish to add a range histogram to the data base, enter an <R> (Range) in the option field of the Add Histograms screen. This action will bring up a Range Format Histogram screen (Figure 176). On this screen you should type in a name and a description for the range histogram. Then you should enter the starting point, the ending point and the probability associated with the first bin of the histogram. Next, for each successive bin of the histogram, an ending point and a probability should be entered. There is a maximum of 20 bins allowed for each range histogram. Figure 176 is an example of inputting a range histogram whose data points lie on the closed interval of 0.0 and 1.5. The probability associated with the data points on the sub-interval of 0.0 and 0.4 is 0.05 (Bin 1), the probability for the sub-interval of 0.4 and 0.8 is 0.3 (Bin 2), the probability for the sub-interval of 0.8 and 1.2 is 0.06 (Bin 3), and the probability for the last sub-interval of 1.2 to 1.5 is 0.2 (Bin 4).

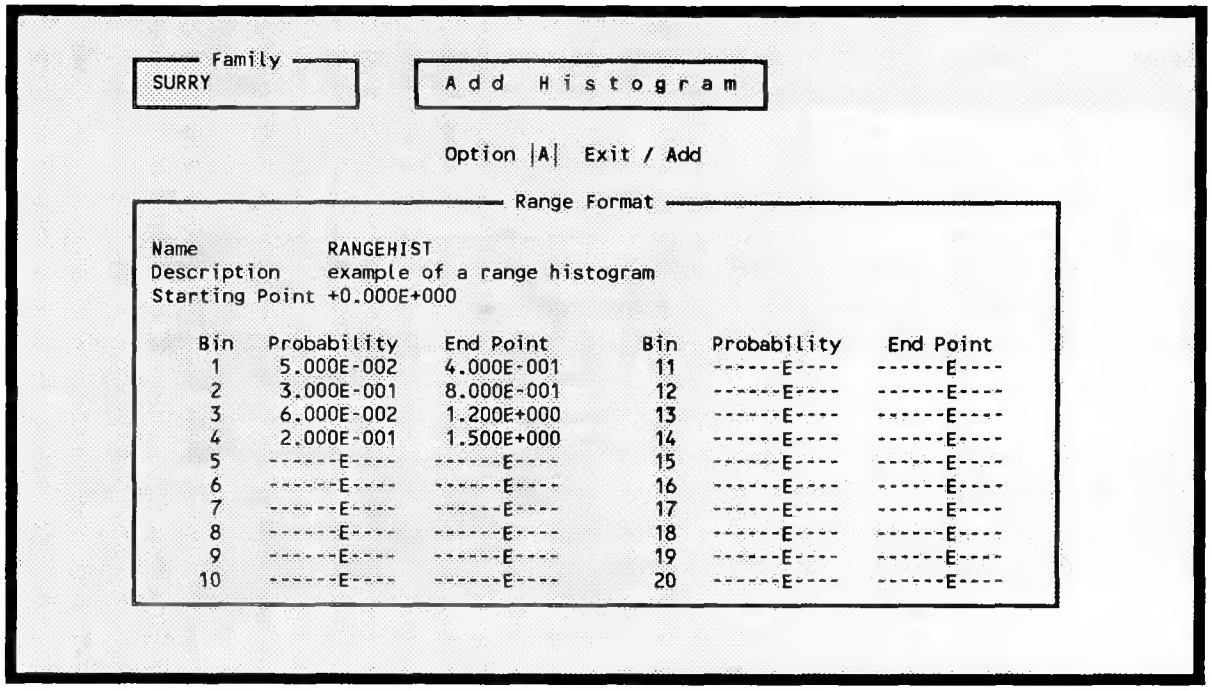


Figure 176. Add a range histogram.

Once you have typed in the histogram data, enter an <A> in the option field and press <Enter> to save the newly created histogram. However, if you wish to exit the Add process without saving the new histogram, enter an <E> in the option field or press the <Esc> key.

7.2.7.3 Modify Histograms. To modify a currently existing histogram, type an <M> (Modify) in the option field of the Edit Histograms screen, highlight the desired histogram and press <Enter>.

If you selected to modify a percentage histogram, then the histogram data will be displayed in percentage format. You may make modifications to the histogram's name, description, or any of the probabilities or percentages. The percentages must still total 100%, before it will be accepted as a valid percentage histogram. Figure 177 demonstrates the screen for modifying histograms in

percentage format.

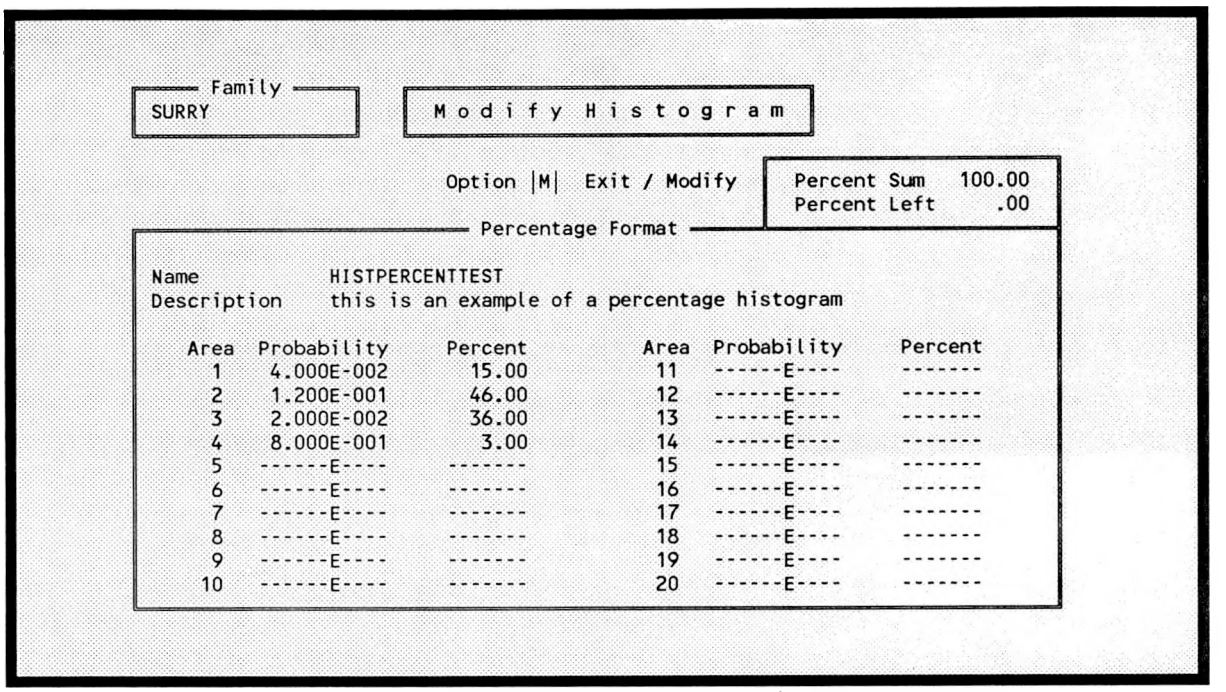


Figure 177. Modify a percentage histogram.

If you selected to modify a range histogram, then the histogram data will be displayed in range format. You may change the histogram's name, description, and any of the bin's starting points, ending points or probabilities. Figure 178 demonstrates the screen for modifying histograms in range format.

If you wish to save the modifications made to the selected histogram, type an <M> (Modify) in the option field of the Modify Histograms screen and press <Enter>. If you wish to exit this screen without modifying the histogram, enter an <E> in the option field and press <Enter>, or press the <Esc> key.

7.2.7.4 Delete Histograms. To delete an existing histogram from the data base, type a <D> (Delete) in the option field of the Edit Histograms screen, highlight the histogram to be deleted, and press <Enter>.

This action will result in displaying the selected histogram in the appropriate format on the Delete Histograms screen. To delete the histogram, type a <D> (Delete) in the option field and press <Enter>. To exit the Delete Histograms screen without deleting the histogram being displayed, press the <Esc> key or enter an <E> (Exit) in the option field. Figure 179 and Figure 180 show examples of the Delete Histograms screen for percentage histograms and range histograms, respectively.

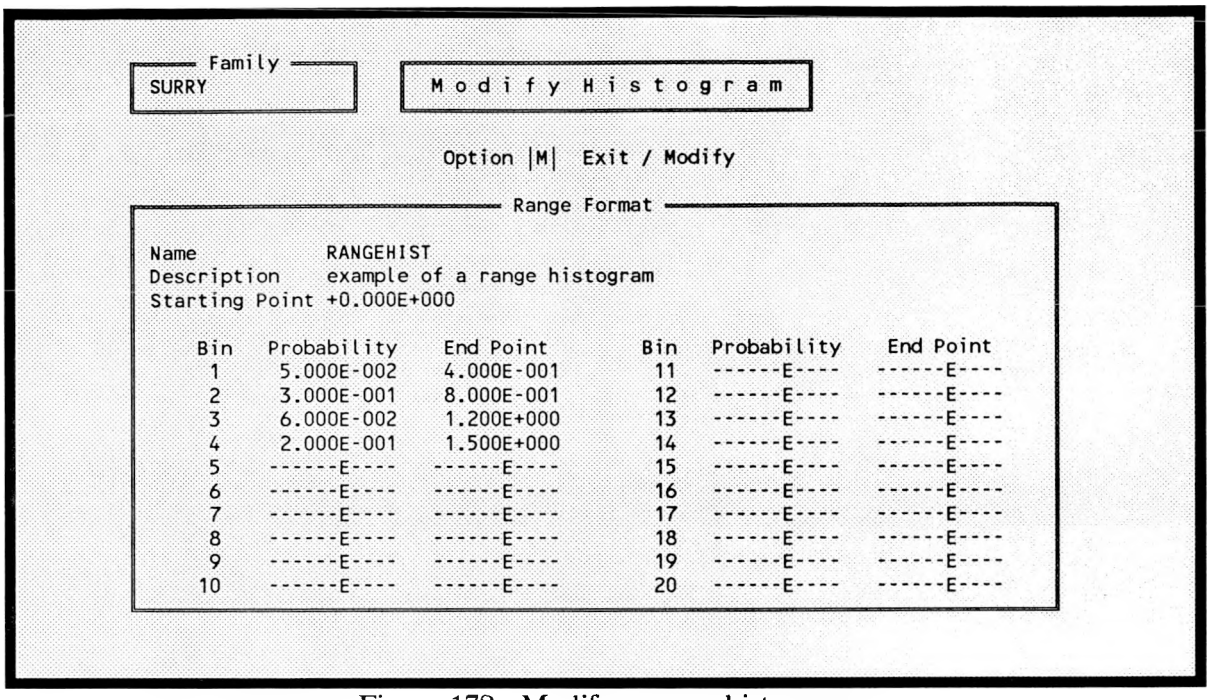


Figure 178. Modify a range histogram.

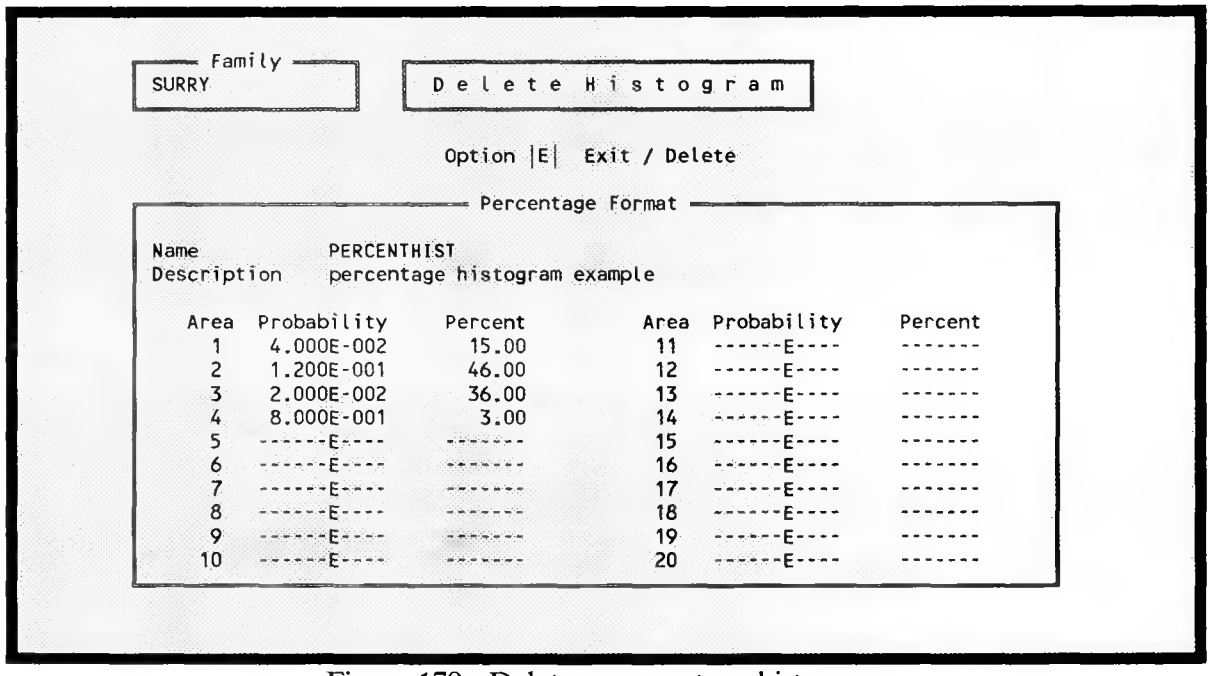


Figure 179. Delete a percentage histogram.

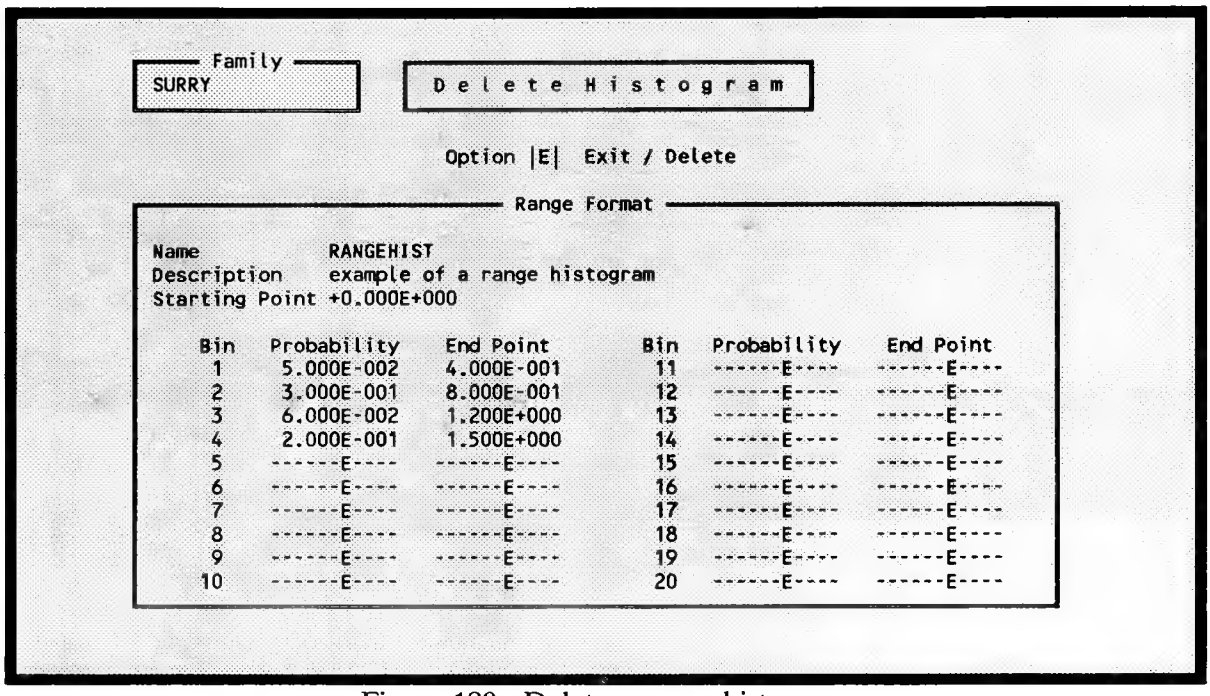


Figure 180. Delete a range histogram.

7.2.8 Generate Changes

This option applies the event data modifications specified by the selected change sets to the basic event data file. This option must be executed prior to any data analysis if you wish the change set modifications to be reflected in the analysis results. The Generate Changes option creates new current event data, which is used when a user wishes to run an uncertainty analysis on a selected sequence.

To activate this function, type <G> (Generate Changes) in the option field, use the function key <F2> to mark the change sets to be used during the generation process, and then press <Enter>. Upon pressing <Enter>, the default mission time is displayed at the bottom of the screen (Figure 181). If you do not wish to change the mission time, press <Enter>. **New event data has been generated with changes** is displayed when the changes are successfully generated. If no changes were made, the message **New event data has been generated (no changes)** is displayed at the bottom of the Change Sets screen.

This option transfers the temporary values for the basic events marked with either a probability change or a class change in the marked change set to the current event data values. If an event in the change set has both a class change and a probability change associated with it, the probability change takes precedence over the class change when generating new current case event data values. If the event does not have an associated probability change or class change, then the current case event data values will be set equal to the base case data for that event.

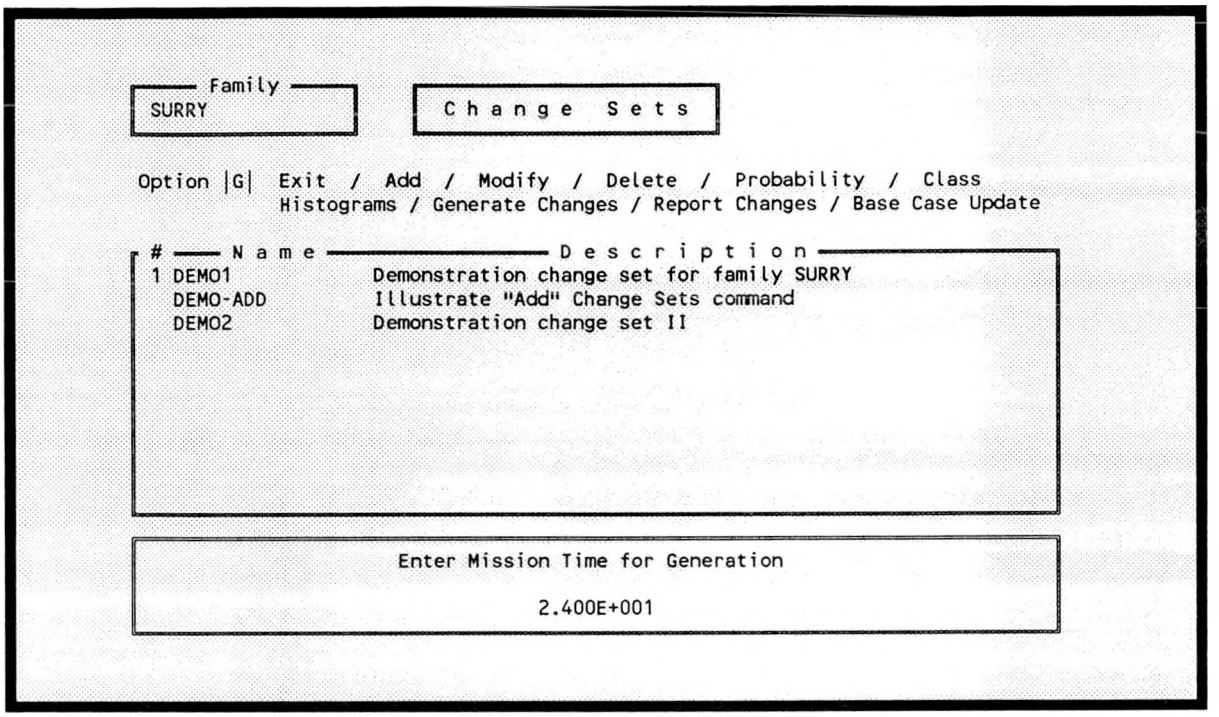


Figure 181. Set mission time for generate changes.

If you select the Generate Changes option without marking any of the change sets, then the current case data will be initialized to the base case data.

If more than one change set is marked when you enter the Generate Changes option, then the probability and class changes in the changes set marked with the highest number will take precedence over any changes from lower numbered change sets.

For example, three change sets (CS) are marked and Event A has both a probability change and a class change associated with it in CS 2. Event B has a probability change in CS 1, and a class change in CS 3. Event C has only a class change in CS 1. Event D has no probability changes or class changes associated with it in any of the three marked change sets. The outcome of the Generate Changes option on these three marked change sets would be as follows:

The current case data for event A would be set to the temporary values associated with the probability change in CS 2. (Probability changes take precedence over class changes when they occur for the same event within the same change set.)

The current case data for event B would be set equal to the temporary values associated with the class change in CS 3. (The probability or class change in higher numbered change set takes precedence over changes in lower numbered change sets.)

The current case data for event C would be set to the temporary values associated with the class change in CS 1.

The current case data for event D would be set to the base case values for event D. (There were no probability changes or class changes made to event D in any of the marked change sets.)

7.2.9 Reports

This option allows you to create reports that reflect the event modifications that currently exist within the data base. There are three report types: Unaffected Events, Affected Events, and All Events (Figure 182). Each of the report types may be sorted by event name, ascending probability, or change sets. In addition, a report may be routed to the console, an attached printer, or a disk file. When a report is routed to the printer or a disk file, the data will be echoed on the console.

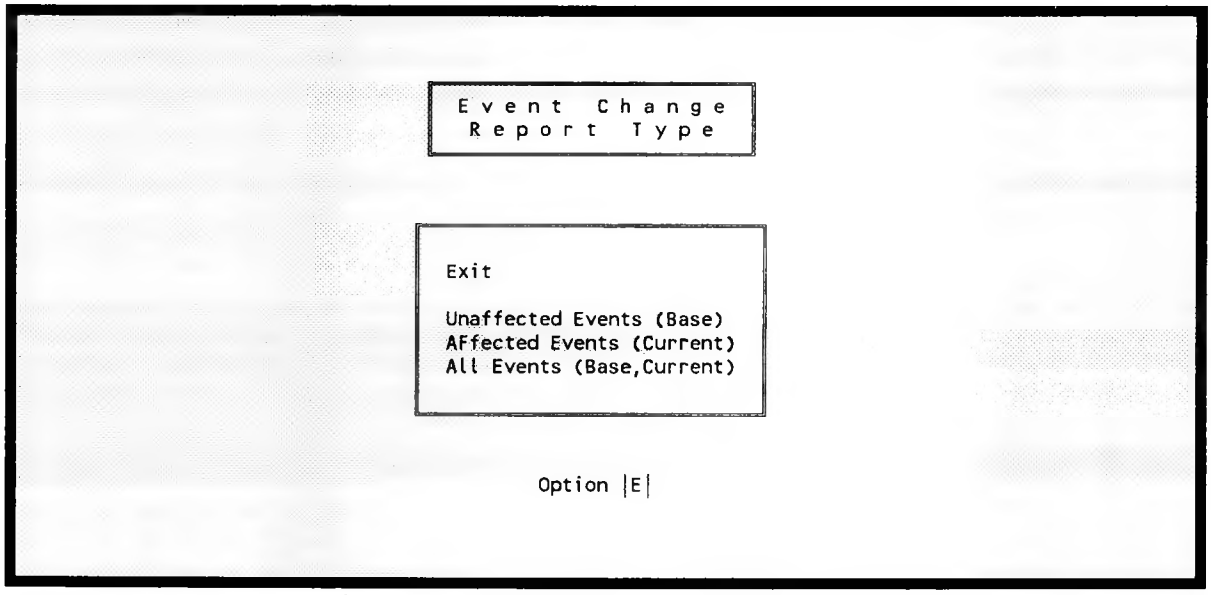


Figure 182. Selecting the event report type.

7.2.9.1 Exit. This option returns you to the Change Sets screen. To invoke the option, type <E> in the command field and press <Enter>, or press the <Esc> key.

7.2.9.2 Unaffected Events (Base). This option allows you to generate a report of the events that are not affected by any of the change sets that currently exist in the data base. To invoke the option, type <U> in the command field and press <Enter>. The sort selection menu will be displayed, allowing you to sort the data by event name, ascending probability, or change set (Figure 183).

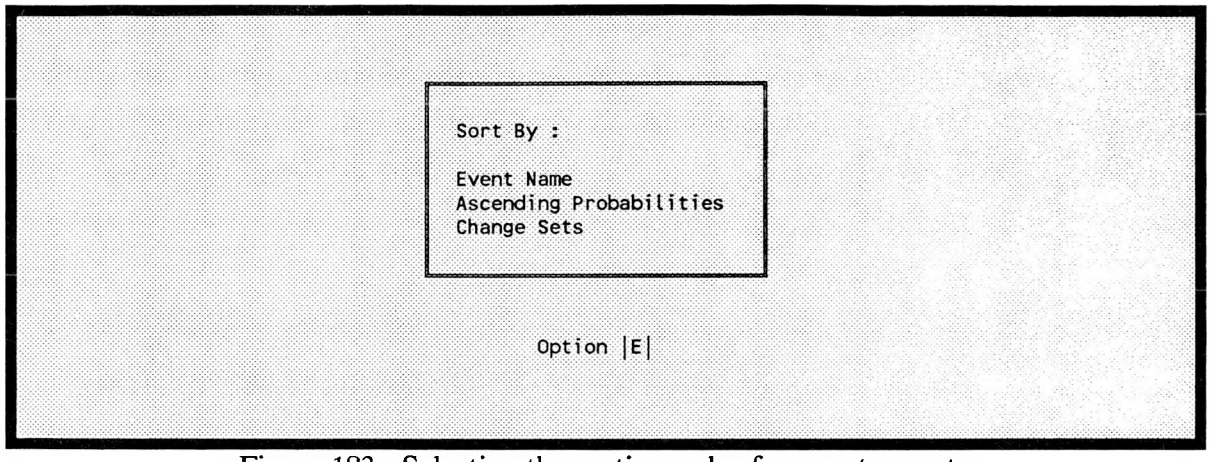


Figure 183. Selecting the sorting order for event reports.

After the sorting method has been selected, you are asked to specify the routing of the report (Figure 184).

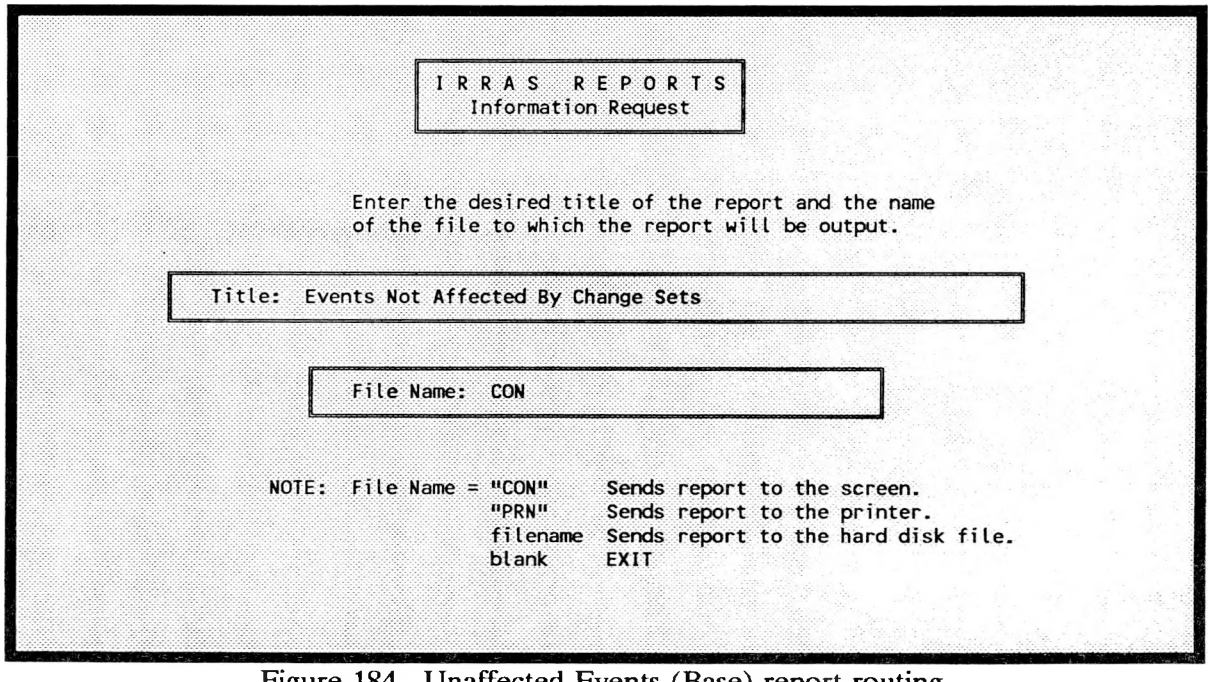


Figure 184. Unaffected Events (Base) report routing.

7.2.9.3 AFfected Events (Current). This option allows you to generate a report of the events that are affected by the change sets that currently exist in the data base. To invoke the option, type <F> in the command field and press <Enter>. The sort selection menu will be presented allowing you to sort the data by event name, ascending probability, or change set (Figure 183).

After the sorting method has been selected, you are asked to specify the routing of the report (Figure 185).

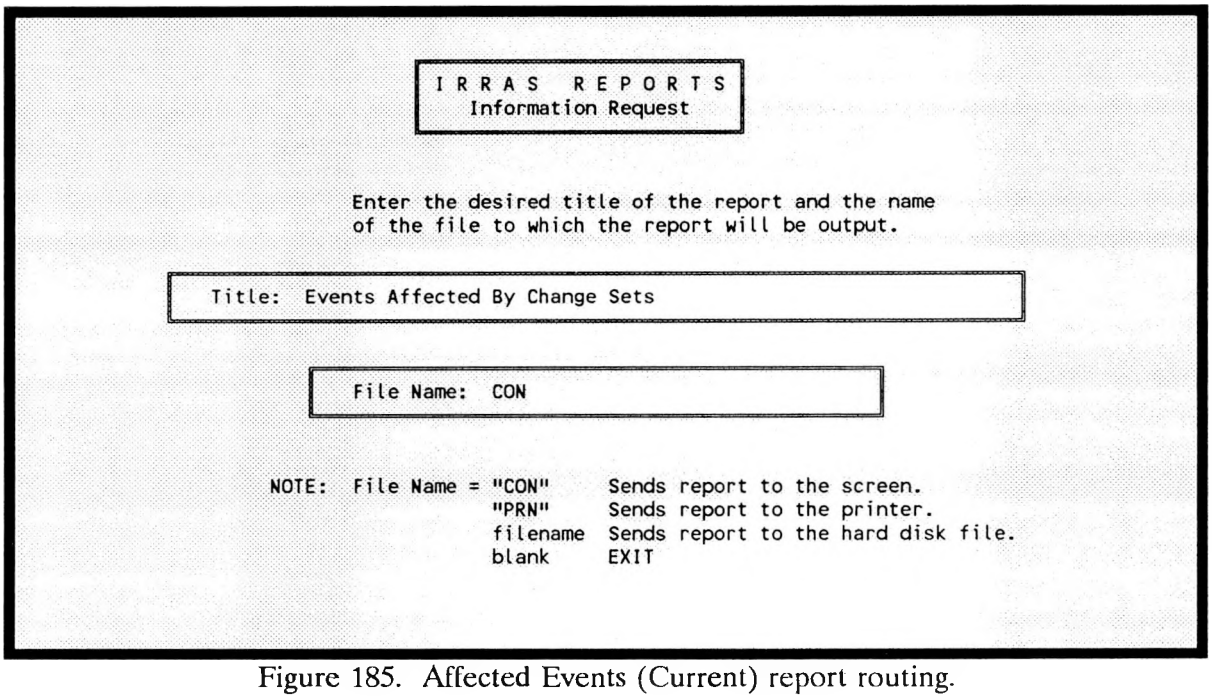


Figure 185. Affected Events (Current) report routing.

7.2.9.4 All Events (Base, Current). This option allows you to generate a report of all of the events in the data base. The report will indicate which events are affected by a change set. To invoke the option, type <A> in the command field and press <Enter>. The sort selection menu will be presented allowing you to sort the data by event name, ascending probability, or change set (Figure 183).

After the sorting method has been selected, you are asked to specify the routing of the report (Figure 186).

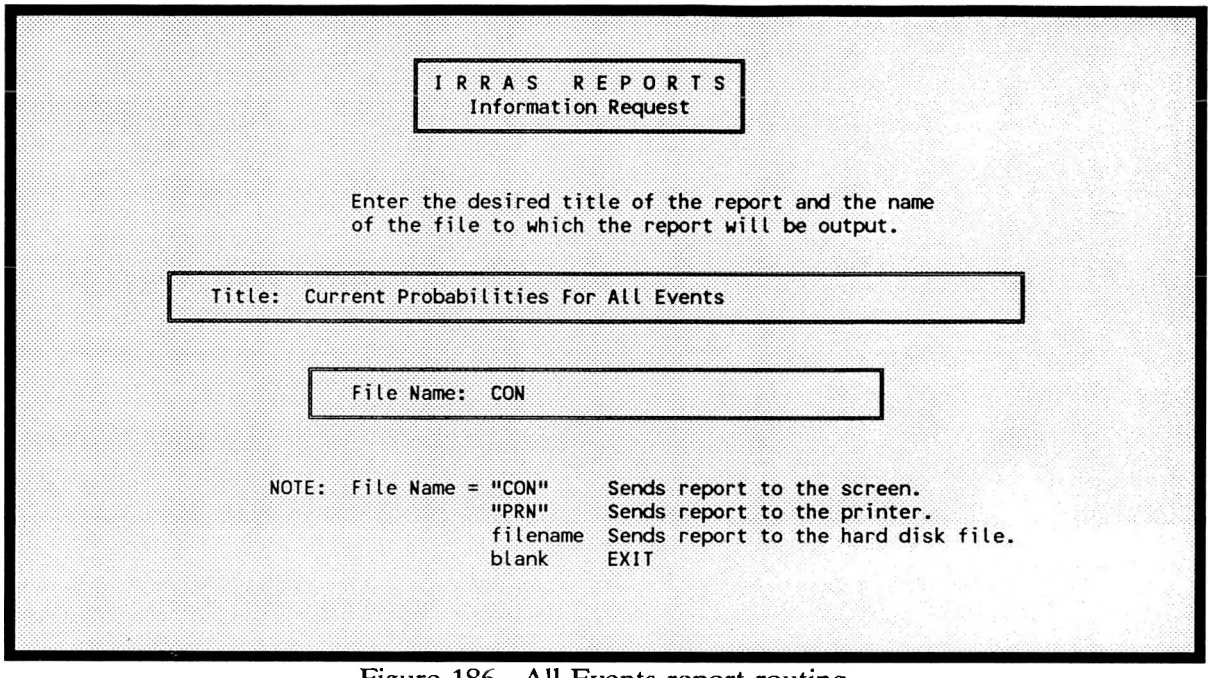


Figure 186. All Events report routing.

7.2.10 Base Case Update

This option allows you to overwrite the base case data values stored in the data base with the current (temporary) data values you have used for event tree analysis. After executing this option, the original base case data is no longer available.

To invoke this option, type <B> (Base Case Update) in the option field, mark the desired change set(s) and press <Enter>. A confirmation screen (Figure 187) will appear to ensure you wish to update the base case values with the temporary data values from the marked change set(s). To terminate the process type an <N> in the option field and press <Enter>. To initiate the update process type a <Y> in the option field and press <Enter>. Upon pressing <Enter>, the default mission time is displayed at the bottom of the screen (Figure 188). If you do not wish to change the mission time press <Enter>.

In order to run a base case update at least one Change Set must be marked. This option transfers the temporary values for the basic events marked with either a probability change or a class change in a change set to the base case values. The existing base case values will be lost. Any event in the change set which does not have either a class change or a probability change associated with it will maintain its existing base case data. Upon completion of the base case update, the message **Base case events have been updated with changed values** will appear at the bottom of the screen.

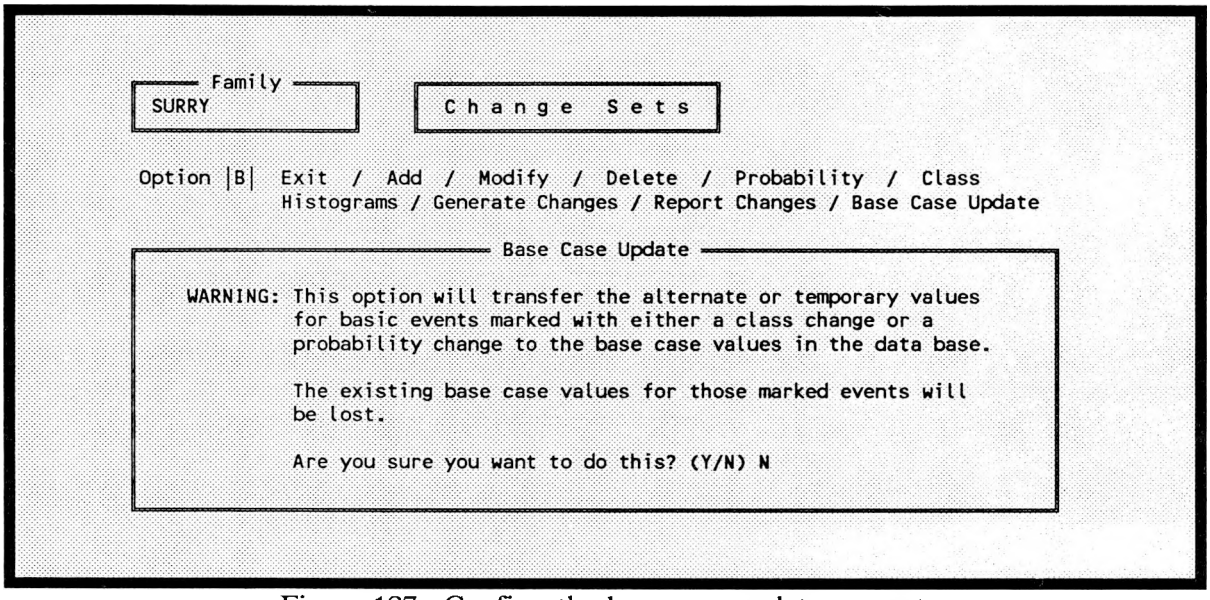


Figure 187. Confirm the base case update request.

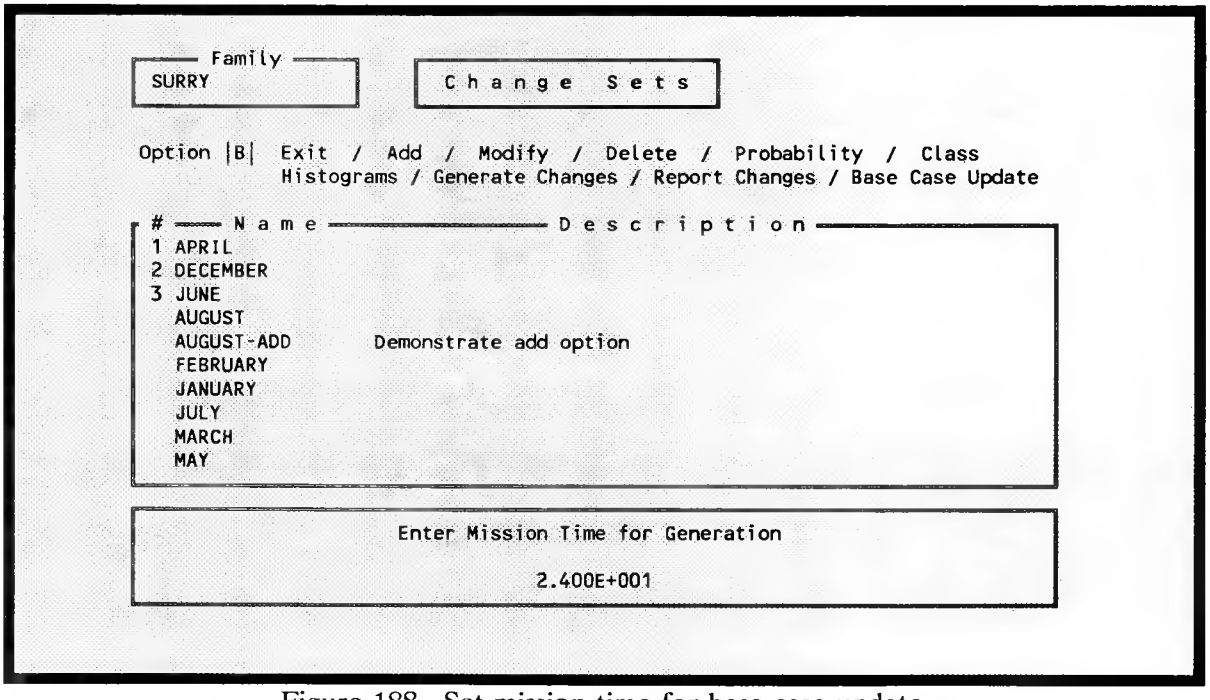


Figure 188. Set mission time for base case update.

If an event in a marked change set has both a class change and a probability change associated with it, the probability change takes precedence and will be used to update the base case values.

If more than one change set has been marked and is being used in the base case update, then the probability and class changes in the highest numbered change set take precedence over changes from lower numbered change sets. For example, if Event A has a probability change associated with it in Change Set 1, and a class change associated with it in Change Set 2, then the class change from Change Set 2 would override the probability change from Change Set 1.

7.3 Analyze Sequences

This option provides the means to recalculate sequence values after events and/or cut sets have been modified. To invoke the option, highlight Analyze Sequences or type <A> in the option field, and press <Enter>. Figure 189 shows the main screen for sequence analysis which lists the sequences defined for the current family. The letters c, q, and u (in any combination) may precede a sequence name and are defined as follows:

c - flags the sequence as having cut sets that must be recalculated
q - flags the sequence as having cut sets that must be requantified
u - flags the sequence as needing uncertainty distributions recalculated

Once these functions have been executed the corresponding letter is removed from the display. The options available from the Analyze Sequences screen are Exit, Generate Cut Sets, Cut Set Update, Quantification, Uncertainty Analysis, Split Fraction, and Base Case Update. You have the choice of using either the Monte Carlo sampling technique or the Latin Hypercube sampling technique for running the uncertainty analysis process.

7.3.1 Exit

To return to the Event Tree Analysis menu, type an <E> (Exit) in option field and press <Enter>, or press the <Esc> key.

7.3.2 Generate Cut Sets

This option allows you to generate the cut sets for a selected sequence based on cut set generation cutoff values. You are given the opportunity to specify several cut set generation cutoff values which will be used to determine if a cut set is to be retained or discarded from the selected sequence.

You are given the ability to generate cut sets for a selected sequence, a group of sequences, or all sequences within the current family. To invoke the Generate Cut Sets for a single selected sequence, type <G> (Generate Cut Sets) in the option field, highlight the desired sequence, and press <Enter>. To invoke this process for a group of sequences, mark the desired sequences using the function keys F2, F3, and F4, type a <G> in the option field, and press <Enter>. To invoke this option for all sequences in the current family, clear all marked entries with the F3 key, type <C> in the option field and press <Enter>. A message **Process all records? (Y/N)** will appear at the

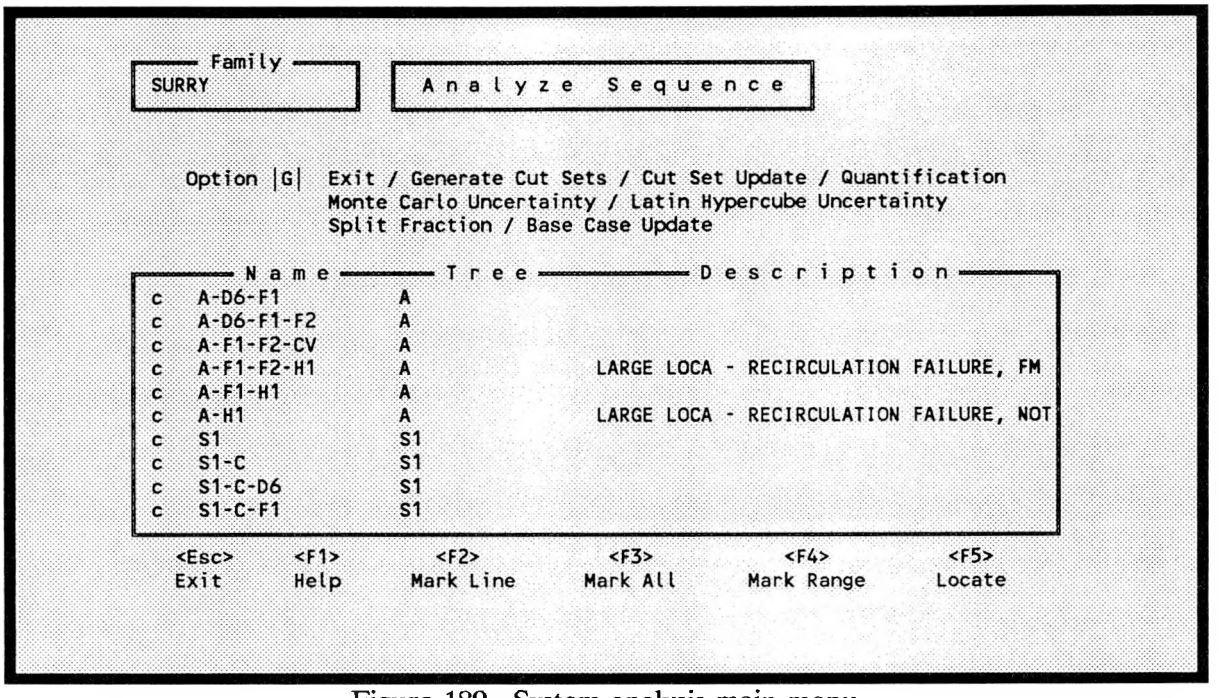


Figure 189. System analysis main menu.

bottom of the screen. Type a <Y> to continue the Generate Cut Sets for all of the sequences, or type an <N> to terminate the update for all sequences.

Whether you are generating cut sets for a single sequence, a group of sequences, or for all sequences, the Cut Set Generation Cutoff Values screen shown in Figure 190 will be displayed. You may change any of the data fields on this screen. Each field is described below. The default values that appear on this screen may be reset to new values by selecting the Utility Options from the IRRAS main menu and then invoking the Define Constants option.

Perform Probability Cutoff? - If you enter a <Y>, then the only cut sets whose product for all of its event probabilities is greater than or equal to the value in the Cutoff Value field will be kept. All other cut sets will be removed.
If you enter an <N>, then the probability for the cut set will not be relevant for determining if the cut set should be retained or discarded.

Perform Cut Set Size Cutoff? - If you enter a <Y>, then only the cut sets whose number of events is less than or equal to the value specified in the Size Cutoff field will be kept in the cut sets for that sequence. All other cut sets will be removed.

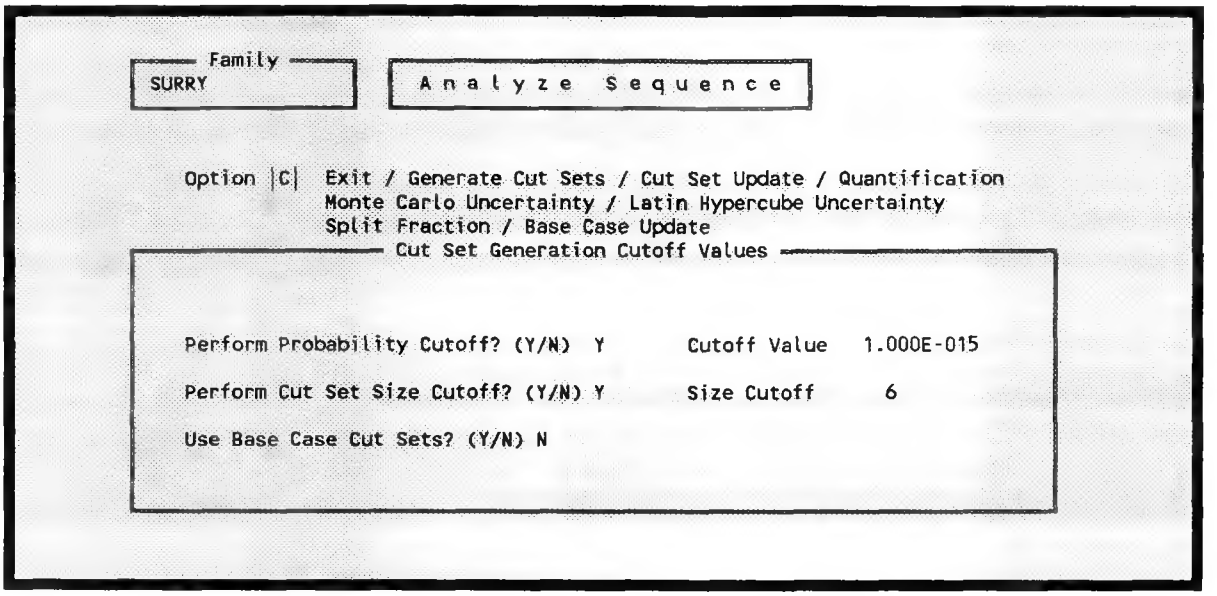


Figure 190. Cut set generation cutoff values.

If you enter an <N>, then the number of events in a cut set will be irrelevant for determining if the cut set should be retained or discarded.

Use Base Case Cut Sets? — If you enter a <Y>, then the base case values will be used as the cut sets to be updated. If you enter an <N>, the alternate cut sets will be used as the cut sets to be updated and resaved.

During processing, the screen shown in Figure 191 is displayed and updated as the calculations proceed. Upon completion of the cut set generation, the results are displayed as shown in Figure 192.

7.3.3 Cut Set Update

This option will update the alternate cut sets for a selected sequence based on cut set generation cutoff values. You are given the opportunity to specify several cut set generation cutoff values which will be used to determine if a cut set is to be retained or discarded from the selected sequence. You are also given the choice of using either the base case cut sets or the alternate case cut sets as the starting set of cut sets to be updated. The updated version of the cut sets will be saved as the new alternate cut sets for the sequence.

You are given the ability to update the alternate cut sets for a selected sequence, the alternate cut sets for a group of sequences, or the alternate cut sets for all of the sequences within the current family. To invoke the Cut Set Update process for a single selected sequence, type <C>

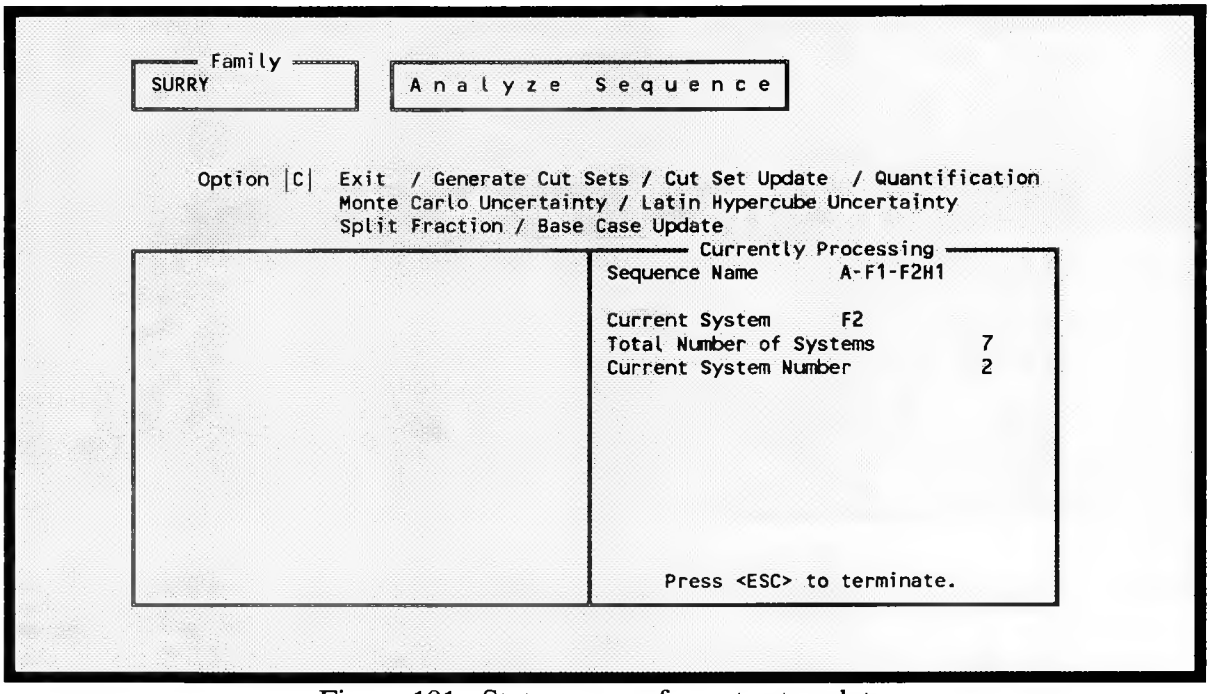


Figure 191. Status screen for cut set update.

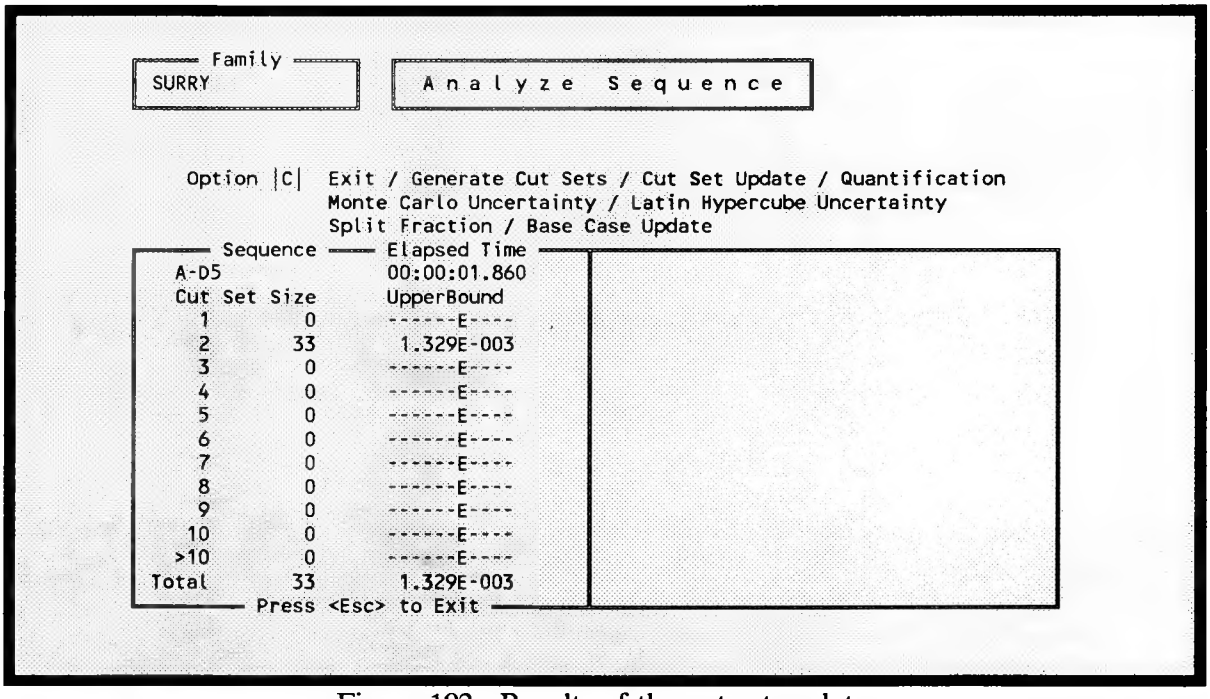


Figure 192. Results of the cut set update.

(Cut Set Update) in the option field, highlight the desired sequence, and press <Enter>. To invoke this process for a group of sequences, mark the desired sequences using the function keys F2, F3, and F4, type a <C> in the option field and press <Enter>. To invoke this option for all sequences in the current family, clear all marked entries with the F3 key, type <C> in the option field and press <Enter>. A message **Process all records? (Y/N)** will appear at the bottom of the screen. Type a <Y> to continue the Cut Set Update for all of the sequences, or type an <N> to discontinue the update for all sequences.

Whether you are updating alternate cut sets for a single sequence, a group of sequences, or for all sequences the Cut Set Generation Cutoff Values screen shown in Figure 193 will be displayed. You may change any of the data fields on this screen. The default values which appear on this screen may be reset to new values by selecting Utility Options on the IRRAS main menu and then invoking Define Constants option.

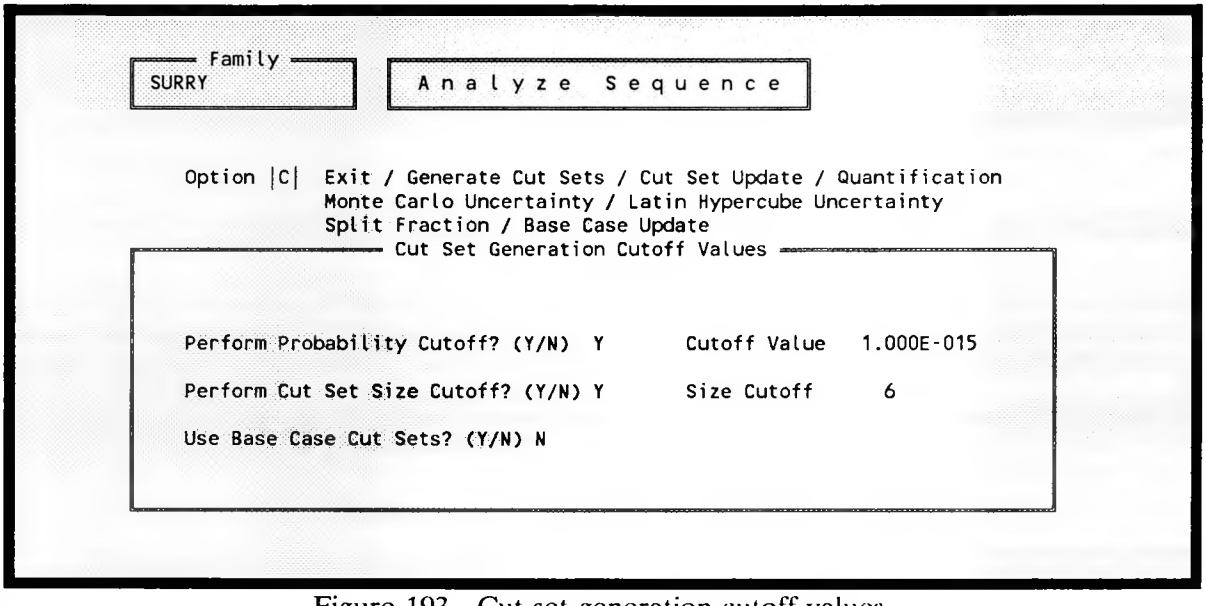


Figure 193. Cut set generation cutoff values.

If you type a <Y> in the Perform Probability Cutoff field, then only the cut sets whose product for all of its event probabilities is greater than or equal to the value in the Cutoff Value field will be kept. All other cut sets will be removed from alternate case cut sets for that sequence. If you type an <N> in this field, then the probability for the cut set will not be relevant for determining if the cut set should be retained or discarded.

If you type a <Y> in the Perform Cut Set Size Cutoff field, then only the cut sets whose number of events is less than or equal to the value in the Size Cutoff field will be kept in the alternate case cut sets for that sequence. All other cut sets will be removed. If you type an <N> in this field, then the number of events in a cut set will be irrelevant for determining if the cut set should be retained or discarded.

If you enter a <Y> in the Use Base Case Cut Sets field, then the base case cut sets will be used as the cut sets to be updated and then stored in the alternate case cut sets. However, if an <N> was entered in this field, the alternate cut sets will be used as the cut sets to be updated and then resaved in the alternate case cut sets.

During processing the screen shown in Figure 194 is displayed and updated as the calculations proceed. Upon completion of the cut set update, the results are displayed as shown in Figure 195.

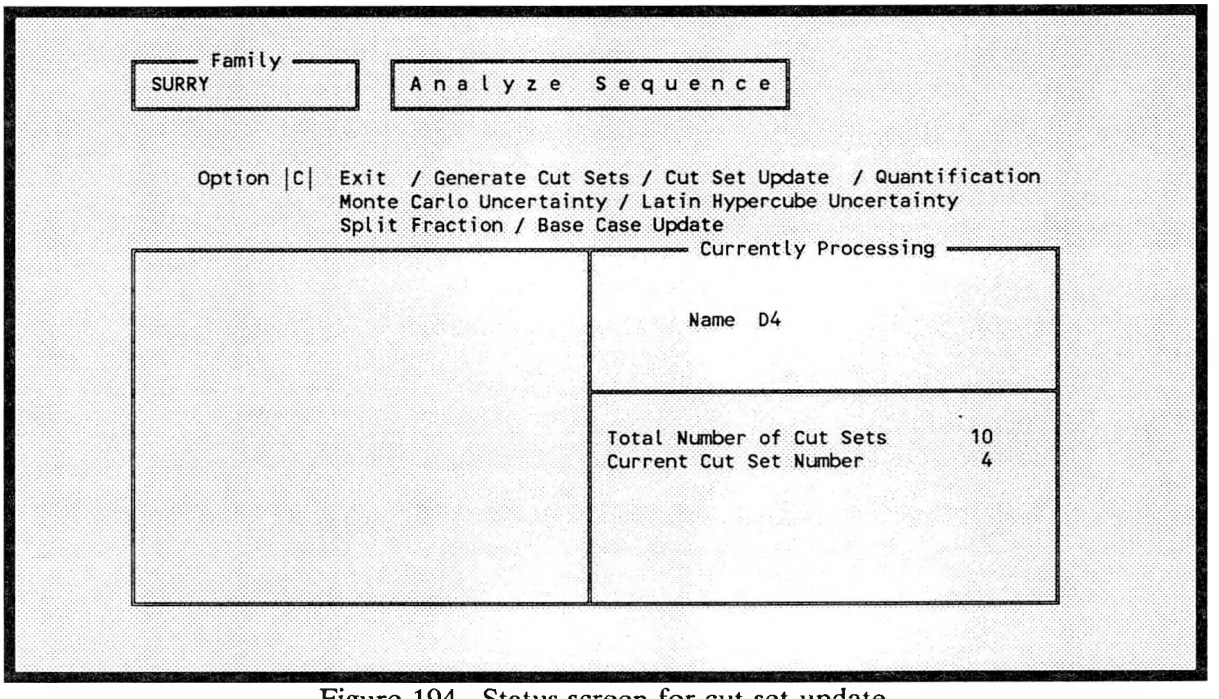


Figure 194. Status screen for cut set update.

The cut set update flag 'c' will then be removed from every sequence on the Analyze Sequence screen in which the cut set update process has been performed. If an error of some kind occurs during the update process then the message **Error in Cut Set analysis** will be displayed at the bottom of the screen.

7.3.4 Quantification

The quantification process will calculate a new minimum cut set upper bound for the sequence cut sets using the current data values (event change sets and alternate case cut sets). The new minimum cut set upper bound is saved with the alternate case cut sets for the selected sequence.

You are given the ability to requantify the alternate cut sets for a selected sequence, for a group of sequences, or for all of the sequences within the current family. To invoke the Quantification process for a single selected sequence, type <Q> (Quantification) in the option field of the Analyze Sequence screen, highlight the desired sequence, and press <Enter>. To invoke this process for a group of sequences, mark the desired sequences using the function keys F2, F3, and F4,

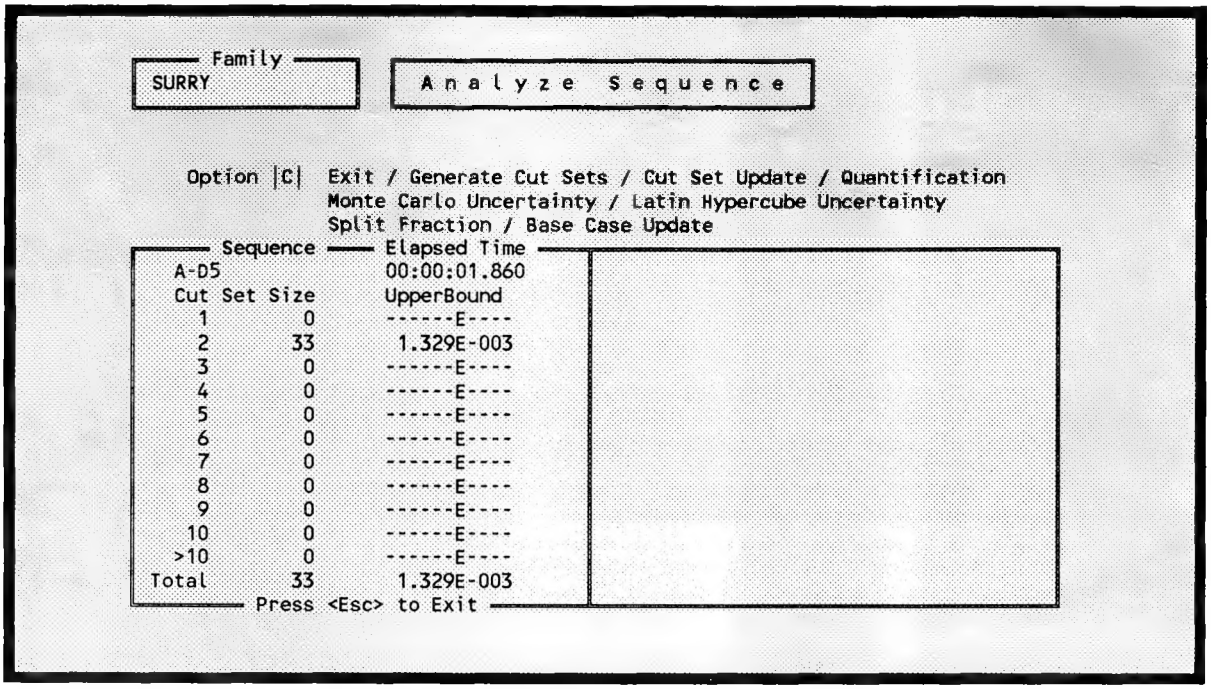


Figure 195. Results of the cut set update.

type a <Q> in the option field and press <Enter>. To invoke this option for all sequences in the current family, type <Q> in the option field and press <Enter>. A message **Process all records (Y/N)?** will appear at the bottom of the screen. Type a <Y> to continue the Quantification process for all of the sequences, or type an <N> to discontinue this process.

During processing the message **Quantification in progress** appears at the bottom of the screen. If an error occurs then the message **Error quantifying cut sets** will be displayed at the bottom of the screen.

Upon completion of the quantification process, the results are displayed as shown in Figure 196. The requantify flag 'q' will then be removed from every sequence on the Analyze Sequence screen for which the quantification process has been performed.

7.3.5 Uncertainty Analysis

This function allows you to run an uncertainty analysis on a sequence using one of the two sampling techniques provided. The two sampling techniques are the Monte Carlo simulation technique and the Latin Hypercube simulation technique.

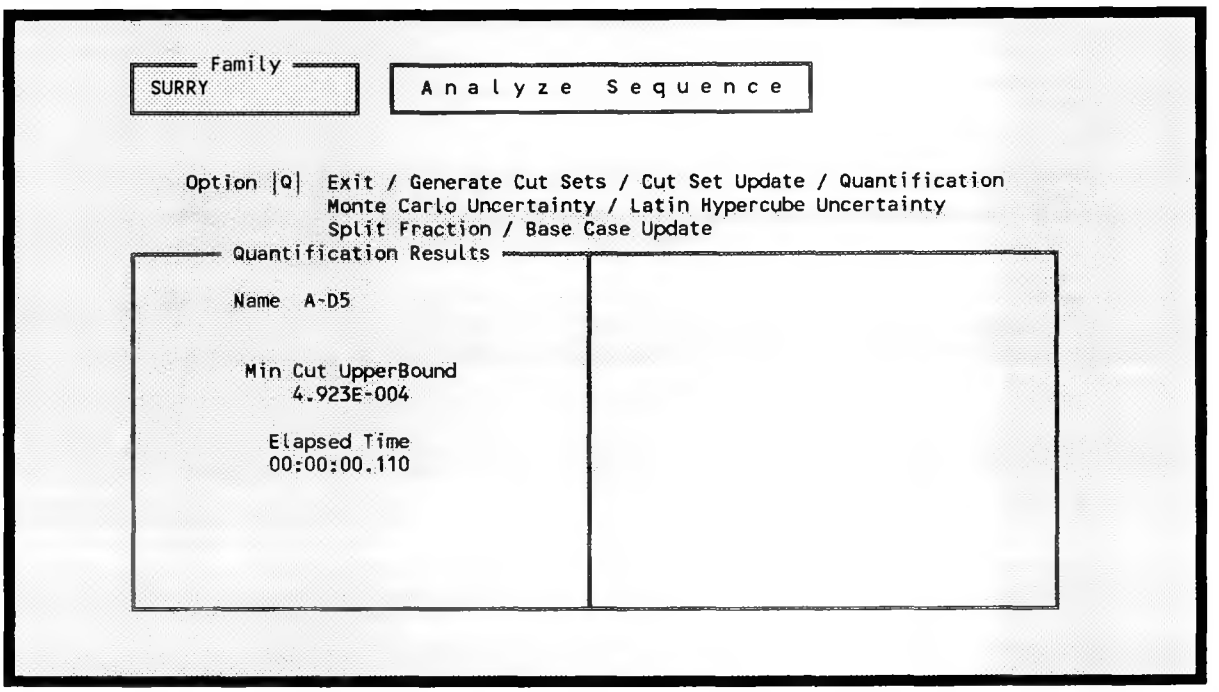


Figure 196. Results of the quantification process.

To use the Monte Carlo sampling technique to obtain an uncertainty analysis for a sequence or a group of sequences, you must type an <M> in the option field of the Analyze Sequence screen and press <Enter>. However, if you wish to use the Latin Hypercube sampling technique, then type an <L> in the option field and press <Enter>.

You are given the option of running an uncertainty analysis on the alternate cut sets for either a single sequence, for a group of sequences, or for all of the sequences within the current family. To invoke this process for a single selected sequence, type <L> or <M> (Latin Hypercube / Monte Carlo) in the option field, highlight the desired sequence, and press <Enter>. To invoke this process for a group of sequences, mark the desired sequences using the function keys F2, F3, and F4, type an <L> or <M> in the option field and press <Enter>. To invoke this process for all sequences in the current family, type <L> or <M> in the option field and press <Enter>. A message **Process all records? (Y/N)** will appear at the bottom of the screen. Type a <Y> to continue the uncertainty analysis for all of the sequences, or type an <N> to discontinue the analysis.

Once the sampling technique for the uncertainty analysis has been selected and the desired sequence(s) selected, the Uncertainty Calculation Values screen will be displayed (Figure 197 for Monte Carlo sampling and Figure 198 for Latin Hypercube sampling). This screen prompts you to enter the number of samples to be generated during the simulation and the initial value of the seed for the random number generator. There will be a default seed in the field for the random seed. You may use this value or enter a new value for the seed. To obtain a random seed from the system clock, you must enter a zero in this field. There will also be a default value in the field for the number of samples. You may use this value or enter another value. You may change the default values for both the number of samples and the random seed in the Utility Options, Define Constants

suboption.

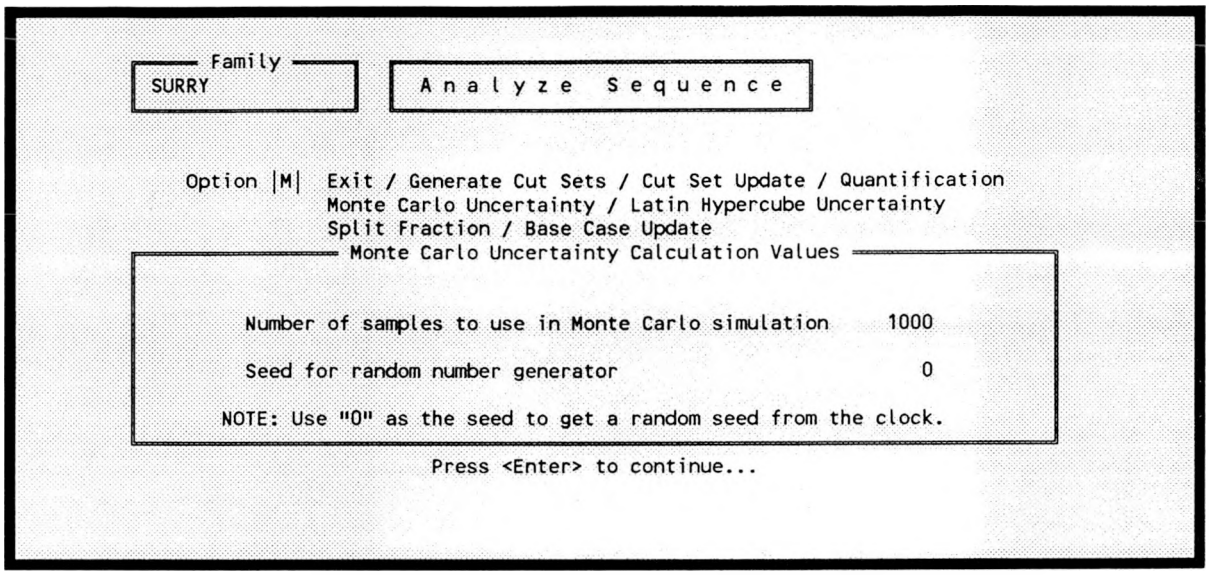


Figure 197. Monte Carlo calculation values.

When using the Monte Carlo sampling technique for the uncertainty analysis, if the number of samples entered is less than ten, then the number of samples will be increased to ten before the uncertainty analysis process will continue. Any number of samples greater than or equal to ten will be allowed, but a number of at least 1000 is probably a better value for improving the reliability of the Monte Carlo results.

When using the Latin Hypercube Sampling (LHS) technique, if the number of samples entered is less than twice the total number of unique events in the sequence, then the number of samples will be increased to two times the total number of unique events before the analysis will continue. The LHS technique gives its best results if the number of samples is at least twice the total number of unique events.

Once the number of samples has been accepted and a seed obtained from the system clock (if necessary), checks will be run to ensure the events with the same correlation classes have consistent failure data, uncertainty data, and distribution types. If any events with inconsistencies exist, an error message will be displayed and the uncertainty analysis process will be terminated so that the inconsistent values may be corrected.

If an error of some type occurs during the uncertainty analysis process, the process is terminated and the message **Error in Uncertainty analysis** is displayed at the bottom of the Analyze Sequence screen.

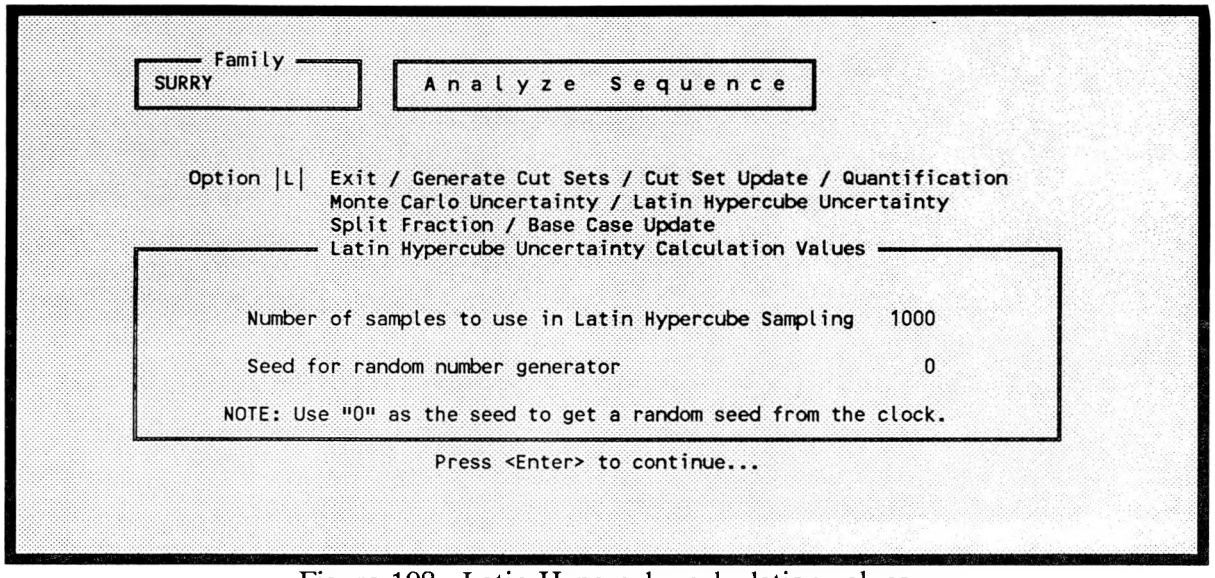


Figure 198. Latin Hypercube calculation values.

If all of the events successfully pass the correlation class checks, then the distribution parameters for the events will be checked to ensure that they are valid. If any of the parameters are invalid, error messages will be displayed and the process will be terminated so the distribution parameters may be corrected.

After both of these checks have been passed, a point estimate will be calculated for the selected sequence. At this point the samples for each event will be generated using the selected sampling technique, either Monte Carlo Sampling technique or the Latin Hypercube Sampling technique. The uncertainty analysis function provides you with eight different distribution types for both sampling techniques. The distributions types include normal, lognormal, beta, gamma, chi-squared, exponential, uniform and the user-defined histograms.

During processing, the current status screen will be displayed and updated as the samples are generated. Figure 199 and Figure 200 illustrate the current status screens for the Monte Carlo and the Latin Hypercube sampling techniques, respectively. When the requested number of samples have been generated or the user has terminated the process of generating the samples by pressing the <Esc> key, statistical information will be calculated using the generated samples. A sample mean, median, and standard deviation will be calculated for the selected sequence. Coefficients of skewness and kurtosis, and quantile values will also be calculated for the sequence. This data will be saved in the data base for the selected sequence.

Upon completion of these calculations, the following values will be displayed on the Uncertainty Results screen for viewing: the sequence name, random seed used, the number of samples generated in this process, the total number of events and cut sets in the sequence being processed, the point estimate, the mean, the median, the 5th and 95th percentile values, the minimum and maximum generated sample values, the standard deviation, the skewness and kurtosis, and the time involved to perform the analysis. Figure 201 and Figure 202 illustrate the Uncertainty Results

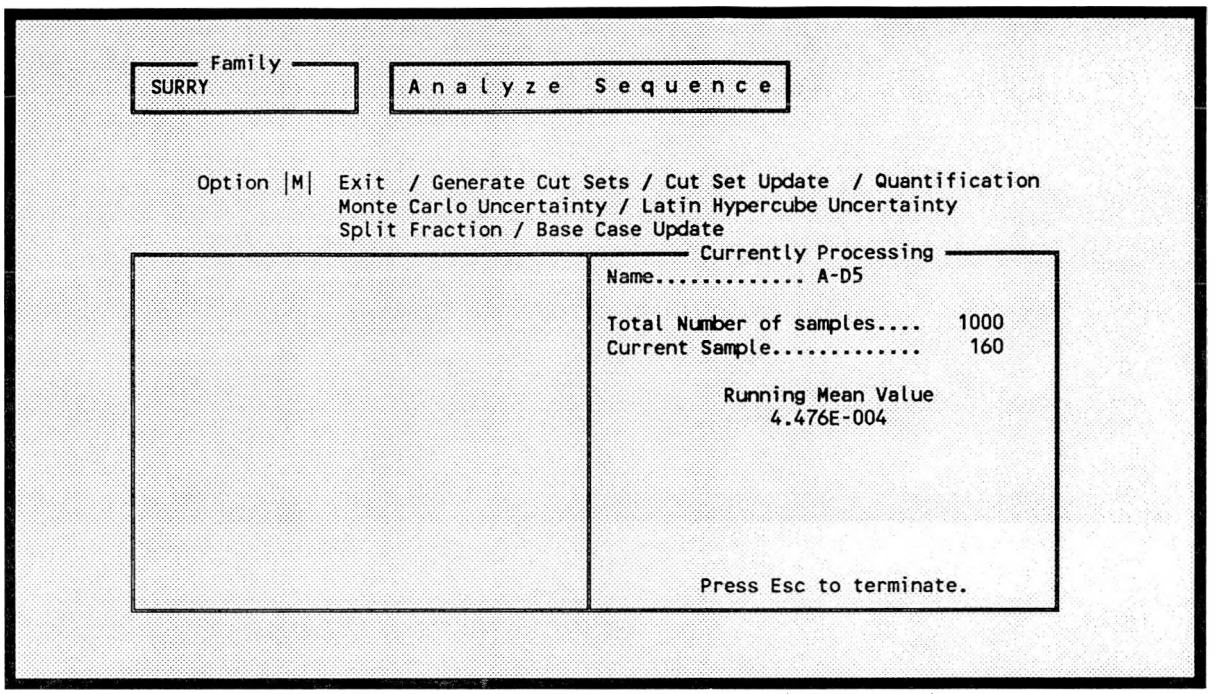


Figure 199. Current status of the Monte Carlo sampling.

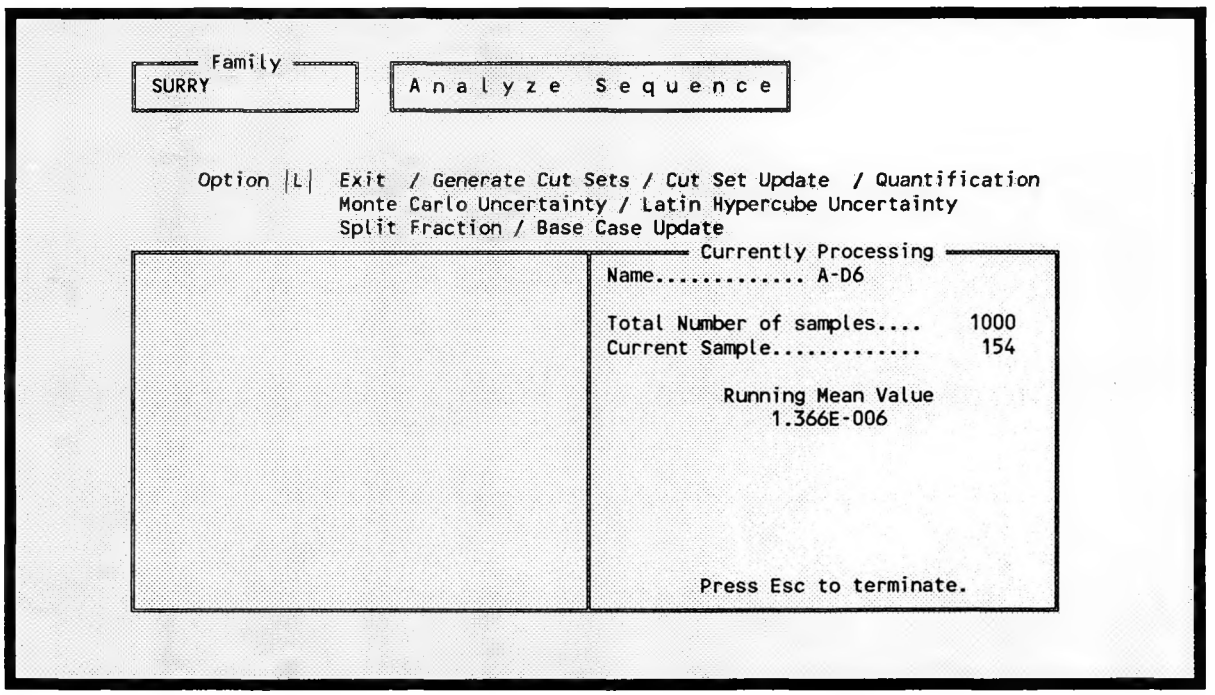


Figure 200. Current status of the Latin Hypercube sampling.

screens for the Monte Carlo and the Latin Hypercube sampling techniques, respectively.

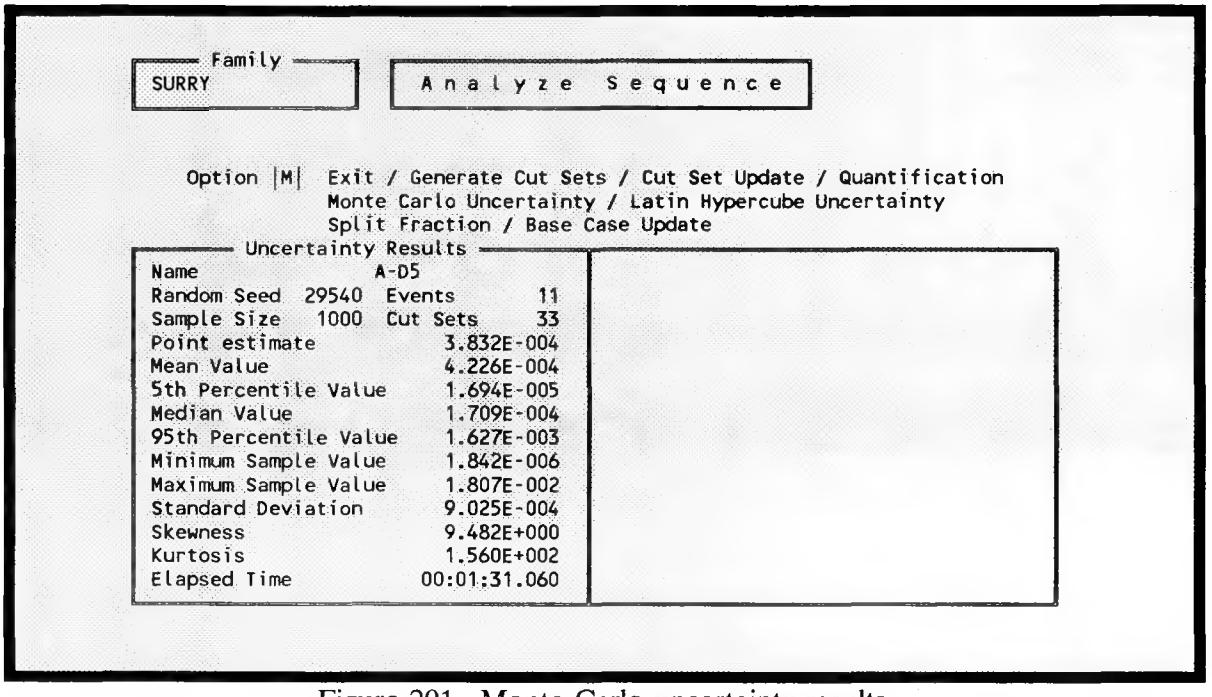


Figure 201. Monte Carlo uncertainty results.

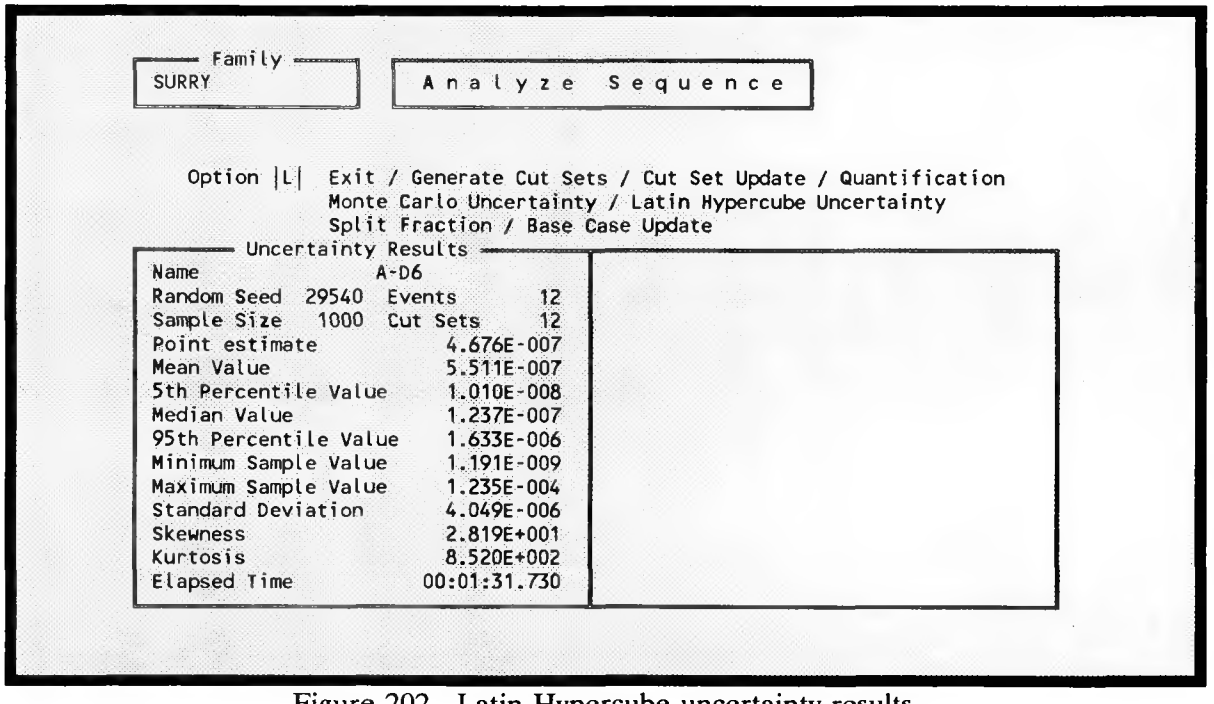


Figure 202. Latin Hypercube uncertainty results.

If only one sequence was selected (highlighted) for the uncertainty analysis process, then you will need to press <Enter> to return to the Analyze Sequence screen from the Uncertainty Results screen. However, if more than one sequence is being processed, the Uncertainty Results screen will be displayed for each sequence, and when all of the selected sequences have processed, you will automatically be returned to the Analyze Sequence screen.

7.3.6 Split Fraction

This option allows you to quantify the sequence cut sets using the mincut upper bound values that have been calculated for each successful or failed system which make up this sequence. This option does not generate cut sets and is usually used to give you a quick approximation of the actual result. The actual results may be obtained by generating cut sets and quantifying these cut sets.

To invoke this option, enter an <S> in the option field, highlight the desired sequence, and press <Enter>. The quantification results are shown in a screen similar to the one shown in Figure 203.

As with previous options, you may specify several sequences or a range of sequences using the <F2> and <F4> function keys, respectively. To process all sequences, enter an <S> in the option field and press <Enter>. The message **Process all entries?** will be displayed. At this prompt, enter a <Y>.

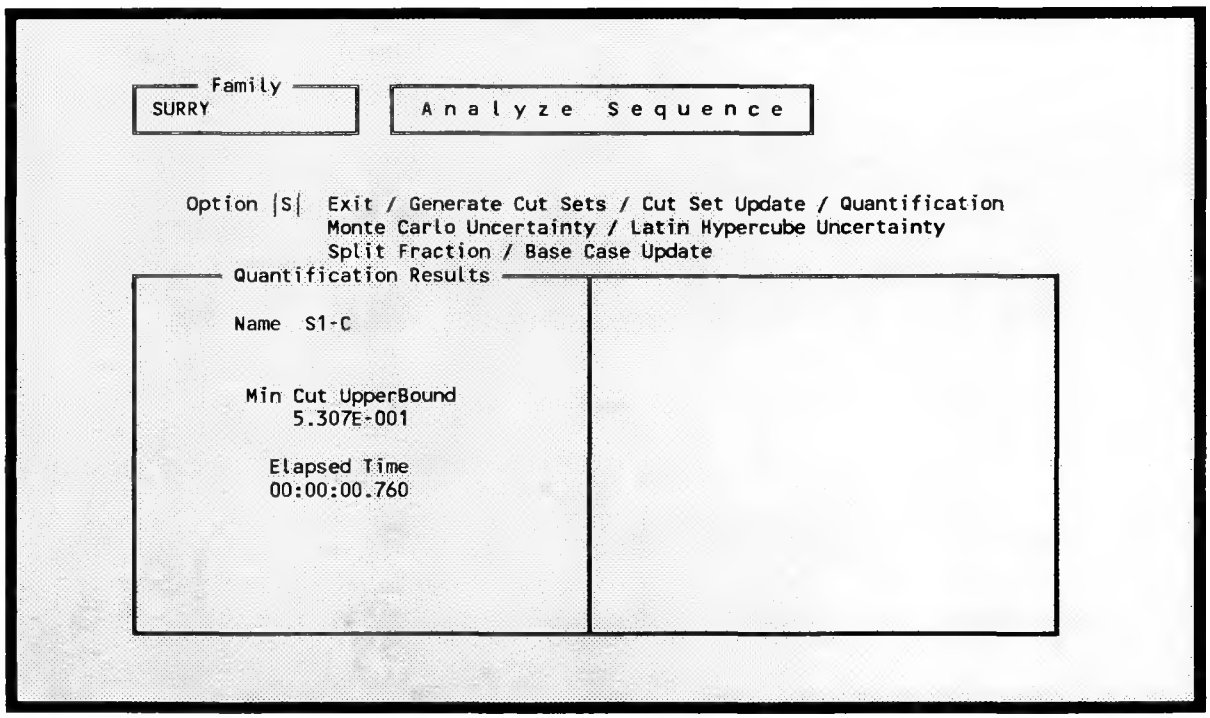


Figure 203. Split fraction display screen.

7.3.7 Base Case Update

This option allows you to overwrite all base case (original) data with the current case data. The base case cut sets will be set to the alternate case cut sets; the base case uncertainty data will be set to the current case uncertainty data; and the base case quantile values will be set equal to the quantile values for the current case. The base case minimum cut set upper bound will be initialized to the current case minimum cut set upper bound. **The original base case data will be lost if this option is executed!**

The base case update may be performed on a single sequence, a group of sequences, or on all of the sequences in the current family. To activate this option for a single sequence, type a <B> (Base Case Update) in the option field, highlight the desired sequence, and press <Enter>. To perform a base case update on a group of sequences, mark the desired sequences using the F2, F3, or F4 keys, type a <B> in the option field and press <Enter>. To perform this option on all sequences in the current family, type a <B> in the option field and press <Enter>. A message **Process all records? (Y/N)** will appear at the bottom of the screen. Type a <Y> to continue the base case update for all of the sequences, or type an <N> to discontinue the update for all sequences.

A warning screen (Figure 204) will then be displayed asking for a (Y/N) confirmation prior to performing the update. To terminate the update, type an <N> in the option field or press the <Esc> key. To initiate the base case update, type a <Y> in the option field. This will cause the current case data to overwrite the base case data. Upon completion of this process, a message **Base case update complete** will be displayed at the bottom of the screen.

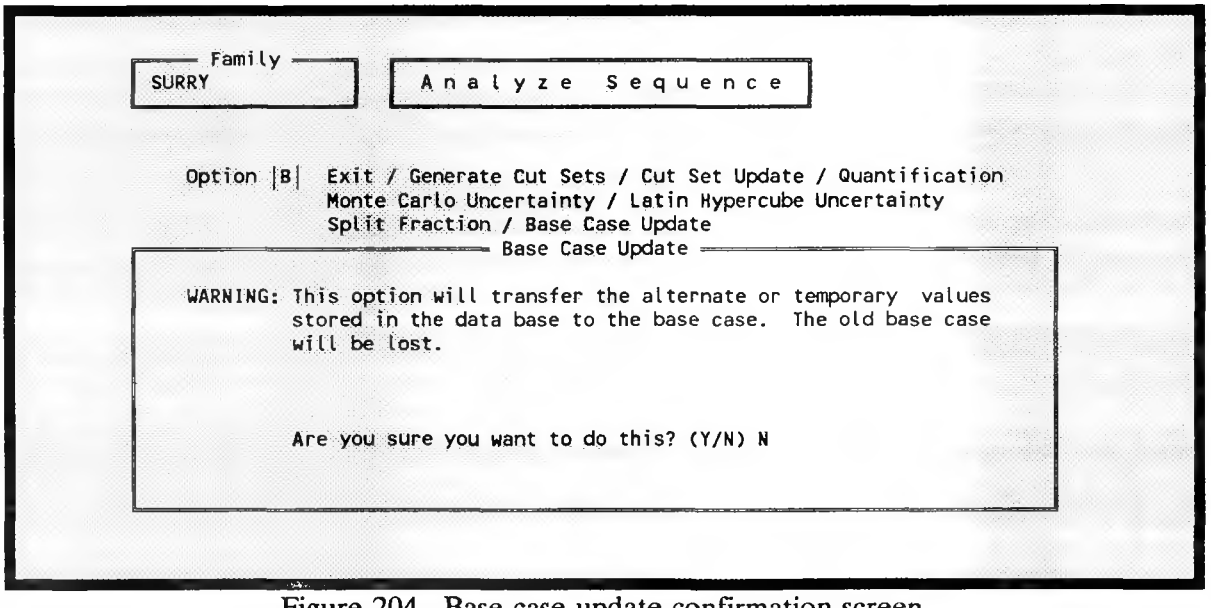


Figure 204. Base case update confirmation screen.

7.4 Display Results

To display the results of your sequence analysis, highlight Display Results or type <D> on the Event Tree Analysis screen and press <Enter>. The Display Sequence Results screen will be displayed showing a list of the sequences contained in the data base (Figure 205). The following options are available: Exit, Cut Sets, Importance, and Uncertainty. In addition, the following function keys may be used:

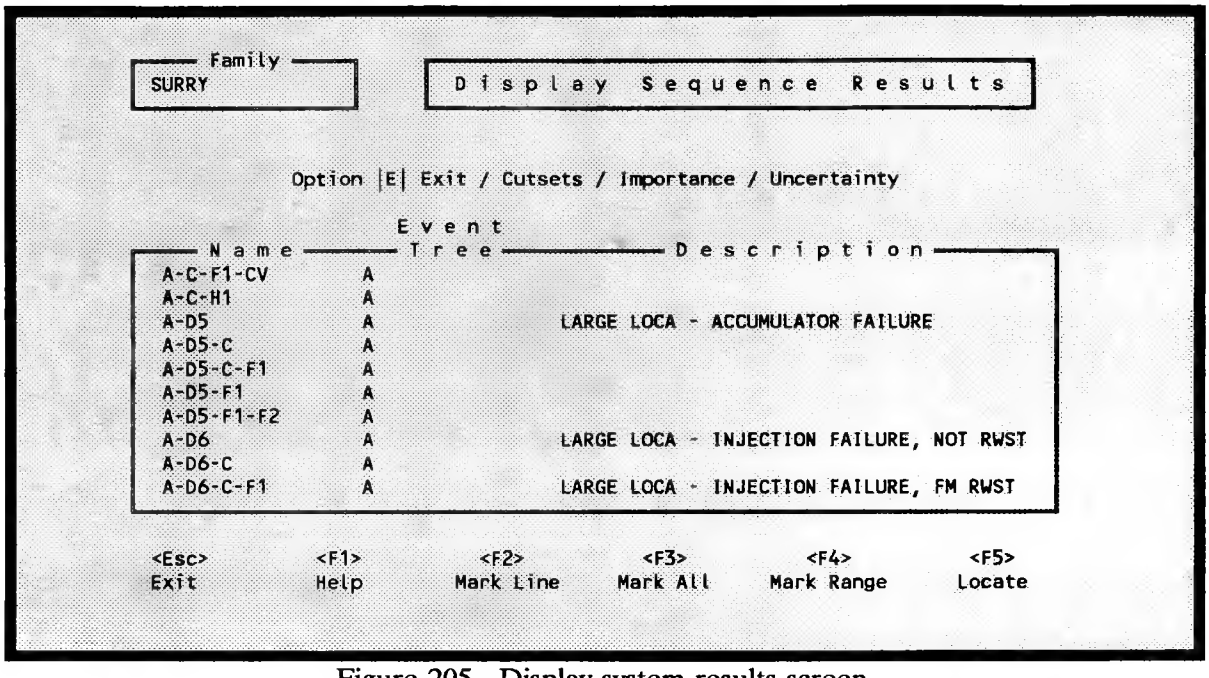


Figure 205. Display system results screen.

<Esc> Returns to the previous screen.

<F1> Displays a general help screen.

<F2> Mark/Unmark tags items for use in the selected option.

<F3> Clear All Marked events removes the marks (*) from the listed items. If no items are marked, this option will mark all of the items.

<F4> Mark/Unmark range of items quickly tags large numbers of items for processing.

<F5> Locates a specific sequence. When you invoke this option, a screen similar to the one shown in Figure 206 will be displayed. Enter the sequence name you wish to locate and press <Enter>. If the sequence exists, it will be highlighted on the display.

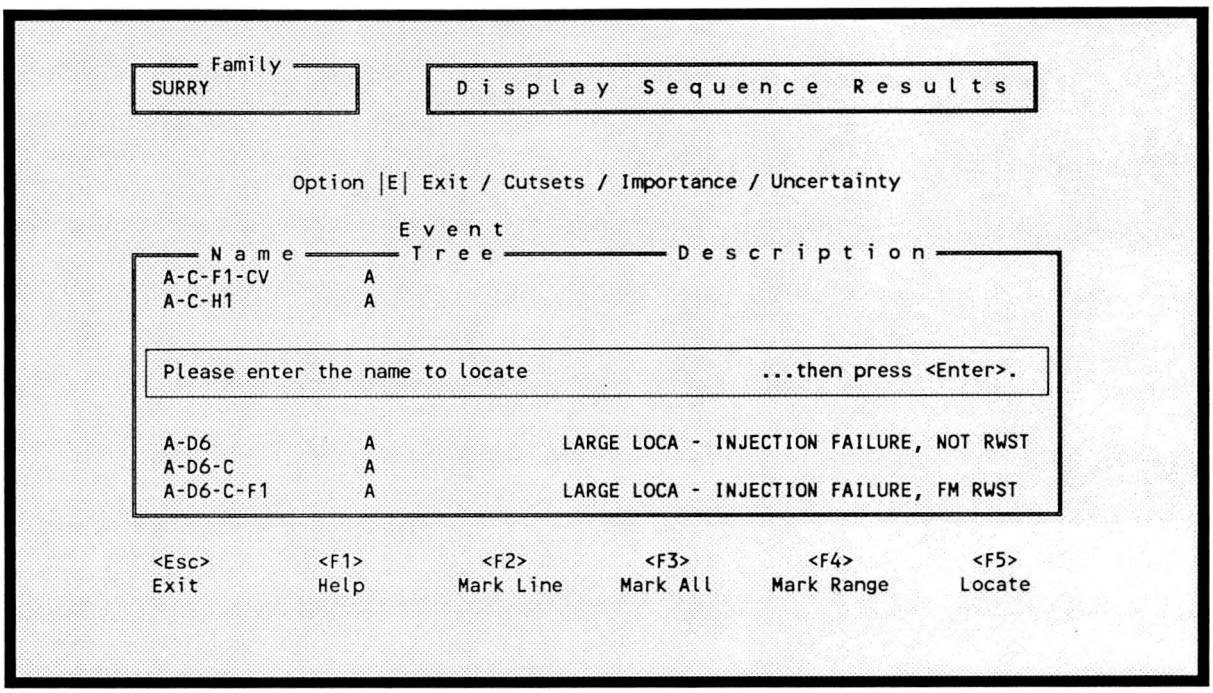


Figure 206. Locate a specific system using <F5>.

7.4.1 Exit

This option terminates the process and returns to the Event Tree Analysis screen. To invoke the option, type <E> in the option field and press <Enter>, or press the <Esc> key.

7.4.2 Cut Sets

This option displays the sequence cut sets (Figure 207), their percent of contribution to the sequence, frequency, and the event names that make up the cut sets. The sequence minimum upper bound, the number of cut sets that make up the sequence, the current partition upper bound, the percentage that the partition contributes to the sequence, and the number of cut sets in the partition are displayed at the bottom of the screen.

7.4.2.1 Exit. This option terminates the process and returns to the previous screen. To invoke this option, type<E> and press <Enter>, or press the <Esc> key.

7.4.2.2 Partition. The partition option allows you to redefine a sequence as a subset of the original cut sets. The functions available to perform this task are: Exit, Include, Exclude, Complement, Reset, and View Events.

To invoke this option, type <P>, highlight a sequence, and press <Enter>. Figure 208 will be displayed.

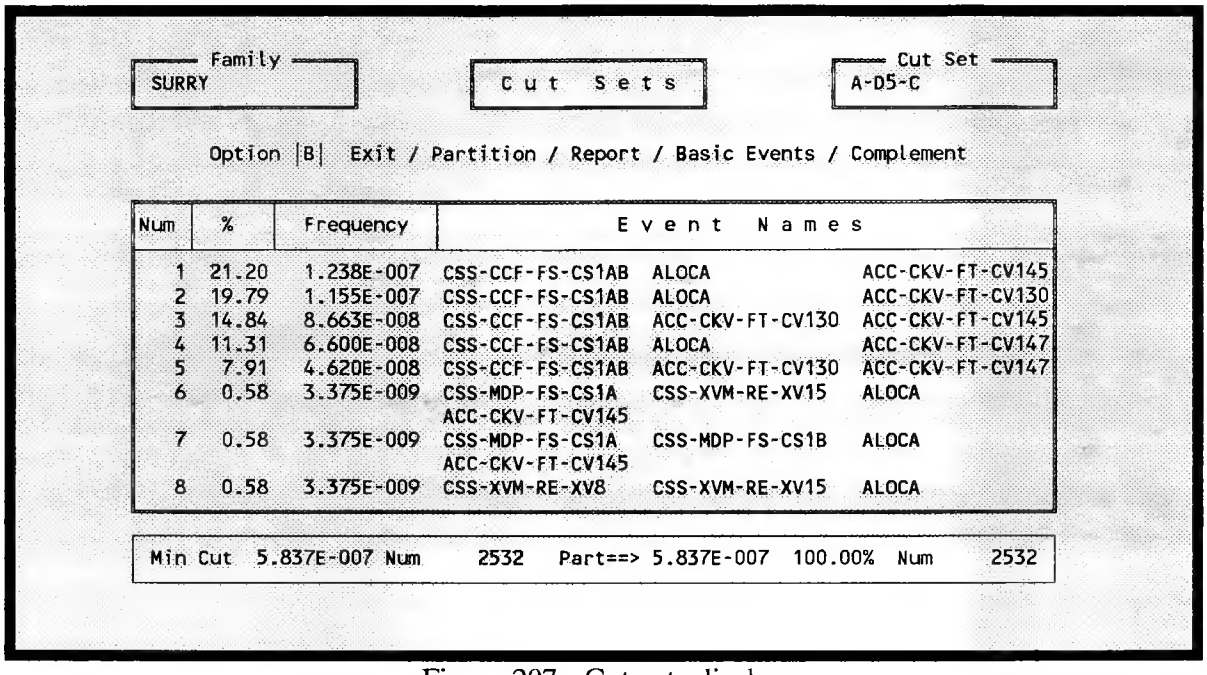


Figure 207. Cut sets display.

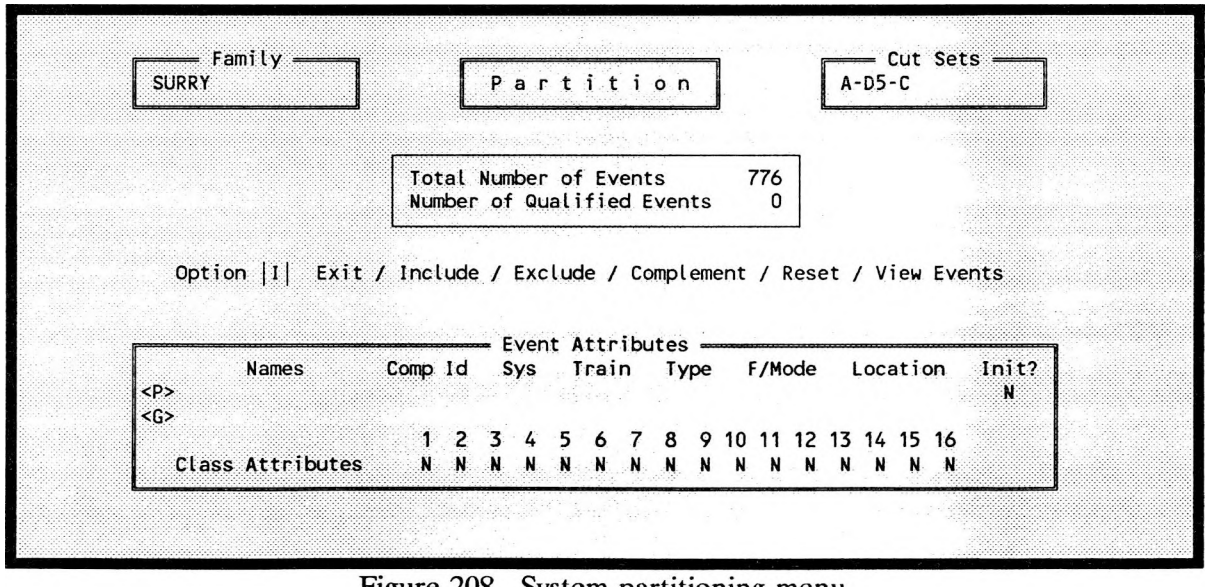


Figure 208. System partitioning menu.

Exit: This option terminates the process and returns to the previous screen. To invoke this option, type <E> and press <Enter>, or press the <Esc> key.

Include: To establish a partition via this option, type <I> in the option field, fill in the entry fields on the screen that are to be used to qualify the events that are to be included in the new partition, and press <Enter>. The application proceeds to qualify the events and when complete will update the Number of Qualified Events field that appears at the top of the screen. In this case, qualified events are those events which contain the included attributes. Returning to the Cut Sets screen via the Exit option, you will see that the sequence cut set list contains only those cut sets that are made up of qualified events (see Figure 209). If the sequence cut sets do not contain any of the qualified events, then the message **No cutsets qualify** is displayed at the bottom of the screen.

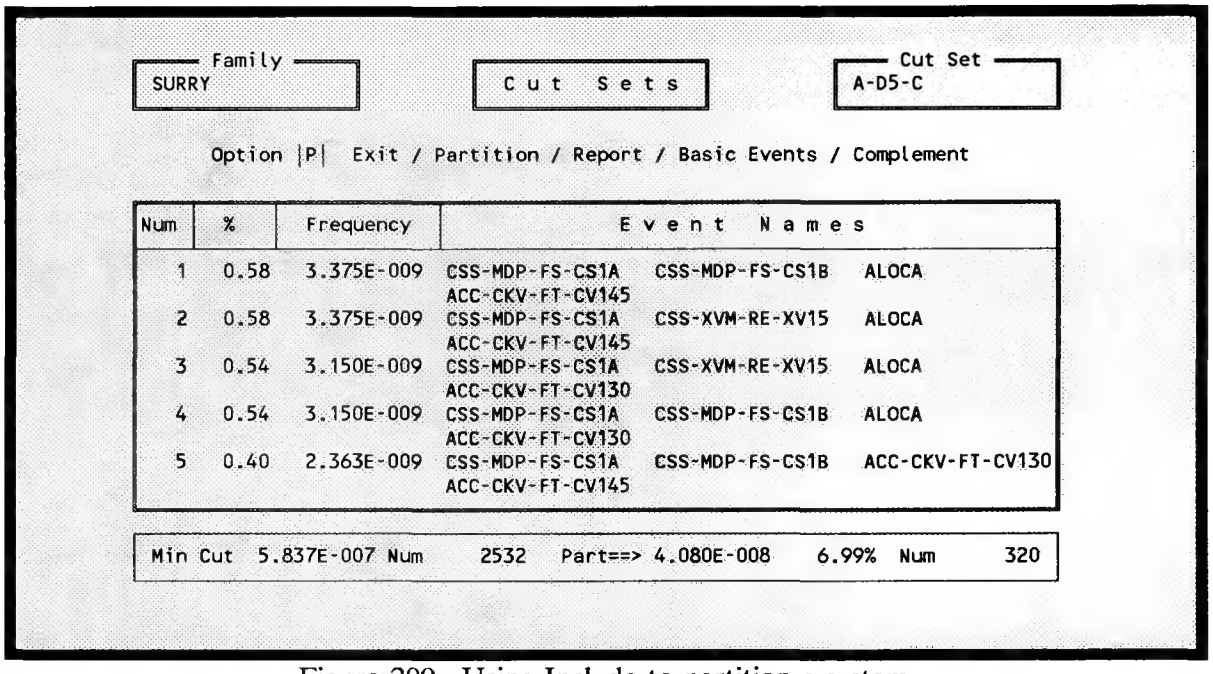


Figure 209. Using Include to partition a system.

EXclude: To establish a partition via this option, type <X> in the option field, then fill in the entry fields on the screen that are to be used to qualify the events that are not to be included in the new partition and press <Enter>. The application proceeds to qualify the events. When it is complete it will update the Number of Qualified Events field that appears at the top of the screen. In this case, qualified events are those that do not contain any of the excluded attributes. Returning to the Cut Sets screen via the Exit option you will see that the sequence cut set list contains only those cut sets that are made up of qualified events (see Figure 210) If the sequence cut sets do not contain any of the qualified events, then the message **No cutsets qualify** is displayed at the bottom of the screen.

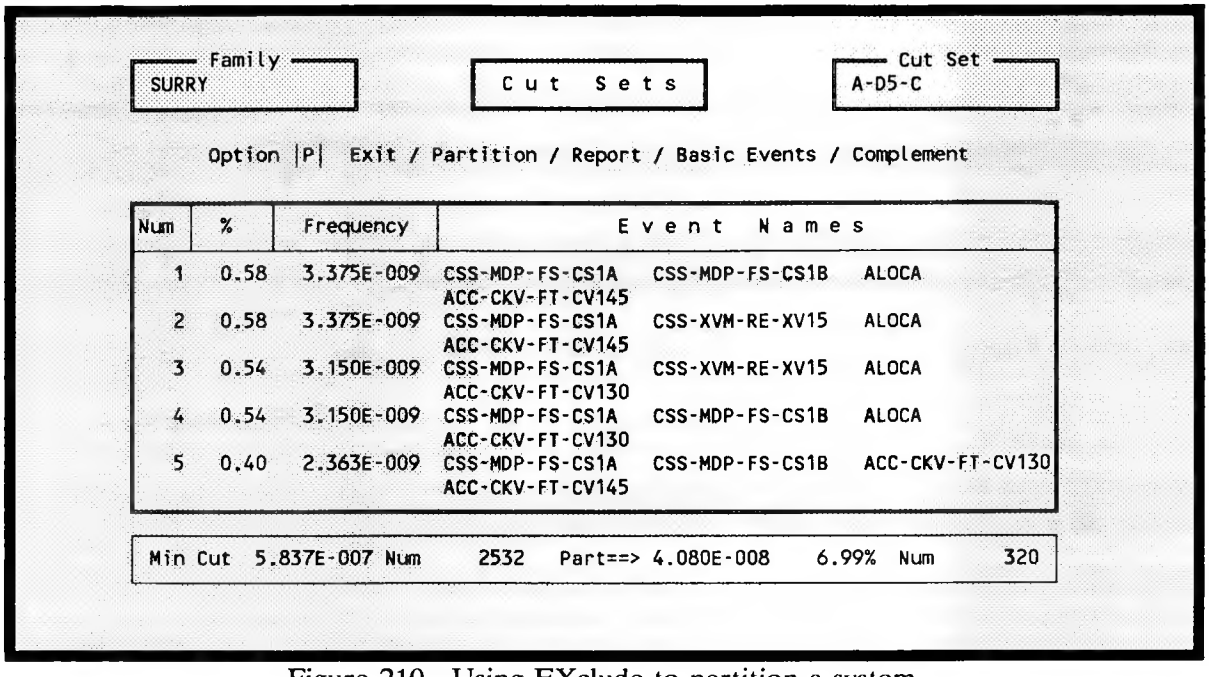


Figure 210. Using EXclude to partition a system.

Complement: To establish a partition via this option, type <C> in the option field, and press <Enter>. This causes all currently qualified events to be disqualified, and all unqualified events to become the set of qualified events. The Number of Qualified Events field at the top of the screen will change accordingly. Returning to the Cut Sets screen via the Exit option you will see that the cut set list contains only those cut sets that are made up of qualified events. If the cut sets do not contain any of the qualified events then the message **No cutsets qualify** is displayed at the bottom of the screen.

Reset: This option sets all family events to qualified. This, of course, removes all partitioning from the current sequence cut sets. To activate this option, type <R> in the option field and press <Enter>. (Assume the partition shown in Figure 209). Type <R> in the option field and press <Enter>. The original cut set list is the result, as shown in Figure 207.

View Events: This option displays the list of family events and allows you to mark those events that are to be considered qualified events (Figure 211). To activate this option, type <V> in the option field and press <Enter>. Mark the events, using <F2>, <F3>, or <F4> keys, that are considered qualified and press <Enter>. You will be returned to the Partition screen where the number of qualified events will be updated accordingly (Figure 212). If the cut sets do not contain any of the qualified events, then the message **No cutsets qualify** is displayed at the bottom of the screen.

7.4.2.3 Report. The Report option allows you to generate a report of the data that is displayed on the screen. The report may be displayed on the console, sent to an attached printer, or saved in a disk file for later processing (Figure 213).

To invoke this option, type <R> in the option field, and press <Enter>. Upon pressing <Enter>, the Information Request screen is displayed (Figure 213). This screen shows a default title and file name. You may change these defaults to meet your needs.

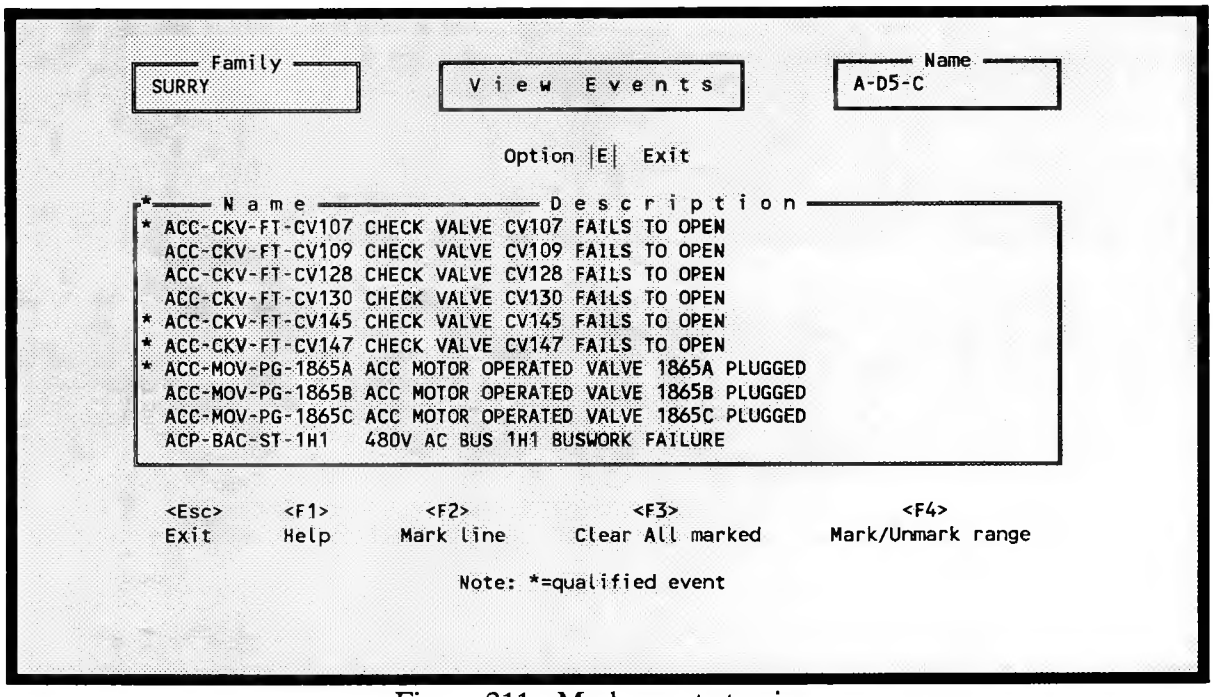


Figure 211. Mark events to view.

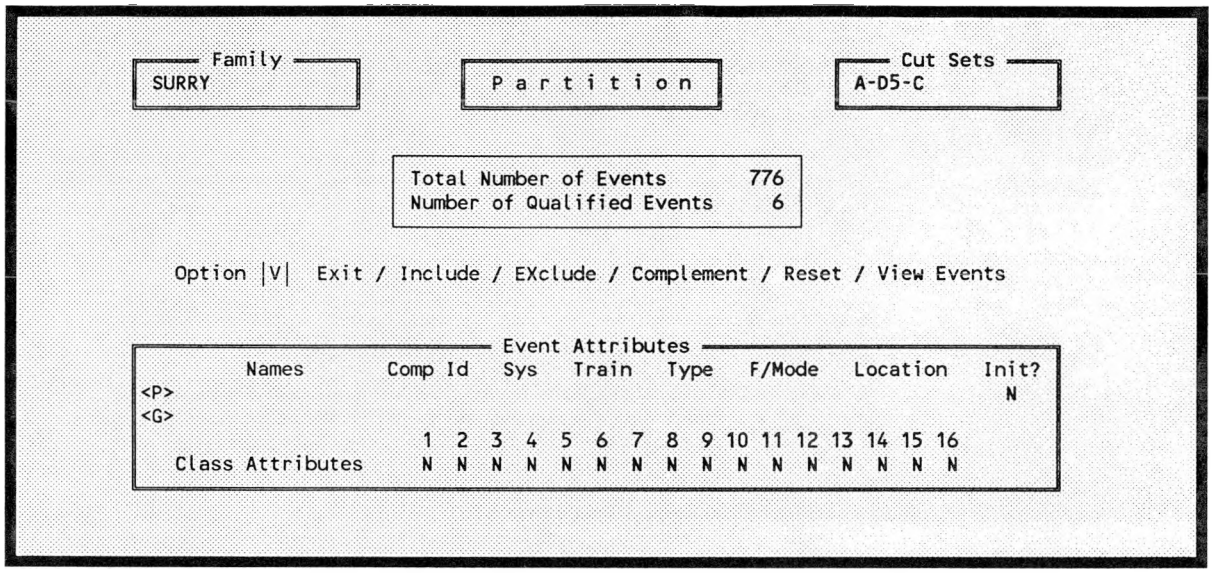


Figure 212. Results of marking events to view.

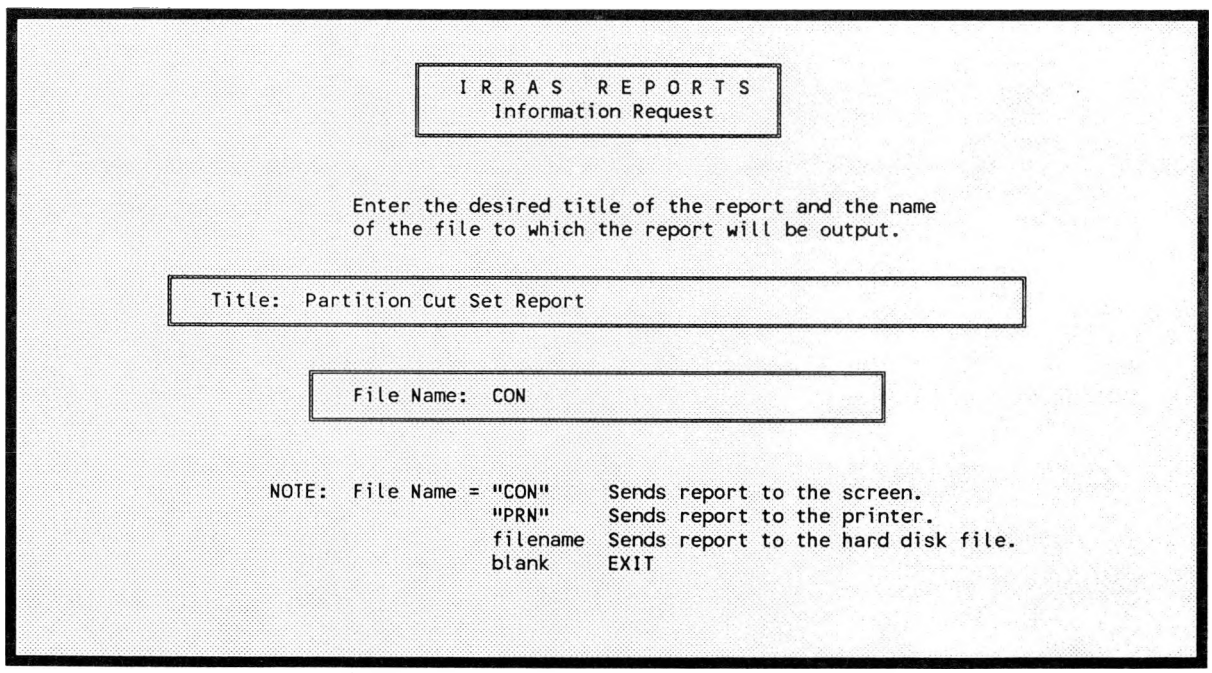


Figure 213. Partition report type selection.

7.4.2.4 Basic Events. The Basic Event option provides the following detailed information about the events that make up a cut set: name, description, probability, component ID, system, component type, failure mode, and location (Figure 214). To invoke this option, type <B> in the option field, highlight a cut set, and press <Enter>.

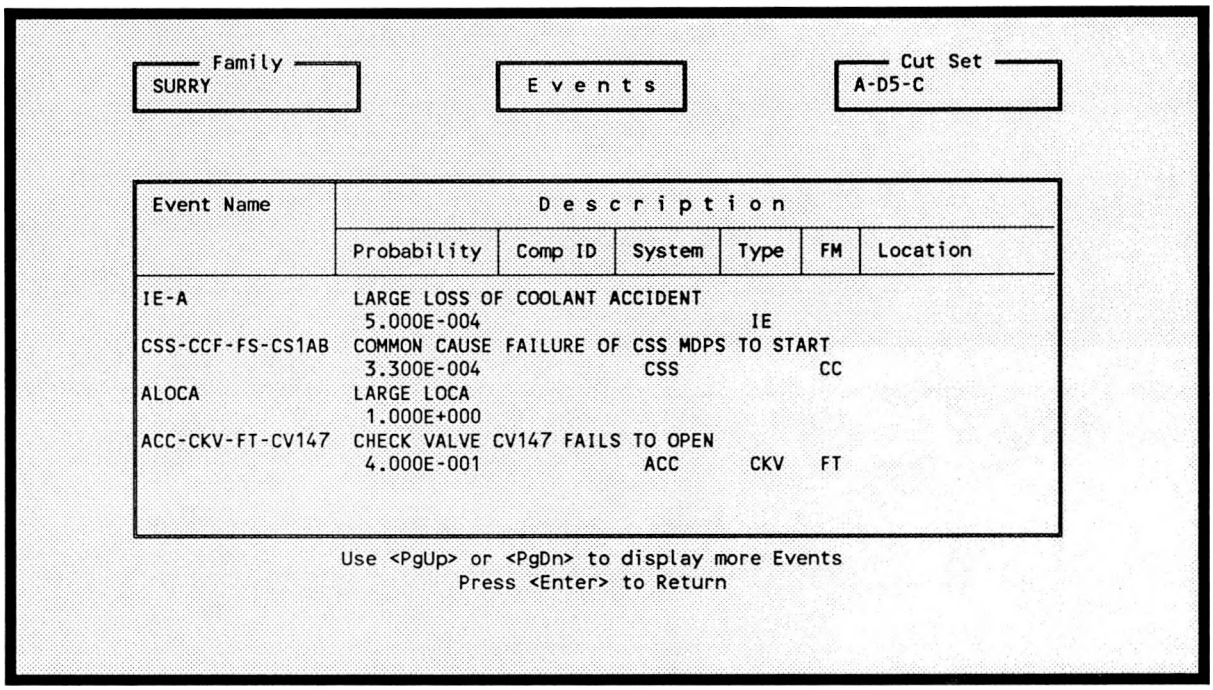


Figure 214. Details of a cut sets basic events.

7.4.2.5 Complement. The Complement option operates on the current sequence partition. Its function is to set all currently qualified cut sets to unqualified. This allows you to split a system into two partitions and then switch between the two partitions to view the results. To invoke this option, type <C> in the option field and press <Enter>. (Assume the partition shown in Figure 209). Type <C> and press <Enter>. The resulting display is shown in Figure 210).

7.4.3 Importance

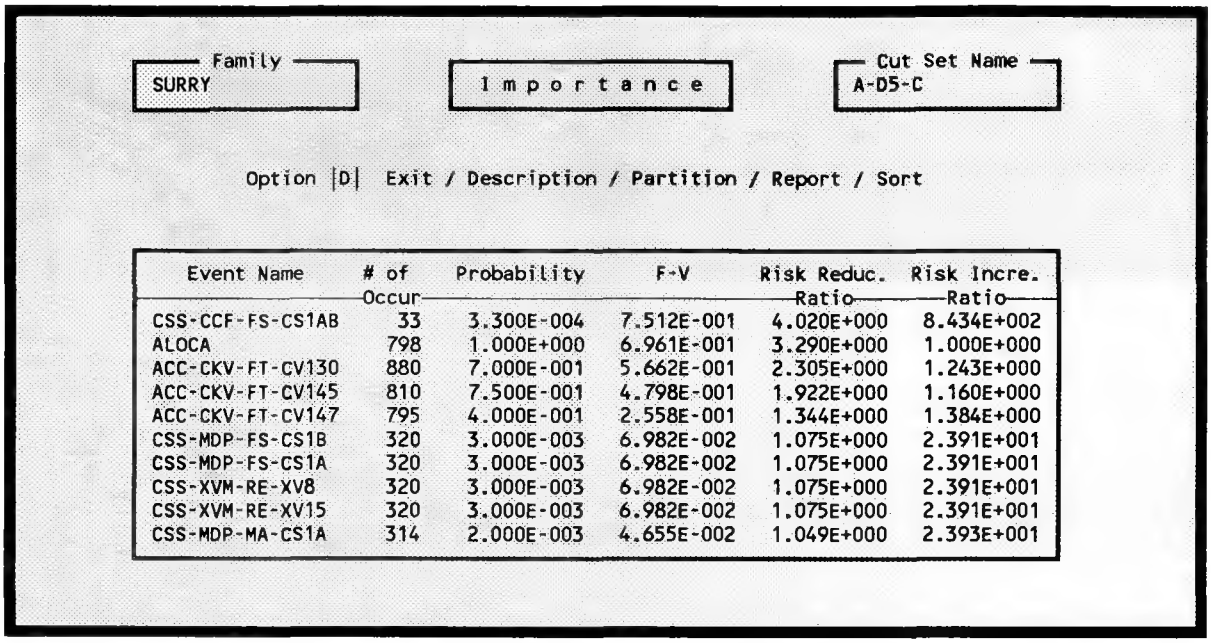
This option calculates and displays the following three importance measures for each event in the sequence:

- Fussell-Vesely importance - an indication of the percentage of the minimal cut set upper bound contributed by the basic event.

- Risk Reduction Ratio - an indication of how much the minimal cut set upper bound would decrease if the basic event was made perfect (never fail).

- Risk Increase Ratio - an indication of how much the minimal cut set upper bound would increase if the basic event was always failed.

To invoke this option, type <I> in the option field, highlight a sequence (or you may process all records by not specifying a sequence), and press <Enter>. By default, when the importance data is first displayed it is sorted, high to low, on Fussell-Vesely (Figure 215).



Event Name	# of Occur	Probability	F-V	Risk Reduc. Ratio	Risk Incre. Ratio
CSS-CCF-FS-CS1AB	33	3.300E-004	7.512E-001	4.020E+000	8.434E+002
ALOCA	798	1.000E+000	6.961E-001	3.290E+000	1.000E+000
ACC-CKV-FT-CV130	880	7.000E-001	5.662E-001	2.305E+000	1.243E+000
ACC-CKV-FT-CV145	810	7.500E-001	4.798E-001	1.922E+000	1.160E+000
ACC-CKV-FT-CV147	795	4.000E-001	2.558E-001	1.344E+000	1.384E+000
CSS-MDP-FS-CS1B	320	3.000E-003	6.982E-002	1.075E+000	2.391E+001
CSS-MDP-FS-CS1A	320	3.000E-003	6.982E-002	1.075E+000	2.391E+001
CSS-XVM-RE-XV8	320	3.000E-003	6.982E-002	1.075E+000	2.391E+001
CSS-XVM-RE-XV15	320	3.000E-003	6.982E-002	1.075E+000	2.391E+001
CSS-MDP-MA-CS1A	314	2.000E-003	4.655E-002	1.049E+000	2.393E+001

Figure 215. Initial display of importance measures.

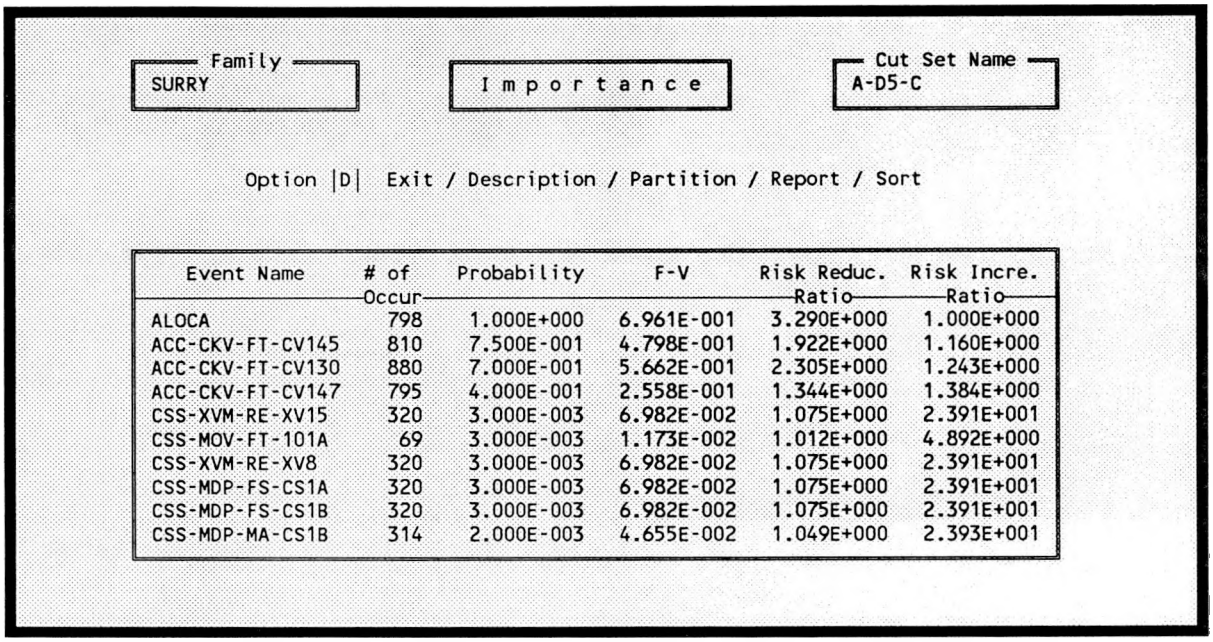
7.4.3.1 Exit. Returns you to the previous screen.

7.4.3.2 Description. Displays the full description for the highlighted event on the bottom of the screen. To invoke this option, enter a <D>, highlight the desired event, and press <Enter>. If no event is highlighted, the message **An event must be selected first...** is displayed.

7.4.3.3 Partition. This option invokes the same process as described in Section 7.4.2.2.

7.4.3.4 Report. This option invokes the same process as described in Section 7.4.2.3.

7.4.3.5 Sort. When you invoke this option, Figure 216 will be displayed. As shown, the data can be sorted by the following: Name, Occurrence, Probability, F-V, Reduction, and Increase.



Event Name	# of Occur	Probability	F-V	Risk Reduc. Ratio	Risk Incre. Ratio
ALOCA	798	1.000E+000	6.961E-001	3.290E+000	1.000E+000
ACC-CKV-FT-CV145	810	7.500E-001	4.798E-001	1.922E+000	1.160E+000
ACC-CKV-FT-CV130	880	7.000E-001	5.662E-001	2.305E+000	1.243E+000
ACC-CKV-FT-CV147	795	4.000E-001	2.558E-001	1.344E+000	1.384E+000
CSS-XVM-RE-XV15	320	3.000E-003	6.982E-002	1.075E+000	2.391E+001
CSS-MOV-FT-101A	69	3.000E-003	1.173E-002	1.012E+000	4.892E+000
CSS-XVM-RE-XV8	320	3.000E-003	6.982E-002	1.075E+000	2.391E+001
CSS-MDP-FS-CS1A	320	3.000E-003	6.982E-002	1.075E+000	2.391E+001
CSS-MDP-FS-CS1B	320	3.000E-003	6.982E-002	1.075E+000	2.391E+001
CSS-MDP-MA-CS1B	314	2.000E-003	4.655E-002	1.049E+000	2.393E+001

Figure 216. Importance measures sorted by probability.

7.4.4 Uncertainty

The Uncertainty option displays the distribution and confidence limits of a sequence for both base and current data vales. This data was calculated using either the Latin Hypercube simulation technique or the Monte Carlo simulation technique. To invoke this option, type <U> (Uncertainty) in the option field of the Display Sequence Results screen, highlight the desired sequence, and press <Enter>. Figure 217 shows the base and current case uncertainty data for the highlighted sequence.

From this screen you may either return to the Sequence Display screen or view the quantile values associated with the current case data or the base case data. To return to the Display Sequence Results screen, type an <E> (Exit) in the option field and press <Enter>, or press the <Esc> key. To view the quantile values for the current case, type a <C> in the option field and press <Enter>. A screen showing the quantile values will appear (Figure 218). To return to the previous screen press <Enter>. If you wish to view base case quantile values, type a <B> in the option field and press <Enter>.

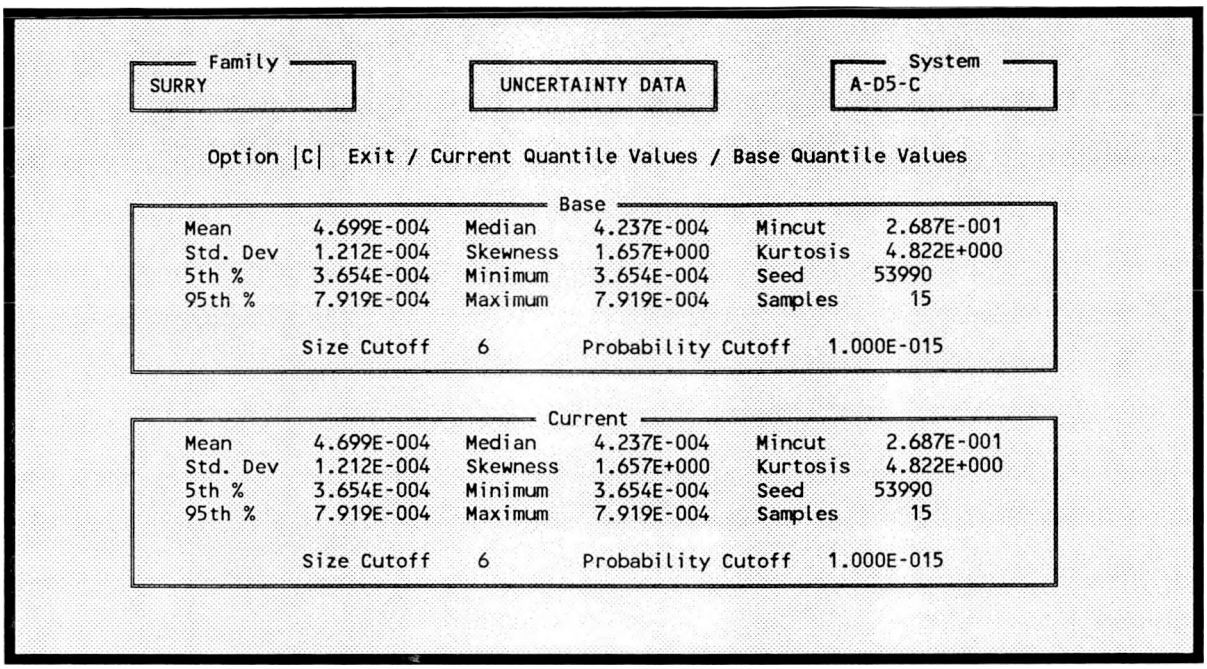
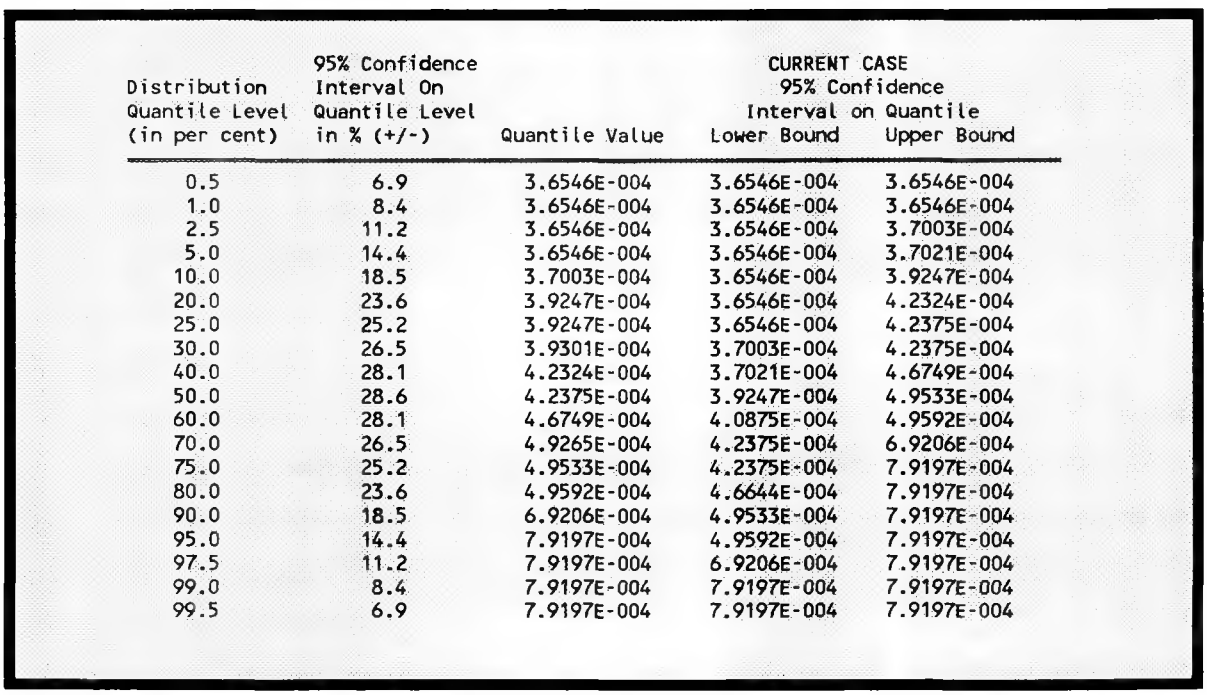


Figure 217. Uncertainty data display.



Distribution Quantile Level (in per cent)	95% Confidence Interval On Quantile Level in % (+/-)	Quantile Value	CURRENT CASE 95% Confidence Interval on Quantile Lower Bound	Upper Bound
0.5	6.9	3.6546E-004	3.6546E-004	3.6546E-004
1.0	8.4	3.6546E-004	3.6546E-004	3.6546E-004
2.5	11.2	3.6546E-004	3.6546E-004	3.7003E-004
5.0	14.4	3.6546E-004	3.6546E-004	3.7021E-004
10.0	18.5	3.7003E-004	3.6546E-004	3.9247E-004
20.0	23.6	3.9247E-004	3.6546E-004	4.2324E-004
25.0	25.2	3.9247E-004	3.6546E-004	4.2375E-004
30.0	26.5	3.9301E-004	3.7003E-004	4.2375E-004
40.0	28.1	4.2324E-004	3.7021E-004	4.6749E-004
50.0	28.6	4.2375E-004	3.9247E-004	4.9533E-004
60.0	28.1	4.6749E-004	4.0875E-004	4.9592E-004
70.0	26.5	4.9265E-004	4.2375E-004	6.9206E-004
75.0	25.2	4.9533E-004	4.2375E-004	7.9197E-004
80.0	23.6	4.9592E-004	4.6644E-004	7.9197E-004
90.0	18.5	6.9206E-004	4.9533E-004	7.9197E-004
95.0	14.4	7.9197E-004	4.9592E-004	7.9197E-004
97.5	11.2	7.9197E-004	6.9206E-004	7.9197E-004
99.0	8.4	7.9197E-004	7.9197E-004	7.9197E-004
99.5	6.9	7.9197E-004	7.9197E-004	7.9197E-004

Figure 218. Quantile values display.

7.5 Cut Set Editor

The cut set editor provides you with the means to edit the base case/alternate sequence cut sets. Generally, base case cut sets are the cut sets that represent the data in its original form. If you have performed a base case update this may not be true. Alternate cut sets represent data that was modified during previous cut set editor sessions.

Any event name entered during cut set editing may be preceded by a "/" to indicate that it is to be treated as a complemented event. The probability of a complemented event is 1 - the failure probability.

To invoke this option, highlight Cut Set Editor or type <C> in the option field and press <Enter>. Figure 219 shows the Cut Set Editor screen indicating the sequence names and descriptions. Whether the sequence has associated base case cut sets and/or alternate cut sets, is indicated by the letter B and/or A preceding the sequence name. To edit the base case cut set, select <B>, highlight a sequence showing a letter B, and press <Enter>. Likewise to edit an alternate cut set select <A>, highlight a sequence showing a letter A, and press <Enter>. If a sequence name is not flagged with a B or A it may still be edited.

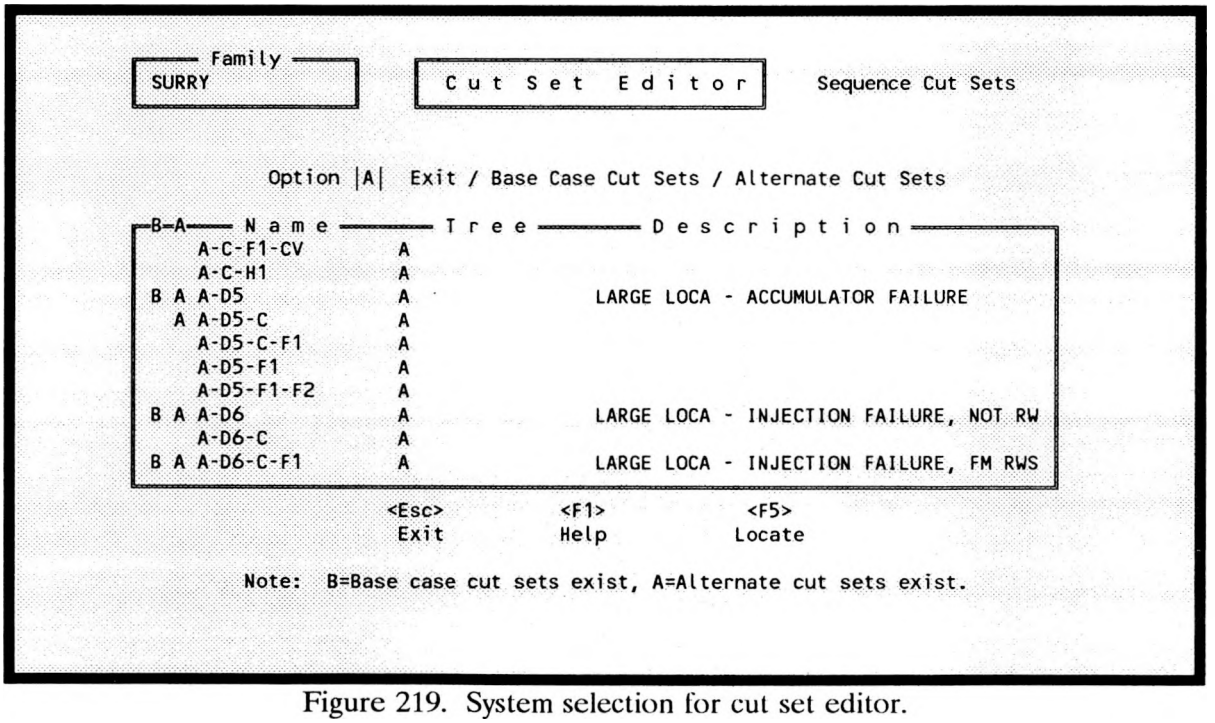


Figure 219. System selection for cut set editor.

In any case the screen shown in Figure 220 is displayed. This screen shows 14 editing options which are activated by a single key stroke. The 14 options include: Exit, Add, Modify, Delete, Locate, Next, Previous, Search, Options, Insert Events, Replace Events, Copy Cut Sets and Replace Events, Undo Delete, and Find and Delete Cut Sets. The Add, Modify, and Delete functions will

perform their function on either the entire cut set or on a single event in a cut set depending upon where the cursor is positioned at the time the key to activate the function is pressed. If the cursor is in the first column of the screen, then the function will be performed on the entire cut set. However, if the cursor is in one of the other four columns, then the function will be performed on the event where the cursor is positioned.

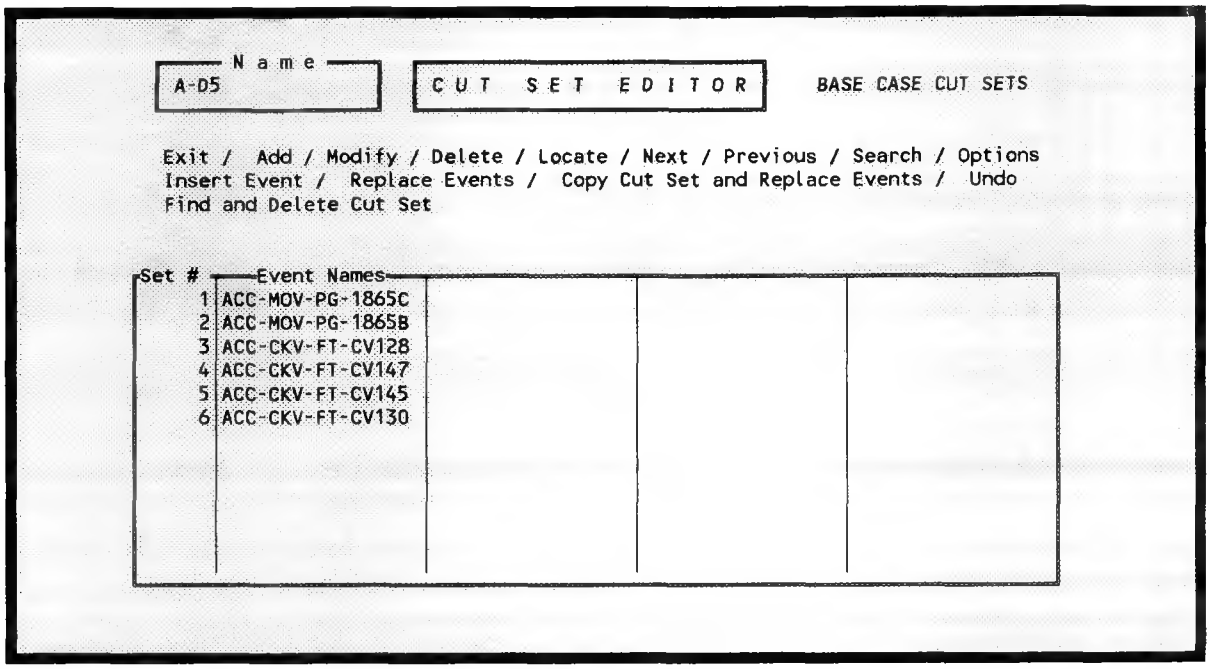


Figure 220. Cut set editor main menu.

To move the cursor about the editing window, use the keyboard cursor pad. The arrow keys move one field in each respective direction. The <Home> key places the cursor in the upper right corner of the window. The <End> key moves the cursor to the bottom left. The <PgUp> key moves the window up one page (12 lines). The <PgDn> key moves the window down one page. <Ctrl-PgUp> and <Ctrl-PgDn> move to the top and bottom of the file. Pressing the function key <F1> toggles between two cut set editor screens. One screen shows the editing options and the other shows the available cursor movements.

7.5.1 Exit

This option returns you to the Cut Set Editor screen (Figure 219). After pressing <E> (Exit) you are asked if the changes are to be saved or discarded (Figure 221). If the changes are saved, the sequence and plant frequencies are recalculated to reflect the new cut set configurations. These new frequencies will be reflected in all of the data base displays and reports.

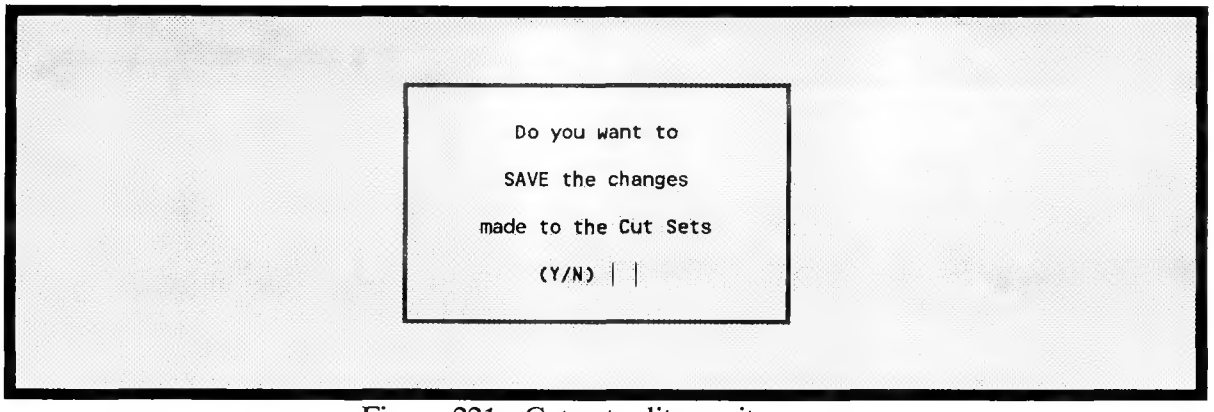


Figure 221. Cut set editor exit screen.

7.5.2 Add

This option allows you to add a cut set to a sequence or an event to a cut set. To add a new cut set, move the cursor into the set number column and press <A>. The cut set display is cleared, and the cursor is placed in the event name column (Figure 222). The event names, that make up the cut set may be entered using the <Tab> key to move between fields, and the <Enter> key to end the addition. The window is then updated and the cursor is positioned on the new cut set (Figure 223). The <Insert> key also invokes the Add option.

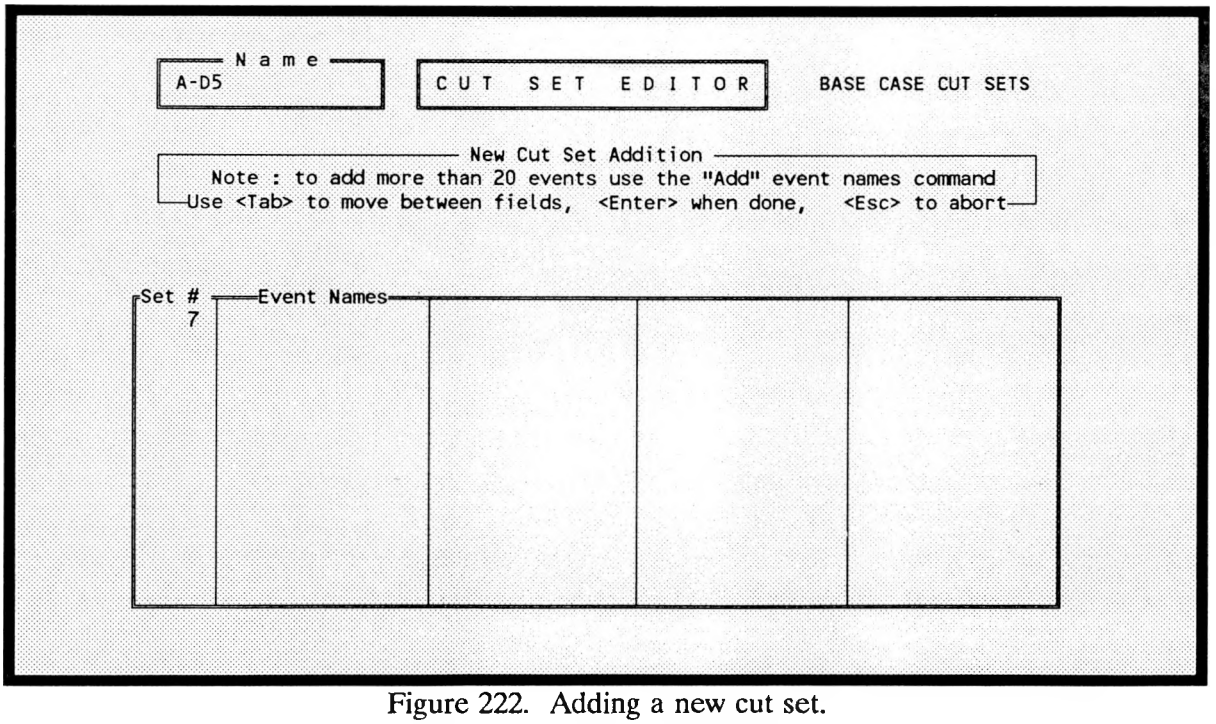


Figure 222. Adding a new cut set.

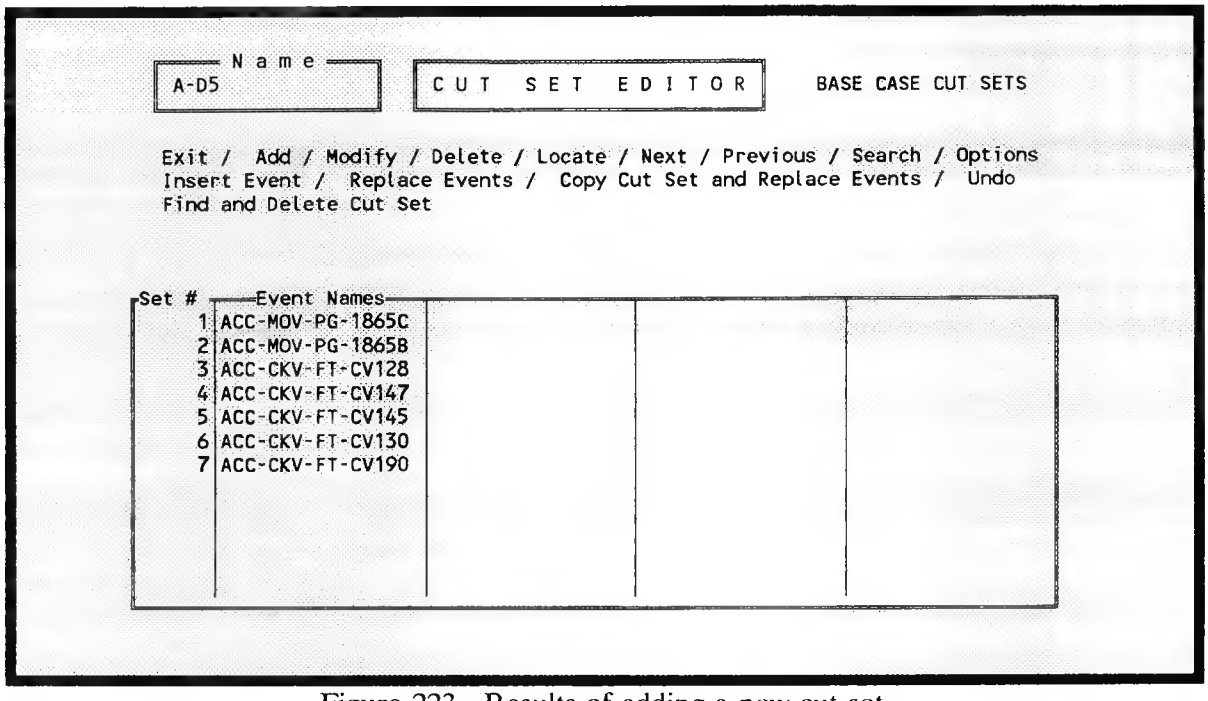


Figure 223. Results of adding a new cut set.

To add an event to a cut set, place the cursor in the row of the cut set you wish the event to be in and press <A>. Enter the event name. Figure 224 shows the editor screen ready to add an event name. Figure 225 shows the results of adding a new event.

7.5.3 Modify

To modify events of an entire cut set, place the cursor in the first column of the screen and press the <M> key. This will display a screen containing the first 20 events of the cut set to be modified (Figure 226). After making modifications to the events of the cut set, press <Enter> to save the modifications or press <Esc> to abort the modification process.

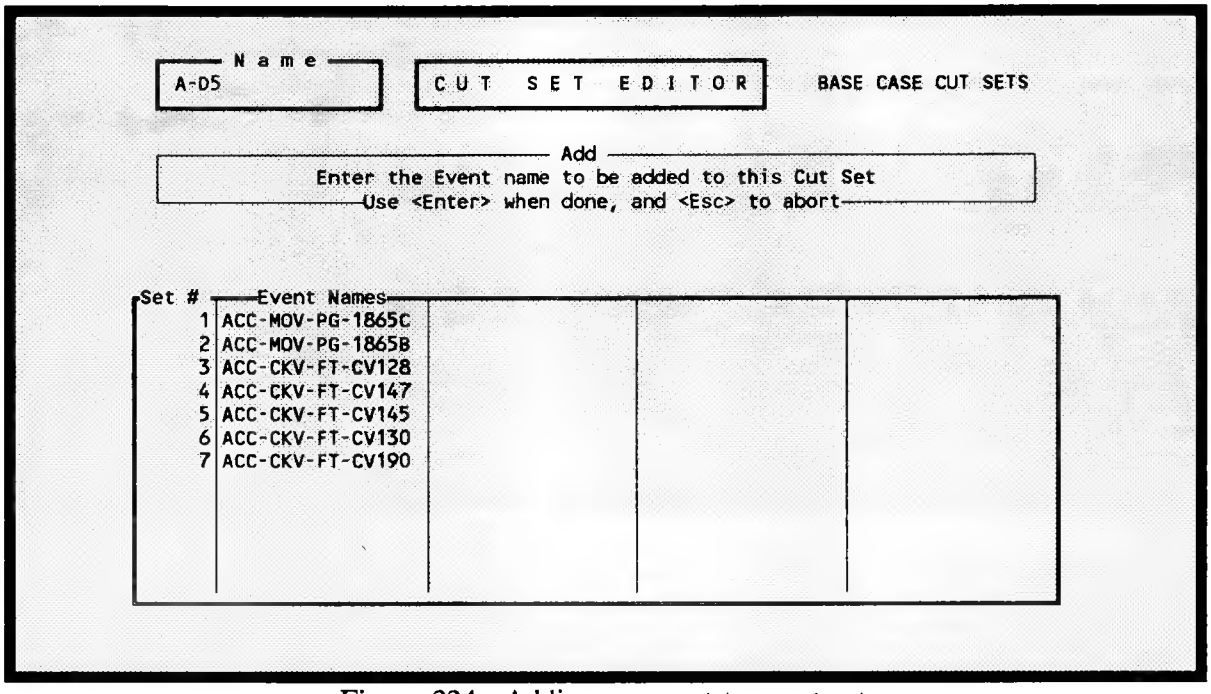


Figure 224. Adding an event to a cut set.

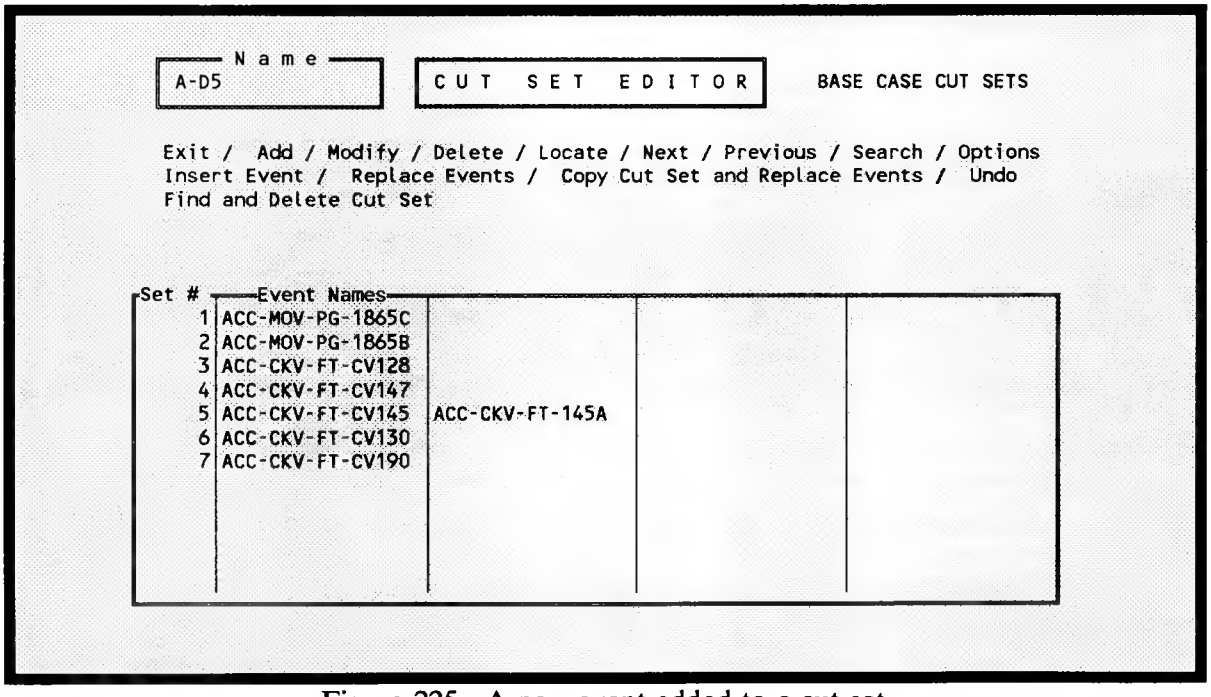


Figure 225. A new event added to a cut set.

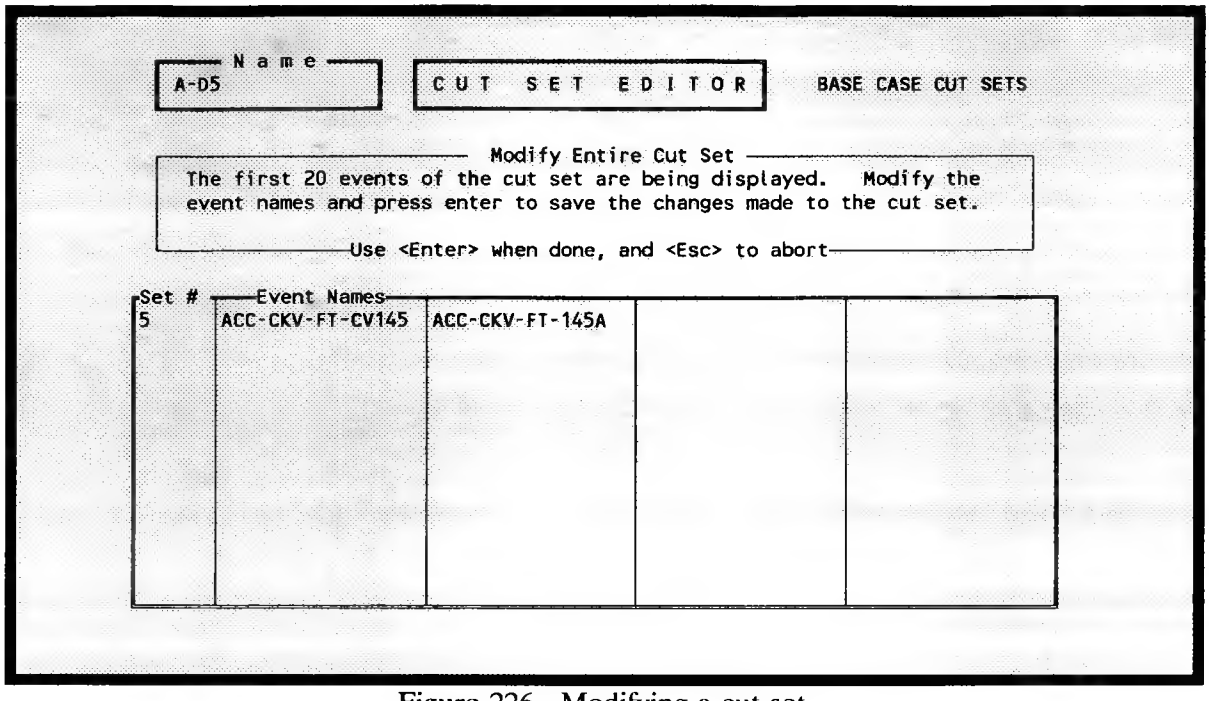


Figure 226. Modifying a cut set.

To change a single event in a cut set, position the cursor on the desired event and press the <M> key. This will display the Change Event Name Screen (Figure 227) to allow you to modify the current event. When modifying an event, you may use all of the alphanumeric keys, in addition to the <Ins> and <Del> keys.

7.5.4 Delete

This option allows you to delete an entire cut set (Figure 228) or an individual event (Figure 229). Placing the cursor on a cut set number and pressing <D> (Delete) causes the entire cut set to be deleted. If the cursor is placed on an event name, the event at that location only is deleted from the cut set.

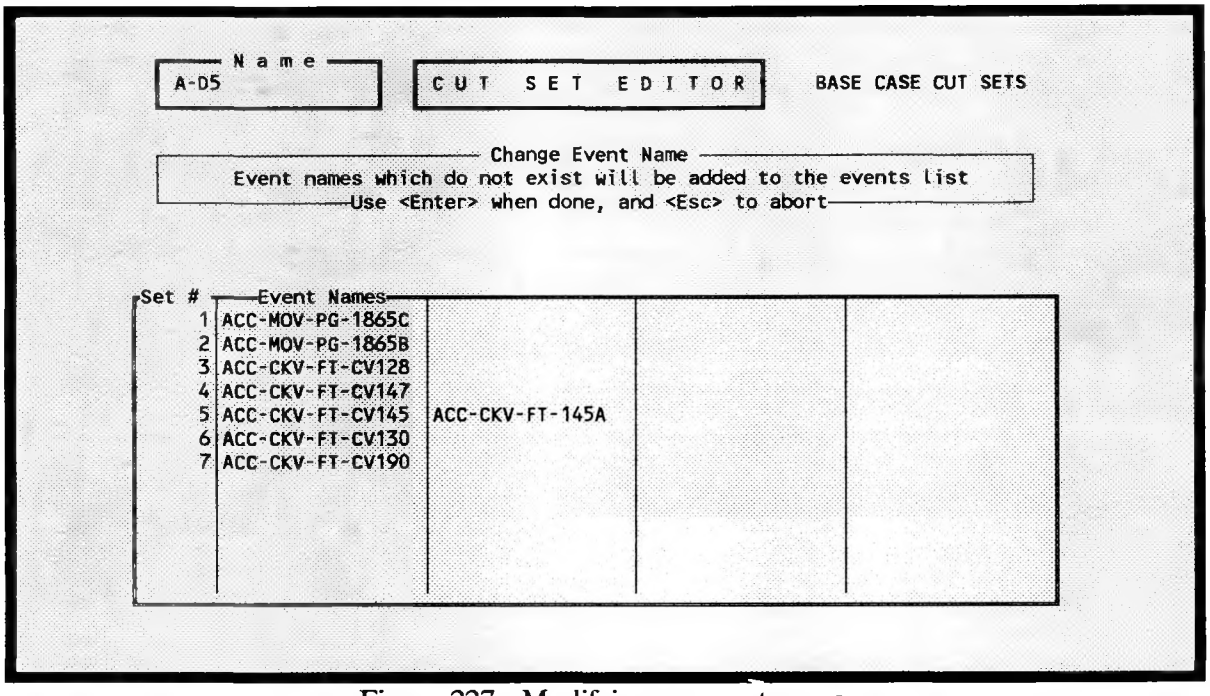


Figure 227. Modifying an event name.

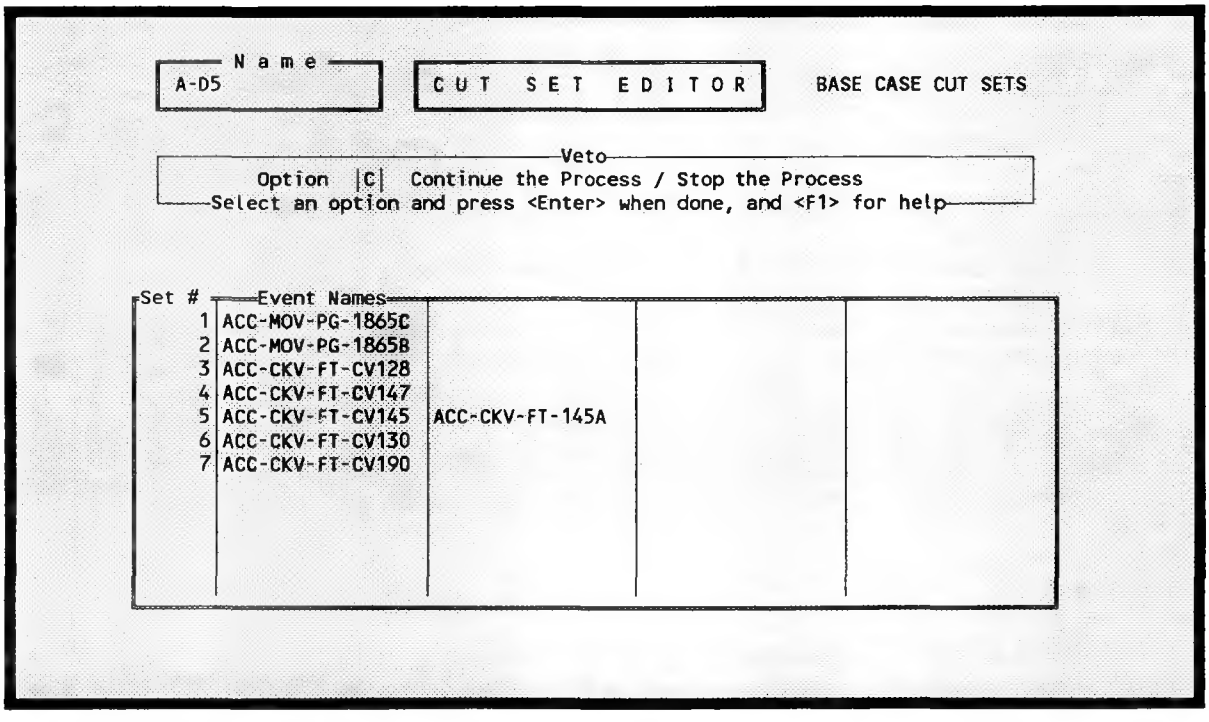


Figure 228. Delete a cut set.

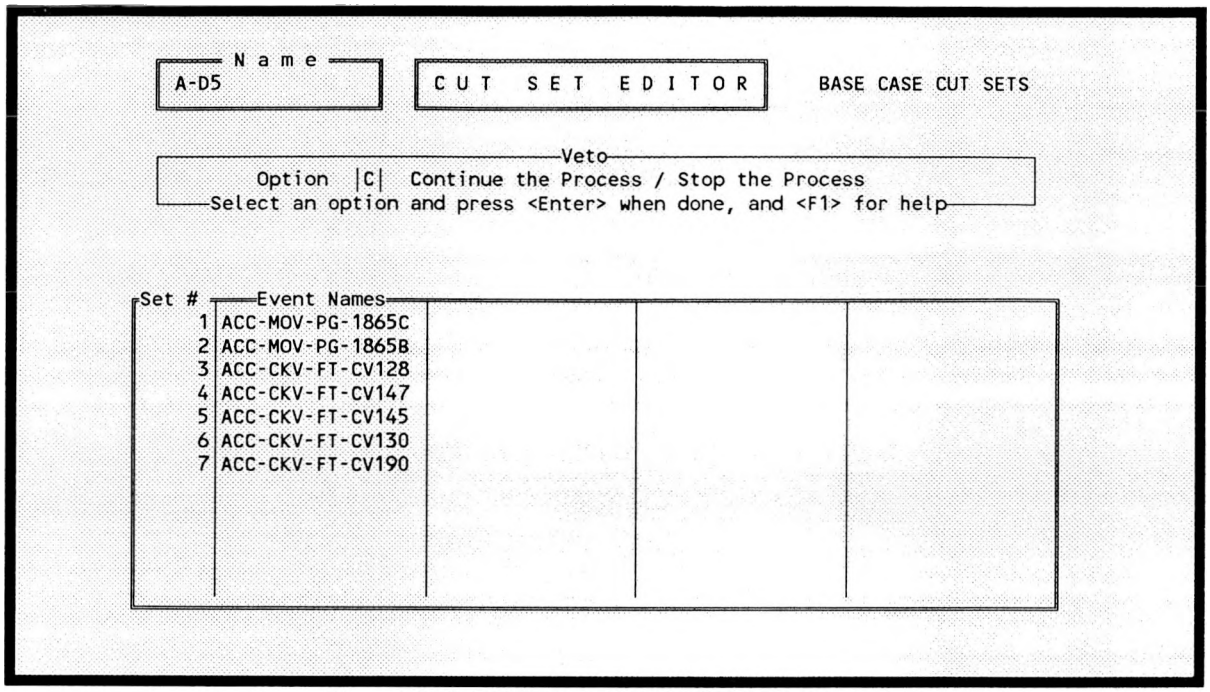


Figure 229. Delete an event from a cut set.

When the delete option is invoked the option list on the display is replaced by a veto menu. For deletions, the Veto option is always turned on unless you specifically turn it off. The veto options function as follows:

Stop. Typing <S> aborts the delete operation for the highlighted cut set or event.

Continue the process. Typing <C> and pressing <Enter> results in deleting a cut set or event.

7.5.5 Locate

The locate option allows you to search the list of all existing events and the list of all the newly added events for events that meet the desired search criteria. Events that meet the desired search criteria are considered to be qualified events. You are then able to locate the first occurrence of one of these qualified events from the current set of cut sets.

To invoke this option, press the <L> key. This will display the locate menu (Figure 230). From this screen, the following four options are available: Exit, Locate, Next, and Previous. The number of unique events that exist in the current set of cut sets is listed on this screen, along with the number of currently qualified events.

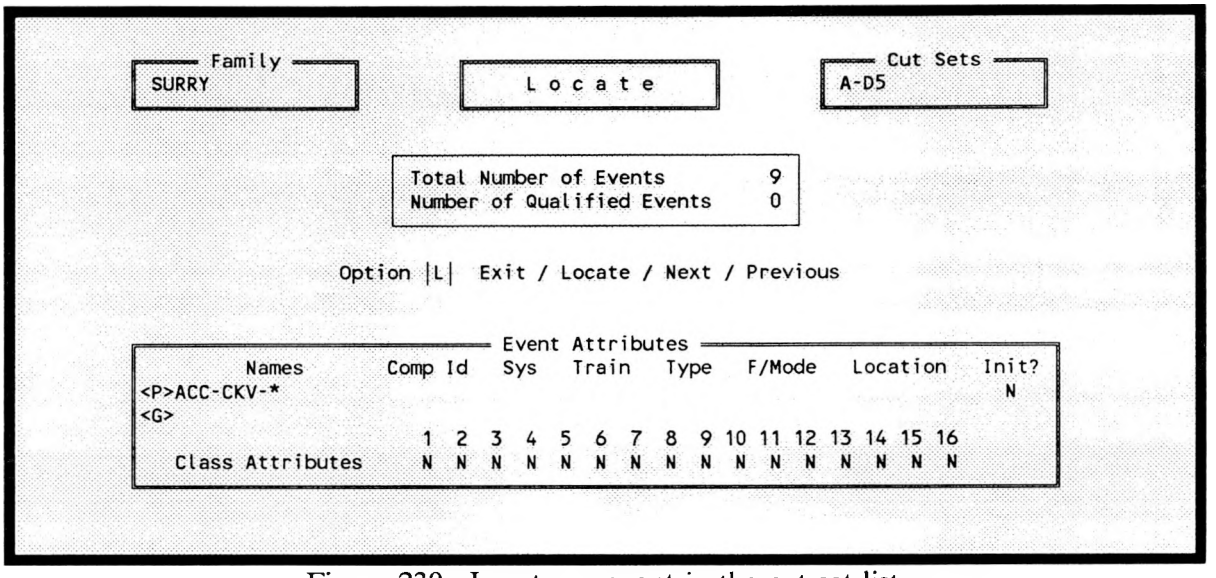


Figure 230. Locate an event in the cut set list.

7.5.5.1 Exit. If the locate function has been performed and an event name exists in the name field of this screen, then upon entering an <E> in the option field, the cursor will be placed on the first occurrence of that event name within the current set of cut sets. If the event does not exist within the current cut sets, then a message stating the event was not found will be displayed.

If the locate function has not been performed then entering an <E> in the option field will simply terminate the locate function. This may also be terminated by pressing the <Esc> key.

7.5.5.2 Locate. This option searches the list of all existing events and the list of all newly added events for events which meet the desired search criteria. This option allows wild card search characters for the two name fields on the screen. A question mark (?) matches any single character in its specified position, and the asterisk (*) matches a character string of any length. This option will use any of the filled event attribute fields on the screen as search criteria. Any events that meet the selected search criteria are considered to be qualified events. The number of currently qualified events will then be updated on the screen. The first qualified event will be displayed on the screen (Figure 231).

NOTE: It is possible for an event to be a qualified event and still not exist in the current set of cut sets.

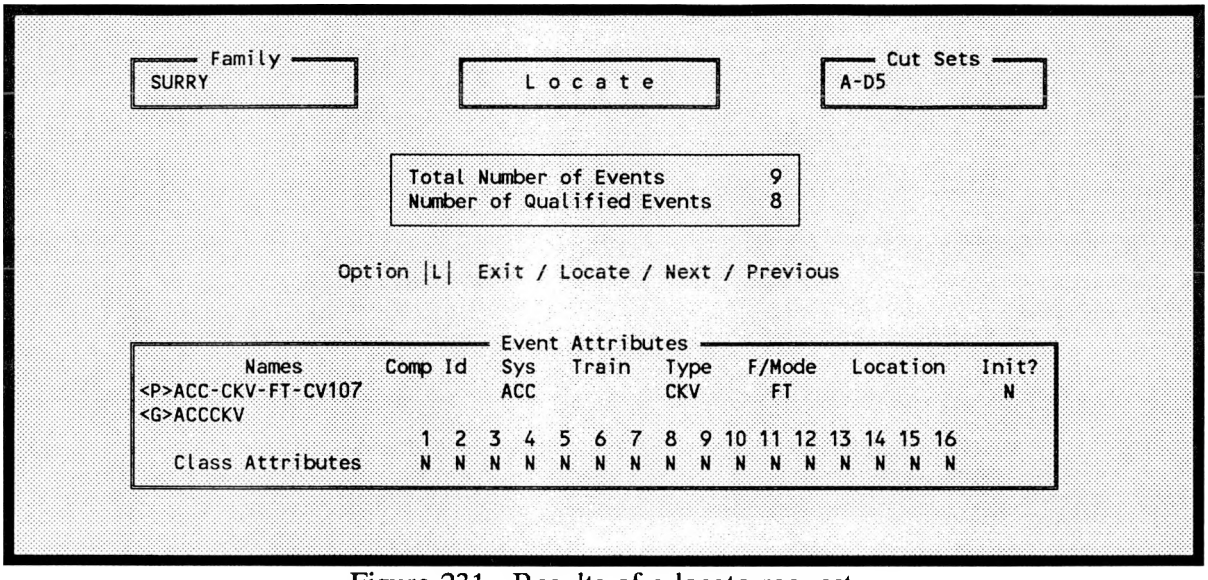


Figure 231. Results of a locate request.

7.5.5.3 Next. This option will display the next qualified event from the list of qualified events.

7.5.5.4 Previous. This option will display the previous qualified event from the list of qualified events.

7.5.6 Next

This option allows you to go to the next occurrence of the event name that was specified in the locate option. To invoke the option, type <N>.

7.5.7 Previous

This option allows you to go back to the previous occurrence of the event name specified in the locate option. To invoke the option, type <P>.

7.5.8 Search

This option provides a fast locate feature for a single event name. As each letter of the event name is typed the cut set list is scanned for the first occurrence of the letter. To invoke the option, type <S> which will replace the option list with the search request on the screen display (Figure 232). The search starts with the top cut set of the current display. Type the desired event name and press <Enter>. The cursor will be positioned on the first occurrence of the requested event. At this point <N> (Next) and <P> (Previous) will allow you to move through the cut set list positioning the cursor on the next or previous occurrence of the requested event name.

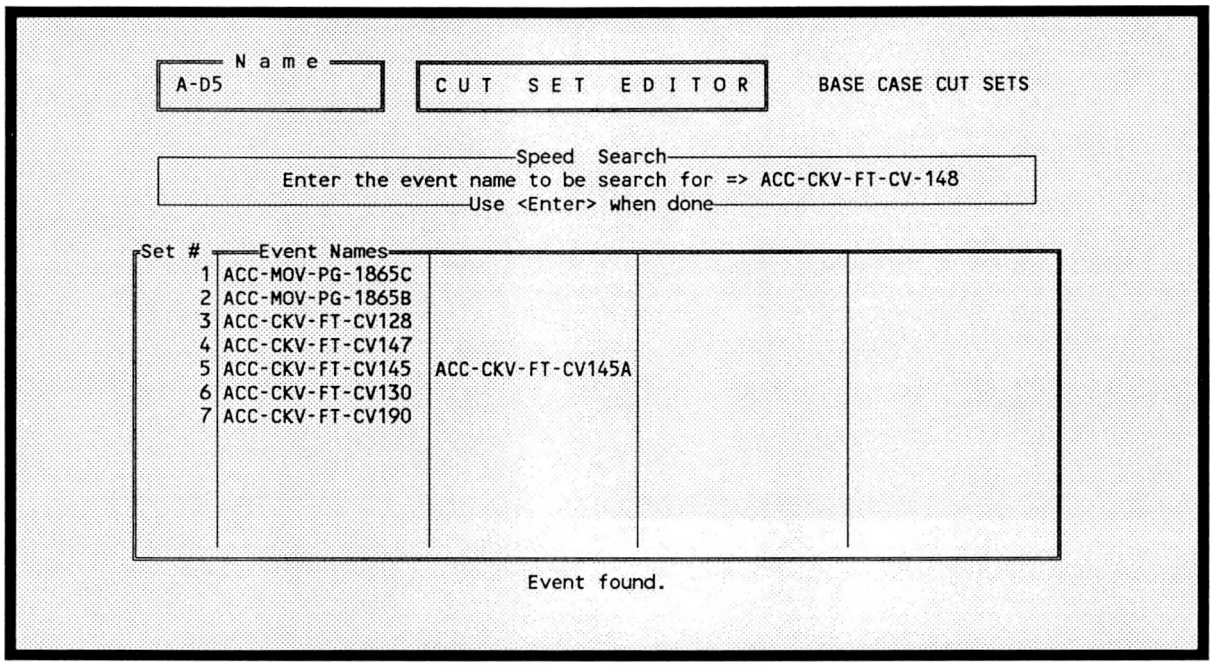


Figure 232. Search for a specific event.

7.5.9 Options

The Options command provides the capability of setting Cut Set Editor defaults. To invoke this option, type <O> which will replace the normal option list with the "default" option list on the screen display (Figure 233). The default options are

- Range - This option sets the maximum number of cut sets that will be searched for the specified string. Range is used by the Replace, Insert, Copy and Replace, and Find and Delete commands. By default, Range is set to 9999.

- Veto - Veto tells each operation to ask again if you wish to modify the cut set data. By default, this is turned off.

- Veto Delete - Functions the same as Veto. However, it applies only to the Delete command. By default, this is turned on.

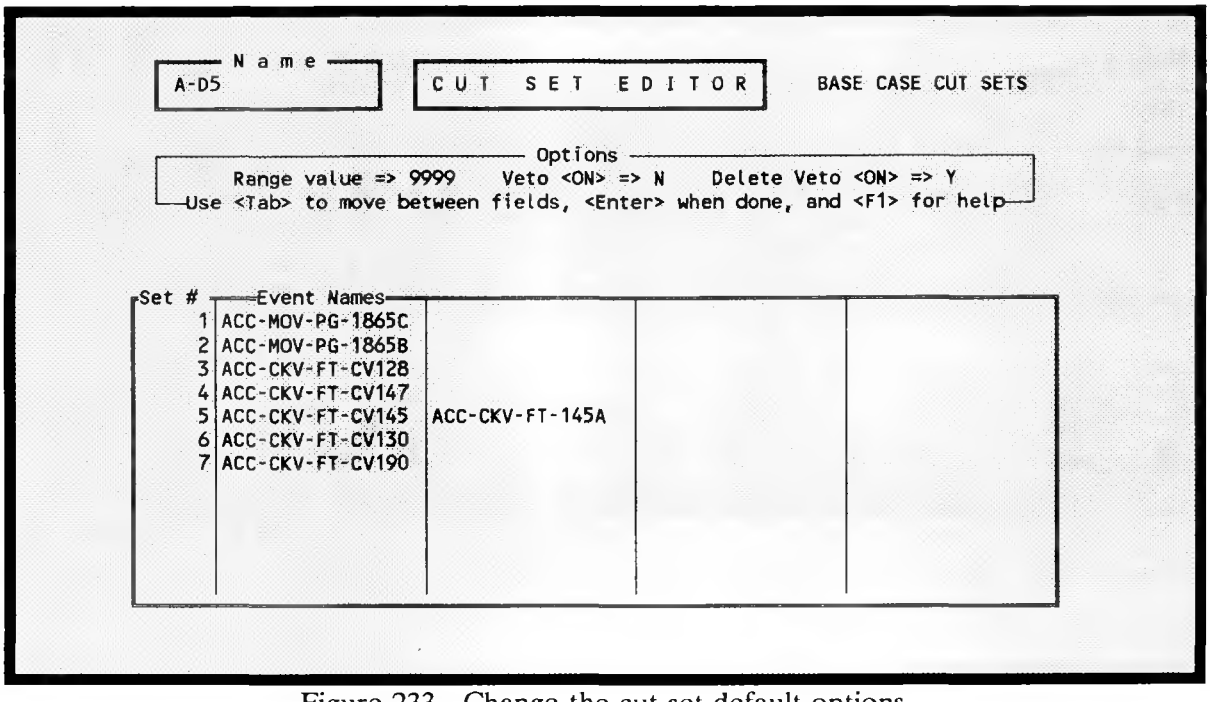


Figure 233. Change the cut set default options.

7.5.10 Insert Event

This option allows you to execute a global insertion of an event. You specify a search string which can consist of up to five event names and the name of the event to be inserted. In all cut sets containing the "search string" the event to be inserted will be added. The search starts with the cut set at the top of the current display. To invoke this option, type <I>, which will replace the option list on the screen with the Find/Insert request as shown in Figure 234.

7.5.11 Replace Events

This option allows you to specify a search string and replace every occurrence of that string with a specified event name. The search string may consist of up to five event names. The replacement is a global function in that all occurrences of the search string will be replaced by the specified event name. The replacement event name may be left blank, which will delete all occurrences of the search string from the cut set list. The search starts with the cut set at the top of the current display. To invoke the option, type <R>, which will replace the option list on the screen with the Find/Replace request (Figure 235).

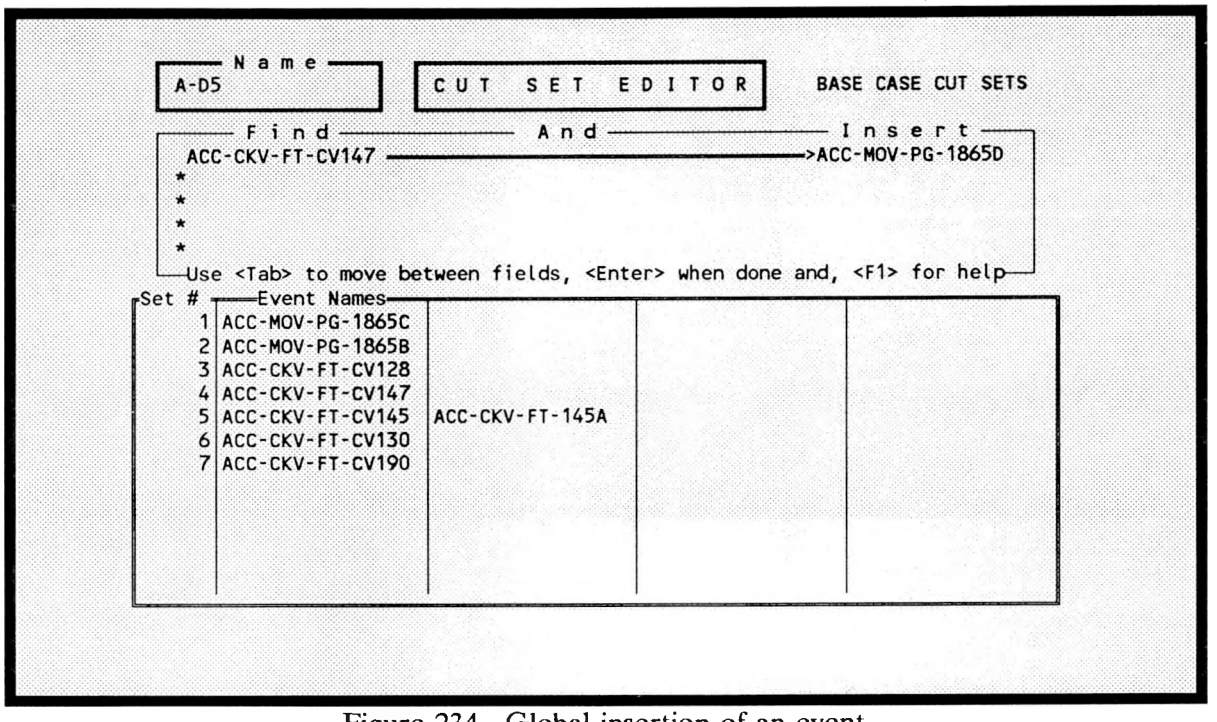


Figure 234. Global insertion of an event.

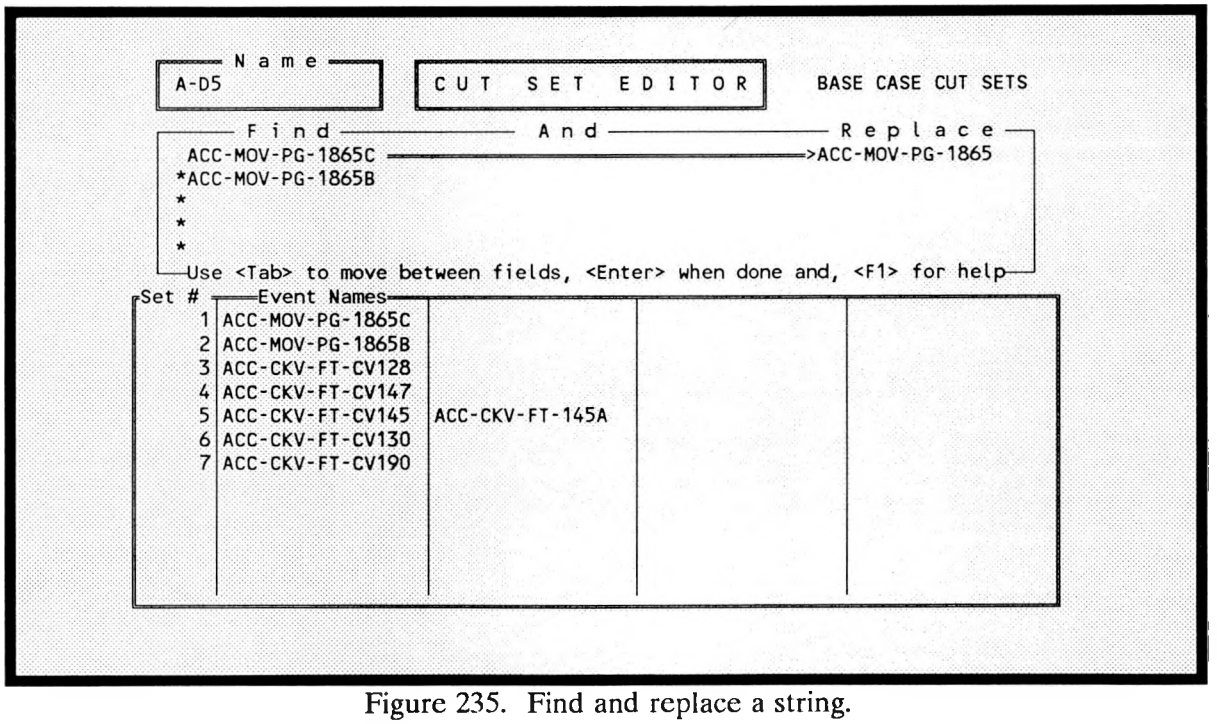


Figure 235. Find and replace a string.

7.5.12 Copy Cut Set and Replace Events

This option allows you to search for cut sets containing a specific string, copy the cut sets (minus the events specified in the search string), and add a specific event to the new cut set. You may specify up to five event names as a search string. If the event name to be added is left blank, the process is terminated. The search starts with the cut set at the top of the current display. To invoke this option, type <C>, which will replace the option list on the display with the Copy/Replace request (Figure 236).

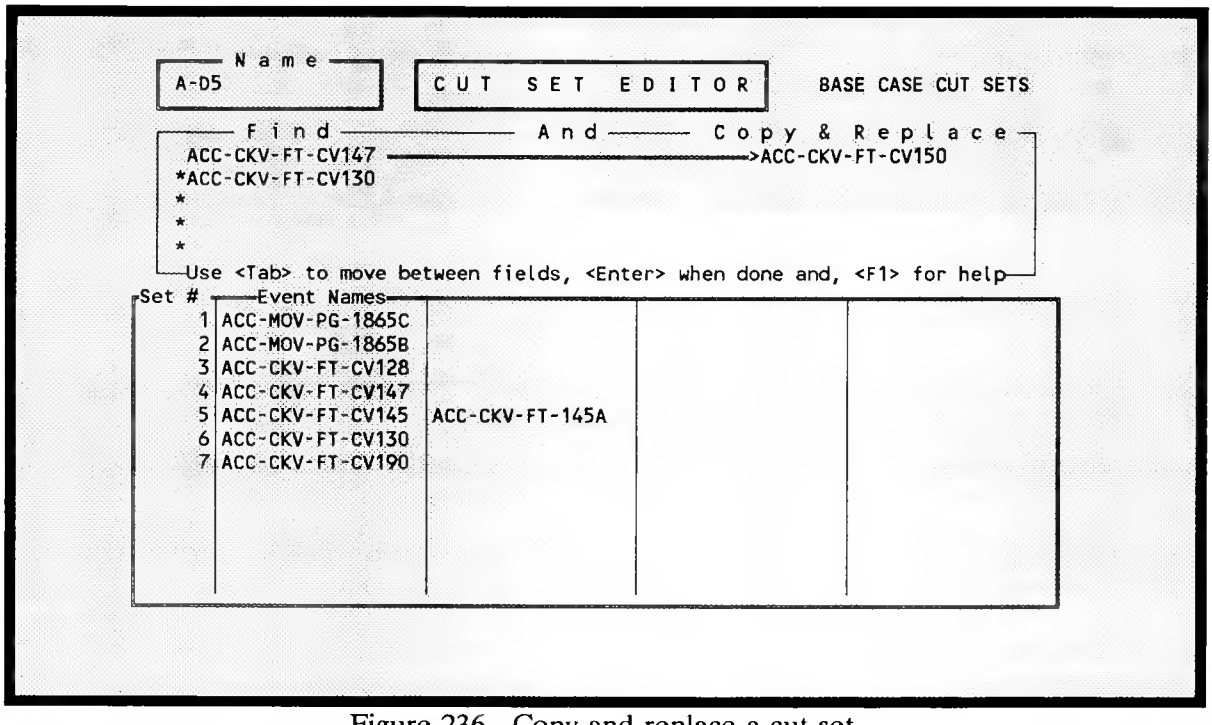


Figure 236. Copy and replace a cut set.

7.5.13 Undo

This option allows you to recover the last item deleted. The item may be an entire cut set or a single event. A deletion may be undone only if the Undo Delete command is used immediately after the deletion has occurred. To invoke the option, type <U>.

7.5.14 Find and Delete Cut Set

This option allows you to delete all cut sets that contain a specified string. You may specify up to five event names as a search string. The search begins at the cut set at the top of the current display. To invoke this option, type <F>, which will replace the option list with the find and delete request (Figure 237).

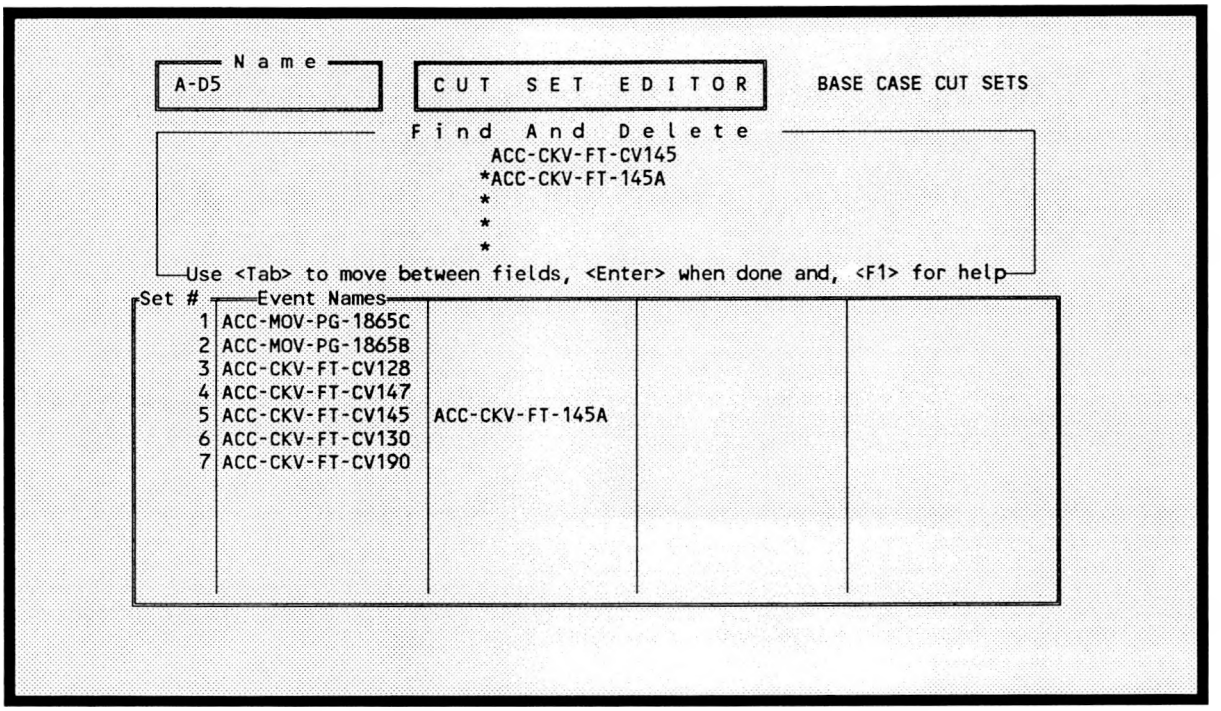


Figure 237. Find and delete cut sets.

7.6 Link Event Trees

This option allows you to define linkage rules and generate sequence logic. When you invoke this option, Figure 238 will be displayed. As shown, three options are available: Exit, Generate Sequences, and Link Editor. In addition, the following special function keys are available:

<Esc> Returns you to the Event Tree Graphics System Menu.

<F1> Displays on-line help messages.

<F2> Marks a file for further processing. When you mark a file, an asterisk will appear in front of the file name.

<F3> Marks all the displayed files for further processing.

<F4> Allows you to mark a range of files for further processing.

<F5> Allows you to locate a specific file for further processing. When you invoke this function, Figure 239 will be displayed. Enter the file name to locate and press <Enter>. The specified file will be highlighted. If the file name does not exist, an error message will be displayed and you will be returned to the previous screen.

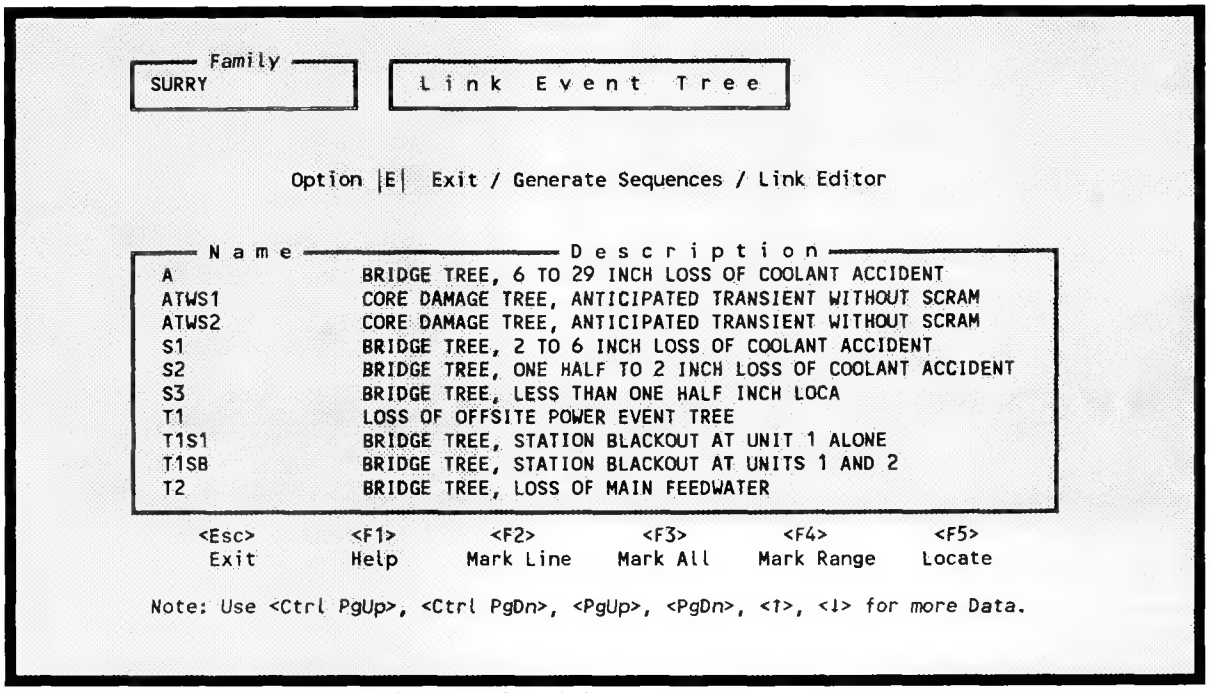


Figure 238. Link event tree screen.

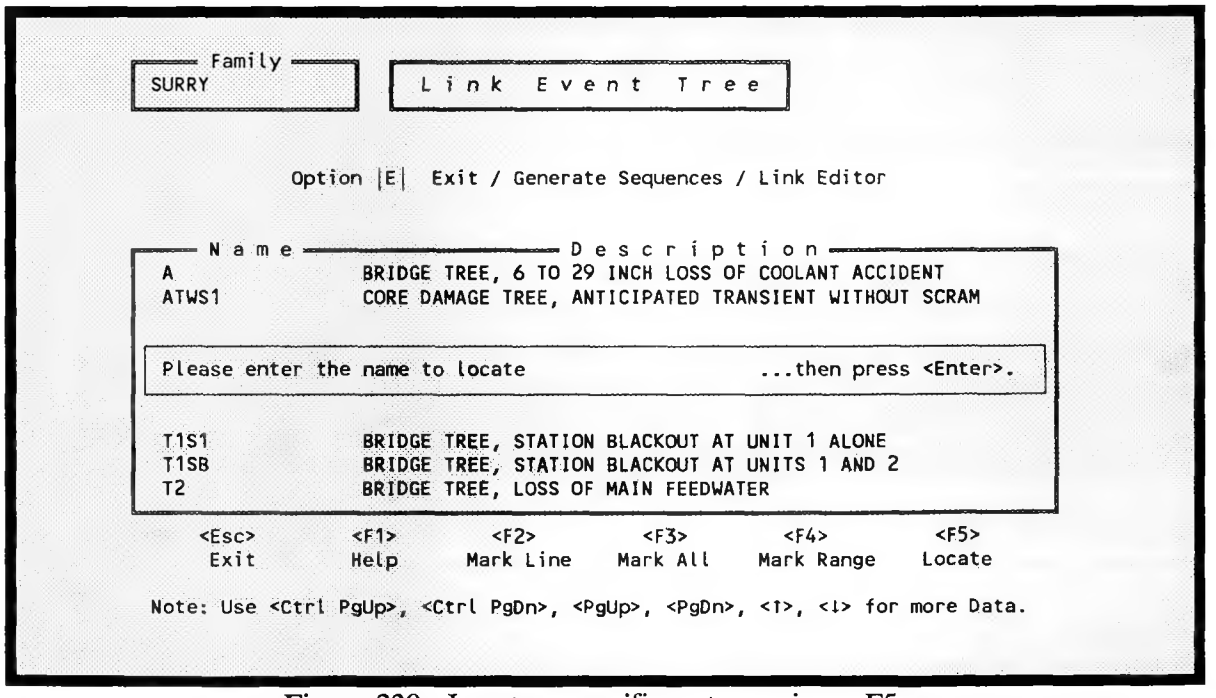


Figure 239. Locate a specific system using <F5>.

To move around the Link Event Tree screen (Figure 238), use the <PgUp>, <PgDn> and arrow keys.

7.6.1 Exit

This option returns you to the Event Tree Graphics System menu. To invoke this option, enter an <E">in the option field and press <Enter>, or press the <Esc> key.

7.6.2 Generate Sequences

This option allows you to generate sequence logic for event trees. During sequence generation the sequence logic is created as specified in the event tree logic, and then the linkage rules are applied. To invoke this option for a single selected event tree, enter a <G> in the option field, highlight the desired event tree, and press <Enter>. To invoke this process for a group of event trees, mark the desired event trees using the function keys F2, F3, and F4, enter a <G> in the option field, and press <Enter>. To invoke this option for all event trees in the current family, clear all marked entries, type a <G> in the option field, and press <Enter>. A message **Process all records? (Y/N)** will appear at the bottom of the screen. Type a <Y> to generate sequences for all of the event trees, or type an <N> to terminate the sequence generation process.

In all three cases, after pressing <Enter> Figure 240 will be displayed. On this screen you must enter a file name where the report is written. The following options are provided:

CON	-	Sends the report to the screen.
PRN	-	Sends the report to the printer.
filename	-	Sends the report to the specified hard disk file name. A default name is provided, which can be changed by simply typing over the default name.
blank	-	No report is generated, but the sequences are generated.
<Esc>	-	Terminates the process without generating the sequences.

The Sequence Generation report contains the listing of the sequences' names, the systems that make up the sequences, any substitutions of systems (based on the linkage rules), and any transfers to other event trees.

After sequence generation begins, the first message displayed is **Reading Logic for event tree: <event tree name>.** As each sequence in that event tree is generated, the message **Processing sequence: <sequence name>** is displayed. If there are any transfers in the event tree, the reading logic message will be displayed again, but this time with the name of the event tree being transferred to. When all the sequences for the event tree have been created, the message **Deleting old/unused sequences for <event tree name>** will appear. At this time all the sequences for the event tree that are no longer valid will be removed.

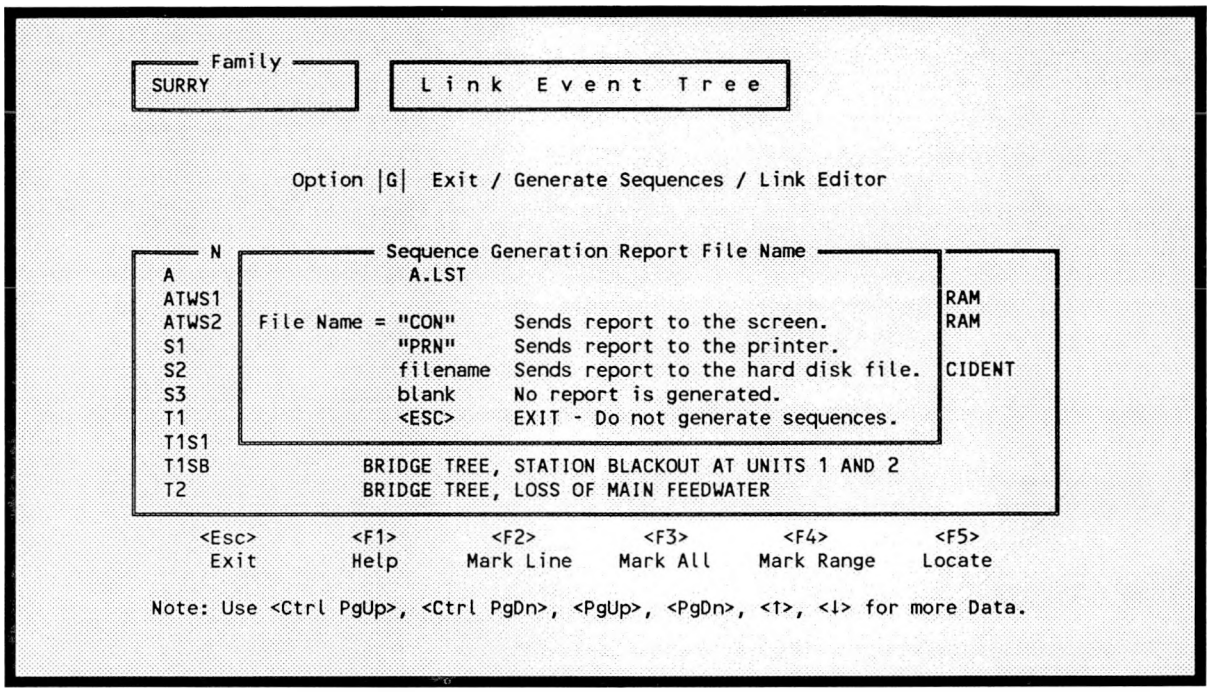


Figure 240. Generate sequences output screen.

7.6.3 Link Editor

This option allows you to specify linkage rules for an event tree. A linkage rule is a special case, an exception, or substitution to the normal sequence generation. During sequence generation the sequence logic is created as specified in the event tree logic, and then the linkage rules are applied. For example, event tree A contains a sequence named SEQ-1. According to the strict logic of the event tree, the systems that make up SEQ-1's logic are SYS-1, SYS-2, SYS-3, and SYS-4. A linkage rule would enable you to replace all occurrences of SYS-4 in any sequence in the event tree with SYS-5. Or, you may want to replace SYS-4 with SYS-5 if and only if SYS-2 and SYS-3 are also present in the sequence logic.

To invoke this option for a single selected event tree, enter an <L> in the option field, highlight the desired event tree, and press <Enter>. To invoke this process for a group of event trees, mark the desired event trees using the function keys F2, F3, and F4, type an <L> in the option field, and press <Enter>. To invoke this option for all event trees in the current family, clear all marked entries, type an <L> in the option field, and press <Enter>. A message **Process all records? (Y/N)** will appear at the bottom of the screen. Type a <Y> to edit the linkage rules for all of the event trees, or type an <N> to terminate the editing process.

In each case, when you press <Enter> Figure 241 will be displayed showing the rules (if any) for the event tree shown in the upper right hand corner. The message **Reading in tops and systems names** will be displayed. A top is a system that is used in the selected event tree. Then the message **Reading in rules** will be displayed. The rules (if any) for the event tree will then be shown. The first or # column is the rule number or the order in which the rules will be applied. Rule 2 takes

precedence over rule 1 and rule n takes precedence over rule n-1. The second and third columns are the conditional columns. If a top or system must exist before a substitution can take place, those tops will be named here. There is no limit on the number of conditional tops for a rule. The fourth or replaced top column contains the tops to be substituted and the fifth column contains the tops/systems to use in place of the replaced tops. The following options are available: Exit, Add, Insert, Copy, Delete, and Restore.

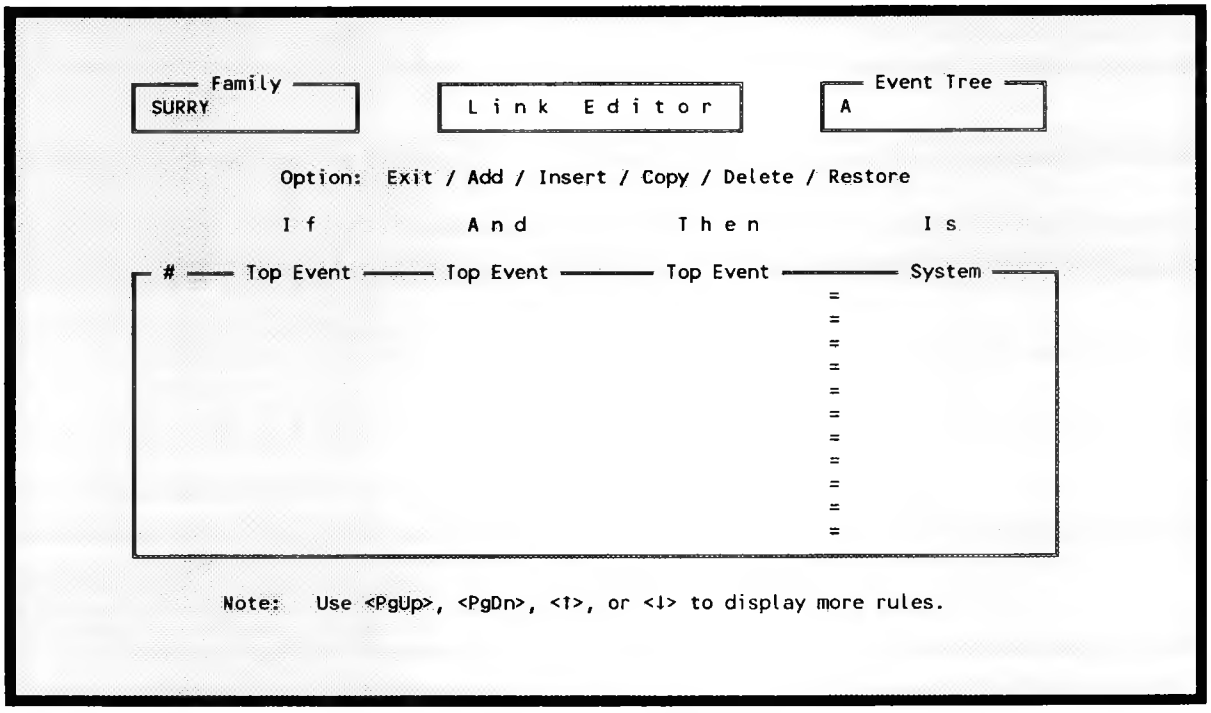


Figure 241. Link editor screen.

7.6.3.1 Exit. This option returns you to the Link Event Tree menu. To invoke this option type an <E>, or press the <ESC> key. Figure 242 will be displayed asking you if you want to save the rules and then exit. To save the rules in the data base, type a <Y>, and press <Enter>. To exit without saving the rules, type a <N> and press <Enter>.

7.6.3.2 Add. This option allows you to add a new rule or modify an existing rule, if the cursor is in the first column, or add/modify a top or system if the cursor is in any other column. To add a rule, move the cursor to the first column and type an <A>. A default rule number will appear in the first column. Press <Enter> and the cursor will be moved to the second column. A line of dashes will appear above the rule that is being added. This is to assist in keeping the rules separated. To add a conditional top, type <A>, enter the name of the conditional top, and type <Enter>. If the name you entered is not a top for this event tree, the message **Name not found...** is displayed. A list of all the tops for this event tree is displayed in a help form on the right side of menu. To select one the tops from the help form, press <F1>, move the cursor to the top to be add, and press <Enter> (see Figure 243). All conditional tops and replaced tops are added in this same way. The replacement top is added in much the same way with some differences. When you type <A>, the list of all systems in the family is displayed in a help form on the left hand side of the form (see

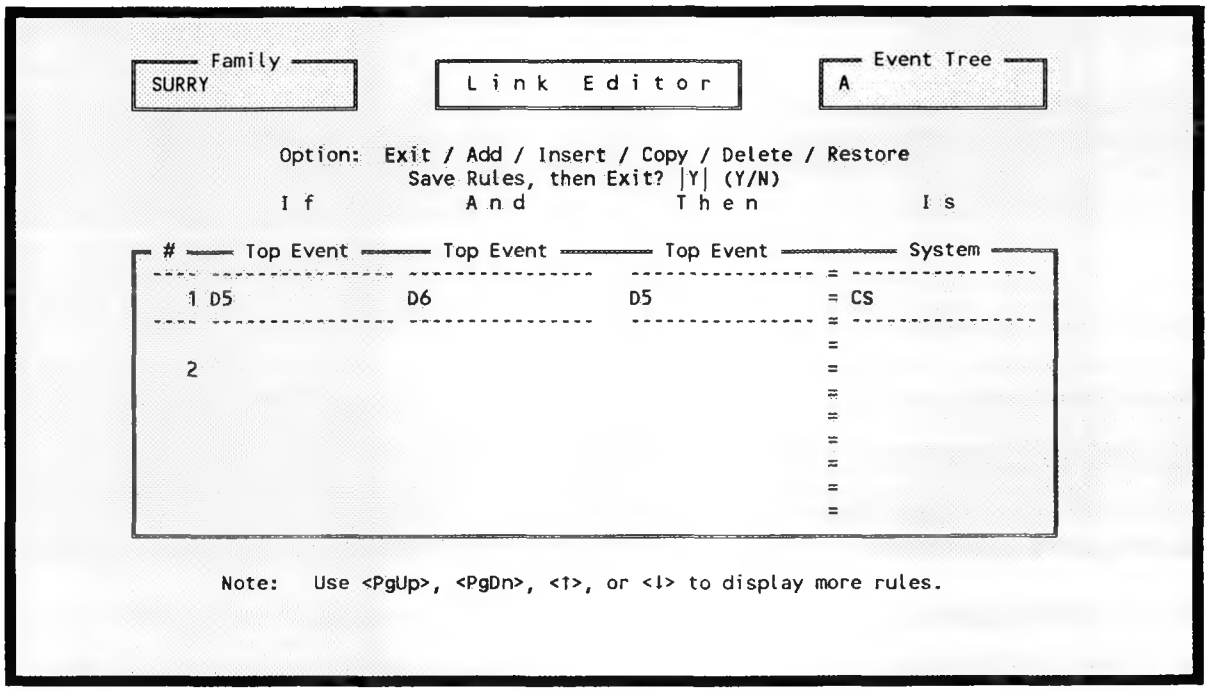


Figure 242. Save linkage rules screen.

Figure 244).

Any system in the family can be entered here, and the message **Name not found...** will be displayed if the name entered is not a system. To modify a rule, position the cursor over the top/system to be changed, type <A>, and enter the new top/system name just as you do on an add.

7.6.3.3 Insert. This option adds one blank line after the line containing the cursor, regardless of the column the cursor is in.

7.6.3.4 Copy. This option copies one rule after another. Figure 245 contains the copy menu. The rule number closest to the cursor will be in the first blank, but you may enter any other existing rule in its place. To copy the desired rule, enter an existing rule in the second blank and a copy of the first rule will be placed after the second rule.

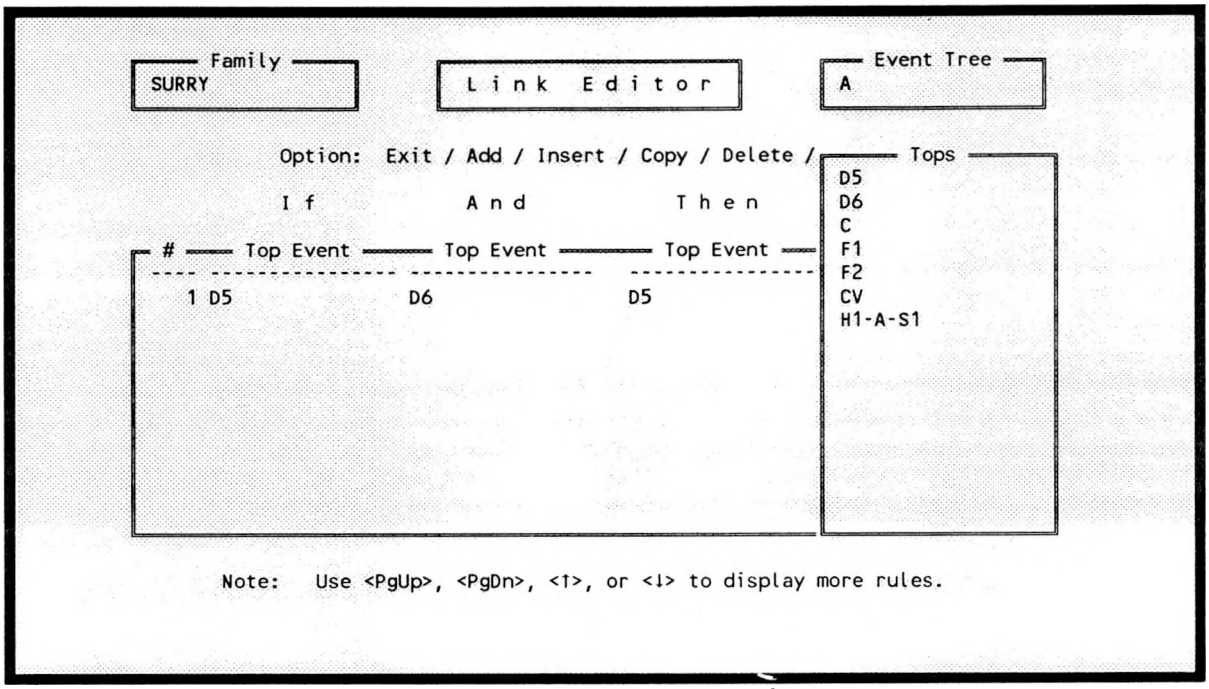


Figure 243. Tops listing help form.

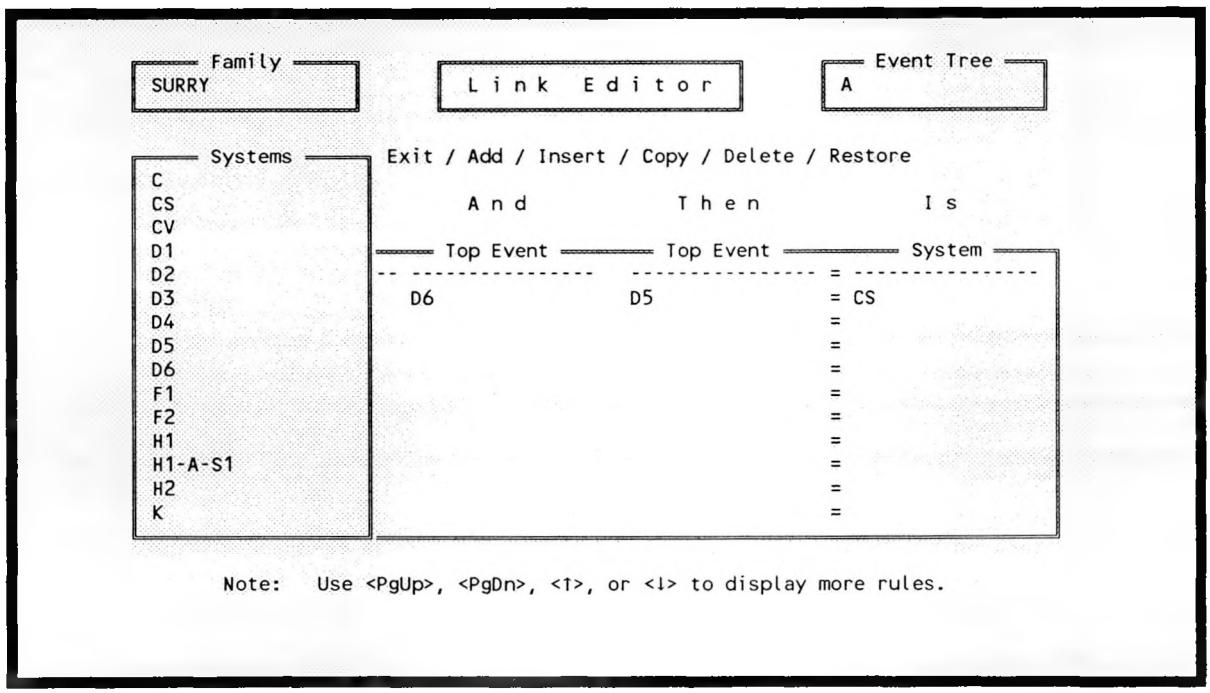


Figure 244. Systems listing help form.

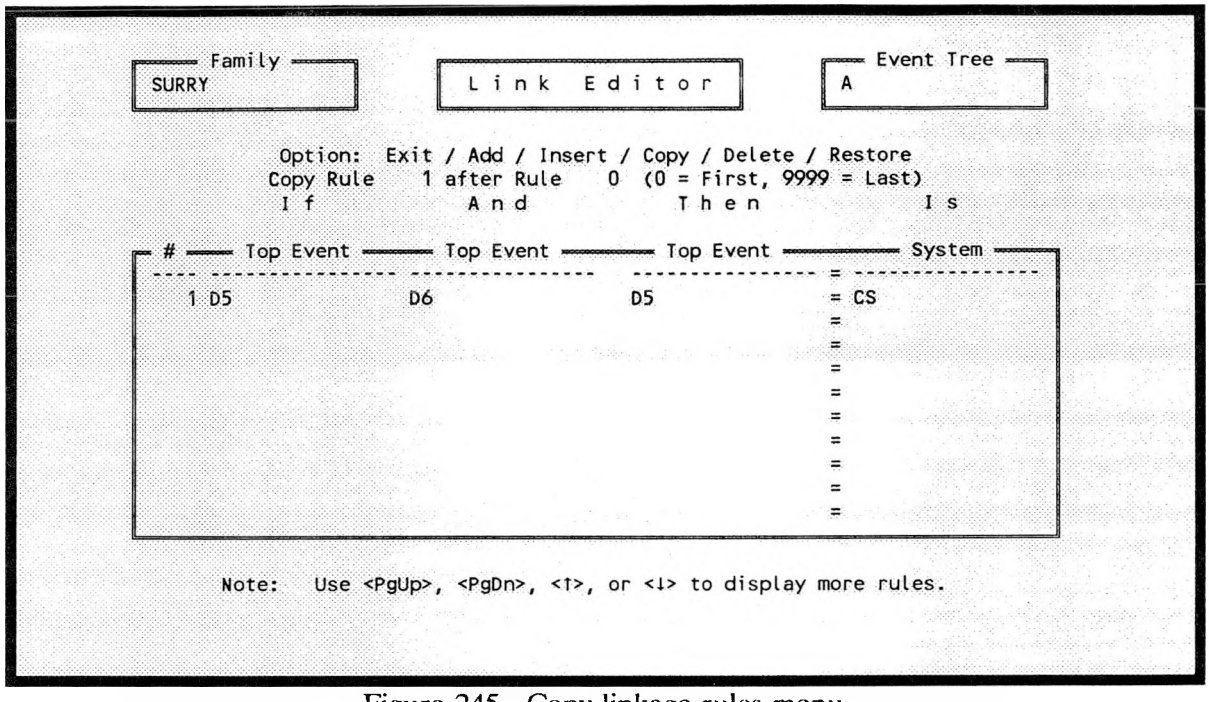


Figure 245. Copy linkage rules menu.

7.6.3.5 Delete. This option deletes the entire selected rule if in the first column, or a top or system if in any other column. To delete a rule, place the cursor in the first column of the rule to be deleted and type a <D>. To delete a system or top, place the cursor in the column where the desired system or top is located and type a <D>.

7.6.3.6 Restore. This option restores the last deleted rule if the cursor is in the first column, or a top or system if the cursor is in any other column.

NOTE: **Please note there is a one to one relationship between replaced tops and replacement tops/system. In other words, a group of systems cannot replace one top, and a group of tops cannot be replaced by one system. An example of a multi-branch failure is shown in Figure 246.**

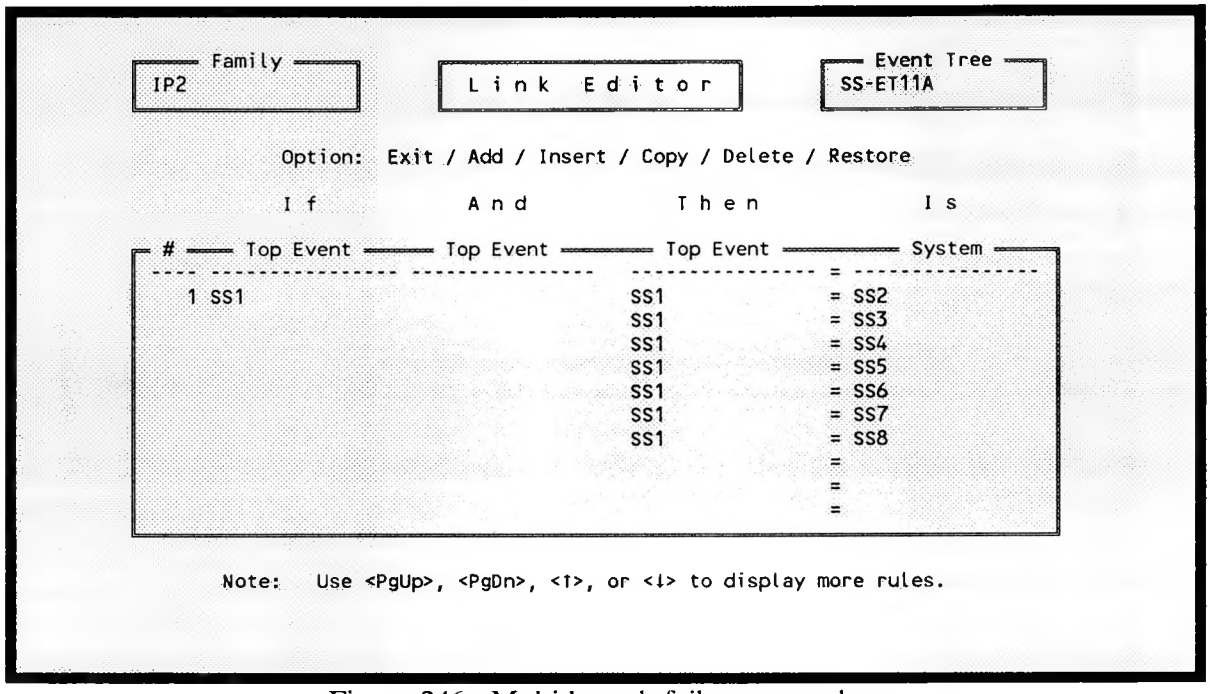


Figure 246. Multi-branch failure example.

8.0 MODIFY DATA BASE

This option allows you to modify the base or original family data files: family, event trees, systems, end states, basic events, attributes, graphics, and histograms. To invoke this option, type <M> in the option field or highlight Modify Data Base and press <Enter>. Figure 247 will be displayed.

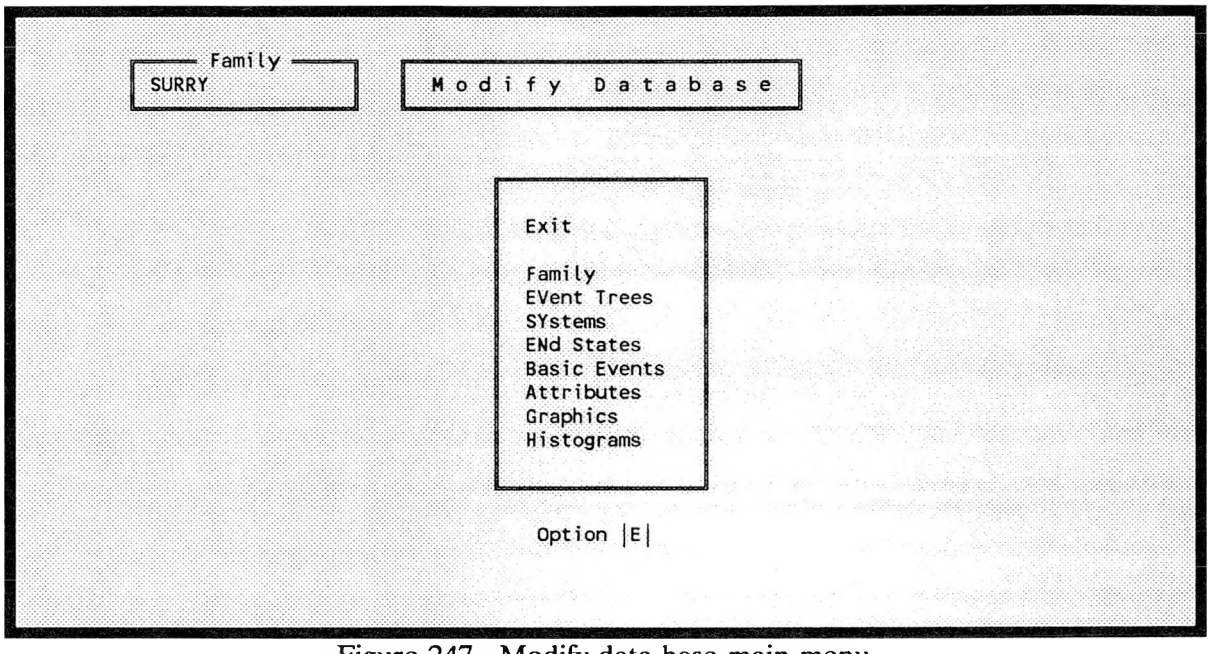


Figure 247. Modify data base main menu.

In general, each of the options shown in Figure 247 use the same modification functions: Exit, Add, Modify, Delete, and Locate. Some of the options have additional functions such as: Text and Sequences.

8.1 Exit

This option returns you to the IRRAS main menu. To invoke this option, type <E> in the option field and press <Enter>, or press the <Esc> key.

8.2 Family

This option allows you to add, modify, and delete a family or modify the associated text. To invoke this option, type <F> in the option field or highlight Family and press <Enter>. Figure 248 will be displayed. The following function keys are available:

<Esc>	Exits the Edit Family option and returns you to the Modify Database screen.
<F1>	Displays associated help messages.
<F5>	Allows you to locate a family that may not appear on the initial family list.

When you press <F5> a blank line is displayed in the center of the screen. Type the name of the family you wish to locate, and press <Enter>. If the family exists in the data base, it will be highlighted on the screen. If the family is not found, a message **Family not found. Please check the spelling** will be displayed at the bottom of the screen.

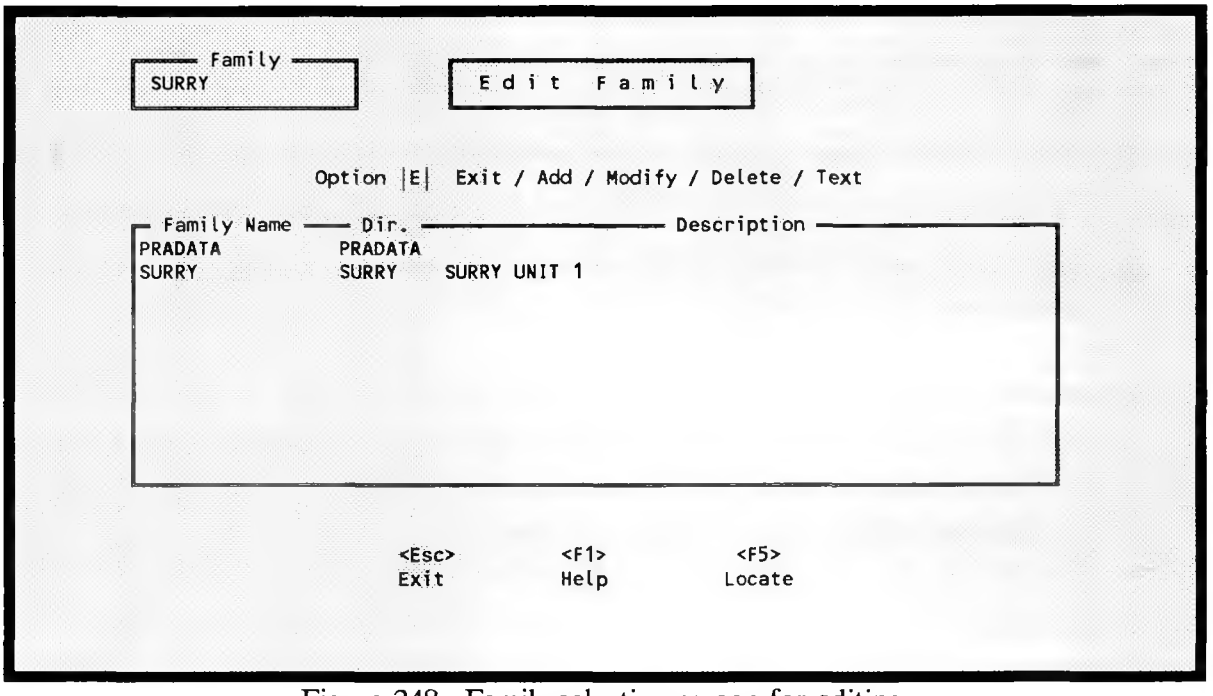


Figure 248. Family selection screen for editing.

8.2.1 Exit

This option returns you to the Modify Database screen. To invoke this option, type <E> in the option field and press <Enter>, or press the <Esc> key.

8.2.2 Add

This option allows you to add a family to the data base. To invoke this option type <A> in the option field and press <Enter>. The Add Family screen (shown in Figure 249) will be displayed. The only required information to be entered on this screen is the family name. The options at this point are Exit, Add, and Passwords.

8.2.2.1 Exit. This option returns you to the Edit Family screen. To invoke this option, type <E> in the option field and press <Enter>, or press the <Esc> key.

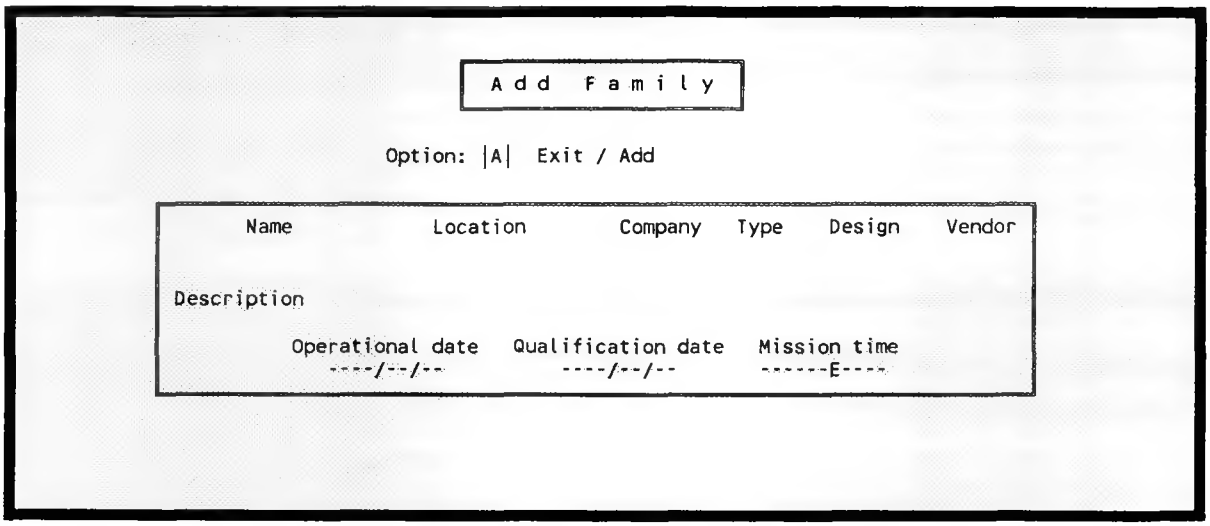


Figure 249. Editing screen for adding a family.

8.2.2.2 Add. This option performs the actual addition of the family to the data base. To invoke this option, type <A> in the option field, enter a family name and any of the other information you wish, and press <Enter>. At completion of the Add you are returned to the Edit Family screen which will reflect the addition of the new family.

8.2.3 Modify

This option allows you to modify the family data record. To invoke this option type <M> in the option field, highlight the family you wish to edit, and press <Enter>. The Modify Family screen is shown in Figure 250. The options at this point are Exit and Modify.

8.2.3.1 Exit. This option returns you to the Edit Family screen. To invoke this option, type <E> in the option field and press <Enter>, or press the <Esc> key.

8.2.3.2 Modify. This option applies the actual modification of the family data to the data base. To invoke this option, type <M> in the option field, modify any of the data fields on the screen and press <Enter>. On completion of the Modify you are returned to the Edit Family screen.

8.2.4 Delete

This option allows you to delete family data records from the data base. To invoke this option, type <D> in the option field and press <Enter>. The Delete Family screen is shown in Figure 251. The options at this point are Exit and Delete.

8.2.4.1 Exit. This option returns you to the Edit Family screen. To invoke this option, type <E> in the option field and press <Enter>, or press the <Esc> key.

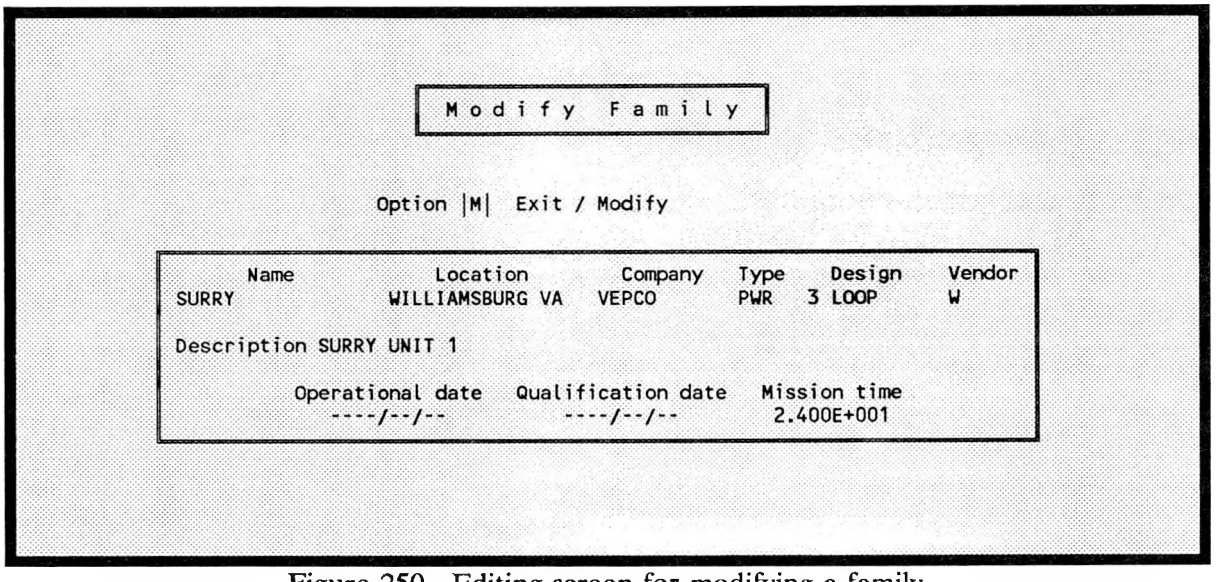


Figure 250. Editing screen for modifying a family.

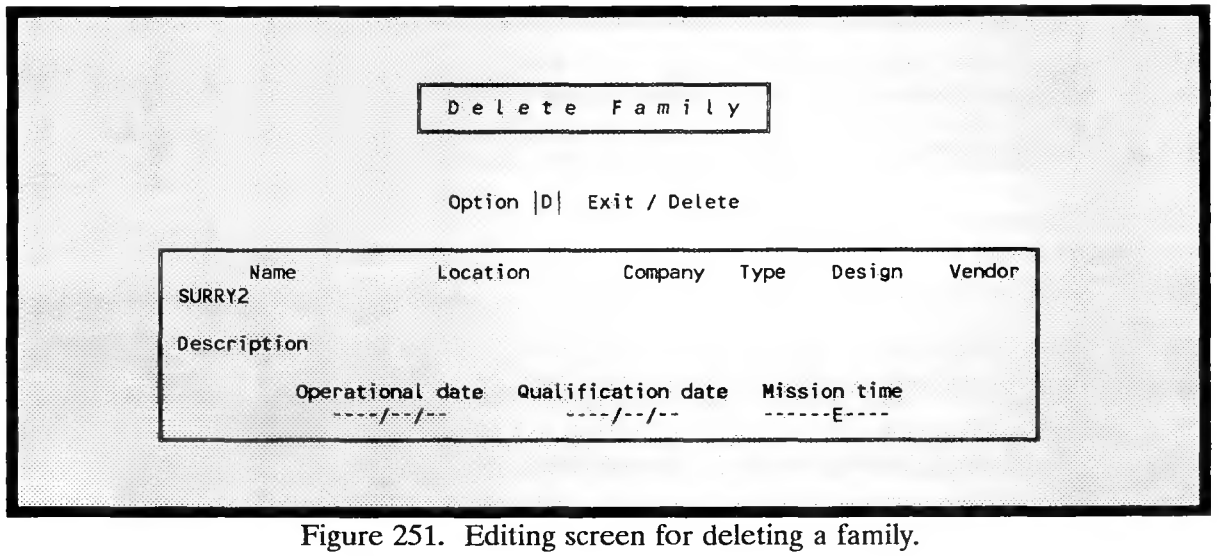


Figure 251. Editing screen for deleting a family.

8.2.4.2 Delete. This option verifies the delete family request. To invoke this option, type <D> in the option field and press <Enter>. A warning screen is superimposed over the Delete Family screen allowing you to cancel the deletion process (Figure 252). Enter a <Y> to delete the family or an <N> to terminate the deletion process. If you respond with a <Y>, the message **Deletion completed** will be displayed at the bottom of the screen.

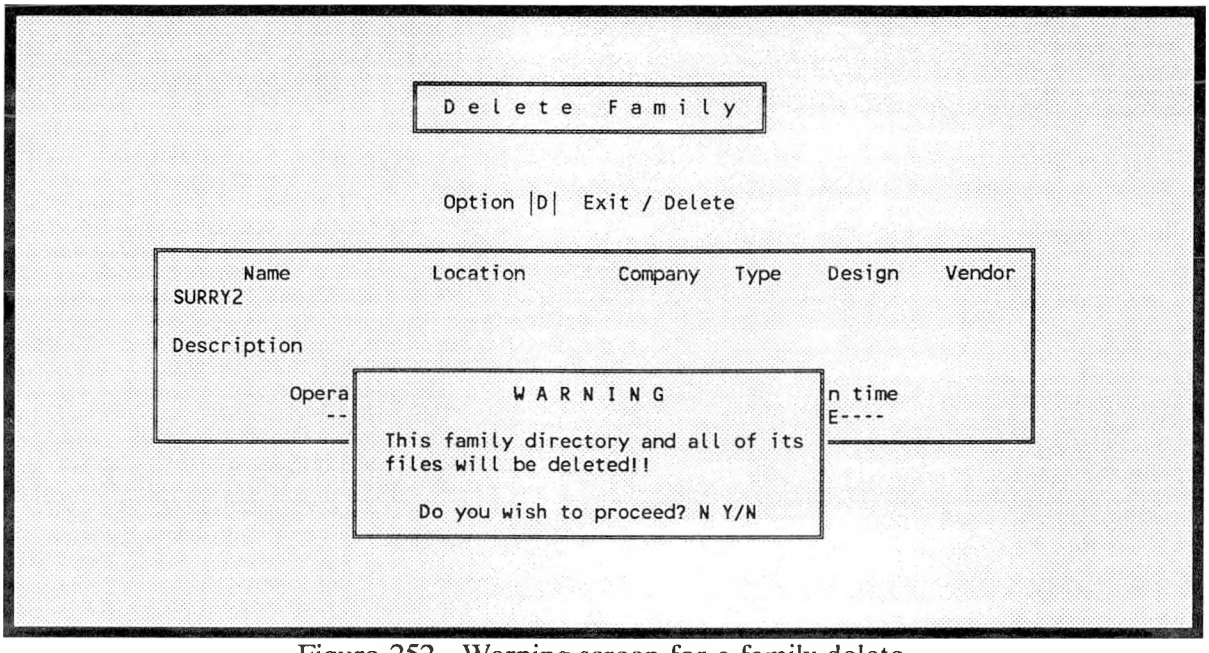


Figure 252. Warning screen for a family delete.

8.2.5 Text

This option allows you to view and edit any descriptive text associated with a specific family. To invoke this option, type <T> in the option field, highlight a family, and press <Enter>.

The initial display for this option displays the first 13 lines of the text block. The following keys allow you to display additional lines of text:

PgDn	-	presents the next 13 lines of text.
PgUp	-	presents the previous 13 lines of text.
Ctrl-PgDn	-	presents the last 13 lines of text.
Ctrl-PgUp	-	presents the first 13 lines of text.

The editing keys are

Ctrl-Z	-	Exits the text editing feature and saves the text information as it currently exists.
ESC	-	Exits without saving changes.
Alt-A	-	Adds a line after the line at the current cursor position.
Alt-B	-	Adds a line before the line at the current cursor position.
Alt-H	-	Displays editing keys help screen.
Alt-D	-	Deletes a line at the current cursor position.
Alt-R	-	Restores the previous deleted text.
Del	-	Deletes a character at current cursor position.
Ins	-	Inserts a character at current cursor position.

Ctrl-End - Deletes all characters from the current cursor position to the end of the cursor line. The arrow keys are used to move the cursor within the block of text.

The editor does not line wrap, therefore, you must use <Alt-A> to establish each new line of text. If you wish to save your text changes, press <Ctrl-Z>. After you have pressed <Ctrl-Z> you are returned to the Edit Family screen with the message **Text record modified** displayed at the bottom of the screen. If you pressed <Esc>, you will be returned to the family selection screen with the message **Text record not modified** displayed at the bottom of the screen.

8.3 Event Trees

This option allows you to modify the event tree data records. To invoke this option, type <V> in the option field or highlight Event Trees and press <Enter>. The Edit Event Trees screen listing all of the event trees belonging to the current family will be displayed (Figure 253). The modification options are: Exit, Add, Modify, Delete, Text, and Sequences. In addition, the following function keys are available:

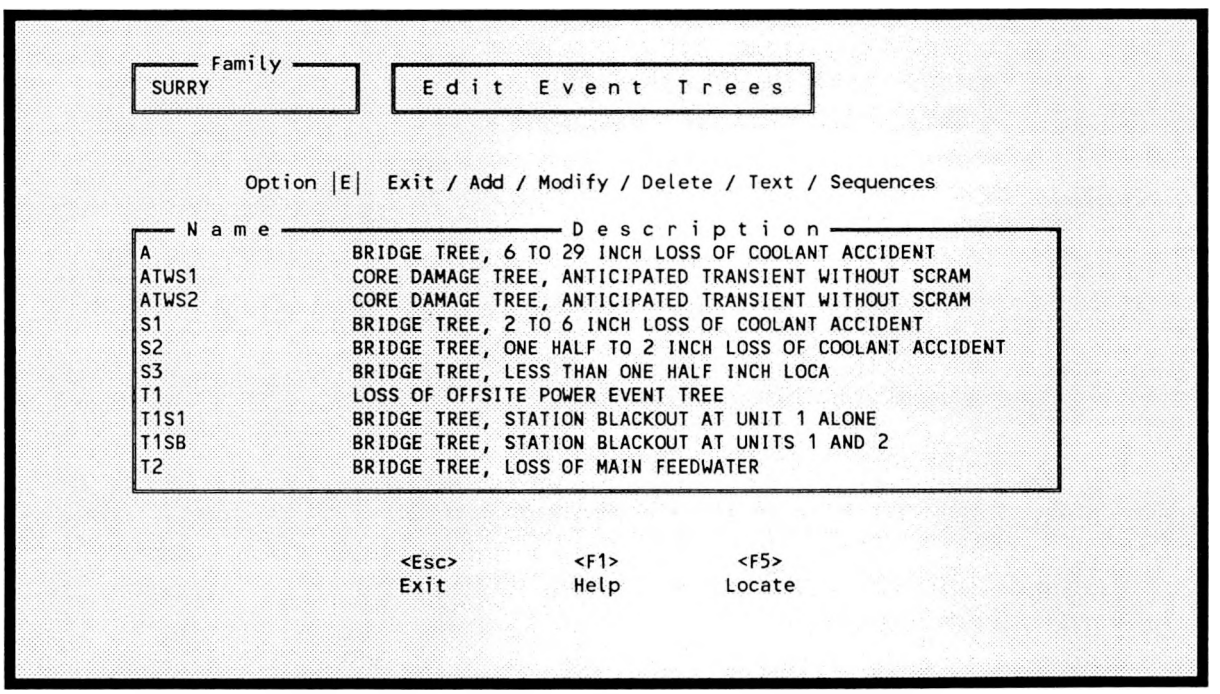


Figure 253. Selection screen for event tree editing.

<Esc> Exits the edit event trees option and returns you to the Modify Database menu.

<F1> Displays associated help messages.

<F5> Positions the cursor on a specific event tree name. When you press <F5>, a blank line will appear in the middle of the event tree list. Enter the event tree name you wish to locate and press <Enter>. The event tree name list will be redisplayed with the requested event tree name highlighted. If the requested event tree cannot be found, the next highest event tree in the sort order will be highlighted.

8.3.1 Exit

This option returns you to the Modify Database main menu. To invoke this option, type <E> in the option field and press <Enter>, or press the <Esc> key.

8.3.2 Add

This option allows you to add an event tree to the current family. To invoke this option, type <A> in the option field and press <Enter>. The Add Event Tree screen will be displayed (Figure 254). The options at this point are Exit and Add.

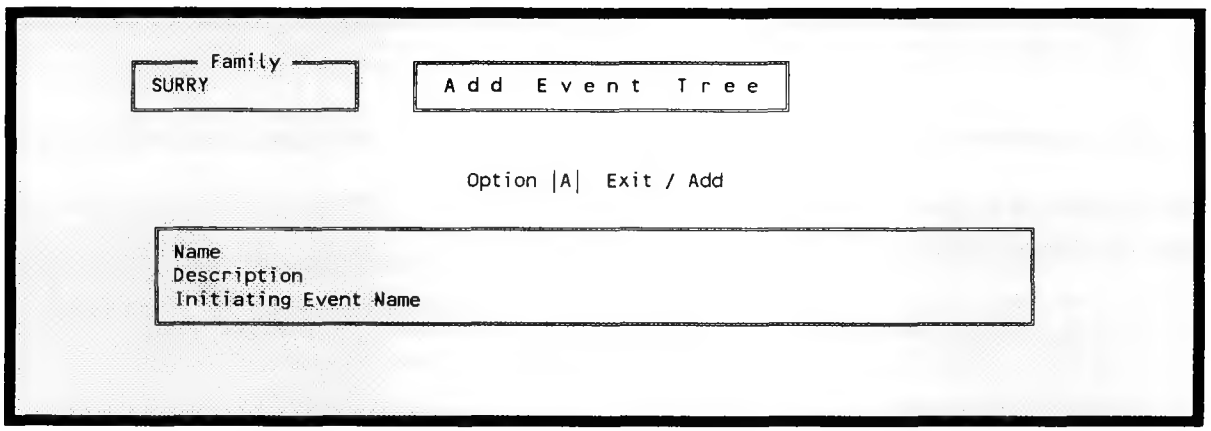


Figure 254. Editing screen for adding an event tree.

8.3.2.1 Exit. This option returns you to the Edit Event Trees screen. To invoke this option, type <E> in the option field and press <Enter>, or press the <Esc> key.

8.3.2.2 Add. This option performs the actual add of a new event tree record. To invoke this option, type <A> in the option field, fill in the requested data fields, and press <Enter>. The required information for an event tree add is the name and initiating event.

If, for the initiating event name, you enter the name of an event that is not an initiating event, a message **Event (name) is not an initiating event - not added** is displayed. If you enter an event name that does not exist in the data base, a message **Event (name) does not exist - not added** is displayed. If no initiating event is entered, a message **Event tree must have an initiating event - not added** will be displayed. If the initiating event is valid, the message **Record added** will be displayed.

8.3.3 Modify

This option allows you to modify an event tree record. To invoke this option, type <M> in the option field, highlight an event tree name, and press <Enter>. The Modify Event Tree screen is shown in Figure 255. The options at this point are Exit and Modify.

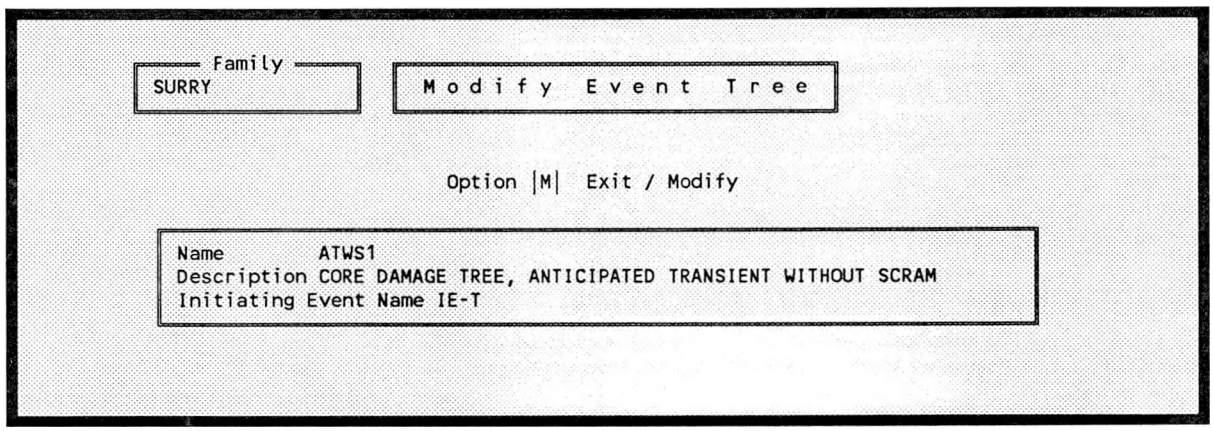


Figure 255. Editing screen for modifying an event tree.

8.3.3.1 Exit. This option returns you to the Edit Event Trees screen. To invoke this option, type <E> in the option field and press <Enter>, or press the <Esc> key.

8.3.3.2 Modify. This option performs the actual modification of the event tree record. To invoke this option, type <M> in the option field, modify any of the data fields on the Modify Event Trees screen, and press <Enter>.

If, for the initiating event name, you enter the name of an event that is not an initiating event, a message **Event (name) is not an initiating event - not modified** is displayed. If you enter an event name that does not exist in the data base, a message **Event (name) does not exist - not modified** is displayed. If the initiating event is valid and you modify the date and press <Enter>, you will be returned to the Edit Event Trees screen with the message **Record modified** displayed.

8.3.4 Delete

This option allows you to delete an event tree record and associated sequence records from the data base. To invoke this option, type <D> in the option field, highlight an event tree, and press <Enter>. The delete event tree record is shown in Figure 256. The options at this point are Exit and Delete.

8.3.4.1 Exit. This option returns you to the Edit Event Trees screen. To invoke this option, type <E> in the option field and press <Enter>, or press the <Esc> key.

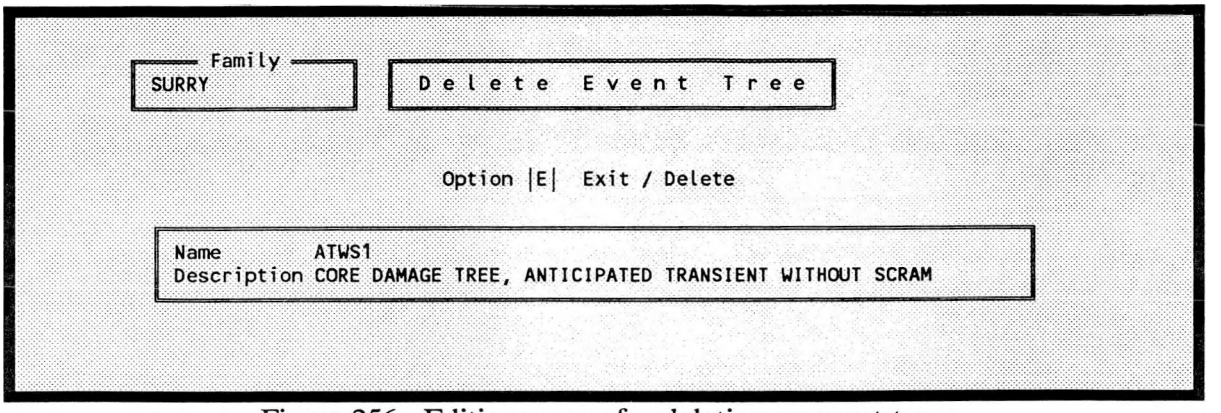


Figure 256. Editing screen for deleting an event tree.

8.3.4.2 Delete. This option performs the actual deletion of the event tree record. To invoke this option, type <D> in the option field and press <Enter>. A warning screen will overlay the Delete Event Tree screen, allowing you to cancel the deletion at this point (Figure 257). If you respond Y (yes), all sequence records associated with the event tree will be deleted from the data base. You will be returned to the Edit Event Trees screen with the message **Record deleted** displayed.

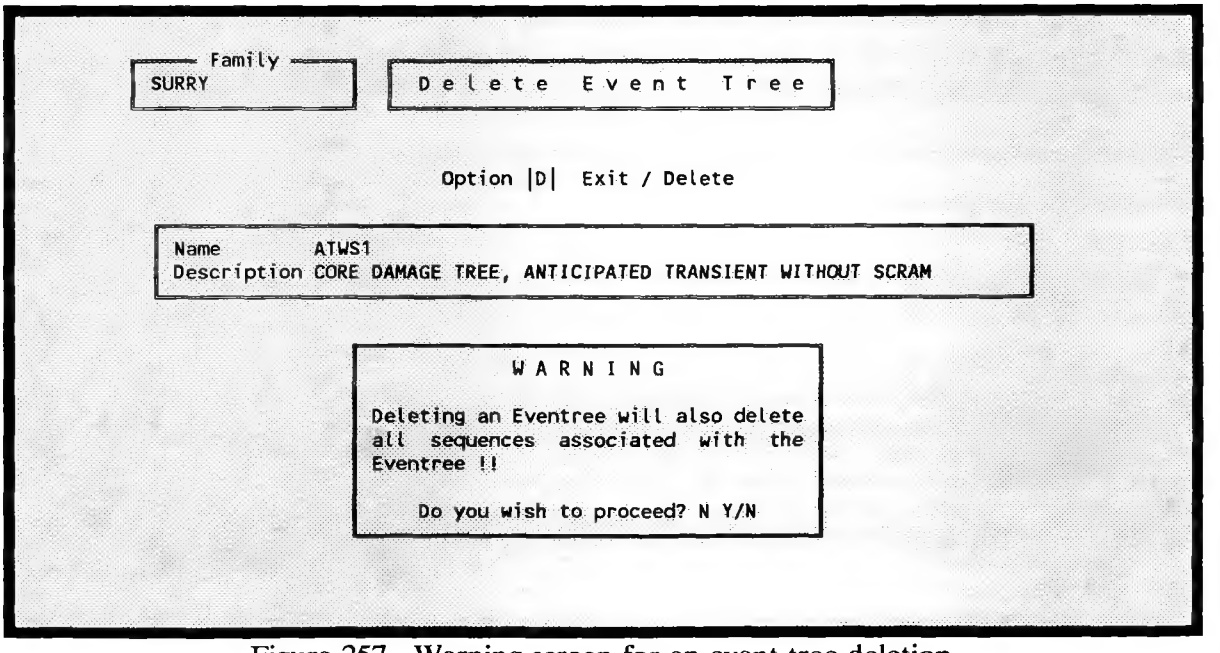


Figure 257. Warning screen for an event tree deletion.

8.3.5 Text

This option allows you to view and edit any descriptive text associated with a specific event tree. To invoke this option, type <T> in the option field, highlight an event tree, and press <Enter>.

The initial display for this option displays the first 13 lines of the text block. The following keys allow you to display additional lines of text:

PgDn	-	presents the next 13 lines of text.
PgUp	-	presents the previous 13 lines of text.
Ctrl-PgDn	-	presents the last 13 lines of text.
Ctrl-PgUp	-	presents the first 13 lines of text.

The editing keys are

Ctrl-Z	-	Exits the text editing feature and saves the text information as it currently exists.
ESC	-	Exits without saving changes.
Alt-A	-	Adds a line after the line at the current cursor position.
Alt-B	-	Adds a line before the line at the current cursor position.
Alt-H	-	Displays editing keys help screen.
Alt-D	-	Deletes a line at the current cursor position.
Alt-R	-	Restores the previous deleted text.
Del	-	Deletes a character at current cursor position.
Ins	-	Inserts a character at current cursor position.
Ctrl-End	-	Deletes all characters from the current cursor position to the end of the cursor line.

The arrow keys are used to move the cursor within the block of text.

The editor does not line wrap, therefore, you must use <Alt-A> to establish each new line of text. If you wish to save your text changes, press Ctrl-Z. After you have pressed Ctrl-Z, you are returned to the Edit Event Trees screen with the message **Text record modified** displayed. If you pressed the <Esc> key, you will be returned to the Edit Event Trees screen with the message **Text record not modified** displayed at the bottom.

8.3.6 Sequences

This option allows you to modify the sequence records associated with an event tree. To invoke this option, type <S> in the option field, highlight an event tree name, and press <Enter>. If an event tree was not highlighted before pressing <Enter>, the message **An event tree must be highlighted first** will be displayed. After highlighting an event tree and pressing <Enter>, the Edit Sequences screen shown in Figure 258 will be displayed. The editing options for sequences are: Exit, Add, Modify, Delete, and Text. In addition, the following function keys are available:

<Esc>	Returns you to the Edit Event Trees screen.

<F1> Displays on-line help messages.

<F5> Positions the cursor on a specific sequence name. When you press <F5> a blank line will appear in the middle of the sequence list. Enter the sequence name you wish to locate and press <Enter>. The sequence list will be redisplayed with the requested sequence name highlighted. If the requested sequence cannot be found, the next highest sequence in the sort order will be highlighted.

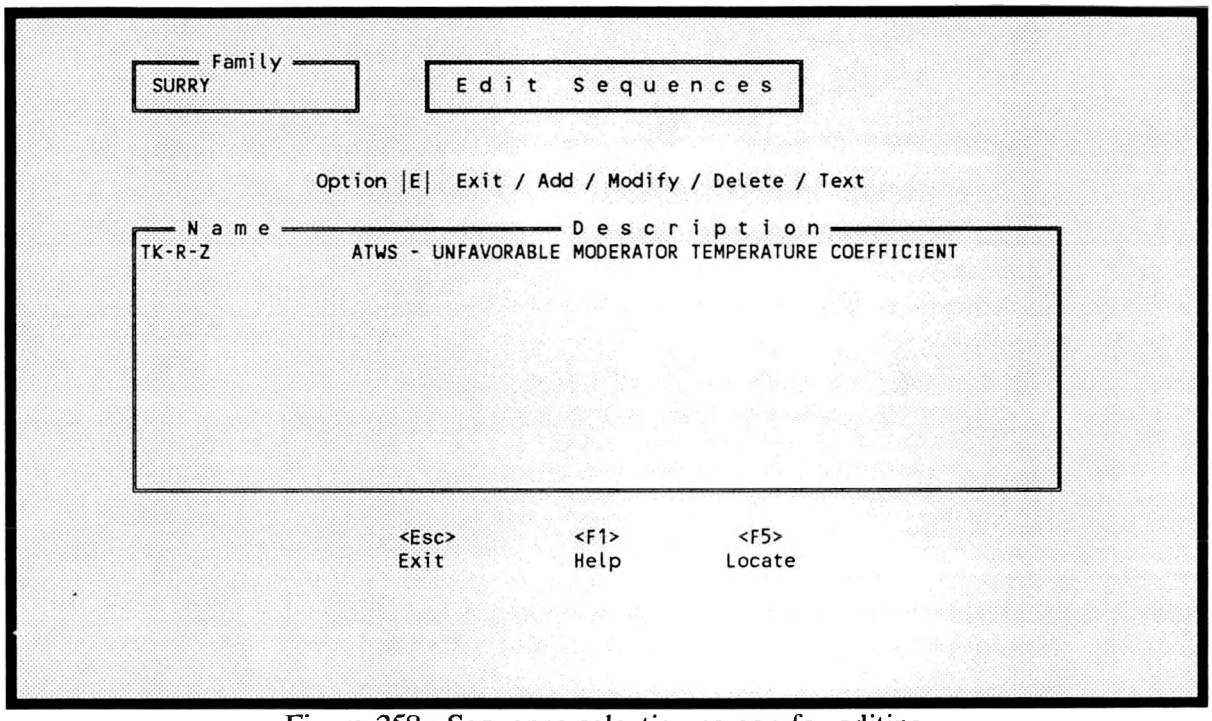


Figure 258. Sequence selection screen for editing.

8.3.6.1 Exit. This option returns you to the Edit Event Trees screen. To invoke this option, type <E> in the option field and press <Enter>, or press the <Esc> key.

8.3.6.2 Add. This option allows you to add a sequence record to the data base. To invoke this option, type <A> in the option field and press <Enter>. The Add Sequence screen is shown in Figure 259. The options at this point are Exit and Add.

8.3.6.2.1 Exit--This option returns you to the Edit Sequences screen. To invoke this option, type <E> in the option field and press <Enter>, or press the <Esc> key.

8.3.6.2.2 Add--This option performs the actual add of a new sequence record. To invoke this option, type <A> in the option field, fill in the requested data fields, and press <Enter>. The only required information for a sequence add is the name. When complete, press <Enter>. You will be returned to the Edit Sequences screen with the message **Record added** displayed.

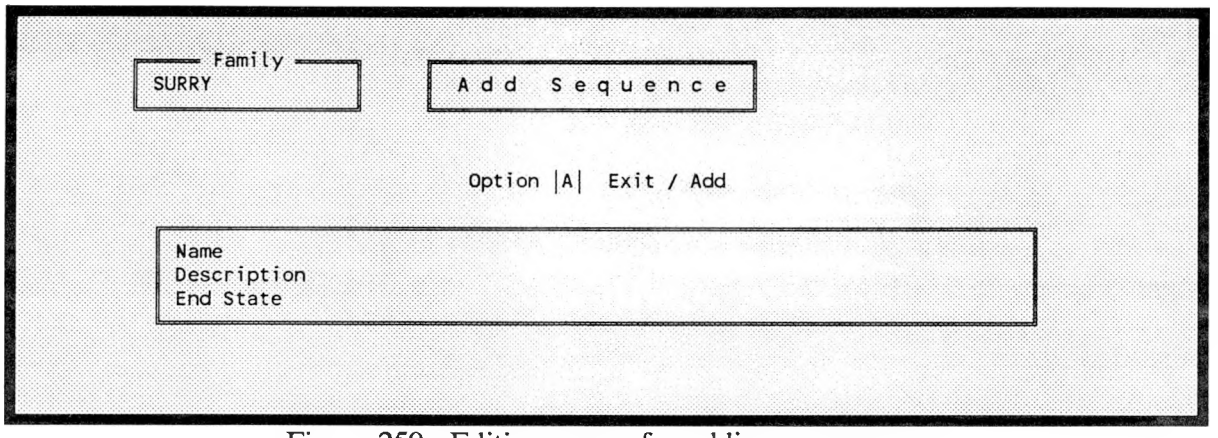


Figure 259. Editing screen for adding a sequence.

8.3.6.3 Modify. This option allows you to modify a sequence record. To invoke this option, type <M> in the option field, highlight a sequence name, and press <Enter>. The Modify Sequence screen is shown in Figure 260. The options at this point are Exit and Modify.

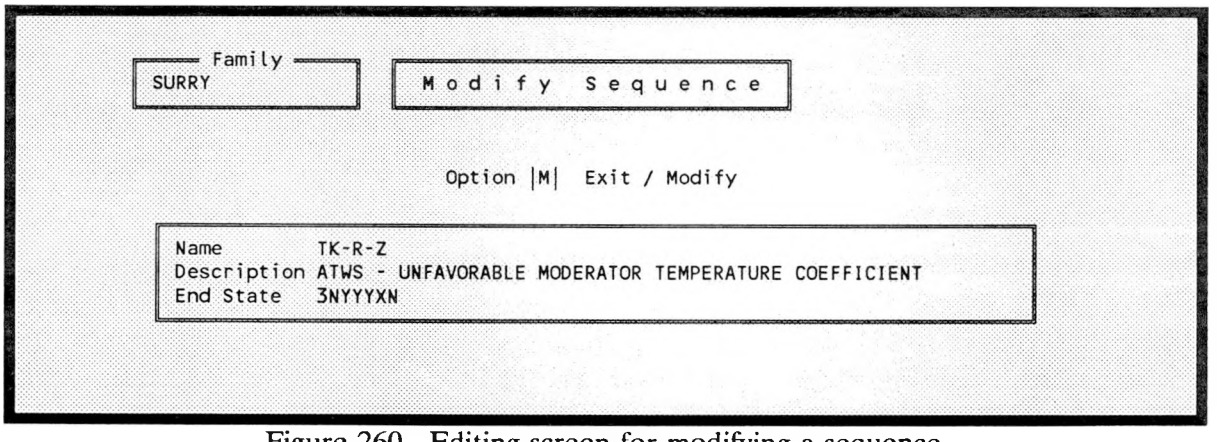


Figure 260. Editing screen for modifying a sequence.

8.3.6.3.1 Exit--This option returns you to the Edit Sequences screen. To invoke this option, type <E> in the option field and press <Enter>, or press the <Esc> key.

8.3.6.3.2 Modify--This option performs the actual modification of the sequence record. To invoke this option, type <M> in the option field, modify any of the data fields on the Modify Sequence screen, and press <Enter>. You will be returned to the Edit Sequences screen with the message **Record Modified** displayed at the bottom of the screen.

8.3.6.4 Delete. This option allows you to delete a sequence record. To invoke this option, type <D> in the option field, highlight a sequence name and press <Enter>. The Delete Sequence screen is shown in Figure 261. Two options are available: Exit and Delete.

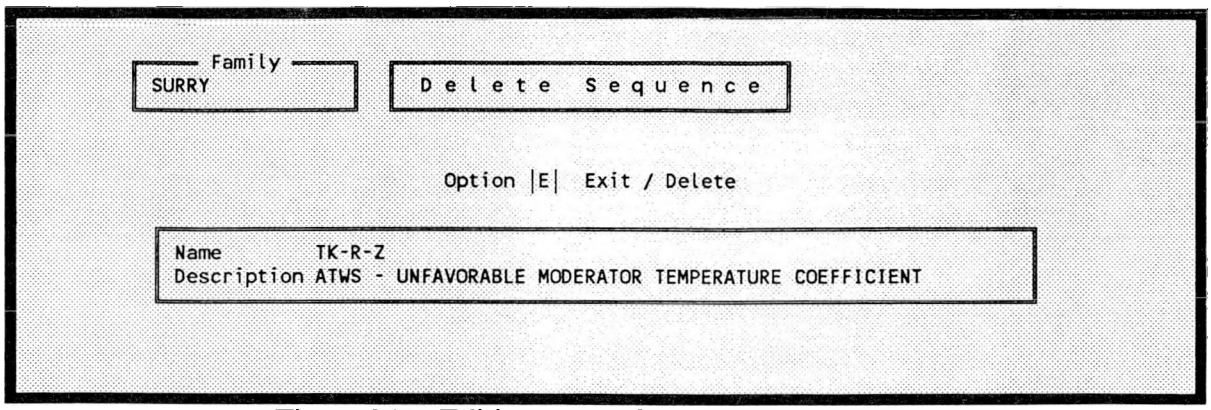


Figure 261. Editing screen for deleting a sequence.

8.3.6.4.1 Exit-- This option returns you to the Edit Sequences screen. To invoke this option, type <E> in the option field and press <Enter>, or press the <Esc> key.

8.3.6.4.2 Delete-- This option performs the actual deletion of the sequence record. To invoke this option, type <D> in the option field and press <Enter>. The message **Record deleted.** will be displayed at the bottom of the screen.

8.3.6.5 Text. This option allows you to view and edit any descriptive text that has been associated with a specific sequence. To invoke this option, type <T> in the option field, highlight a sequence name, and press <Enter>.

The initial display for this option displays the first 13 lines of the text block. The following keys allow you to display additional lines of text:

PgDn	-	presents the next 13 lines of text.
PgUp	-	presents the previous 13 lines of text.
Ctrl-PgDn	-	presents the last 13 lines of text.
Ctrl-PgUp	-	presents the first 13 lines of text.

The editing keys are

Ctrl-Z	-	Exits the text editing feature and saves the text information as it currently exists.
ESC	-	Exits without saving changes.
Alt-A	-	Adds a line after the line at the current cursor position.
Alt-B	-	Adds a line before the line at the current cursor position.
Alt-H	-	Displays editing keys help screen.
Alt-D	-	Deletes a line at the current cursor position.
Alt-R	-	Restores the previous deleted text.
Del	-	Deletes a character at current cursor position.
Ins	-	Inserts a character at current cursor position.
Ctrl-End	-	Deletes all characters from the current cursor position to the end of the cursor line.

The arrow keys are used to move the cursor within the block of text.

The editor does not line wrap, therefore, you must use <Alt-A> to establish each new line of text. If you wish to save your text changes, press <Ctrl-Z>. After you have pressed <Ctrl-Z>, you are returned to the Edit Event Trees screen with the message **Text record modified** displayed at the bottom of the screen. If you pressed the <Esc> key, you will be returned to the Edit Event Trees screen with the message **Text record not modified** displayed at the bottom of the screen.

8.4 Systems

This option allows you to modify the system data records. To invoke this option, type <Y> in the option field or highlight SYstems and press <Enter>. The Edit Systems screen lists all of the systems contained in the current family (Figure 262). The modification options are: Exit, Add, Modify, Delete, and Text. In addition, the following function keys are available:

<Esc> Returns you to the Modify Database menu.

<F1> Displays on-line help messages.

<F5> Positions the cursor on a specific system name. When <F5> is pressed, a blank line will appear in the middle of the system list. Enter the system name you wish to locate and press <Enter>. The system name list will be redisplayed with the requested system name highlighted. If the requested system cannot be found, the next highest system in the sort order will be highlighted.

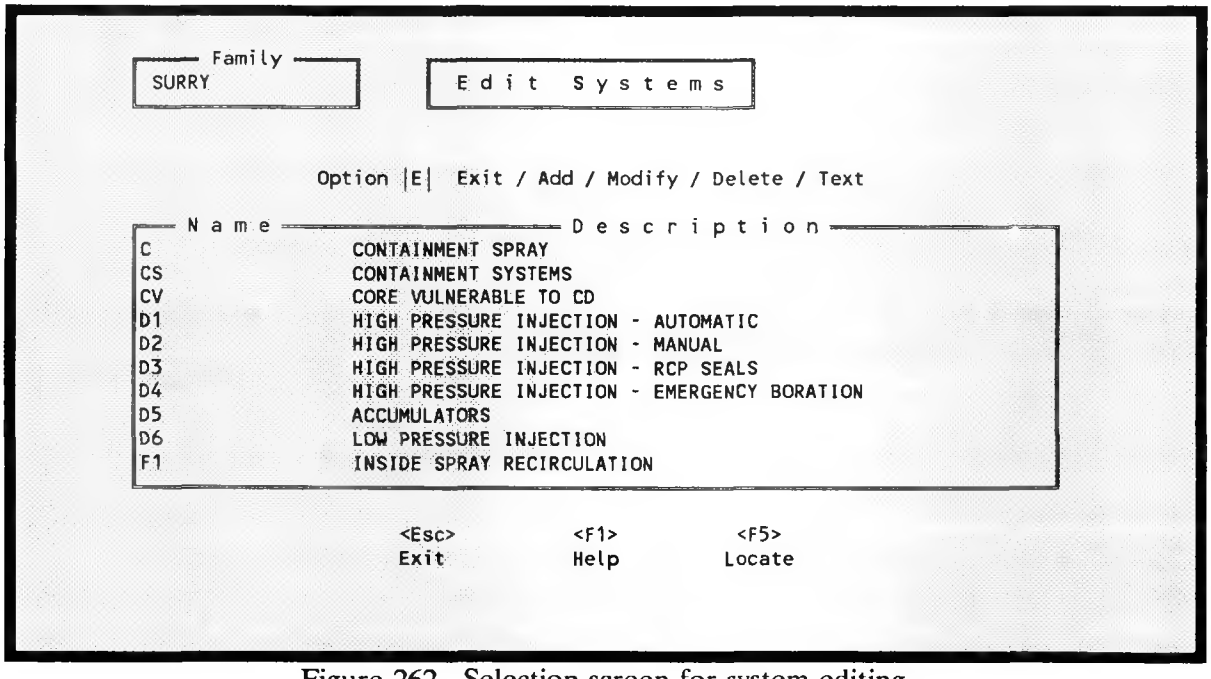


Figure 262. Selection screen for system editing.

8.4.1 Exit

This option returns you to the Modify Database menu. To invoke this option, type <E> in the option field and press <Enter>, or press the <Esc> key.

8.4.2 Add

This option allows you to add a system record to the current family. To invoke this option, type <A> in the option field and press <Enter>. The Add System screen is shown in Figure 263. The options at this point are Exit and Add.

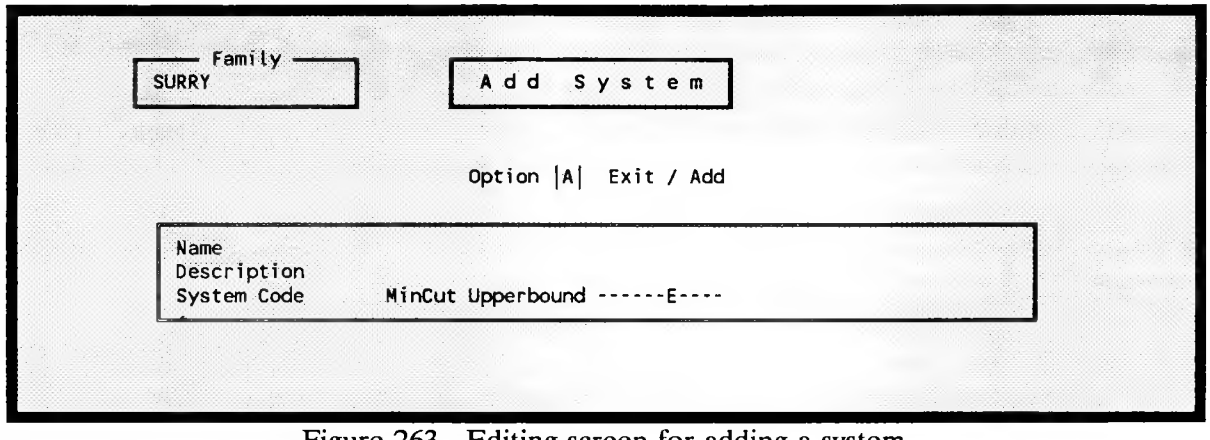


Figure 263. Editing screen for adding a system.

8.4.2.1 Exit. This option returns you to the Edit Systems screen. To invoke this option, type <E> in the option field and press <Enter>, or press the <Esc> key.

8.4.2.2 Add. This option performs the actual add of a new system record. To invoke this option, type <A> in the option field, fill in the requested data fields, and press <Enter>. The only required information for a system add is the name. When complete, you will be returned to the Edit Systems screen with the message **Record Added** displayed.

8.4.3 Modify

This option allows you to modify a system record. To invoke this option, type <M> in the option field, highlight a system name, and press <Enter>. The Modify System screen is shown in Figure 264. The options at this point are Exit and Modify.

8.4.3.1 Exit. This option returns you to the Edit Systems screen. To invoke this option, type <E> in the option field and press <Enter,> or press the <Esc> key.

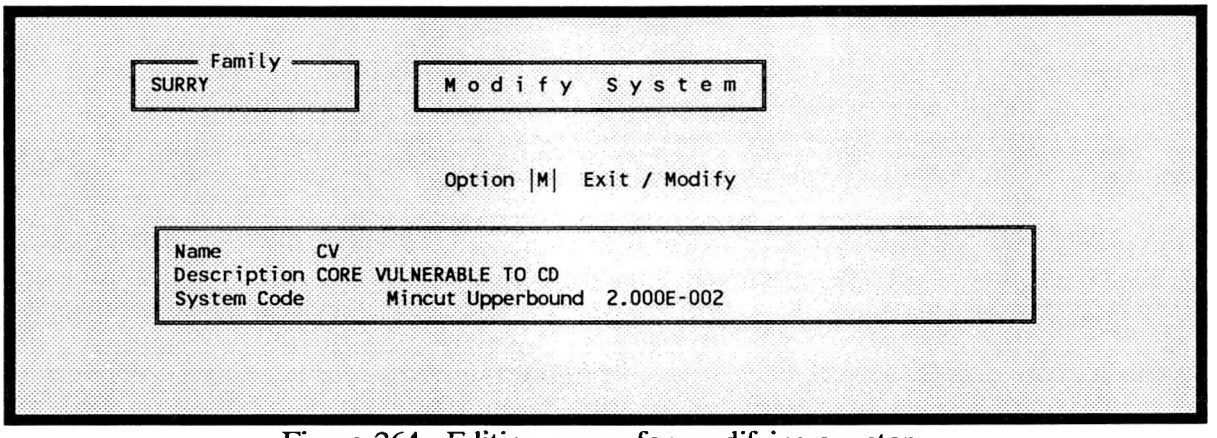


Figure 264. Editing screen for modifying a system.

8.4.3.2 Modify. This option performs the actual modification of the system record. To invoke this option, type <M> in the option field, modify any of the data fields on the Modify System screen, and press <Enter>. When completed, you will be returned to the Edit Systems screen with the message **Record modified** displayed.

8.4.4 Delete

This option allows you to delete a system record from the data base. To invoke this option, type <D> in the option field, highlight a system and press <Enter>. The Delete System screen is shown in Figure 265. The options at this point are Exit and Delete.

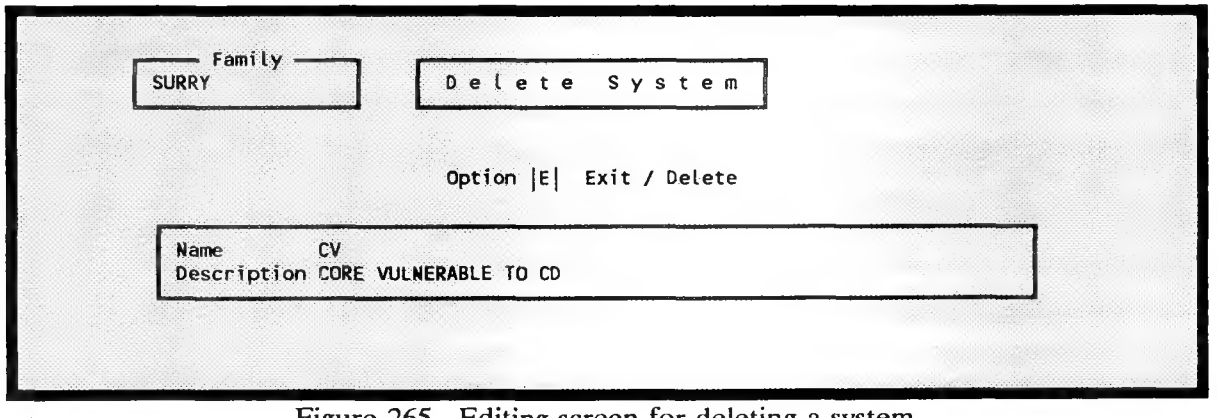


Figure 265. Editing screen for deleting a system.

8.4.4.1 Exit. This option returns you to the Edit Systems screen. To invoke this option, type <E> in the option field and press <Enter>, or press the <Esc> key.

8.4.4.2 Delete. This option performs the actual deletion of the system record. To invoke this option, type <D> in the option field and press <Enter>. When complete, you will be returned to the Edit Systems screen with the message **Record deleted** displayed.

8.4.5 Text

This option allows you to view and edit any descriptive text associated with a specific system. To invoke this option, type <T> in the option field, highlight a system name, and press <Enter>.

The initial display for this option displays the first 13 lines of the text block. The following keys allow you to display additional lines of text:

PgDn	-	presents the next 13 lines of text.
PgUp	-	presents the previous 13 lines of text.
Ctrl-PgDn	-	presents the last 13 lines of text.
Ctrl-PgUp	-	presents the first 13 lines of text.

The editing keys are

Ctrl-Z	-	Exits the text editing feature and saves the text information as it currently exists.
ESC	-	Exits without saving changes.
Alt-A	-	Adds a line after the line at the current cursor position.
Alt-B	-	Adds a line before the line at the current cursor position.
Alt-H	-	Displays editing keys help screen.
Alt-D	-	Deletes a line at the current cursor position.
Alt-R	-	Restores the previous deleted text.
Del	-	Deletes a character at current cursor position.
Ins	-	Inserts a character at current cursor position.
Ctrl-End	-	Deletes all characters from the current cursor position to the end of the cursor line.

The arrow keys are used to move the cursor within the block of text.

The editor does not line wrap, therefore, you must use <Alt-A> to establish each new line of text. If you wish to save your text changes, press <Ctrl-Z>. After you have pressed <Ctrl-Z>, you are returned to the Edit Systems screen with the message, **Text record modified** displayed at the bottom of the screen. If you press the <Esc> key, you are returned to the Edit Systems screen with the message **Text record not modified** displayed at the bottom of the screen.

8.5 End States

This option allows you to modify the end state data records. To invoke this option, type <N> in the option field or highlight ENd States and press <Enter>. The Edit End State screen, which lists all of the end states belonging to the current family, is shown in Figure 266. The modification options are: Exit, Add, Modify, Delete, and Text. In addition, the following function keys are available:

<Esc>	Returns you to the Modify Database Menu.
<F1>	Displays on-line help messages.
<F5>	Positions the cursor on a specific end state name. When you press <F5> a

blank line will appear in the middle of the end state list. Enter the end state name you wish to locate and press <Enter>. The end state name list will be redisplayed with the requested end state name highlighted. If the requested end state cannot be found, the next highest end state in the sort order will be highlighted.

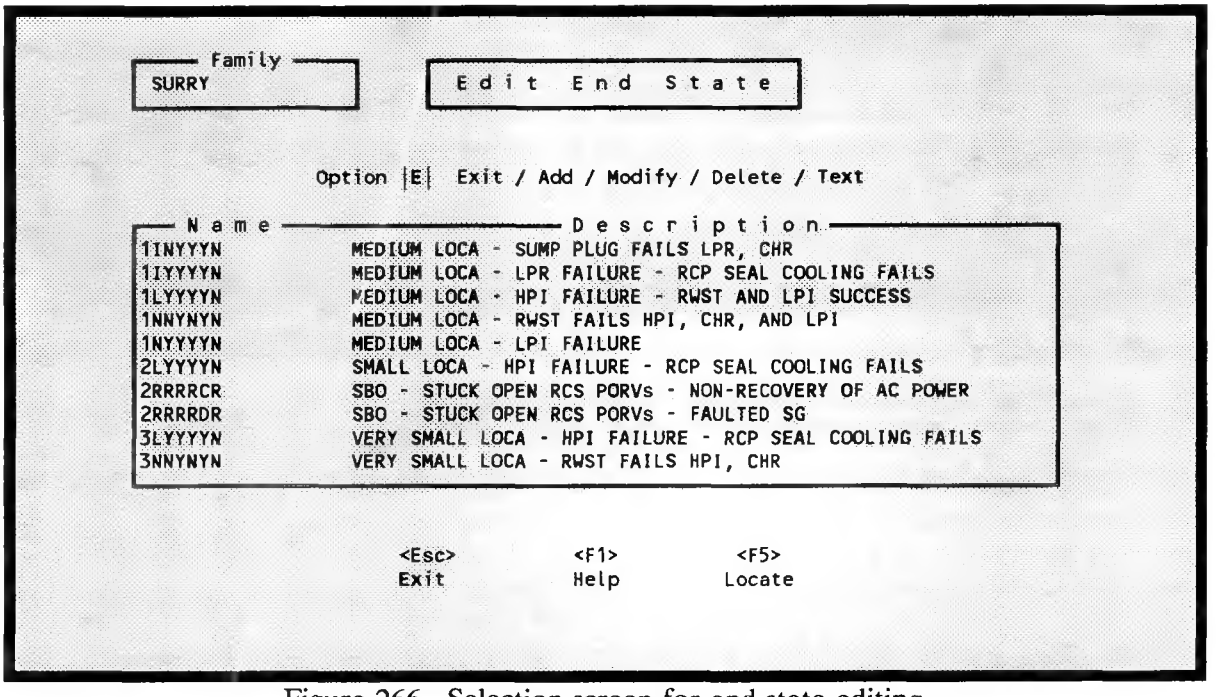


Figure 266. Selection screen for end state editing.

8.5.1 Exit

This option returns you to the Modify Database menu. To invoke this option, type <E> in the option field and press <Enter>, or press the <Esc> key.

8.5.2 Add

This option allows you to add an end state record to the current family. To invoke this option, type <A> in the option field and press <Enter>. The Add End State screen is shown in Figure 267. The options at this point are Exit and Add.

8.5.2.1 Exit. This option returns you to the Edit End State screen. To invoke this option, type <E> in the option field and press <Enter>, or press the <Esc> key.

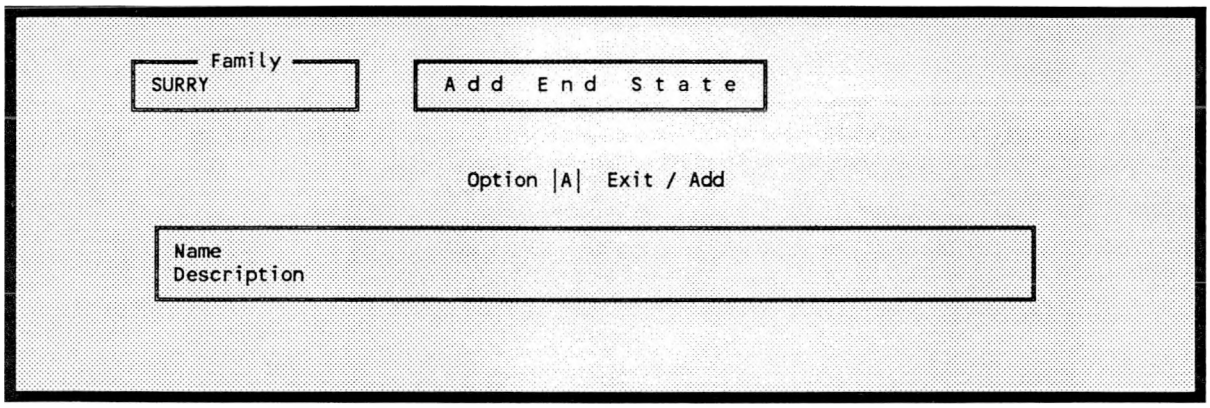


Figure 267. Editing screen for adding an end state.

8.5.2.2 Add. This option performs the actual add of a new end state record. To invoke this option, type <A> in the option field, fill in the requested data fields, and press <Enter>. The only required information for an end state add is the name. When complete, you will be returned to the Edit End State screen with the message **Record added** displayed.

8.5.3 Modify

This option allows you to modify an end state record. To invoke this option, type <M> in the option field, highlight an end state name, and press <Enter>. The Modify End State screen is shown in Figure 268. The options at this point are Exit and Modify.

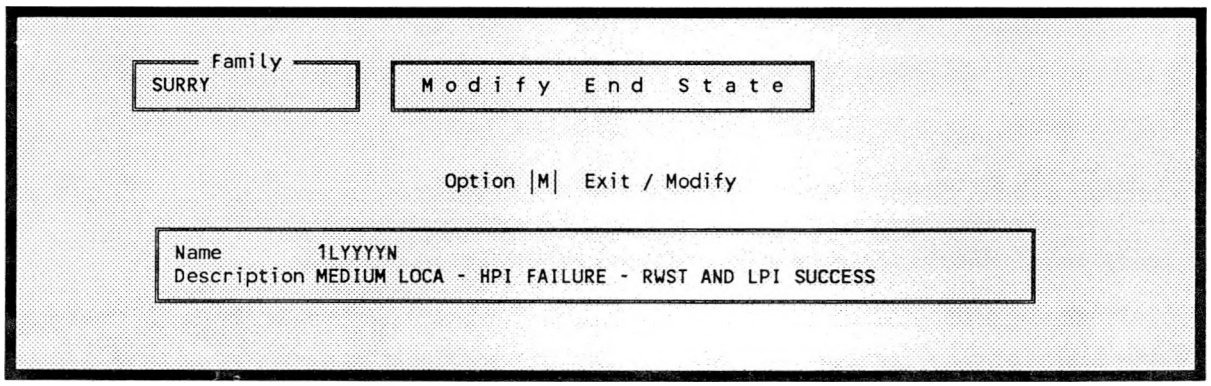


Figure 268. Editing screen for modifying an end state.

8.5.3.1 Exit. This option returns you to the Edit End State screen. To invoke this option, type <E> in the option field and press <Enter>, or press the <Esc> key.

8.5.3.2 Modify. This option performs the actual modification of the end state record. To invoke this option, type <M> in the option field, modify any of the data fields on the Modify End State screen, and press <Enter>. When complete, you will be returned to the Edit End State screen with the message **Record modified** displayed at the bottom of the screen.

8.5.4 Delete

This option allows you to delete an end state record from the data base. To invoke this option, type <D> in the option field, highlight an end state and press <Enter>. The Delete End State screen is shown in Figure 269. The options at this point are Exit and Delete.

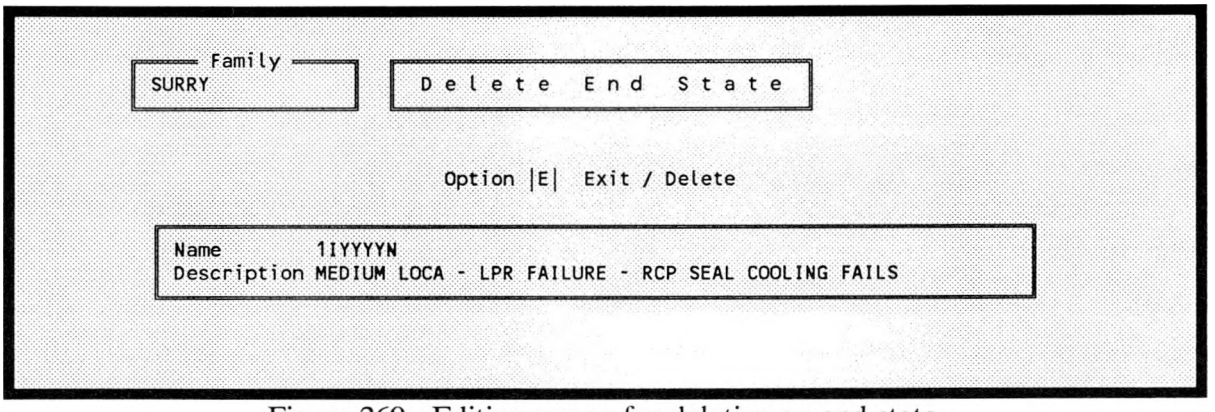


Figure 269. Editing screen for deleting an end state.

8.5.4.1 Exit. This option returns you to the Edit End State screen. To invoke this option, type <E> in the option field and press <Enter>, or press the <Esc> key.

8.5.4.2 Delete. This option performs the actual deletion of the end state record. To invoke this option, type <D> in the option field and press <Enter>. When complete, you will be returned to the Edit End State screen with the message **Record deleted** displayed at the bottom of the screen.

8.5.5 Text

This option allows you to view and edit any descriptive text associated with a specific end state. To invoke this option, type <T> in the option field, highlight an end state name, and press <Enter>.

The initial display for this option displays the first 13 lines of the text block. The following keys allow you to display additional lines of text:

PgDn	-	presents the next 13 lines of text.
PgUp	-	presents the previous 13 lines of text.
Ctrl-PgDn	-	presents the last 13 lines of text.
Ctrl-PgUp	-	presents the first 13 lines of text.

The editing keys are

Ctrl-Z	-	Exits the text editing feature and saves the text information as it currently exists.
ESC	-	Exits without saving changes.
Alt-A	-	Adds a line after the line at the current cursor position.

Alt-B	-	Adds a line before the line at the current cursor position.
Alt-H	-	Displays editing keys help screen.
Alt-D	-	Deletes a line at the current cursor position.
Alt-R	-	Restores the previous deleted text.
Del	-	Deletes a character at current cursor position.
Ins	-	Inserts a character at current cursor position.
Ctrl-End	-	Deletes all characters from the current cursor position to the end of the cursor line.

The arrow keys are used to move the cursor within the block of text.

The editor does not line wrap, therefore, you must use <Alt-A> to establish each new line of text. If you wish to save your changes, press <Ctrl-Z>. After you have pressed <Ctrl-Z>, you are returned to the Edit End State screen with the message, **Text record modified** displayed at the bottom of the screen. If you pressed <Esc>, you are returned to the End State screen with the message **Text record not modified** displayed at the bottom of the screen.

8.6 Basic Events

This option allows you to modify the basic event data records. To invoke this option, type <B> in the option field or highlight Basic Events and press <Enter>. The Edit Events screen, listing all of the basic events belonging to the current family, is displayed (Figure 270). The modification options are: Exit, Add, Modify, and Delete. In addition, the following function keys are available:

<Esc>	Returns you to the Modify Database menu.
<F1>	Displays on-line help messages.
<F5>	Positions the cursor on a specific basic event name. When you press <F5>, a blank line will appear in the middle of the basic event list. Enter the basic event name you wish to locate and press <Enter>. The basic event name list will be redisplayed with the requested basic event name highlighted. If the requested basic event cannot be found, the next highest basic event in the sort order will be highlighted.

8.6.1 Exit

This option returns you to the Modify Database menu. To invoke this option, type <E> in the option field and press <Enter>, or press the <Esc> key.

8.6.2 Add

This option allows you to add a basic event record to the current family. To invoke this option, type <A> in the option field and press <Enter>. The Add Event screen is shown in Figure 271. The options at this point are Exit and Add.

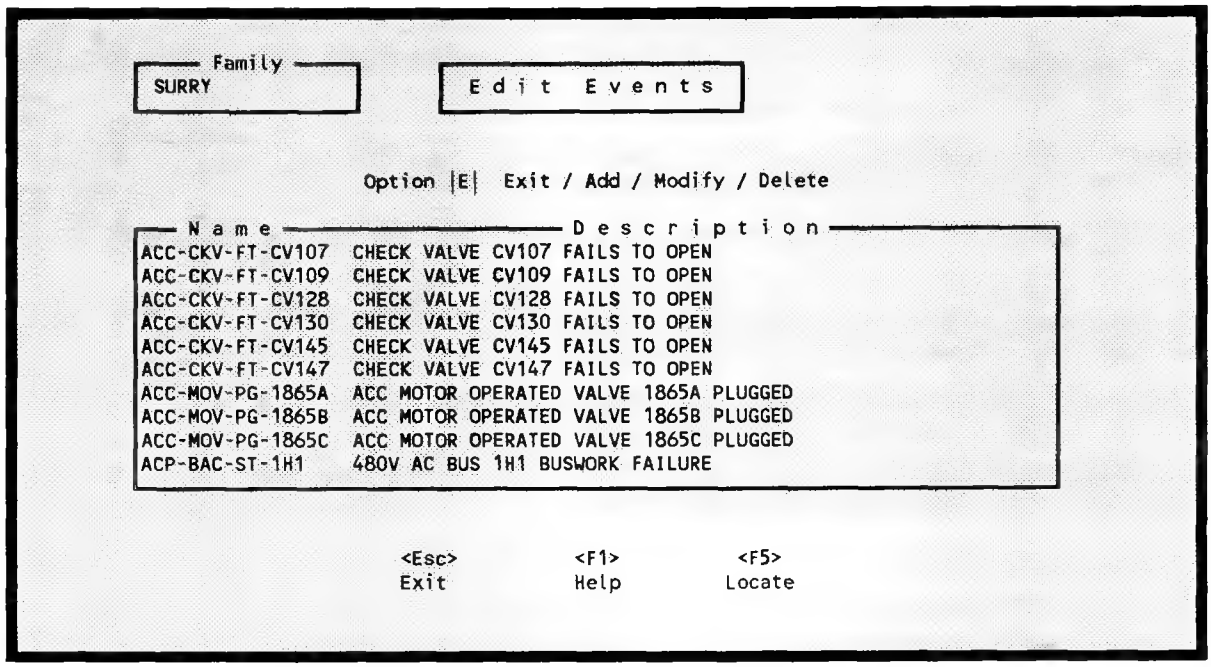


Figure 270. Selection screen for basic event editing.

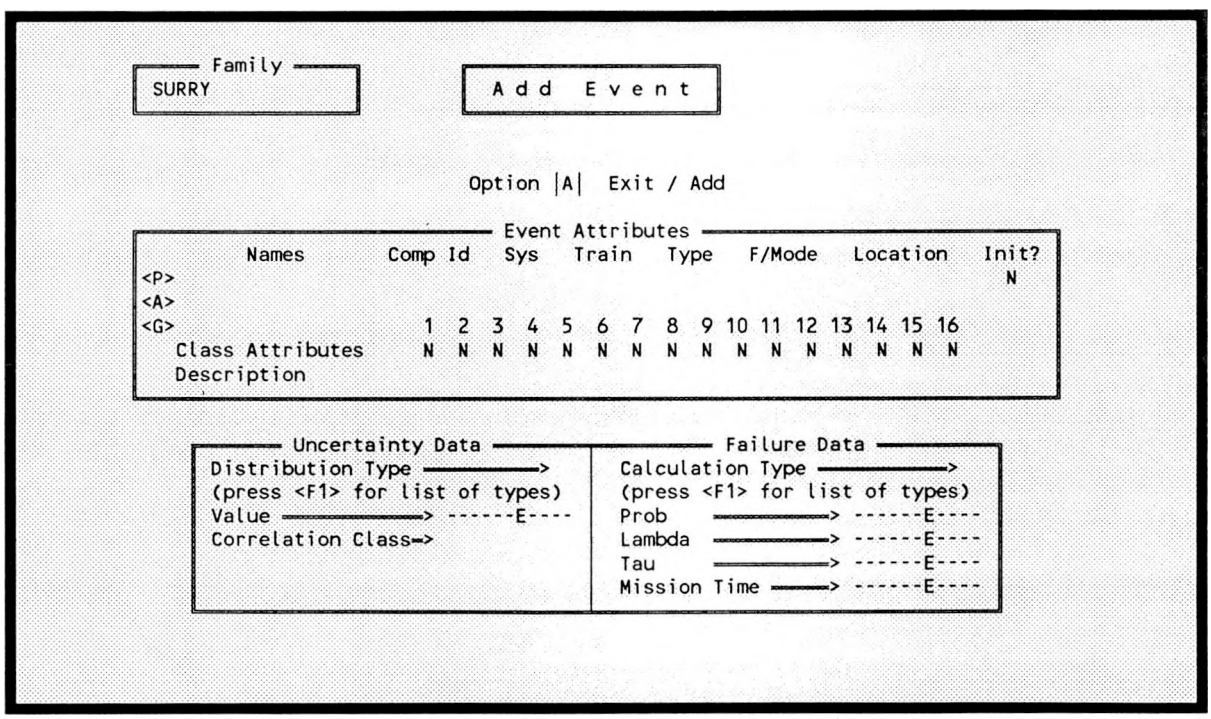


Figure 271. Editing screen for adding a basic event.

8.6.2.1 Exit. This option returns you to the Edit Events screen. To invoke this option, type <E> in the option field and press <Enter>, or press the <Esc> key.

8.6.2.2 Add. This option performs the actual add of a new basic event record. To invoke this option, type <A> in the option field, fill in the requested data fields, and press <Enter>. The only required information for a basic event add is the name. When complete, you will be returned to the Edit Event screen with the message **Record Added** displayed at the bottom of the screen.

8.6.3 Modify

This option allows you to modify a basic event record. To invoke this option, type <M>in the option field, highlight a basic event name, and press <Enter>. The Modify Basic Event screen is shown in Figure 272. The options at this point are Exit and Modify.

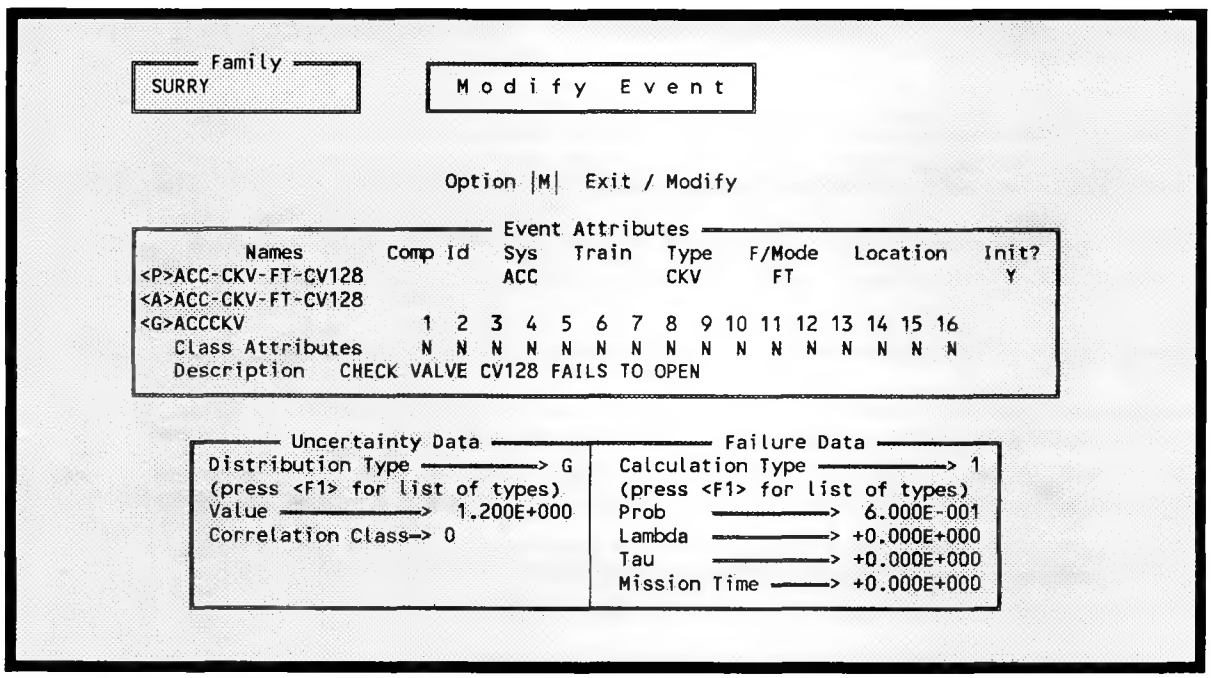


Figure 272. Editing screen for modifying a basic event.

8.6.3.1 Exit. This option returns you to the Edit Events screen. To invoke this option, type <E> in the option field and press <Enter>, or press the <Esc> key.

8.6.3.2 Modify. This option performs the actual modification of the basic event record. To invoke this option, type <M> in the option field, modify any of the data fields on the Modify Basic Event screen, and press <Enter>. When complete, you will be returned to the Edit Events screen with the message **Record Modified** displayed at the bottom of the screen.

8.6.4 Delete

This option allows you to delete a basic event record from the current family. To invoke this option, type <D> in the option field, highlight a basic event and press <Enter>. The Delete Basic Event screen is shown in Figure 273. The options at this point are Exit and Delete.

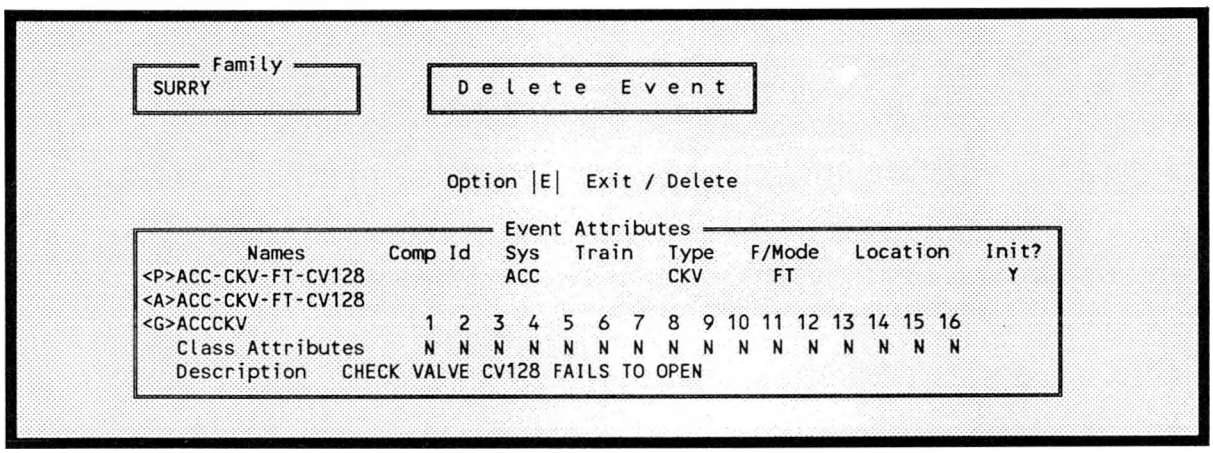


Figure 273. Editing screen for deleting a basic event.

8.6.4.1 Exit. This option returns you to the Edit Events screen. To invoke this option, type <E> in the option field and press <Enter>, or press the <Esc> key.

8.6.4.2 Delete. This option performs the actual deletion of the basic event record. To invoke this option, type <D> in the option field and press <Enter>. When complete, you will be returned to the Edit Events screen with the message **Record deleted** displayed at the bottom of the screen.

8.7 Attributes

This option allows you to edit the five attributes in the current family (Figure 274): Systems, Locations, Failure Modes, Class Attributes, and Basic Event Types. The options available within each of these attributes are: Exit, Add, Modify, and Delete. In addition, the following function keys are available:

<Esc>	Returns you to the Edit Attributes menu.
<F1>	Displays on-line help messages.
<F5>	Positions the cursor on a specific attribute name. When you press <F5>, a blank line will appear in the middle of the attribute list. Enter the attribute name you wish to locate and press <Enter>. The attribute name list will be redisplayed with the requested attribute name highlighted. If the requested attribute cannot be found, the next highest attribute in the sort order will be highlighted.

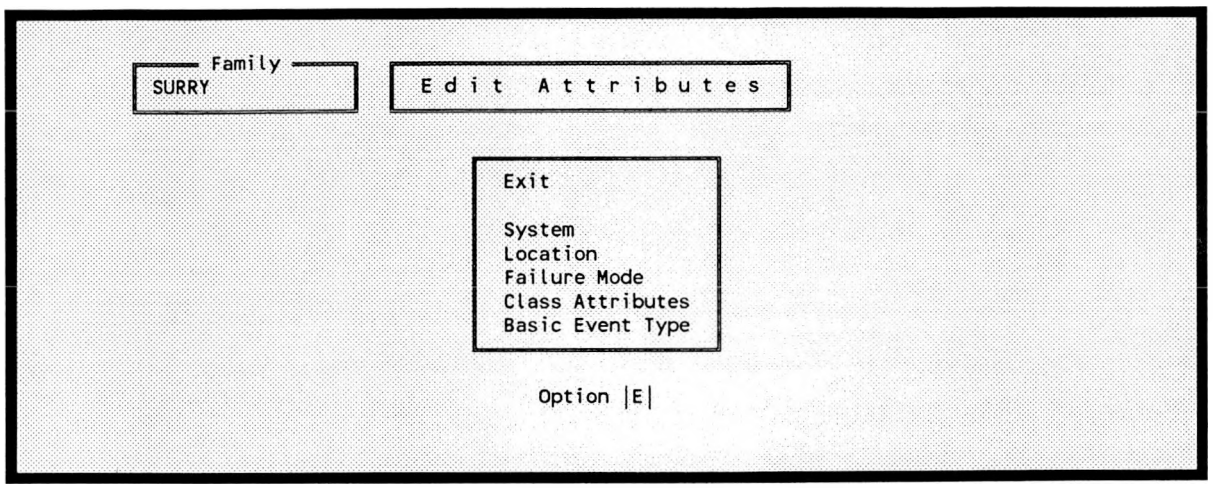


Figure 274. Attribute selection for editing.

The Edit Attributes screen shown in Figure 274 and succeeding screens (Figure 275 - Figure 278) are consistent throughout the attributes option for each of the five categories.

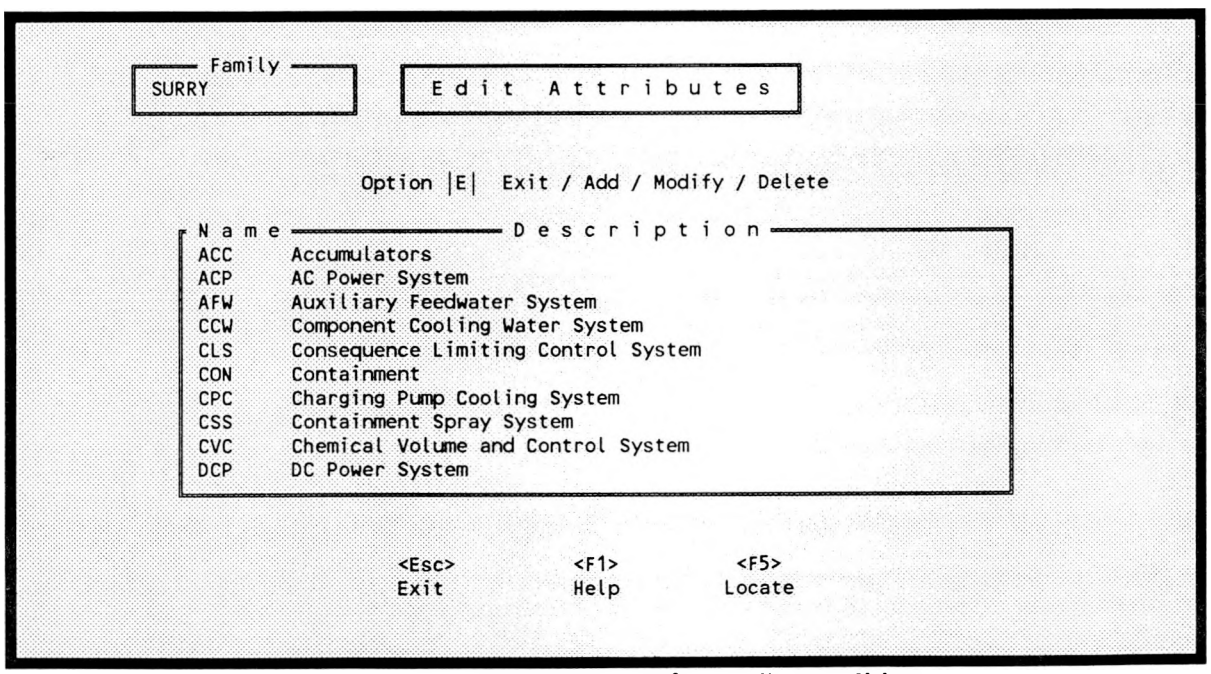


Figure 275. Selection screen for attribute editing.

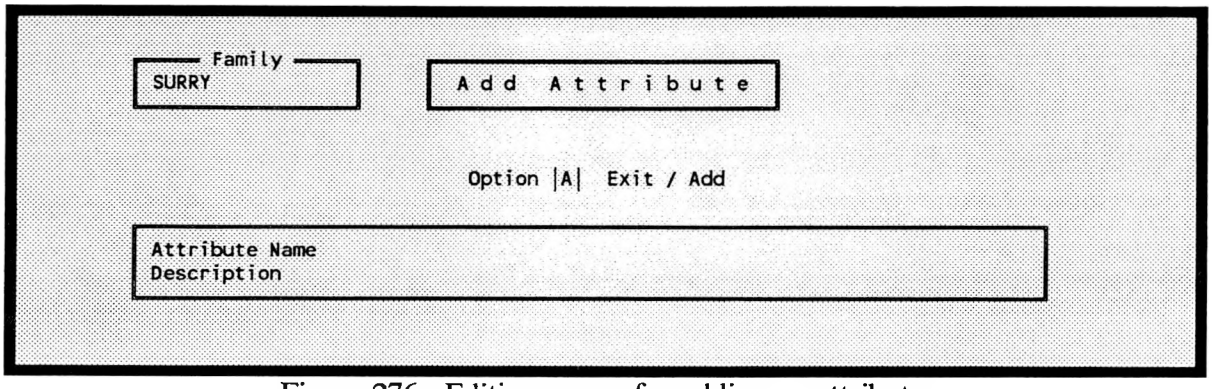


Figure 276. Editing screen for adding an attribute.

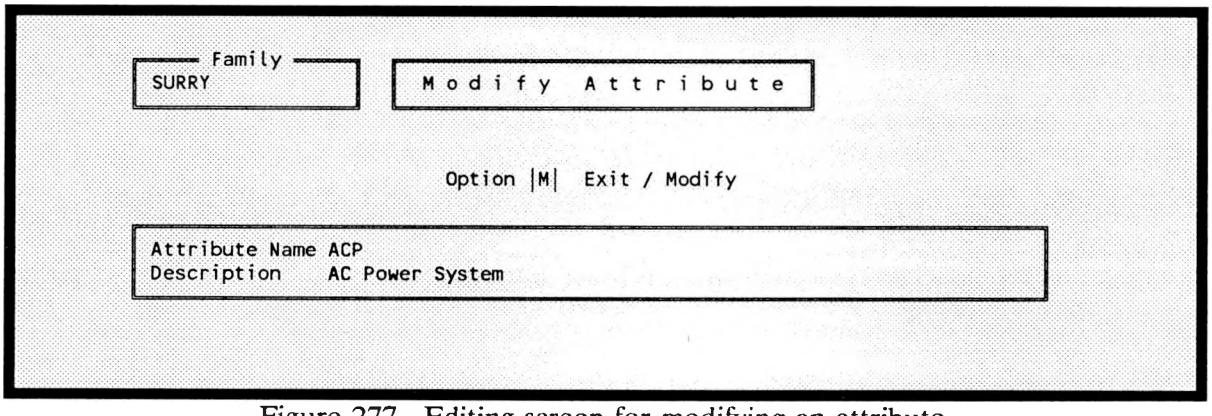


Figure 277. Editing screen for modifying an attribute.

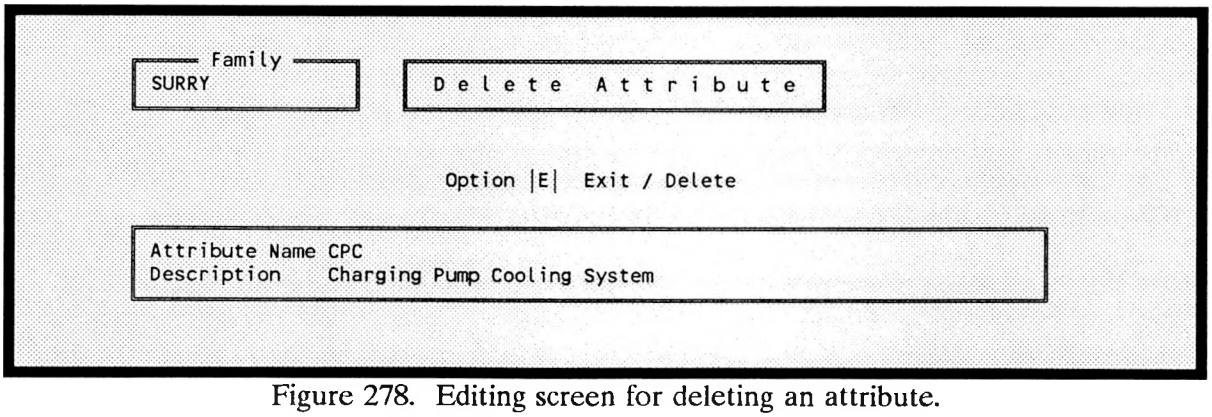


Figure 278. Editing screen for deleting an attribute.

To invoke this option, type <A> in the option field or highlight Attributes and press <Enter>. This will display a list of attribute categories (see Figure 274). Highlighting a category or typing a category's highlighted letter and pressing <Enter> displays the list of attributes available under the selected category.

8.7.1 Exit

This option returns you to the Modify Database menu. To invoke this option, type <E> in the option field and press <Enter>, or press the <Esc> key.

8.7.2 System

This option allows you to modify the system attributes. To invoke this option, type <S> in the option field or highlight System and press <Enter>. The screen shown in Figure 275, listing the system attributes, will be displayed. The option available are Exit, Add, Modify, and Delete.

8.7.2.1 Exit. This option returns you to the Edit Attributes menu. To invoke this option, type <E> in the option field and press <Enter>, or press the <Esc> key.

8.7.2.2 Add. This option allows you to add a new system record to the current family. To invoke this option, type <A> in the option field and press <Enter>. The Add Attribute screen is shown in Figure 276. The options at this point are Exit and Add.

8.7.2.2.1 Exit--This option returns you to the Edit Attributes screen. To invoke this option, type <E> in the option field and press <Enter>, or press the <Esc> key.

8.7.2.2.2 Add--This option performs the actual add of a new system record. To invoke this option, type <A> in the option field, fill in the requested data fields, and press <Enter>. The only required information for an attribute add is the name. When complete, you will be returned to the Edit Attributes screen with the message **Record added** displayed at the bottom of the screen.

8.7.2.3 Modify. This option allows you to modify a system record. To invoke this option, type <M> in the option field, highlight an attribute name, and press <Enter>. The Modify Attribute screen is shown in Figure 277. The options at this point are Exit and Modify.

8.7.2.3.1 Exit--This option returns you to the Edit Attributes screen. To invoke this option, type <E> in the option field and press <Enter>, or press the <Esc> key.

8.7.2.3.2 Modify--This option performs the actual modification of the attribute record. To invoke this option, type <M> in the option field, modify any of the data fields on the Modify Attribute screen, and press <Enter>. When complete, you will be returned to the Edit Attributes screen with the message **Record modified** displayed at the bottom of the screen.

8.7.2.4 Delete. This option allows you to delete a system record from the current family. To invoke this option, type <D> in the option field, highlight a system and press <Enter>. The Delete Attribute screen is shown in Figure 278. The options at this point are Exit and Delete.

8.7.2.4.1 Exit-- This option returns you to the Edit Attributes screen. To invoke this option, type <E> in the option field and press <Enter>, or press the <Esc> key.

8.7.2.4.2 Delete-- This option performs the actual deletion of the attribute record. To invoke this option, type <D> in the option field and press <Enter>. When complete, you will be returned to the Edit Attributes screen with the message **Record deleted** will be displayed at the bottom of the screen.

8.7.3 Location

This option allows you to modify the location attributes. To invoke this option, type <L> in the option field or highlight Location and press <Enter>. The screen shown in Figure 275, listing the location attributes, will be displayed. The option available are Exit, Add, Modify, and Delete.

8.7.3.1 Exit. This option returns you to the Edit Attributes main menu. To invoke this option, type <E> in the option field and press <Enter>, or press the <Esc> key.

8.7.3.2 Add. This option allows you to add a location record to the current family. To invoke this option, type <A> in the option field and press <Enter>. The Add Attribute screen is shown in Figure 276. The options at this point are Exit and Add.

8.7.3.2.1 Exit--This option returns you to the Edit Attributes screen. To invoke this option, type <E> in the option field and press <Enter>, or press the <Esc> key.

8.7.3.2.2 Add-- This option performs the actual add of a new location record. To invoke this option, type <A> in the option field, fill in the requested data fields, and press <Enter>. The only required information for an attribute add is the name. When complete, you will be returned to the Edit Attributes screen with the message **Record Added** displayed at the bottom of the screen.

8.7.3.3 Modify. This option allows you to modify a location record. To invoke this option, type <M> in the option field, highlight an attribute name, and press <Enter>. The Modify Attribute screen is shown in Figure 277. The options at this point are Exit and Modify.

8.7.3.3.1 Exit--This option returns you to the Edit Attributes screen. To invoke this option, type <E> in the option field and press <Enter>, or press the <Esc> key.

8.7.3.3.2 Modify--This option performs the actual modification of the attribute record. To invoke this option, type <M> in the option field, modify any of the data fields on the Modify Attribute screen, and press <Enter>. When complete, you will be returned to the Edit Attributes screen with the message **Record Modified** displayed at the bottom of the screen.

8.7.3.4 Delete. This option allows you to delete a location record from the current family. To invoke this option, type <D> in the option field, highlight an attribute and press <Enter>. The Delete Attribute screen is shown in Figure 278. The options at this point are Exit and Delete.

8.7.3.4.1 Exit--This option returns you to the Edit Attributes screen. To invoke this option, type <E> in the option field and press <Enter>, or press the <Esc> key.

8.7.3.4.2 Delete--This option performs the actual deletion of the attribute record. To invoke this option, type <D> in the option field and press <Enter>. When complete, you will be returned to the Edit Attributes screen with the message **Record Deleted** displayed at the bottom of the screen.

8.7.4 Failure Mode

This option allows you to modify the failure mode attributes. To invoke this option, type <F> in the option field or highlight Failure Modes and press <Enter>. The screen shown in Figure 275, listing the failure mode attributes, will be displayed. The option available are Exit, Add, Modify, and Delete.

8.7.4.1 Exit. This option returns you to the Edit Attributes main menu. To invoke this option, type <E> in the option field and press <Enter>, or press the <Esc> key.

8.7.4.2 Add. This option allows you to add a failure mode attribute record to the current family. To invoke this option, type <A> in the option field and press <Enter>. The Add Attribute screen is shown in Figure 276. The options at this point are Exit and Add.

8.7.4.2.1 Exit--This option returns you to the Edit Attribute screen. To invoke this option, type <E> in the option field and press <Enter>, or press the <Esc> key.

8.7.4.2.2 Add--This option performs the actual add of a new failure mode attribute record. To invoke this option, type <A> in the option field, fill in the requested data fields, and press <Enter>. The only required information for an attribute add is the name. When complete, you will be returned to the Edit Attributes screen with the message **Record added** displayed at the bottom of the screen.

8.7.4.3 Modify. This option allows you to modify a failure mode attribute record. To invoke this option, type <M> in the option field, highlight an attribute name, and press <Enter>. The Modify Attribute screen is shown in Figure 277. The options at this point are Exit and Modify.

8.7.4.3.1 Exit--This option returns you to the Edit Attributes screen. To invoke this option, type <E> in the option field and press <Enter>, or press the <Esc> key.

8.7.4.3.2 Modify--This option performs the actual modification of the failure mode attribute record. To invoke this option, type <M> in the option field, modify any of the data fields on the Modify Attribute screen, and press <Enter>. When complete, you will be returned to the Edit Attributes screen with the message **Record modified** displayed at the bottom of the screen.

8.7.4.4 Delete. This option allows you to delete a failure mode attribute record from the current family. To invoke this option, type <D> in the option field, highlight an attribute and press <Enter>. The Delete Attribute screen is shown in Figure 278. The options at this point are Exit and Delete.

8.7.4.4.1 Exit--This option returns you to the Edit Attributes screen. To invoke this option, type <E> in the option field and press <Enter>, or press the <Esc> key.

8.7.4.4.2 Delete--This option performs the actual deletion of the attribute record. To invoke this option, type <D> in the option field and press <Enter>. When complete, you will be returned to the Edit Attributes screen with the message **Record deleted** displayed at the bottom of the screen.

8.7.5 Class Attributes

This option allows you to modify the class attributes. To invoke this option, type <C> in the option field or highlight Class Attributes and press <Enter>. The screen shown in Figure 275, listing the class attributes, will be displayed. The option available are Exit, Add, Modify, and Delete.

8.7.5.1 Exit. This option returns you to the Edit Attributes main menu. To invoke this option, type <E> in the option field and press <Enter>, or press the <Esc> key.

8.7.5.2 Add. This option allows you to add a class attribute record to the current family. To invoke this option, type <A> in the option field and press <Enter>. The Add Attribute screen is shown in Figure 276. The options at this point are Exit and Add.

8.7.5.2.1 Exit--This option returns you to the Edit Attributes screen. To invoke this option, type <E> in the option field and press <Enter>, or press the <Esc> key.

8.7.5.2.2 Add--This option performs the actual add of a new class attribute record. To invoke this option, type <A> in the option field, fill in the requested data fields, and press <Enter>. The only required information for an attribute add is the name. When complete, you will be returned to the Edit Attributes screen with the message **Record added** displayed at the bottom of the screen.

8.7.5.3 Modify. This option allows you to modify a class attribute record. To invoke this option, type <M> in the option field, highlight an attribute name, and press <Enter>. The Modify Attribute screen is shown in Figure 277. The options at this point are Exit and Modify.

8.7.5.3.1 Exit--This option returns you to the Edit Attributes screen. To invoke this option, type <E> in the option field and press <Enter>, or press the <Esc> key.

8.7.5.3.2 Modify--This option performs the actual modification of the class attribute record. To invoke this option, type <M> in the option field, modify any of the data fields on the Modify Attribute screen, and press <Enter>. When complete, you will be returned to the Edit Attributes screen with the message **Record modified** displayed at the bottom of the screen.

8.7.5.4 Delete. This option allows you to delete an attribute record from the current family. To invoke this option, type <D> in the option field, highlight an attribute and press <Enter>. The Delete Attribute screen is shown in Figure 278. The options at this point are Exit and Delete.

8.7.5.4.1 Exit--This option returns you to the Edit Attributes screen. To invoke this option, type <E> in the option field and press <Enter>, or press the <Esc> key.

8.7.5.4.2 Delete--This option performs the actual deletion of the attribute record. To invoke this option, type <D> in the option field and press <Enter>. When complete, you will be returned to the Edit Attributes screen with the message **Record deleted** displayed at the bottom of the screen.

8.7.6 Basic Event Type

This option allows you to modify the basic event type attributes. To invoke this option, type <B> in the option field or highlight Basic Event Types and press <Enter>. The screen shown in Figure 275, which lists the basic event type attributes, will be displayed. The option available are Exit, Add, Modify, and Delete.

8.7.6.1 Exit. This option returns you to the Edit Attributes main menu. To invoke this option, type <E> in the option field and press <Enter>, or press the <Esc> key.

8.7.6.2 Add. This option allows you to add a basic event type attribute record to the current family. To invoke this option, type <A> in the option field and press <Enter>. The Add Attribute screen is shown in Figure 276. The options at this point are Exit and Add.

8.7.6.2.1 Exit--This option returns you to the Edit Attribute screen. To invoke this option, type <E> in the option field and press <Enter>, or press the <Esc> key.

8.7.6.2.2 Add--This option performs the actual add of a new basic event type attribute record. To invoke this option, type <A> in the option field, fill in the requested data fields, and press <Enter>. The only required information for an attribute add is the name. When complete, you will be returned to the Edit Attributes screen with the message **Record Added** displayed at the bottom of the screen.

8.7.6.3 Modify. This option allows you to modify a basic event type attribute record. To invoke this option, type <M> in the option field, highlight an attribute name, and press <Enter>. The Modify Attribute screen is shown in Figure 277. The options at this point are Exit and Modify.

8.7.6.3.1 Exit--This option returns you to the Edit Attributes screen. To invoke this option, type <E> in the option field and press <Enter>, or press the <Esc> key.

8.7.6.3.2 Modify--This option performs the actual modification of the attribute record. To invoke this option, type <M> in the option field, modify any of the data fields on the Modify Attribute screen, and press <Enter>. When complete, you will be returned to the Edit Attributes screen with the message **Record Modified** displayed at the bottom of the screen.

8.7.6.4 Delete. This option allows you to delete a basic event type attribute record from the current family. To invoke this option, type <D> in the option field, highlight an attribute and press <Enter>. The Delete Attribute screen is shown in Figure 278. The options at this point are Exit and Delete.

8.7.6.4.1 Exit--This option returns you to the Edit Attributes screen. To invoke this option, type <E> in the option field and press <Enter>, or press the <Esc> key.

8.7.6.4.2 Delete--This option performs the actual deletion of the attribute record. To invoke this option, type <D> in the option field and press <Enter>. When complete, you will be returned to the Edit Attributes screen with the message **Record Deleted** displayed at the bottom of the screen.

8.8 Graphics

This option allows you to edit three categories of graphics data records (Figure 279). They are: P&ID Graphics, Fault Tree Graphics, and Event Tree Graphics. The options available within each of these categories are: Exit, Add, Modify, and Delete. In addition, the following function keys are available:

<Esc> Returns you to the Edit Graphics main menu.
<F1> Displays on-line help messages.
<F5> Positions the cursor on a specific graphics picture name. When you press <F5>, a blank line will appear in the middle of the name list display. Enter the graphics picture name you wish to locate and press <Enter>. The graphic name list will be redisplayed with the requested graphics picture name highlighted. If the requested graphics picture cannot be found, the next highest graphics picture in the sort order will be highlighted.

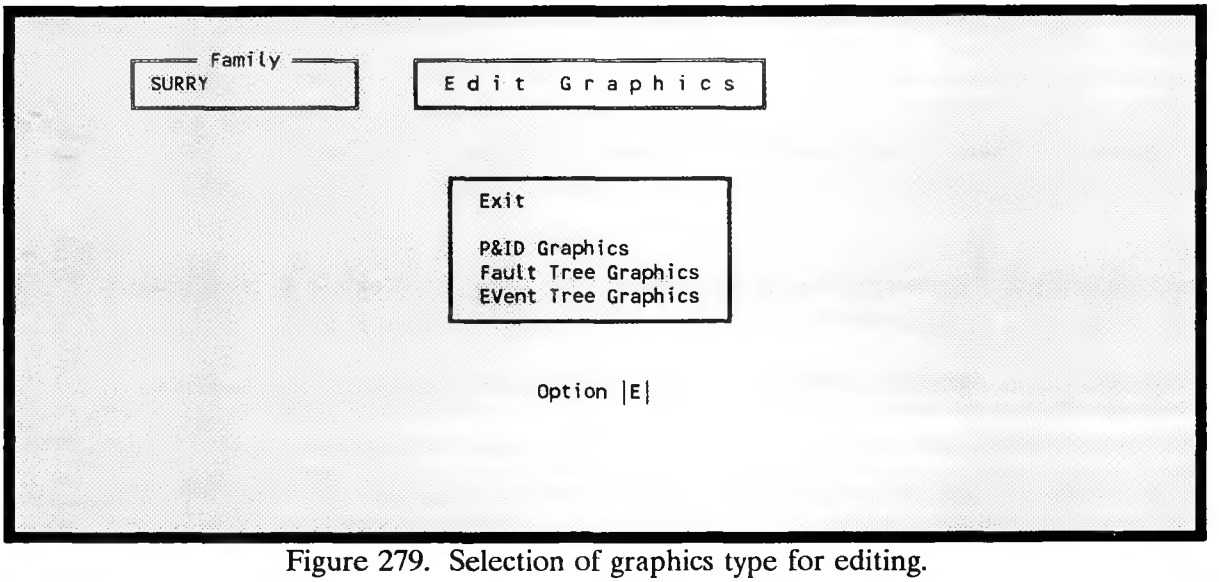


Figure 279. Selection of graphics type for editing.

The Edit Graphics screen shown in Figure 280 and succeeding screens Figure 281 through Figure 283 are consistent throughout the graphics option for each of the three categories.

To invoke this option, type <G> in the option field or highlight Graphics and press <Enter>. This will display a list of graphics categories. Highlighting a category or typing a category's highlighted letter and pressing <Enter> displays the list of graphics records available under the selected category.

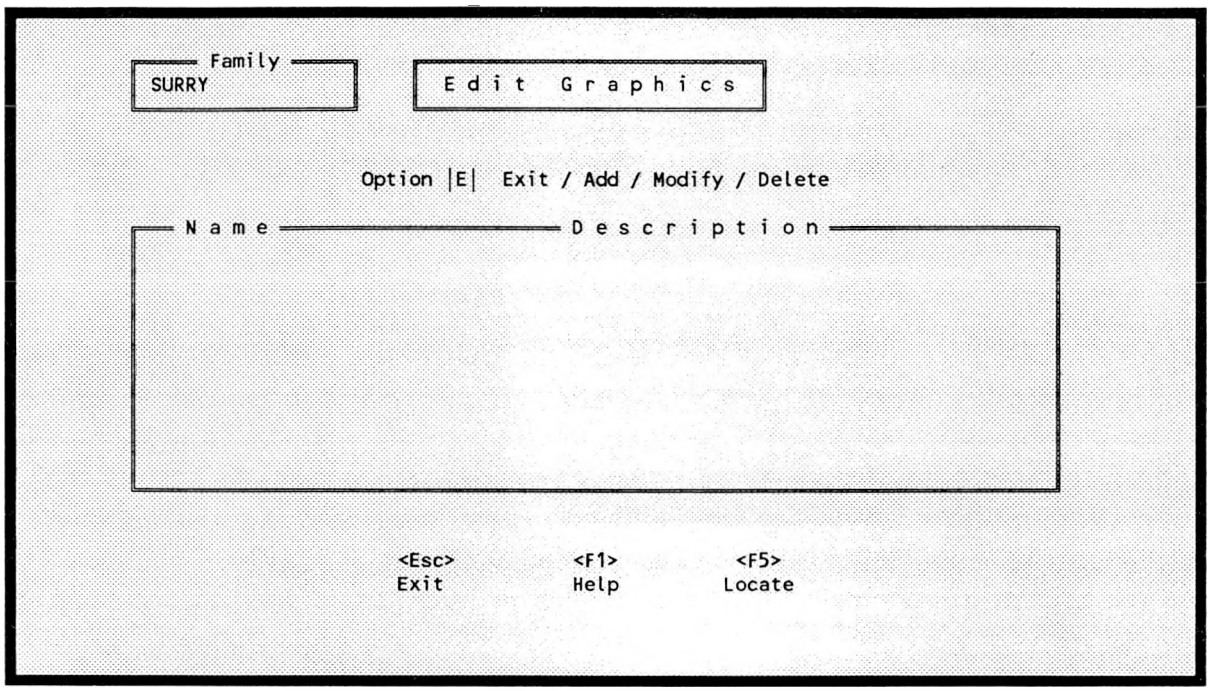


Figure 280. Selection of graphics picture for editing.

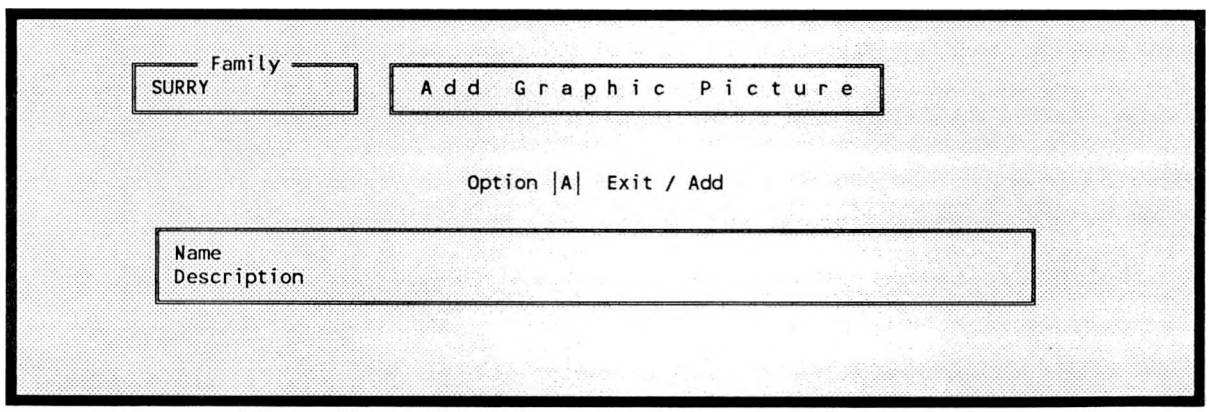


Figure 281. Editing screen for adding a graphics picture.

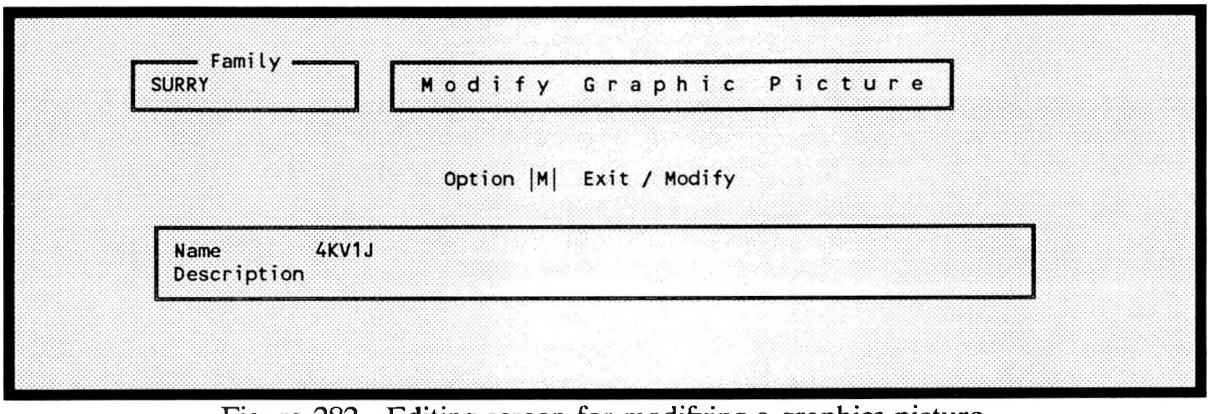


Figure 282. Editing screen for modifying a graphics picture.

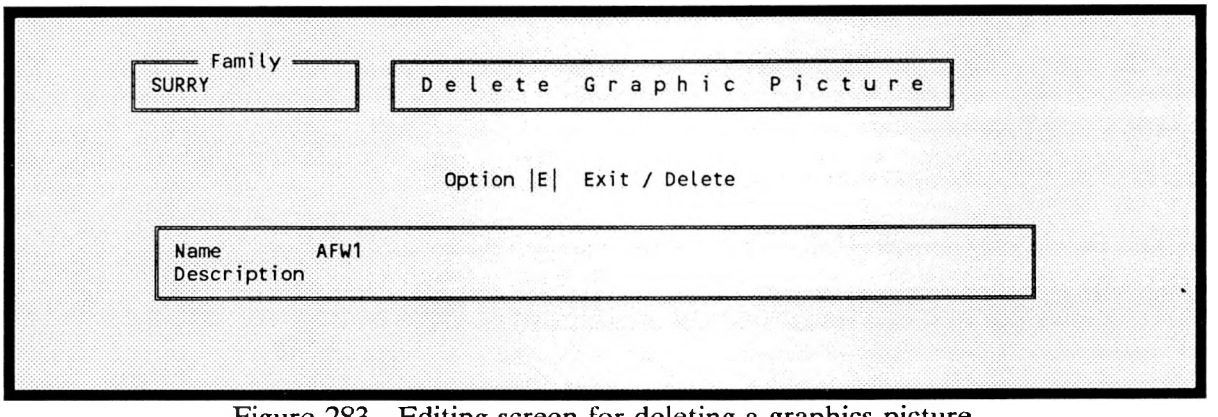


Figure 283. Editing screen for deleting a graphics picture.

8.8.1 Exit

This option returns you to the Edit Graphics main menu. To invoke this option, type <E> in the option field and press <Enter>, or press the <Esc> key.

8.8.2 P&ID Graphics

This option allows you to modify the P&ID Graphics records. To invoke this option, type <P> in the option field or highlight P&ID Graphics and press <Enter>. The screen shown in Figure 280, listing the P&ID graphics pictures, will be displayed. The option available are Exit, Add, Modify, and Delete.

8.8.2.1 Exit. This option returns you to the Edit Graphics main menu. To invoke this option, type <E> in the option field and press <Enter>, or press the <Esc> key.

8.8.2.2 Add. This option allows you to add a graphics picture record to the data base. To invoke this option, type <A> in the option field and press <Enter>. The Add Graphic Picture screen is shown in Figure 281. The options at this point are Exit and Add.

8.8.2.2.1 Exit--This option returns you to the Edit Graphics screen. To invoke this option, type <E> in the option field and press <Enter>, or press the <Esc> key.

8.8.2.2.2 Add--This option performs the actual add of a new graphics picture record. To invoke this option, type <A> in the option field, fill in the requested data fields, and press <Enter>. The only required information for a graphic add is the name. When complete, you will be returned to the Edit Graphics screen with the message **Record added** displayed at the bottom of the screen.

8.8.2.3 Modify. This option allows you to modify a graphics picture record. To invoke this option, type <M> in the option field, highlight a graphics picture name, and press <Enter>. The Modify Graphics Picture screen is shown in Figure 282. The options at this point are Exit and Modify.

8.8.2.3.1 Exit--This option returns you to the Edit Graphics screen. To invoke this option, type <E> in the option field and press <Enter>, or press the <Esc> key.

8.8.2.3.2 Modify--This option performs the actual modification of the graphics picture record. To invoke this option, type <M> in the option field, modify any of the data fields on the Modify Graphics Picture screen, and press <Enter>. When complete, you will be returned to the Edit Graphics screen with the message **Record modified** displayed at the bottom of the screen.

8.8.2.4 Delete. This option allows you to delete a graphics picture from the data base. To invoke this option, type <D> in the option field, highlight a graphics picture and press <Enter>. The Delete Graphics Picture screen is shown in Figure 283. The options at this point are Exit and Delete.

8.8.2.4.1 Exit--This option returns you to the Edit Graphics screen. To invoke this option, type <E> in the option field and press <Enter>, or press the <Esc> key.

8.8.2.4.2 Delete--This option performs the actual deletion of the graphics picture record. To invoke this option, type <D> in the option field and press <Enter>. When complete, you will be returned to the Edit Attributes screen with the message **Record deleted** displayed at the bottom of the screen.

8.8.3 Fault Tree Graphics

This option allows you to modify the Fault Tree Graphics records. To invoke this option, type <F> in the option field or highlight Fault Tree Graphics and press <Enter>. The screen shown in Figure 280, listing the fault tree graphics pictures, will be displayed. The option available are Exit, Add, Modify, and Delete.

8.8.3.1 Exit. This option returns you to the Edit Graphics main menu. To invoke this option, type <E> in the option field and press <Enter>, or press the <Esc> key.

8.8.3.2 Add. This option allows you to add a graphics picture record to the data base. To invoke this option, type <A> in the option field and press <Enter>. The Add Graphics Picture screen is shown in Figure 281. The options at this point are Exit and Add.

8.8.3.2.1 Exit--This option returns you to the Edit Graphics screen. To invoke this option, type <E> in the option field and press <Enter>, or press the <Esc> key.

8.8.3.2.2 Add--This option performs the actual add of a new graphics picture record. To invoke this option, type <A> in the option field, fill in the requested data fields, and press <Enter>. The only required information for a graphics picture add is the name. When complete, you are returned to the Edit Graphics screen with the message **Record added** displayed at the bottom of the screen.

8.8.3.3 Modify. This option allows you to modify a graphics picture record. To invoke this option, type <M> in the option field, highlight a graphics picture name, and press <Enter>. The Modify Graphics Picture screen is shown in Figure 282. The options at this point are Exit and Modify.

8.8.3.3.1 Exit--This option returns you to the Edit Graphics screen. To invoke this option, type <E> in the option field and press <Enter>, or press the <Esc> key.

8.8.3.3.2 Modify--This option performs the actual modification of the graphics picture record. To invoke this option, type <M> in the option field, modify any of the data fields on the Modify Graphics Picture screen, and press <Enter>. When complete, you will be returned to the Edit Graphics screen with the message **Record modified** displayed at the bottom of the screen.

8.8.3.4 Delete. This option allows you to delete a graphics picture from the data base. To invoke this option, type <D> in the option field, highlight a graphics picture and press <Enter>. The Delete Graphics Picture screen is shown in Figure 283. The options at this point are Exit and Delete.

8.8.3.4.1 Exit--This option returns you to the Edit Graphics screen. To invoke this option, type <E> in the option field and press <Enter>, or press the <Esc> key.

8.8.3.4.2 Delete--This option performs the actual deletion of the graphics picture record. To invoke this option, type <D> in the option field and press <Enter>. When complete, you will be returned to the Edit graphics screen with the message **Record deleted** displayed at the bottom of the page.

8.8.4 Event Tree Graphics

This option allows you to modify the Event Tree Graphics records. To invoke this option, type <V> in the option field or highlight Event Tree Graphics and press <Enter>. The screen shown in Figure 280, listing the event tree graphics pictures, will be displayed. The option available are Exit, Add, Modify, and Delete.

8.8.4.1 Exit. This option returns you to the Edit Graphics menu. To invoke this option, type <E> in the option field and press <Enter>, or press the <Esc> key.

8.8.4.2 Add. This option allows you to add a graphics picture record to the data base. To invoke this option, type <A> in the option field and press <Enter>. The Add Graphics Picture screen is shown in Figure 281. The options at this point are Exit and Add.

8.8.4.2.1 Exit--This option returns you to the Edit Graphics screen. To invoke this option, type <E> in the option field and press <Enter>, or press the <Esc> key.

8.8.4.2.2 Add--This option performs the actual add of a new graphics picture record. To invoke this option, type <A> in the option field, fill in the requested data fields, and press <Enter>. The only required information for a graphics add is the name. When complete, you will be returned to the Edit Graphics screen with the message **Record added** displayed at the bottom of the screen.

8.8.4.3 Modify. This option allows you to modify a graphics picture record. To invoke this option, type <M> in the option field, highlight a graphics picture name, and press <Enter>. The Modify Graphics Picture screen is shown in Figure 282. The options at this point are Exit and Modify.

8.8.4.3.1 Exit--This option returns you to the Edit Graphics screen. To invoke this option, type <E> in the option field and press <Enter>, or press the <Esc> key.

8.8.4.3.2 Modify--This option performs the actual modification of the graphics picture record. To invoke this option, type <M> in the option field, modify any of the data fields on the Modify Graphics Picture screen, and press <Enter>. When complete, you will be returned to the Edit Graphics screen with the message **Record modified** displayed at the bottom of the screen.

8.8.4.4 Delete. This option allows you to delete a graphics picture from the data base. To invoke this option, type <D> in the option field, highlight a graphics picture and press <Enter>. The Delete Graphics Picture screen is shown in Figure 283. The options at this point are Exit and Delete.

8.8.4.4.1 Exit--This option returns you to the Edit Graphics screen. To invoke this option, type <E> in the option field and press <Enter>, or press the <Esc> key.

8.8.4.4.2 Delete--This option performs the actual deletion of the graphics picture record. To invoke this option, type <D> in the option field and press <Enter>. When complete, you will be returned to the Edit Graphics screen with the message **Record deleted** displayed at the bottom of the screen.

8.9 Histograms

This option allows you to create, modify, and delete user-defined histograms. This is a useful option for allowing you to input your own distribution for a variable that can not be expressed with one of the predefined distribution types. The Edit Histograms screen (Figure 284) displays the names of all the currently existing histograms with their associated format type. As shown, four options are available: Exit, Add, Modify, and Delete. In addition, the following function keys are available:

<Esc>	Returns you to the Modify Database menu.
<F1>	Displays on-line help messages.
<F5>	Positions the cursor on a specific histogram name. When you press <F5>, a blank line will appear in the middle of the histogram list. Enter the

histogram name you wish to locate and press <Enter>. The histogram list will be redisplayed with the requested histogram name highlighted. If the requested histogram cannot be found, the next highest histogram in the sort order will be highlighted.

To activate this option type an <H> (Histograms) in the option field or highlight Histograms and press <Enter>. Figure 284 will be displayed.

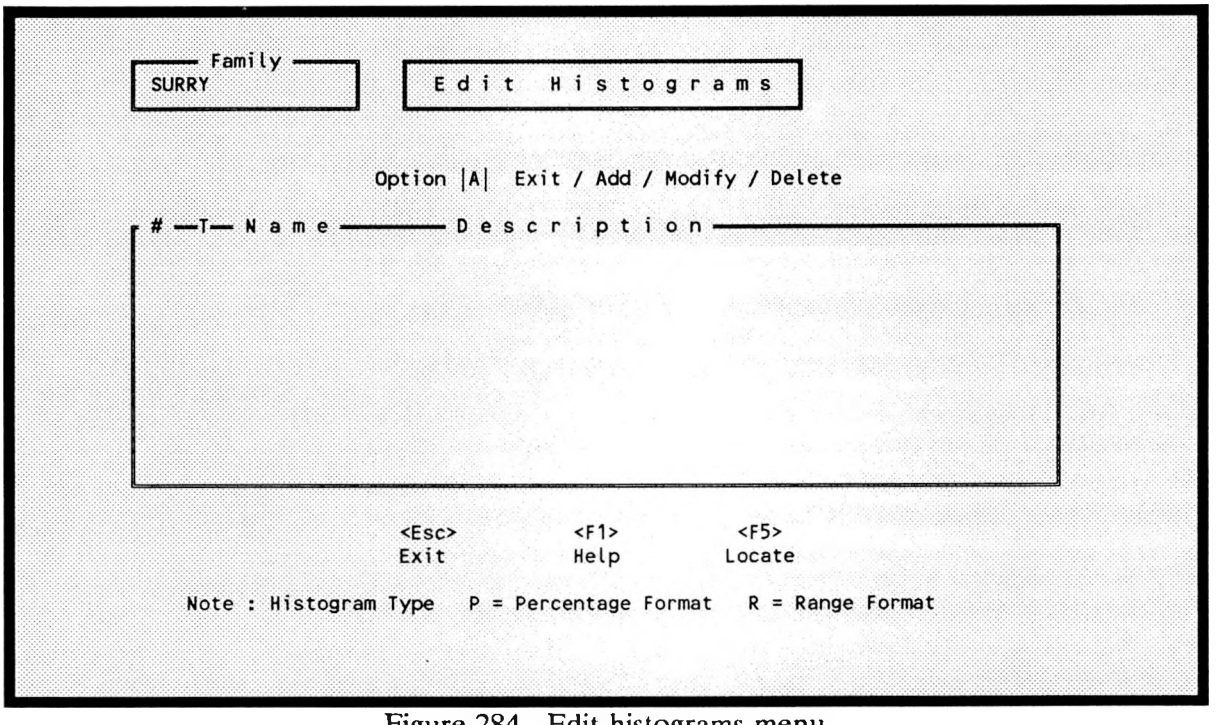


Figure 284. Edit histograms menu.

8.9.1 Exit

This options returns you to the Modify Database screen. To invoke this option, type an <E> (Exit) in the option field and press <Enter>, or press the <Esc> key.

8.9.2 Add Histograms

This option allows you to create a user-defined distribution type. To add a new histogram to the data base, type an <A> (Add) in the option field and press <Enter>. At this point, Figure 285 is displayed and you are given the choice of adding the histogram data in either a percentage format or range format.

If you wish to add a percentage histogram to the data base, enter a <P> (Percentage) in the option field. Entering a <P> in the option field will cause a Percentage Format Histogram screen to appear. From this screen you should type in a name and a description for the new histogram.

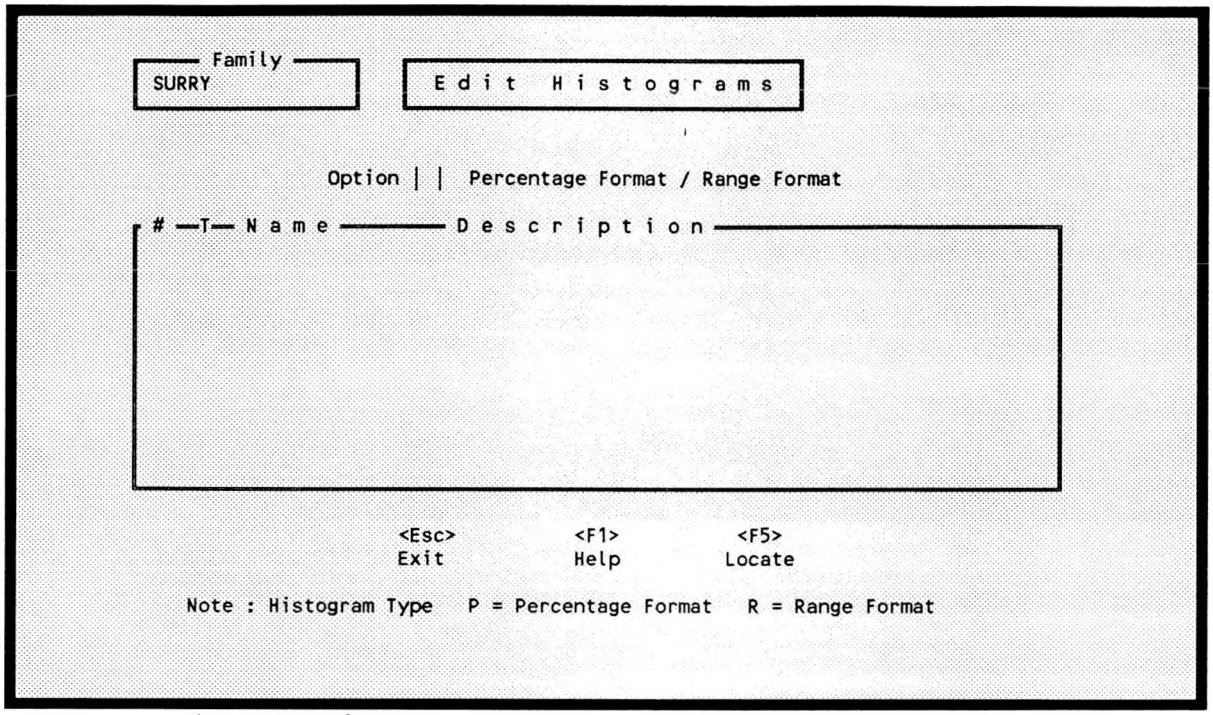


Figure 285. Select percentage or range format for the histogram.

Enter the percentages for the histogram along with the corresponding probabilities. Figure 286 demonstrates how to enter a percentage histogram, given that 15% of the data points have a probability of 0.04, 46% of the data points have a probability of 0.12, 36% of the data points have a probability of 0.02, and the remaining 3% of the data points have a probability of 0.8. The sum of the percentages entered must total 100%, in order for the histogram to be accepted as a valid percentage histogram (Figure 287). In the upper right-hand area of the screen is a box that shows the current sum of the percentages which have been input and the remaining percentage needed to reach the 100% total.

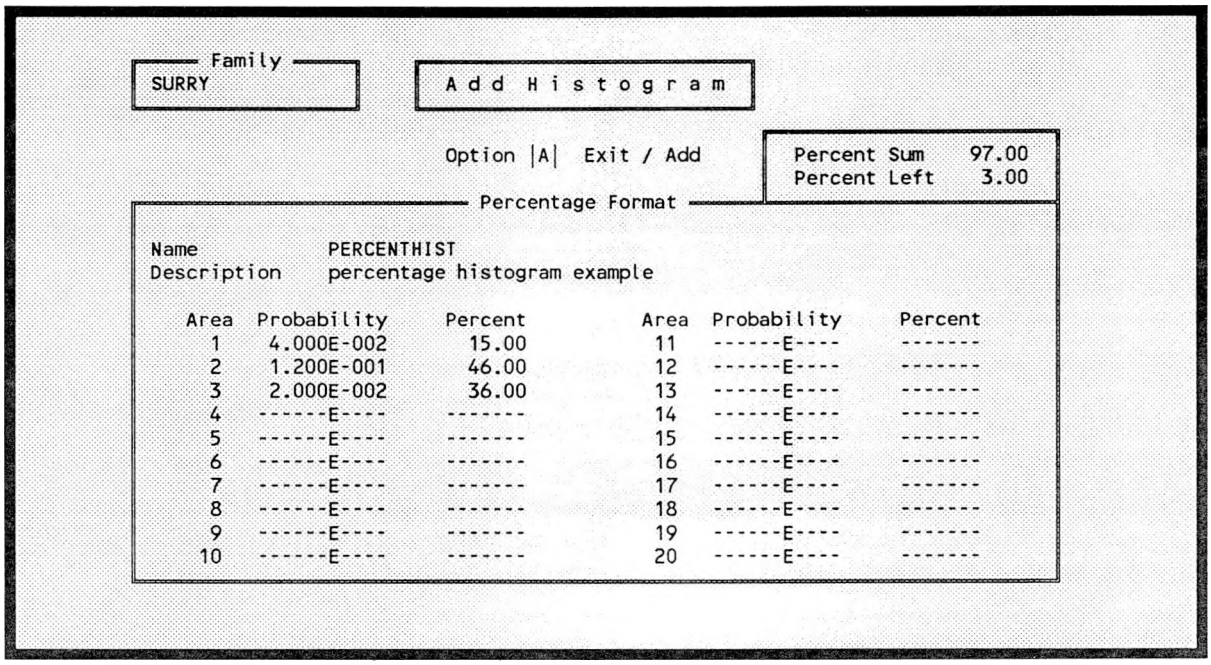


Figure 286. Adding a percentage histogram.

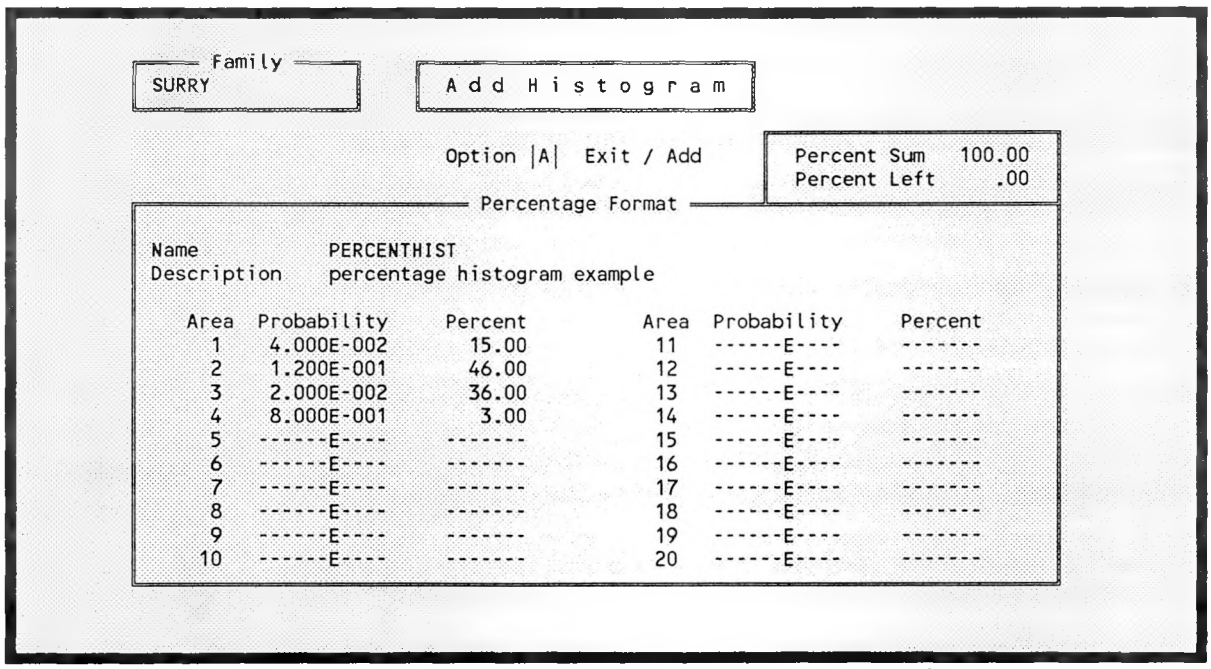


Figure 287. Add the remaining percent to create a valid histogram.

If you wish to add a range histogram to the data base, enter an <R> (Range) in the option field of the Add Histograms screen. This action will bring up a Range Format Histogram screen (Figure 288). On this screen, type in a name and a description for the range histogram. Then enter the starting point, the ending point and the probability associated with the first bin of the histogram. Next, for each successive bin of the histogram, an ending point, and a probability must be entered. There is a maximum of 20 bins allowed for each range histogram. Figure 288 is an example of inputting a range histogram whose data points lie on the closed interval of 0.0 and 1.5. The probability associated with the data points on the sub-interval of 0.0 and 0.4 is 0.05 (Bin 1), the probability for the sub-interval of 0.4 and 0.8 is 0.3 (Bin 2), the probability for the sub-interval of 0.8 and 1.2 is 0.06 (Bin 3), and the probability for the last sub-interval of 1.2 to 1.5 is 0.2 (Bin 4).

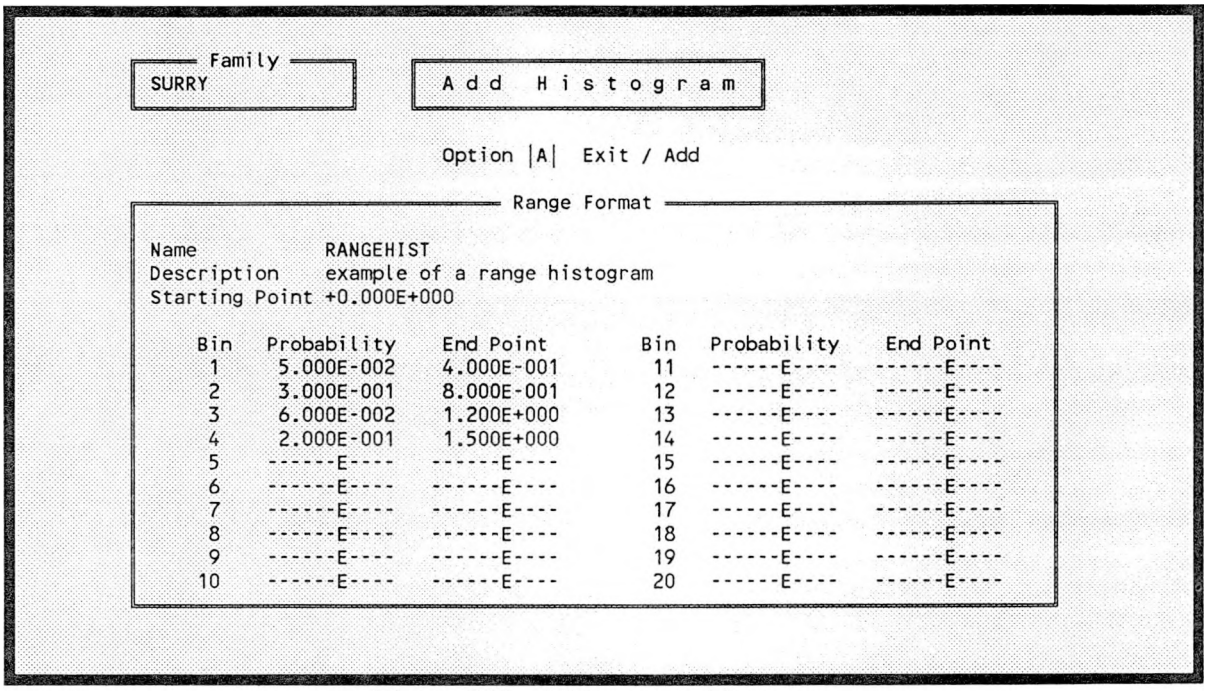


Figure 288. Add a range histogram.

Once you have typed in the histogram data, enter an <A> in the option field and press <Enter> to save the newly created histogram. When complete, you will be returned to the Edit Histograms screen with the message **Record Added** displayed at the bottom of the screen. However, if you wish to exit the Add process without saving the new histogram, enter an <E> in the option field or press the <Esc> key.

8.9.3 Modify Histograms

To modify a currently existing histogram, type an <M> (Modify) in the option field of the Edit Histograms screen, highlight the desired histogram, and press <Enter>.

If you selected to modify a percentage histogram, then the histogram data will be displayed in percentage format. You may make modifications to the histogram's name, description, or any of

the probabilities or percentages. The percentages must still total 100% before it will be accepted as a valid percentage histogram. Figure 289 demonstrates the screen for modifying histograms in percentage format.

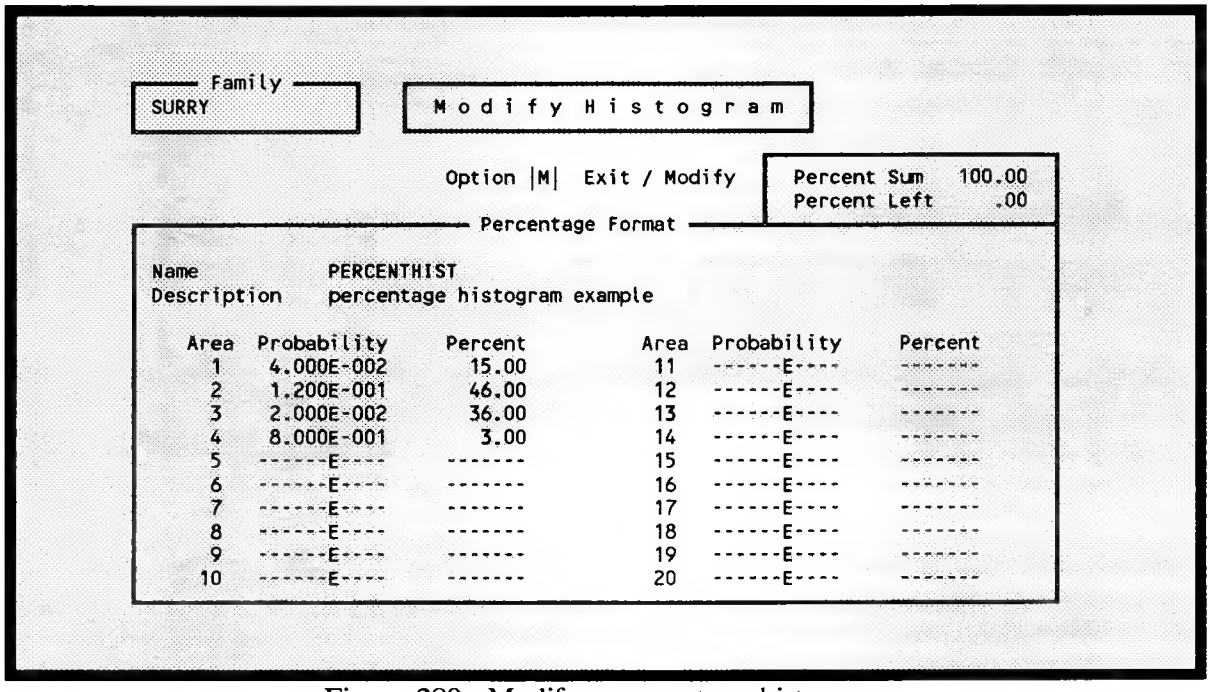


Figure 289. Modify a percentage histogram.

If you selected to modify a range histogram, then the histogram data will be displayed in range format. You may change the histogram's name, description, and any of the bins' starting points, ending points or probabilities. Figure 290 demonstrates the screen for modifying histograms in range format.

If you wish to save the modifications made to the selected histogram, type an <M> (Modify) in the option field of the Modify Histograms screen and press <Enter>. When complete, you will be returned to the Edit Histograms screen with the message **Record modified** displayed at the bottom of the screen. If you wish to exit this screen without modifying the histogram, enter an <E> in the option field and press <Enter>, or press the <Esc> key.

8.9.4 Delete Histograms

To delete an existing histogram from the data base, type a <D> (Delete) in the option field of the Edit Histograms screen, highlight the histogram to be deleted, and press <Enter>.

This action will result in displaying the selected histogram in the appropriate format on the Delete Histograms screen. To delete the histogram, type a <D> (Delete) in the option field and press <Enter>. When complete, you will be returned to the Edit Histograms screen with the message **Record Deleted** displayed at the bottom of the screen. To exit the Delete Histograms

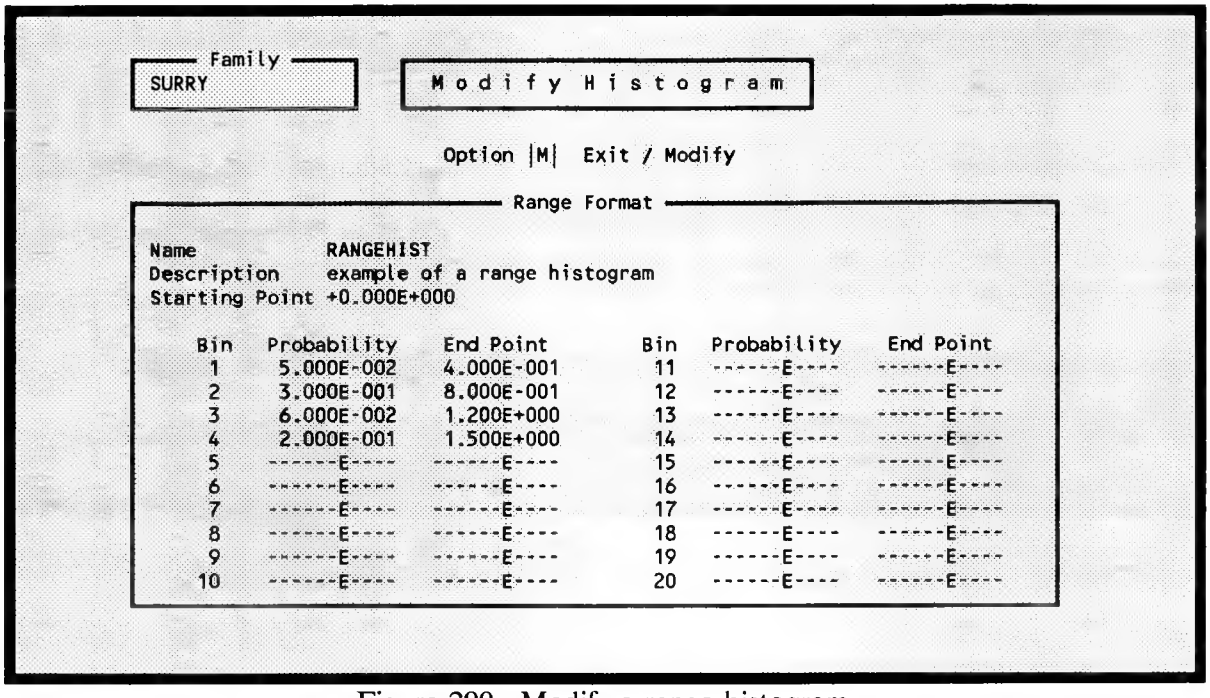


Figure 290. Modify a range histogram.

screen without deleting the histogram being displayed, press the <Esc> key or enter an <E> (Exit) in the option field and press <Enter>. Figure 291 and Figure 292 show examples of the Delete Histograms screen for percentage histograms and range histograms, respectively.

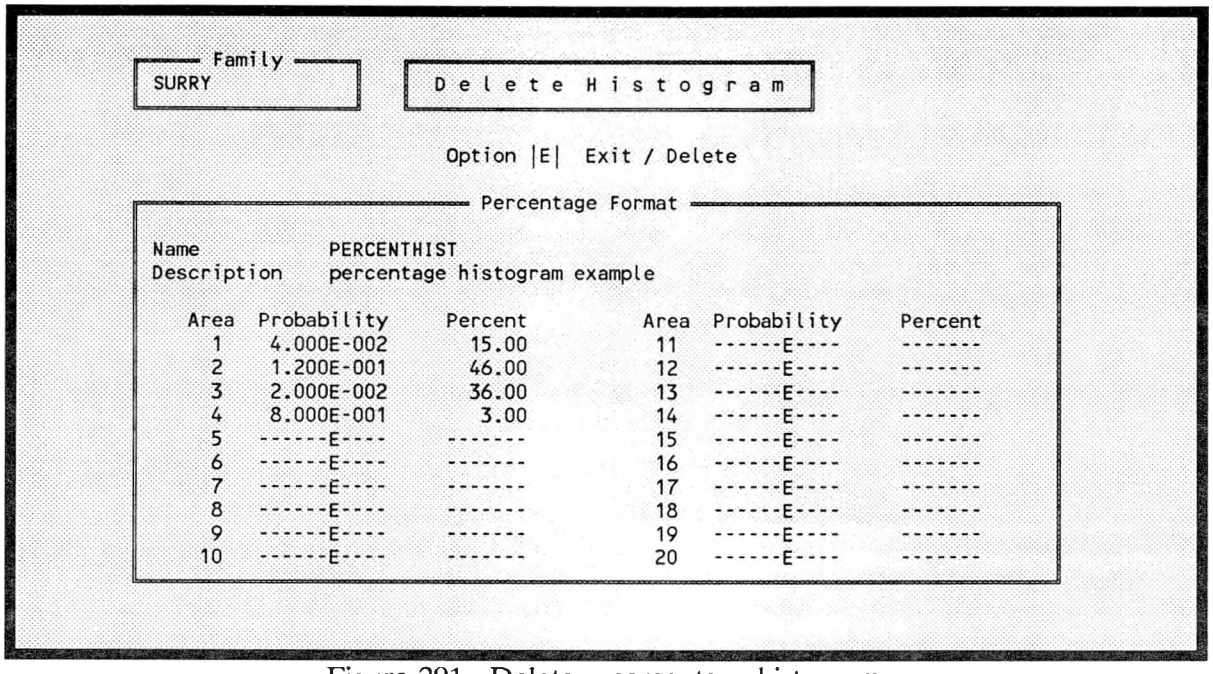


Figure 291. Delete a percentage histogram.

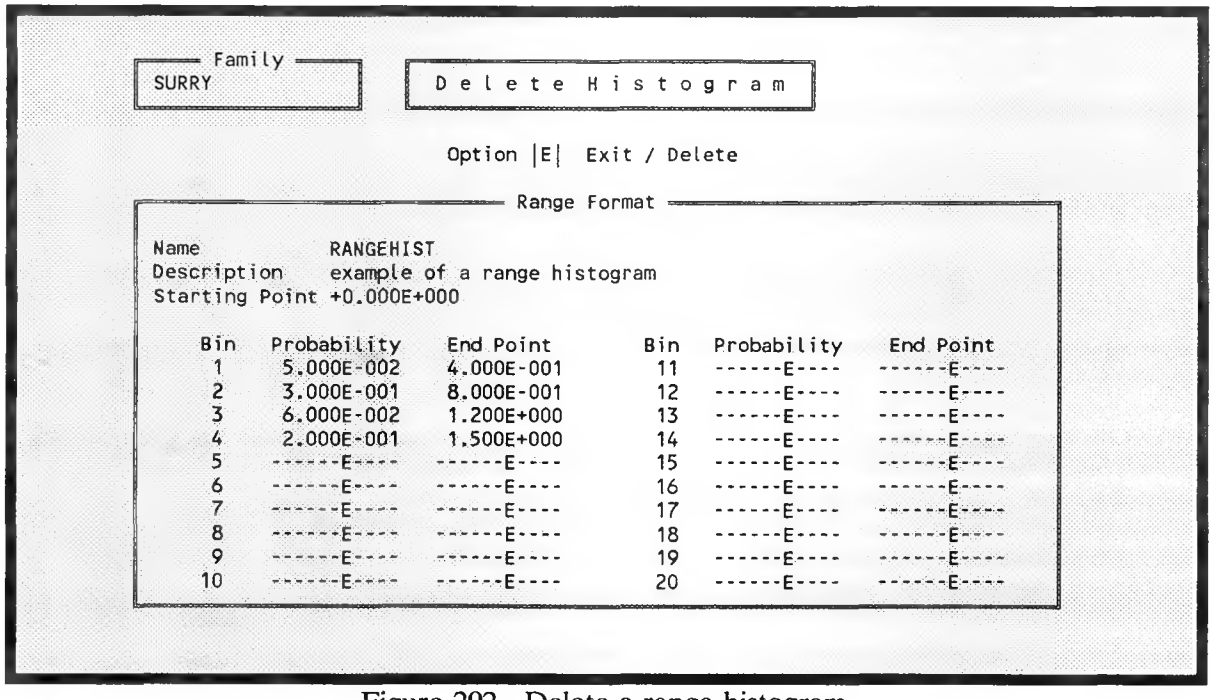


Figure 292. Delete a range histogram.

9.0 REPORT ON DATA BASE

This option allows you to obtain information about the selected family. Reports are available for family, basic events, attributes, systems, event trees, sequences, end states, and user information. To invoke this option, type an <R> or highlight REPORTS on the IRRAS main menu and press <Enter>. The REPORTS main menu is shown in Figure 293. Each report is discussed in the following paragraphs.

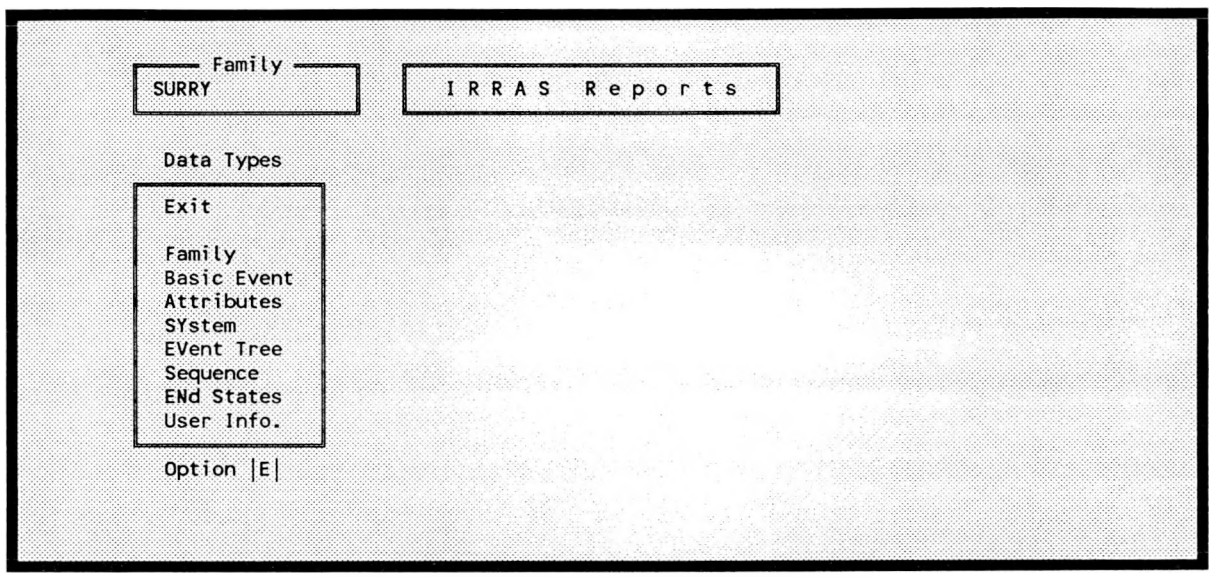


Figure 293. Report on data base main menu.

9.1 Exit

This option returns you to the IRRAS main menu. To invoke this option, type <E> in the option field or highlight Exit and press <Enter>, or press the <Esc> key.

9.2 Family

This option allows you to generate a family summary report which shows you all the families and associated descriptions in the current data base. When you invoke this option, Figure 294 will be displayed. Upon pressing <Enter>, Figure 295 will be displayed. On this screen you must specify the output destination for the report. The following output destinations are provided:

CON	-	Sends the report to the screen.
PRN	-	Sends the report to the printer.
filename	-	Writes the report to the specified hard disk file name.
blank	-	Terminates the option and returns you to the Reports Main Menu without generating the report.
<Esc>	-	Terminates the process and returns you to the main menu (same as blank).

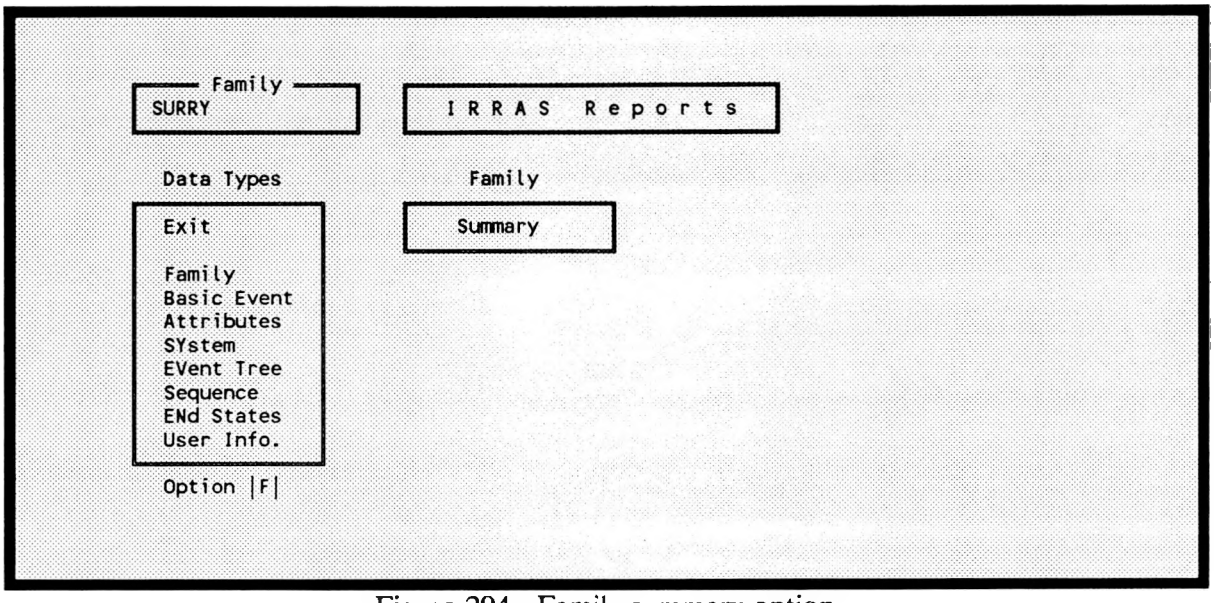


Figure 294. Family summary option.

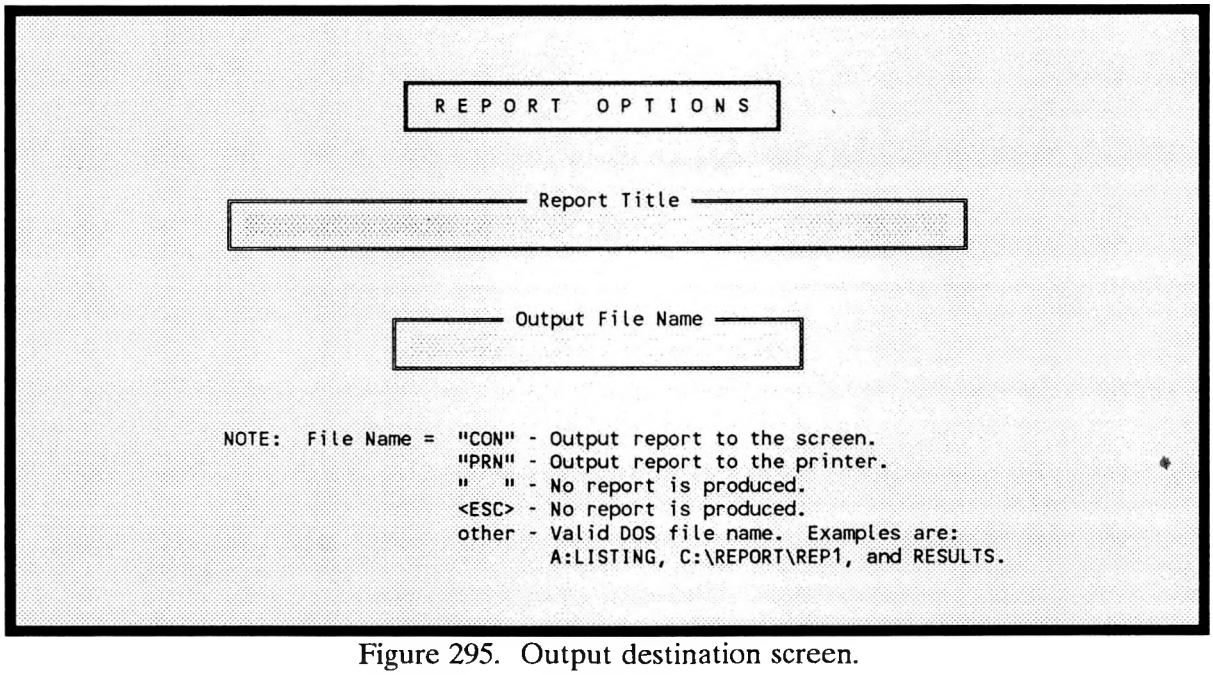


Figure 295. Output destination screen.

9.3 Basic Event

The basic event report option allows you to generate an overview, probabilities, uncertainty data, and cross reference reports (Figure 296). You indicate which basic event report you want to generate by highlighting the desired report using the arrow keys and pressing <Enter>.

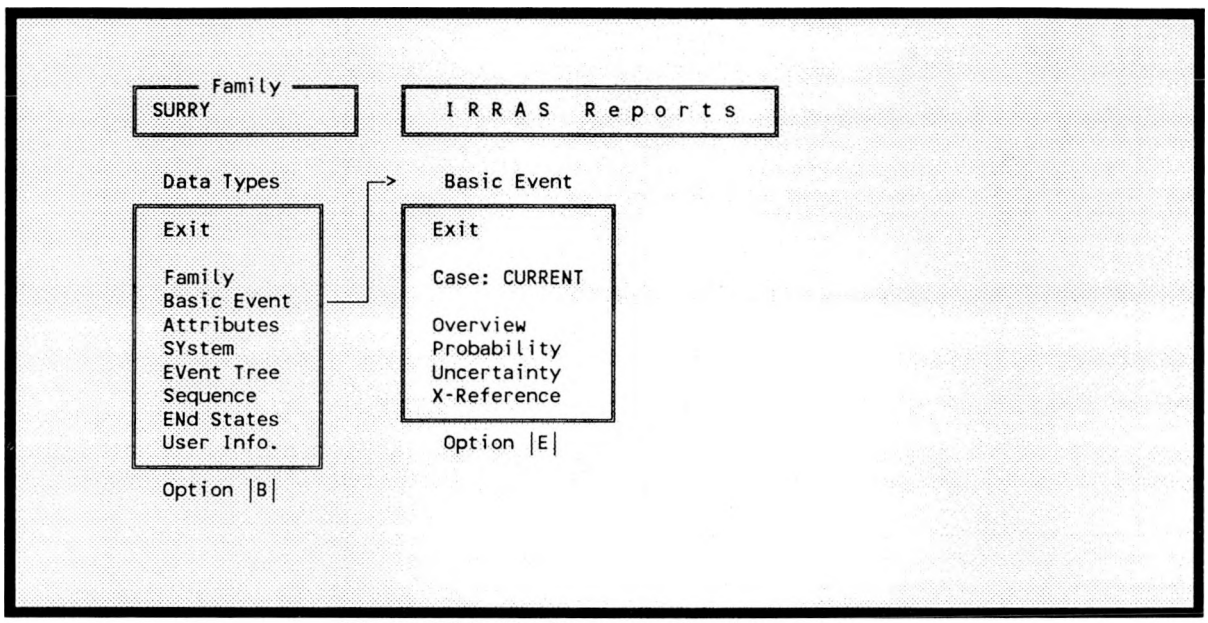


Figure 296. Basic event selection screen.

9.3.1 Basic Event Overview

This option allows you to generate a basic event summary report. The overview report includes the basic event number, primary and secondary name, component type and ID, system location, and attribute fail mode. To invoke this option, highlight Overview and press <Enter>. Figure 297 will be displayed. Two options are available: Exit and Overview. Exit terminates the process and returns you to the previous menu. Overview generates the report based on your event selections. On this screen, you must do one of the following:

1) Press <Enter> to report all basic events.
2) Highlight a basic event and press <Enter>.
3) Mark a group of basic events and press <Enter>.

After a basic event(s) has been selected, the output destination screen will be displayed. Type in the desired destination and press <Enter>.

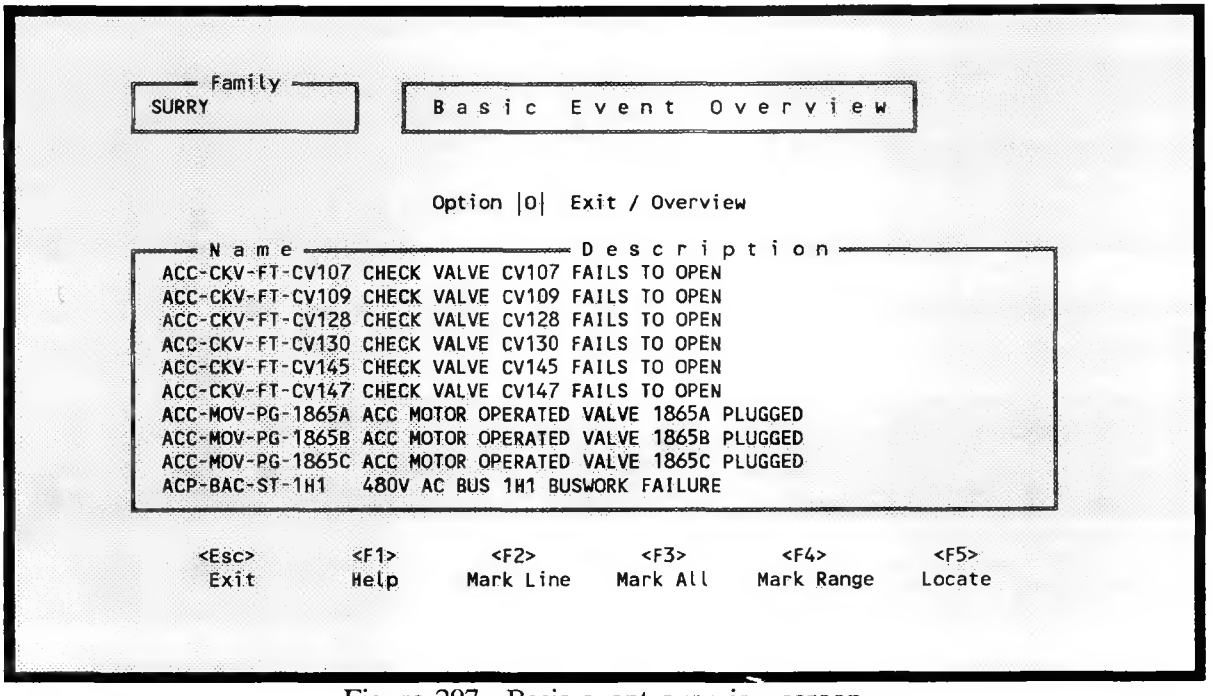


Figure 297. Basic event overview screen.

9.3.2 Basic Event Probability Report

This option allows you to generate a basic event probability report. The probability report shows the event number, primary name, failure calculation type, mean probability, and event lambda and tau values. To invoke this option, highlight Probability and press <Enter>. Figure 298 will be displayed. Two options are available: Exit and Probability. Exit terminates the process and returns you to the previous menu. Probability generates the report based on the event selections. On this screen, you must do one of the following:

1) Press <Enter> to report all basic events.
2) Highlight a basic event and press <Enter>.
3) Mark a group of basic events and press <Enter>.

After a basic event(s) has been selected, the output destination screen will be displayed. Type in the desired destination and press <Enter>.

9.3.3 Basic Event Uncertainty Report

This option allows you to generate a basic event uncertainty report. The report shows the event number, primary name, distribution type, mean probability, uncertainty value, and correlation class. To invoke this option, highlight Uncertainty and press <Enter>. Figure 299 will be displayed. Two options are available: Exit and Uncertainty. Exit terminates the process and returns you to the

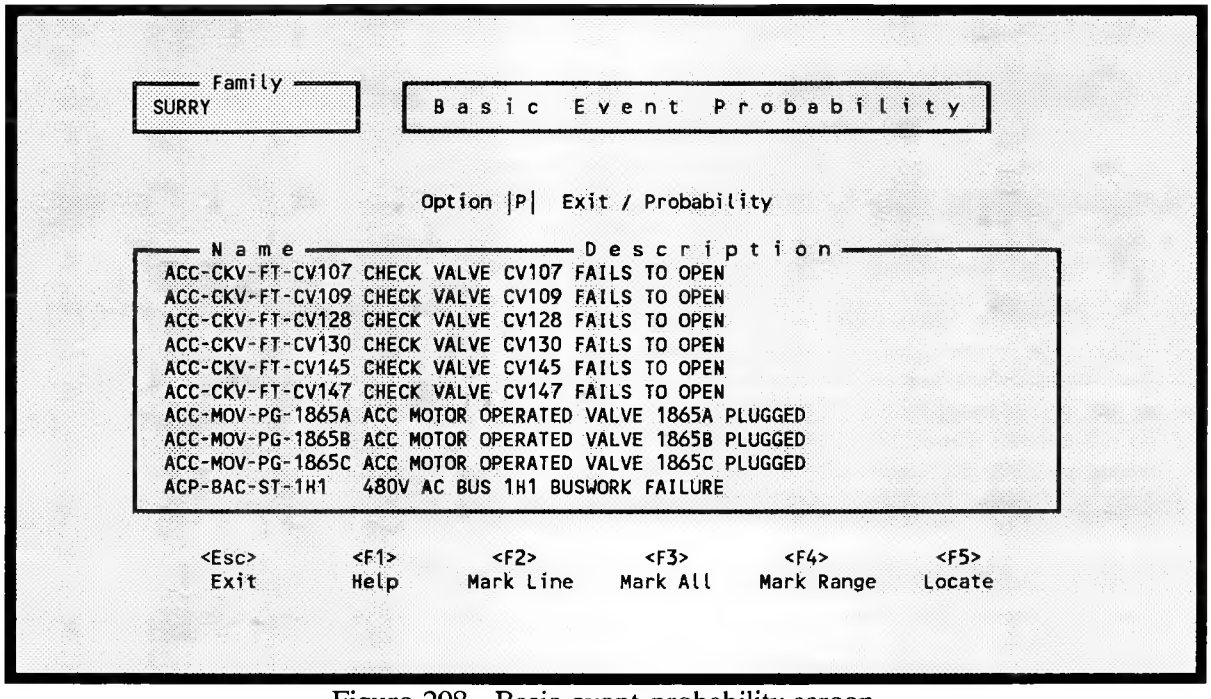


Figure 298. Basic event probability screen.

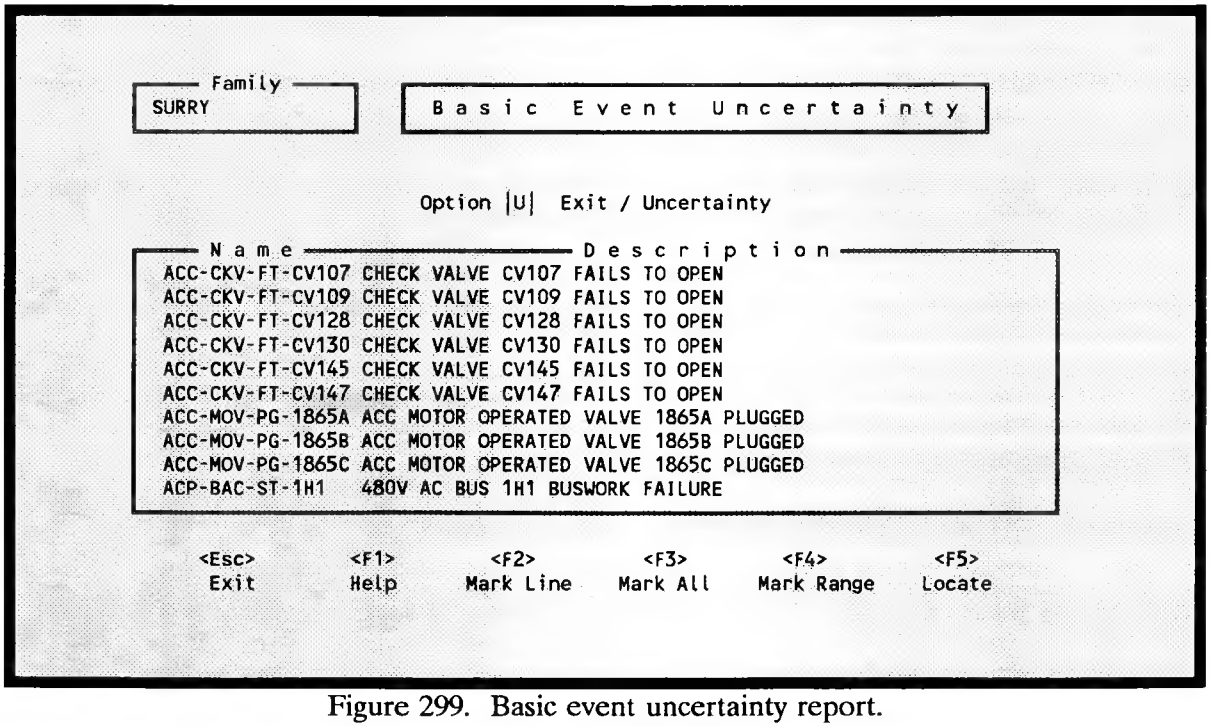


Figure 299. Basic event uncertainty report.

previous menu. Uncertainty generates the report based on your event selections. On this screen, you must do one of the following:

1) Press <Enter> to report all basic events.
2) Highlight a basic event and press <Enter>.
3) Mark a group of basic events and press <Enter>.

After a basic event(s) has been selected, the output destination screen will be displayed. Select the desired destination and press <Enter>. When the report is complete, you will be returned to the Basic Event Uncertainty screen. At this point, you may select another event or enter an <E> in the option field and press <Enter> to return to the IRRAS Report Menu.

9.3.4 Basic Event Cross Reference Report

This option allows you to generate a basic event cross reference report. To invoke this option, highlight X-Reference and press <Enter>. Figure 300 will be displayed. On this screen, you must do one of the following:

1) Press <Enter> to report all basic events.
2) Highlight a basic event and press <Enter>.
3) Mark a group of basic events and press <Enter>.

As shown, there are three cross-reference reports available: Sequence Cut Set, System Cut Set, and System Logic.

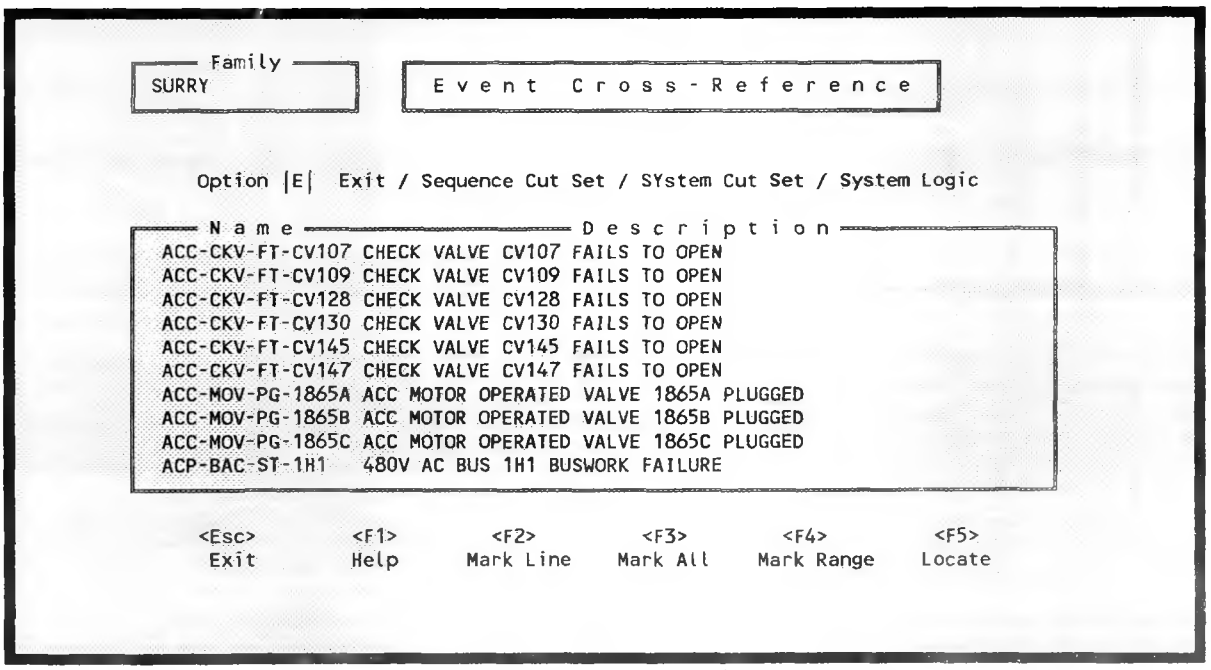


Figure 300. Basic event cross reference screen.

9.3.4.1 Sequence Cut Set. This option produces a sequence cut set cross reference. The report provides an event to sequence cross reference. The report will include the event number, event name and associated sequence names.

To invoke this option, mark the desired event(s), enter an <S> in the option field, and press <Enter>. You may include all sequences by entering an <S> in the option field and pressing <Enter>. The message **Process all records** will be displayed. Enter a <Y> to include all sequences in the report or enter an <N> to terminate the process. In any case, upon pressing <Enter>, the output destination screen will be displayed. Select the desired destination and press <Enter>.

9.3.4.2 System Cut Set. This option produces a system cut set cross reference. This report provides an event to system cross reference. The report includes the event number, the event name and the corresponding system name.

To invoke this option, mark the desired event(s), enter a <Y> in the option field, and press <Enter>. You may include all systems by entering a <Y> in the option field and pressing <Enter>. The message **Process all records** will be displayed. Enter a <Y> to include all systems in the report or enter an <N> to terminate the process. In any case, upon pressing <Enter>, the output destination screen will be displayed. Select the desired destination and press <Enter>.

9.3.3.2 System Logic. This option procedures a system logic cross reference. This report provides an event to system logic cross reference. The report includes the event number, the event name and the corresponding system names.

To invoke this option, mark the desired event(s), enter an <L> in the option field, and press <Enter>. You may include all system logic by entering an <L> in the option field and pressing <Enter>. The message **Process all records** will be displayed. Enter a <Y> to include all system logic in the report or enter an <N> to terminate the process. In any case, upon pressing <Enter>, the output destination screen will be displayed. Select the desired destination and press <Enter>.

9.4 Attributes

This option is not yet available.

9.5 System

This option allows you to generate a variety of system reports. These include summary, logic, cut sets, importance, cross reference, system, and subsystem reports. When you invoke this option, Figure 301 will be displayed. You indicate which system report you want to generate by highlighting the desired report using the arrow keys and pressing <Enter>.

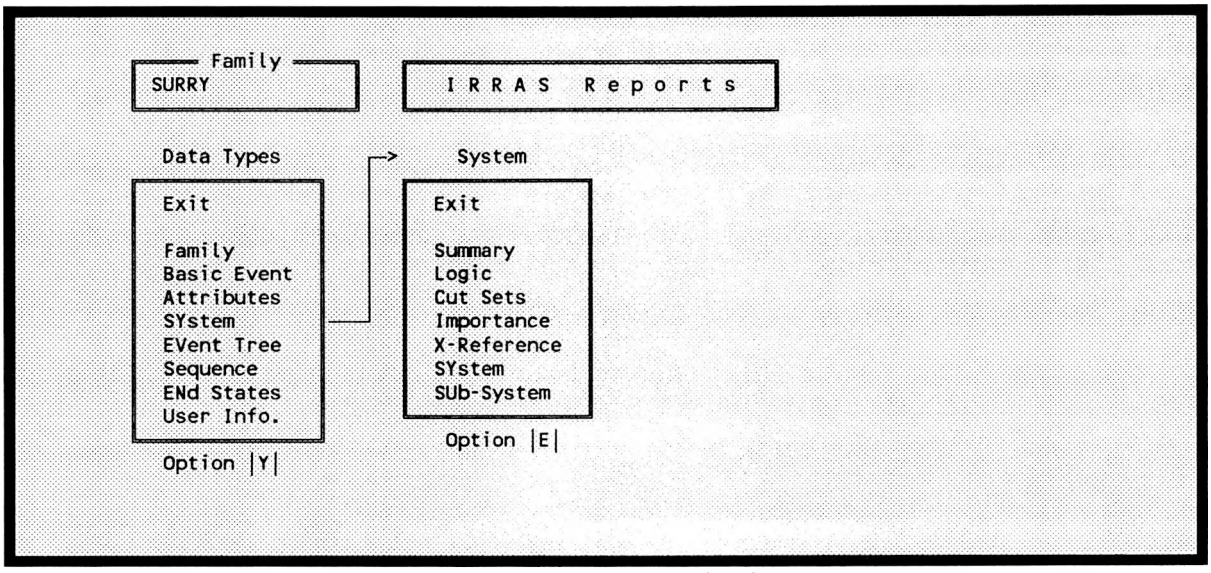


Figure 301. System report selection screen.

9.5.1 System Summary Report

This option allows you to generate a system summary which can be based on current or base case values. When you invoke this option, Figure 302 will be displayed. Three system summary reports are available: Summary, Combination, and Uncertainty. Select the desired system option and press <Enter>.

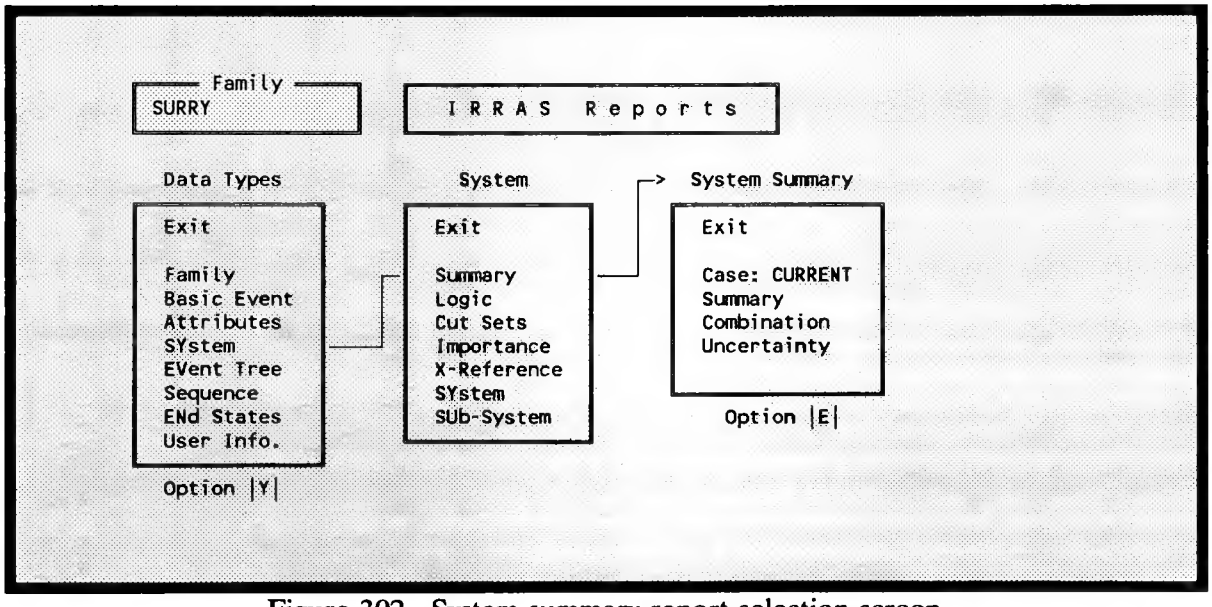


Figure 302. System summary report selection screen.

9.5.1.1 Summary. This option allows you to generate the System Brief Summary Report. This report contains the names of the systems residing in the current family, the associated minimum cut set upper bound, and the system description. When you invoke this option, the output destination screen will be displayed. On this screen, you must type in one of the following output destinations:

CON	-	Sends the report to the screen.
PRN	-	Sends the report to the printer.
filename	-	Writes the report to the specified file name on the hard disk.
blank	-	Terminates the reporting process and returns to the previous screen.
<Esc>	-	Terminates the reporting process and returns to the previous screen.

9.5.1.2 Combination. This option allows you to generate the System Combination Report. This report contains all systems in the current family, the minimum cut set, mean, and number of cut sets in the system. When you invoke this option, the output destination screen will be displayed. On this screen, you must select one of the following output destinations:

CON	-	Sends the report to the screen.
PRN	-	Sends the report to the printer.
filename	-	Writes the report to the specified file name on the hard disk.
blank	-	Terminates the reporting process and returns to the previous screen.
<Esc>	-	Terminates the reporting process and returns to the previous screen.

9.5.1.3 Uncertainty. This option allows you to generate the System Uncertainty Value Report. This report contains all systems in the current family, the mean and median values, standard deviation, the 5th and 95th percentile, the minimum and maximum values, and the seed size. When you invoke this option, the output destination screen will be displayed. On this screen, you must select one of the following output destinations:

CON	-	Sends the report to the screen.
PRN	-	Sends the report to the printer.
filename	-	Writes the report to the specified file name on the hard disk.
blank	-	Terminates the reporting process and returns to the previous screen.
<Esc>	-	Terminates the reporting process and returns to the previous screen.

9.5.2 System Logic Report

This option allows you to generate system logic reports. When you invoke this option, Figure 303 will be displayed. On this screen, all systems names or subtree names contained in the current family are displayed. You may use the Subtrees option to toggle the display from system names to subtree names. If you toggle to subtrees, the report will be based on subtrees not systems. On this screen, you must do one of the following:

1) Press <Enter> to report all systems.
2) Highlight a system and press <Enter>.
3) Mark a group of systems and press <Enter>.

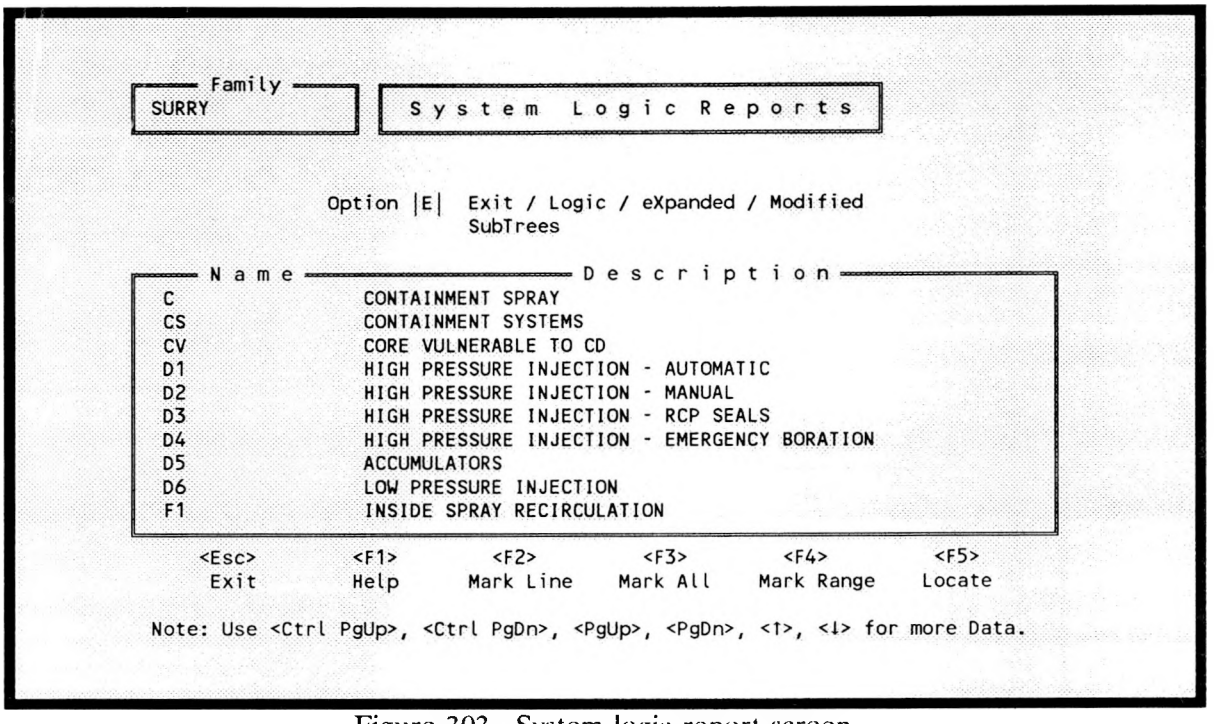


Figure 303. System logic report screen.

As shown, three report options are available: Logic, Expanded, and Modified.

9.5.2.1 Logic. This option allows you to generate the System Logic Report which consists of the gate names, types, and inputs for the specified system(s) or subtree(s). When you invoke this option, the output destination screen will be displayed. On this screen, you must select one of the following output destinations:

CON	-	Sends the report to the screen.
PRN	-	Sends the report to the printer.
filename	-	Writes the report to the specified file name on the hard disk.
blank	-	Terminates the reporting process and returns to the previous screen.
<Esc>	-	Terminates the reporting process and returns to the previous screen.

To invoke this option, mark the system(s) or subtrees to include, enter an <L> in the option field and press <Enter>.

9.5.2.2 eXpanded. This option allows you to generate the System Expanded Logic Report which consists of the gate names, types, and inputs for the specified system(s). When you invoke this option, you will be prompted to enter a starting gate for the report. You may specify a gate or press <Enter> to include all gates. Next, the output destination screen will be displayed. On this screen, you must select one of the following output destinations:

CON	Sends the report to the screen.

PRN	-	Sends the report to the printer.
filename	-	Writes the report to the specified file on the hard disk.
blank	-	Terminates the reporting process and returns to the previous screen.
<Esc>	-	Terminates the reporting process and returns to the previous screen.

To invoke this option, mark the system(s) or subtree(s) to include, enter an <X> in the option field, and press <Enter>.

9.5.2.3 Modified. This option allows you to generate the System Modified Logic Report which consists of the gate names, types, and inputs for the specified system(s). When you invoke this option, you will be prompted to enter a starting gate for the report. You may specify a gate or press <Enter> to include all gates. Next, the output destination screen will be displayed. On this screen, you must select one of the following output destinations:

CON	-	Sends the report to the screen.
PRN	-	Sends the report to the printer.
filename	-	Writes the report to the specified file on the hard disk.
blank	-	Terminates the reporting process and returns to the previous screen.
<Esc>	-	Terminates the reporting process and returns to the previous screen.

To invoke this option, mark the system(s) or subtree(s) to include, enter an <M> in the option field, and press <Enter>.

9.5.3 Cut Sets Report

This option allows you to generate cut set reports based on alternate or base case values. Use the <T>oggle Alternate Cut Set option to set the values to alternate or base case. The Word ALTERNATE or BASE will appear in the upper right corner. When you invoke this option, Figure 304 will be displayed. On this screen, all names of the systems residing in the current family will be displayed. On this screen, you must do one of the following:

1) Press <Enter> to report all systems.
2) Highlight a system and press <Enter>.
3) Mark a group of systems and press <Enter>.

As shown, two report options are available: Cut Set or Quantified Cut Set.

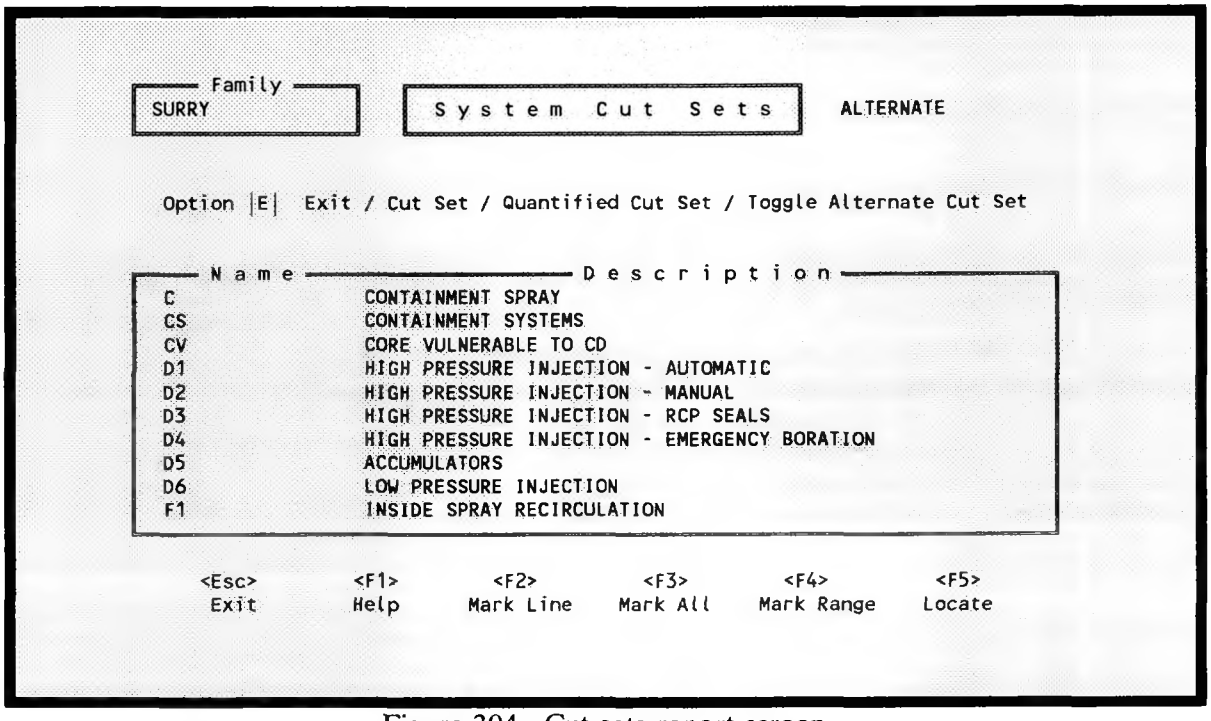


Figure 304. Cut sets report screen.

9.5.3.1 Cut Set. This option allows you to generate the System Cut Sets Report which consists of the cut set number, size, and all corresponding cut sets (alternate or base). When you invoke this option, Figure 305 will be displayed. You can modify any of the default values provided by simply typing over the existing data. Upon pressing <Enter>, the output destination screen will be displayed. On this screen, you must select one of the following output destinations:

CON	-	Sends the report to the screen.
PRN	-	Sends the report to the printer.
filename	-	Writes the report to the specified file on the hard disk.
blank	-	Terminates the reporting process and returns to the previous screen.
<Esc>	-	Terminates the reporting process and returns to the previous screen.

To invoke this option, mark the system(s) to include, enter a <C> in the option field, and press <Enter>.

9.5.3.2 Quantified Cut Set. This option allows you to generate the System Cut Set (Quantification) Report for quantified cut sets only. The report consists of the cut set number, percent of total, percent of the cut set, probability/frequency and all associated cut sets (alternate or base) for the selected system(s). When you invoke this option, Figure 305 will be displayed. You can modify any of the default values provided by simply typing over the existing data. Upon pressing <Enter>, the output destination screen will be displayed. On this screen, you must select one of the following output destinations:

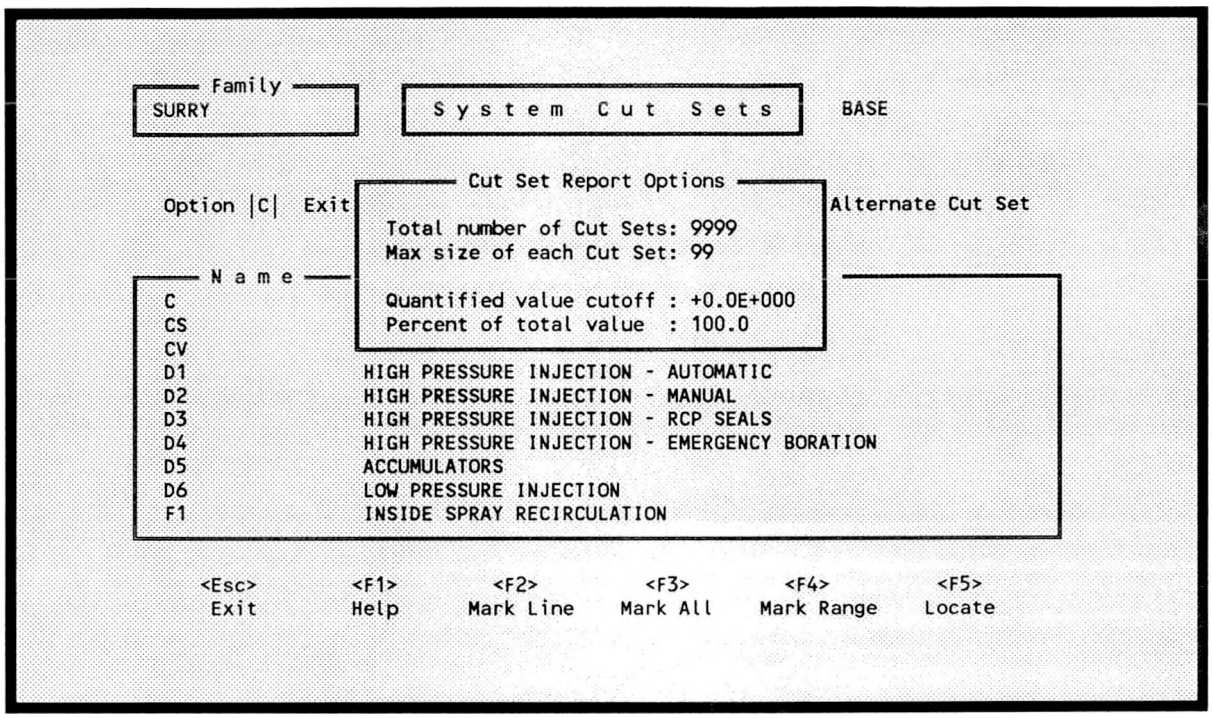


Figure 305. Cut set default report settings.

CON	-	Sends the report to the screen.
PRN	-	Sends the report to the printer.
filename	-	Writes the report to the specified file on the hard disk.
blank	-	Terminates the reporting process and returns to the previous screen.
<Esc>	-	Terminates the reporting process and returns to the previous screen.

To invoke this option, mark the system(s) to include, enter a <Q> in the option field, and press <Enter>.

9.5.4 System Importance

This option allows you to generate importance reports based on alternate or base case values. Use the <T>oggle Alternate Cut Set option to set the values to alternate or base case. The Word ALTERNATE or BASE will appear in the upper right corner. When you invoke this option, Figure 306 will be displayed. On this screen, all names of the systems residing in the current family will be displayed. On this screen, you must do one of the following:

1) Press <Enter> to report all systems.
2) Highlight a system and press <Enter>.
3) Mark a group of systems and press <Enter>.

As shown, two report options are available: Importance and Sort Criteria.

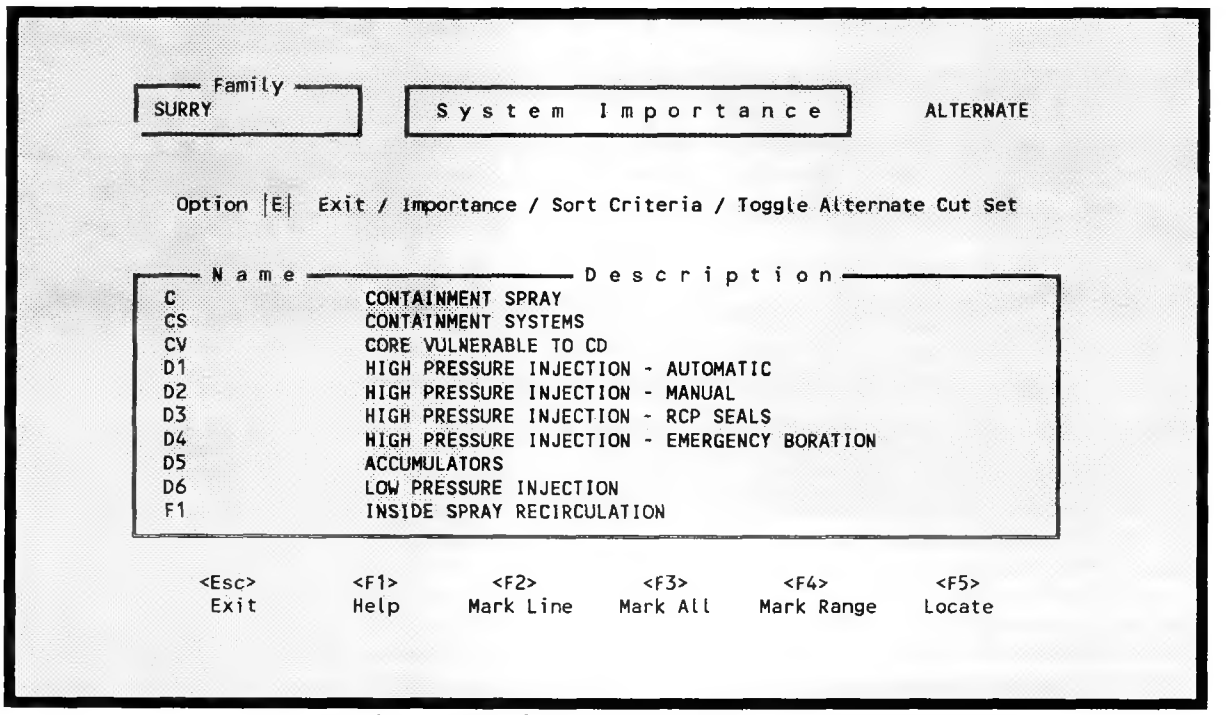


Figure 306. System importance screen.

9.5.4.1 Importance. This option allows you to generate the System Importance Measures report which consists of event names, number of times the event occurs, probability of failure, Fussell-Vesely importance value, risk reduction interval, and risk increase interval for the selected system(s). When you invoke this option, the output destination screen will be displayed. On this screen, you must select one of the following output destinations:

CON	-	Sends the report to the screen.
PRN	-	Sends the report to the printer.
filename	-	Writes the report to the specified file name on the hard disk.
blank	-	Terminates the reporting process and returns to the previous screen.
<Esc>	-	Terminates the reporting process and returns to the previous screen.

To invoke this option, mark the system(s) to include, enter an <I> in the option field, and press <Enter>.

9.5.4.2 Sort Criteria. This option allows you to select the sort order in which to display the System Importance Measures Report. When you invoke this option, Figure 307 will be displayed.

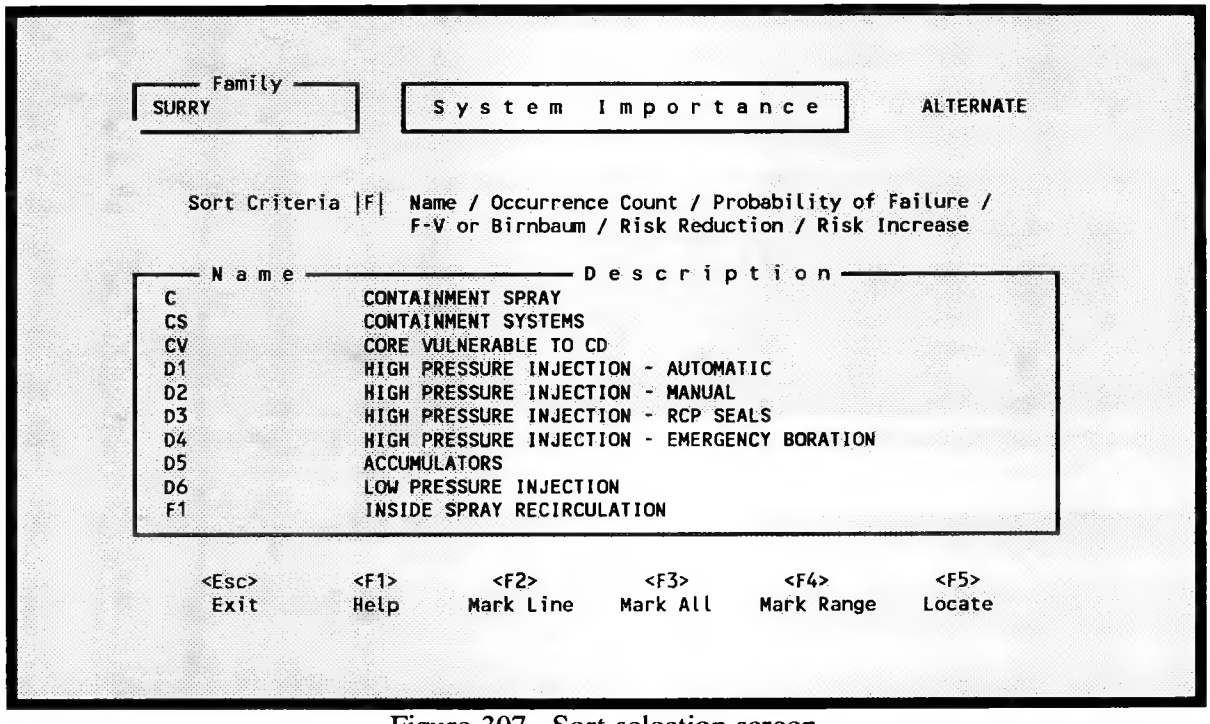


Figure 307. Sort selection screen.

As shown, the following sort options are available:

Name	-	Sorted by event name
Occurrence Count	-	Sorted by the number of occurrences (most to fewest)
Probability of Failure	-	Sorted by the probability failures
F-V or Birnbaum	-	Sorted in Fussell-Vesely or Birnbaum order
Risk Reduction	-	Sorted in risk reduction ratio order
Risk Increase	-	Sorted in risk increase ratio order

9.5.5 System

This option allows you to generate the System Cross Reference Report. This report lists all the systems contained in the current family and their associated subsystem names. When you invoke this option, the output destination screen will be displayed. On this screen, you must select one of the following output destinations:

CON	-	Sends the report to the screen.
PRN	-	Sends the report to the printer.
filename	-	Writes the report to the specified file on the hard disk.
blank	-	Terminates the reporting process and returns to the previous screen.

<Esc> - Terminates the reporting process and returns to the previous screen.

9.5.6 Subsystem

This option allows you to generate the Subtree Cross Reference Report. This report lists all the subsystems contained in the current family and the trees using the subtrees. For each subtree, a list of subtrees using that subtree is provided. When you invoke this option, the output destination screen will be displayed. On this screen, you must select one of the following output destinations:

CON	-	Sends the report to the screen.
PRN	-	Sends the report to the printer.
filename	-	Writes the report to the specified file name on the hard disk.
blank	-	Terminates the reporting process and returns to the previous screen.
<Esc>	-	Terminates the reporting process and returns to the previous screen.

9.6 Event Tree

This option allows you to generate a variety of event tree reports. When you invoke this option, Figure 308 will be displayed. You indicate which event tree report you want to generate by highlighting the desired report using the arrow keys and pressing <Enter>. As shown, the following reports may be generated: Logic/Rules, Initiating Events, Cross Reference, and System.

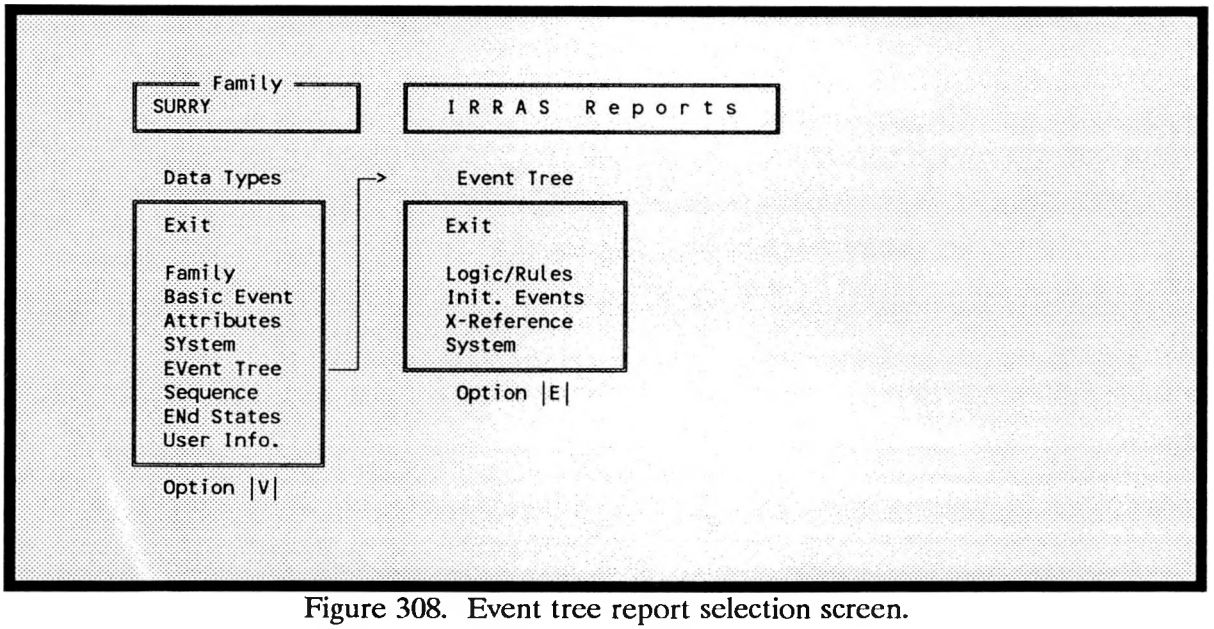


Figure 308. Event tree report selection screen.

9.6.1 Logic/Rules

This option allows you to generate the Event Tree Logic Report and the Event Tree Rules report. When you invoke this option, Figure 309 will be displayed. On this screen all event trees contained in the current family are displayed. On this screen, you must do one of the following:

1) Press <Enter> to report all event trees.
2) Highlight an event tree and press <Enter>.
3) Mark a group of event trees and press <Enter>.

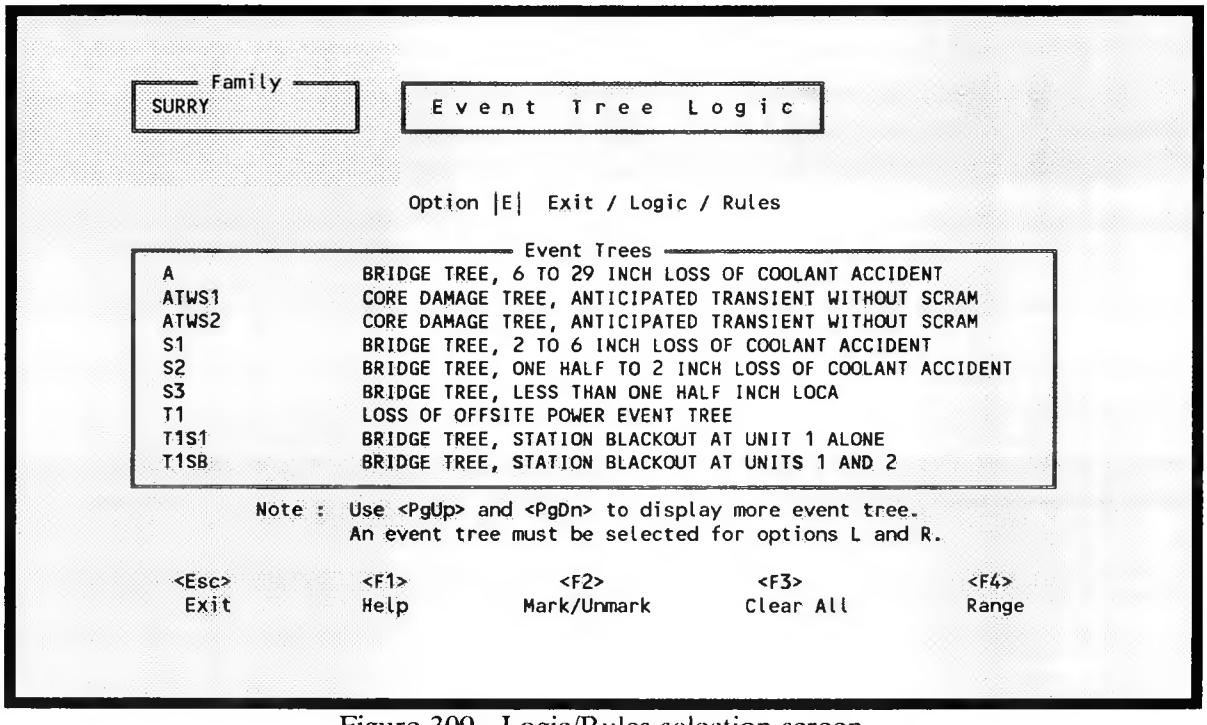


Figure 309. Logic/Rules selection screen.

As shown, two report options are available: Logic and Rules.

9.6.1.1 Logic. This option produces the Event Tree Logic Report. This report lists all sequence names and the associated logic (pass/fail) associated with each selected event tree. To invoke this option, mark the event trees, enter an <L> in the option field, and press <Enter>. When you invoke this option, the output destination screen will be displayed. On this screen, you must select one of the following output destinations:

CON	-	Sends the report to the screen.
PRN	-	Sends the report to the printer.
filename	-	Writes the report to the specified file on the hard disk.
blank	-	Terminates the reporting process and returns to the previous screen.
<Esc>	-	Terminates the reporting process and returns to the previous screen.

9.6.1.2 Rules. This option produces the Event Tree Rules Report. This report lists all linkage rules (exceptions) associated with each selected event tree. To invoke this option, mark the event trees, enter an <R> in the option files, and press <Enter>. The same output options are available as described in Section 9.6.1.1.

9.6.2 Initiating Event Report

This option allows you to generate the Event Tree Initiating Events Report. This report contains the event tree name and the corresponding event tree description and initiating event for all event trees in the current family. When you invoke this option, the output destination screen will be displayed. On this screen, you must select one of the following output destinations:

CON	-	Sends the report to the screen.
PRN	-	Sends the report to the printer.
filename	-	Writes the report to the specified file on the hard disk.
blank	-	Terminates the reporting process and returns to the previous screen.
<Esc>	-	Terminates the reporting process and returns to the previous screen.

9.6.3 System

This option is not yet available.

9.7 Sequence

This option allows you to generate a variety of sequence reports. When you invoke this option, Figure 310 will be displayed. You indicate which sequence report you want to generate by highlighting the desired report using the arrow keys and pressing <Enter>. As shown, the following reports may be generated: Summary, Logic, Cut Sets, and Importance.

9.7.1 Summary

When you invoke this option Figure 311 will be displayed. As shown four different summary reports may be generated: Brief, Summary, Combination and Uncertainty. Each of these reports can be generated using the Current or Base case values.

9.7.1.1 Brief Summary. This option allows you to generate the Sequence Brief Summary Report. The report lists each sequence name contained in the current family, the minimum cut set upper bound, and the sequence description. When you invoke this option, the output destination screen will be displayed, where you must select one of the following output destinations:

CON	-	Sends the report to the screen.
PRN	-	Sends the report to the printer.
filename	-	Writes the report to the specified file name on the hard disk.
blank	-	Terminates the reporting process and returns to the previous screen.
<Esc>	-	Terminates the reporting process and returns to the previous screen.

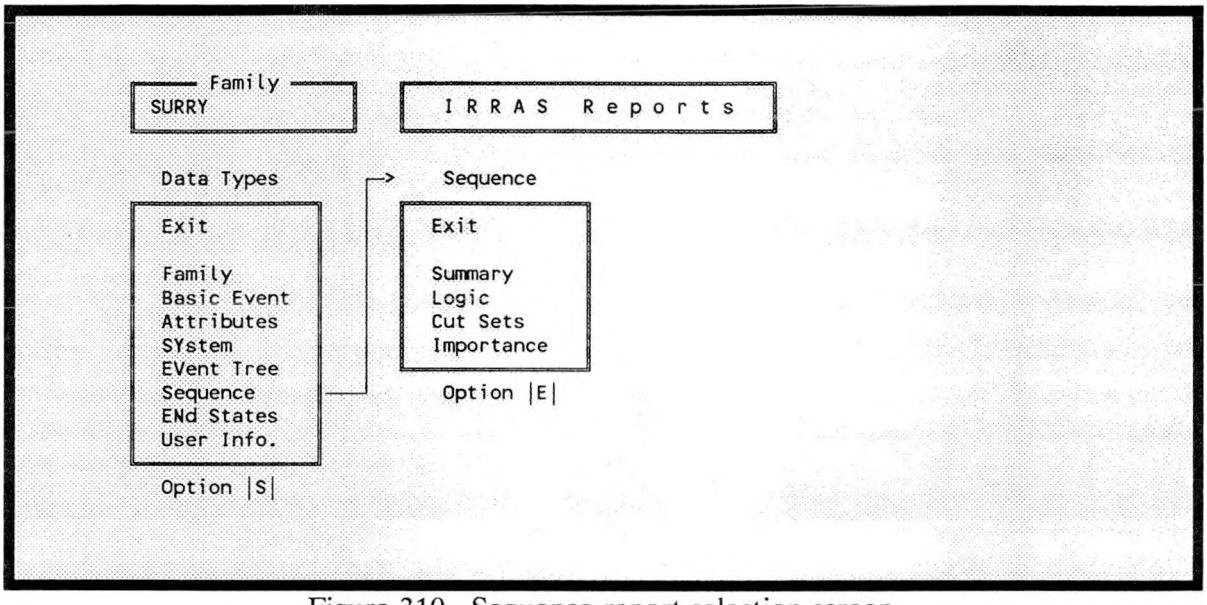


Figure 310. Sequence report selection screen.

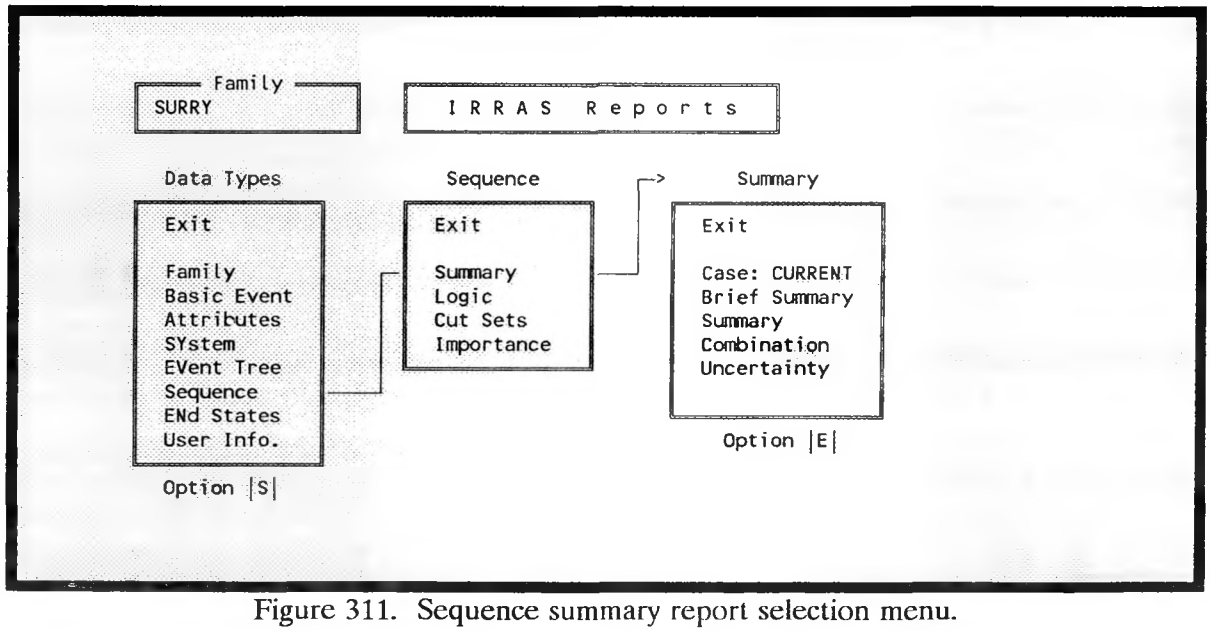


Figure 311. Sequence summary report selection menu.

9.7.1.2 Summary. This option allows you to generate the Sequence Summary Report. The report lists each sequence number and name contained in the current family and the minimum cut set upper bound. When you invoke this option, the output destination screen will be displayed. On this screen, you must select one of the following output destinations:

CON	-	Sends the report to the screen.
PRN	-	Sends the report to the printer.
filename	-	Writes the report to the specified file name on the hard disk.

blank	-	Terminates the reporting process and returns to the previous screen.
<Esc>	-	Terminates the reporting process and returns to the previous screen.

9.7.1.3 Combination. This option allows you to generate the Sequence Combination Report. The report lists each sequence number and name contained in the current family, the minimum cut set value, the mean cut set value, and the number of cut sets contained in each sequence. When you invoke this option, the output destination screen will be displayed. On this screen, you must select one of the following output destinations:

CON	-	Sends the report to the screen.
PRN	-	Sends the report to the printer.
filename	-	Writes the report to the specified file name on the hard disk.
blank	-	Terminates the reporting process and returns to the previous screen.
<Esc>	-	Terminates the reporting process and returns to the previous screen.

9.7.1.4 Uncertainty. This option allows you to generate the Sequence Uncertainty Values Report. The report lists each sequence number and name contained in the current family, the mean and median values, standard deviation, 5th and 95th percentile, minimum and maximum range values, and the seed size. When you invoke this option, the output destination screen will be displayed. On this screen, you must select one of the following output destinations:

CON	-	Sends the report to the screen.
PRN	-	Sends the report to the printer.
filename	-	Writes the report to the specified file name on the hard disk.
blank	-	Terminates the reporting process and returns to the previous screen.
<Esc>	-	Terminates the reporting process and returns to the previous screen.

9.7.2 Logic

This option allows you to generate the Sequence Logic Report. This report contains every sequence number and name contained in the current family, and the logic paths (pass/fail) for the event tree, initiating event, and logic. When you invoke this option, the output destination screen will be displayed. On this screen, you must select one of the following output destinations:

CON	-	Sends the report to the screen.
PRN	-	Sends the report to the printer.
filename	-	Writes the report to the specified file name on the hard disk.
blank	-	Terminates the reporting process and returns to the previous screen.
<Esc>	-	Terminates the reporting process and returns to the previous screen.

9.7.3 Cut Sets

This option allows you to generate two sequence cut set reports using alternate or base cut set values. Use the Toggle Alternate Cut Set option to set the desired values to alternate or base case. The word ALTERNATE or BASE will appear in the upper right corner. When you invoke this option, Figure 312 will be displayed. All sequences contained in the current family are displayed. On this screen, you must do one of the following:

1) Press <Enter> to report all sequences.
2) Highlight a sequence and press <Enter>.
3) Mark a group of sequences and press <Enter>.

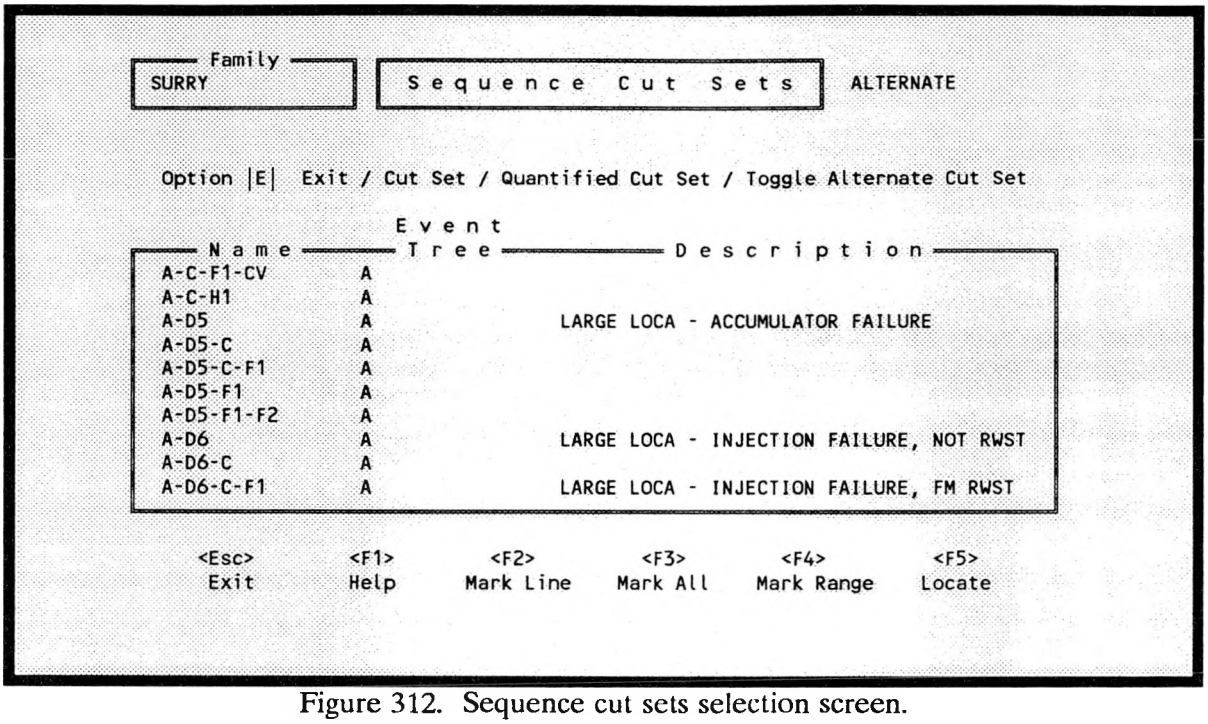


Figure 312. Sequence cut sets selection screen.

As shown, two options are available: Cut Set and Quantified Cut Set.

9.7.3.1 Cut Set. This option allows you to generate the Sequence Cut Sets Report, which consists of the cut set number, size and cut set name for each selected sequence. To invoke this option, mark the sequence(s) to include, enter a <C> in the option field, and press <Enter>. When you invoke this option, Figure 313 will be displayed. You can modify any of the default values provided by simply typing over the existing data. Upon pressing <Enter>, the output destination screen will be displayed. On this screen, you must select one of the following output destinations:

CON	-	Sends the report to the screen.
PRN	-	Sends the report to the printer.
filename	-	Writes the report to the specified file name on the hard disk.
blank	-	Terminates the reporting process and returns to the previous screen.
<Esc>	-	Terminates the reporting process and returns to the previous screen.

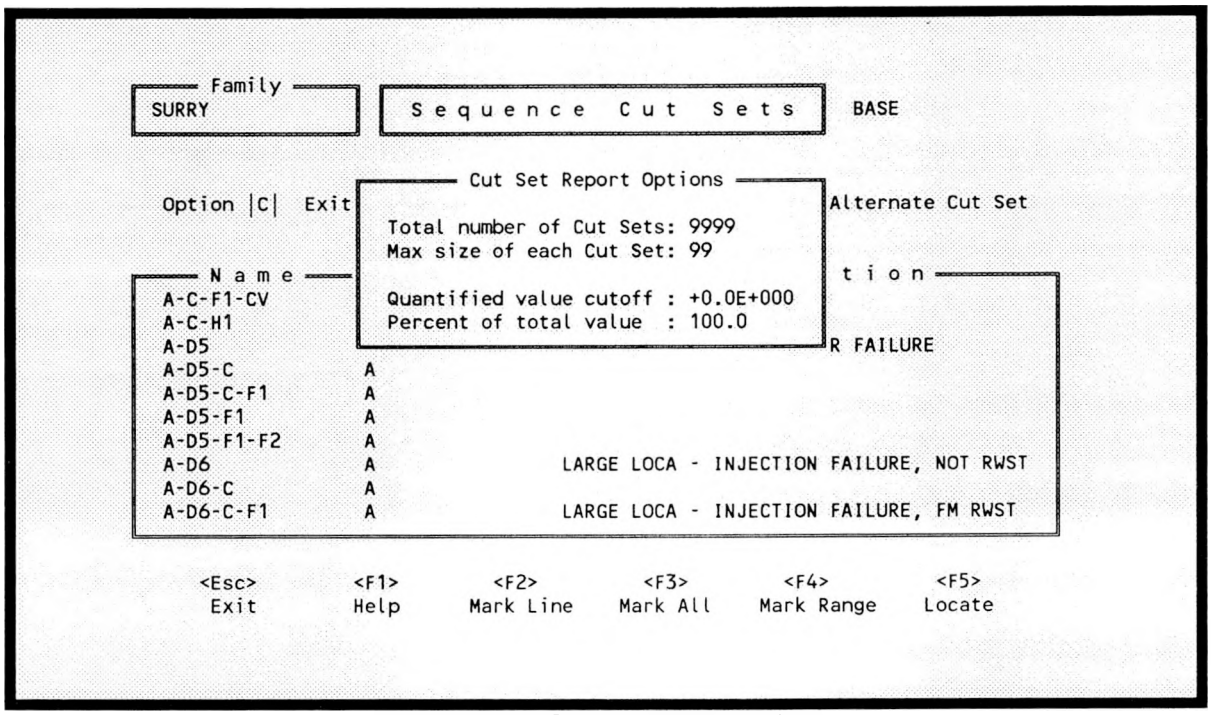


Figure 313. Cut set report options.

9.7.3.2 Quantified Cut Set. This option allows you to generate the Sequence Cut Sets (Quantification) Report, which consists of the cut set number, percent of total, percent of cut set, probability/frequency and all associated cut sets (alternate or base) for the selected sequence(s). To invoke this option, mark the sequence(s) to include, enter a <Q> in the option field, and press <Enter>. When you invoke this option, a screen similar to the one shown in Figure 313 will be displayed. You can modify any of the default values provided by simply typing over the existing data. Upon pressing <Enter>, the output destination screen will be displayed. On this screen, you must select one of the following output destinations:

CON	-	Sends the report to the screen.
PRN	-	Sends the report to the printer.
filename	-	Writes the report to the specified file name on the hard disk.
blank	-	Terminates the reporting process and returns to the previous screen.
<Esc>	-	Terminates the reporting process and returns to the previous screen.

9.7.4 Importance

This option allows you to generate reports based on alternate or base case values. Use the Toggle Alternate Cut Set to set the values to alternate or base case. The word ALTERNATE or BASE will appear in the upper right corner (Figure 314). When you invoke this option, Figure 314 will be displayed. On this screen, all sequence names residing in the current family will be displayed. On this screen, you must do one of the following:

1) Press <Enter> to report all sequences.
2) Highlight a sequence and press <Enter>.
3) Mark a group of sequences and press <Enter>.

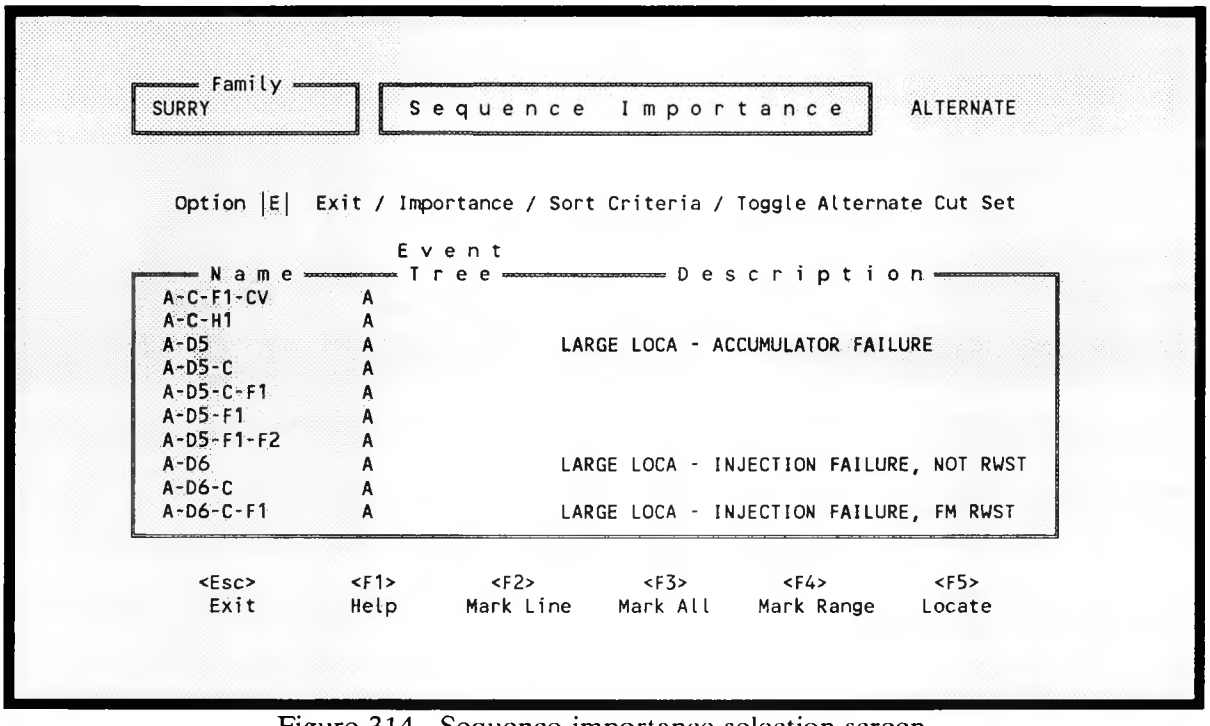


Figure 314. Sequence importance selection screen.

As shown, two options are available: Importance and Sort Criteria.

9.7.4.1 Importance. This option allows you to generate the Sequence Importance Measures Report which consists of event names, number of times the event occurs, probability of failure, Fussell-Vesely importance value, risk reduction interval, and risk increase interval for the selected sequence(s). To invoke this option, mark the sequence(s) to include, enter an <I> in the option field, and press <Enter>. When you invoke this option, the output destination screen will be displayed. On this screen, you must select one of the following output destinations:

CON	-	Sends the report to the screen.
PRN	-	Sends the report to the printer.
filename	-	Writes the report to the specified file name on the hard disk.
blank	-	Terminates the reporting process and returns to the previous screen.
<Esc>	-	Terminates the reporting process and returns to the previous screen.

9.7.4.2 Sort Criteria. This option allows you to select the sort order in which to display the Sequence Importance Measures Report. When you invoke this option, Figure 315 will be displayed.

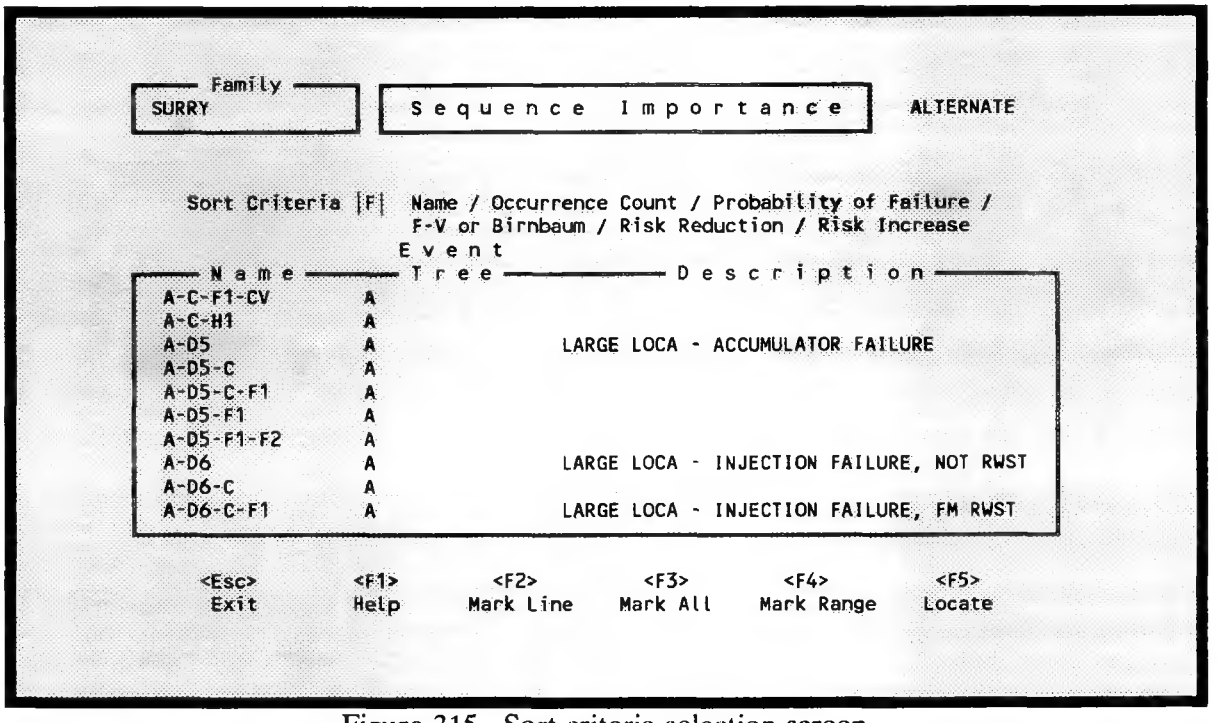


Figure 315. Sort criteria selection screen.

As shown, the following sort options are available:

Name	-	Sorted by event name
Occurrence Count	-	Sorted by the number of occurrences (most to fewest)
Probability of Failure	-	Sorted by probability failures
F-V or Birnbaum	-	Sorted by Fussell-Vesely or Birnbaum values
Risk Reduction	-	Sorted in risk reduction ratio order
Risk Increase	-	Sorted in risk increase ratio order

9.8 End States

This option is not yet available.

9.9 User Info

User Information Reports not yet available.

10. UTILITY OPTIONS

The IRRAS Utility Options allow you to perform routine functions that are required by IRRAS such as defining constants, recovering the data base, and MAR-D data exchange. When you invoke this option, Figure 316 will be displayed.

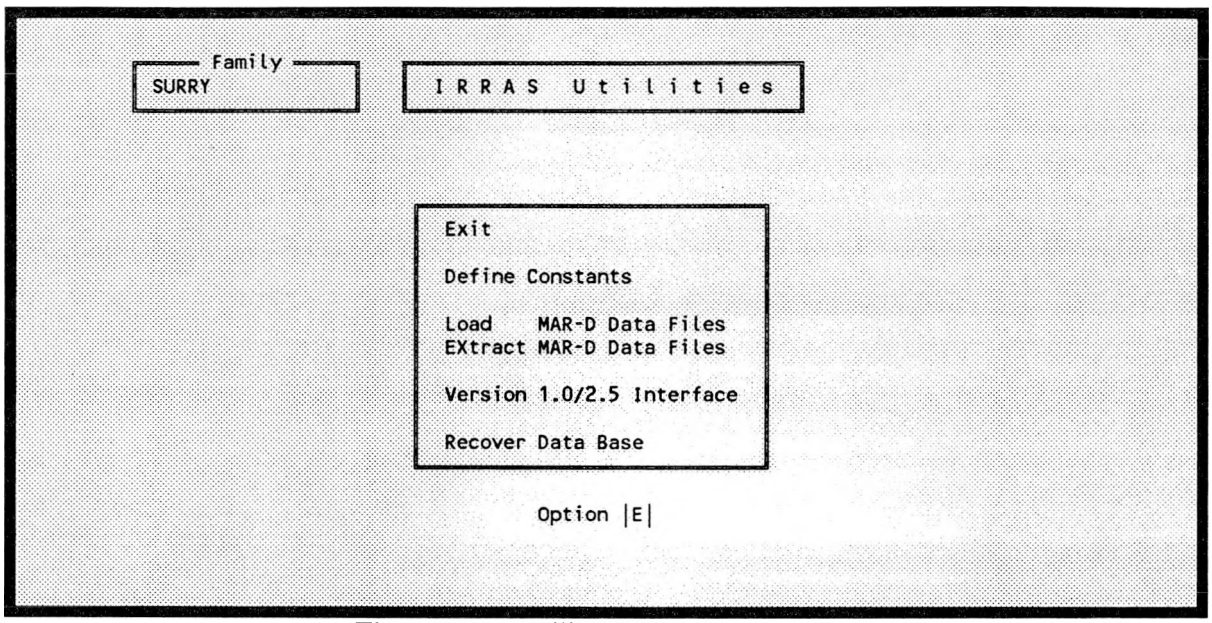


Figure 316. Utility options main menu.

10.1 Exit

Type <E> in the command line, or highlight Exit, and press <Enter>, or press the <Esc> key to return to the IRRAS main menu.

10.2 Define Constants

The Define Constants <D> option allows you to define what hardware the system uses as well as defining uncertainty settings, cut set constants, and default values for the graphics editor. After choosing this option, the User Information Constants screen shown in Figure 317 is displayed. Table 1 provides a brief description of each of the fields in Figure 317.

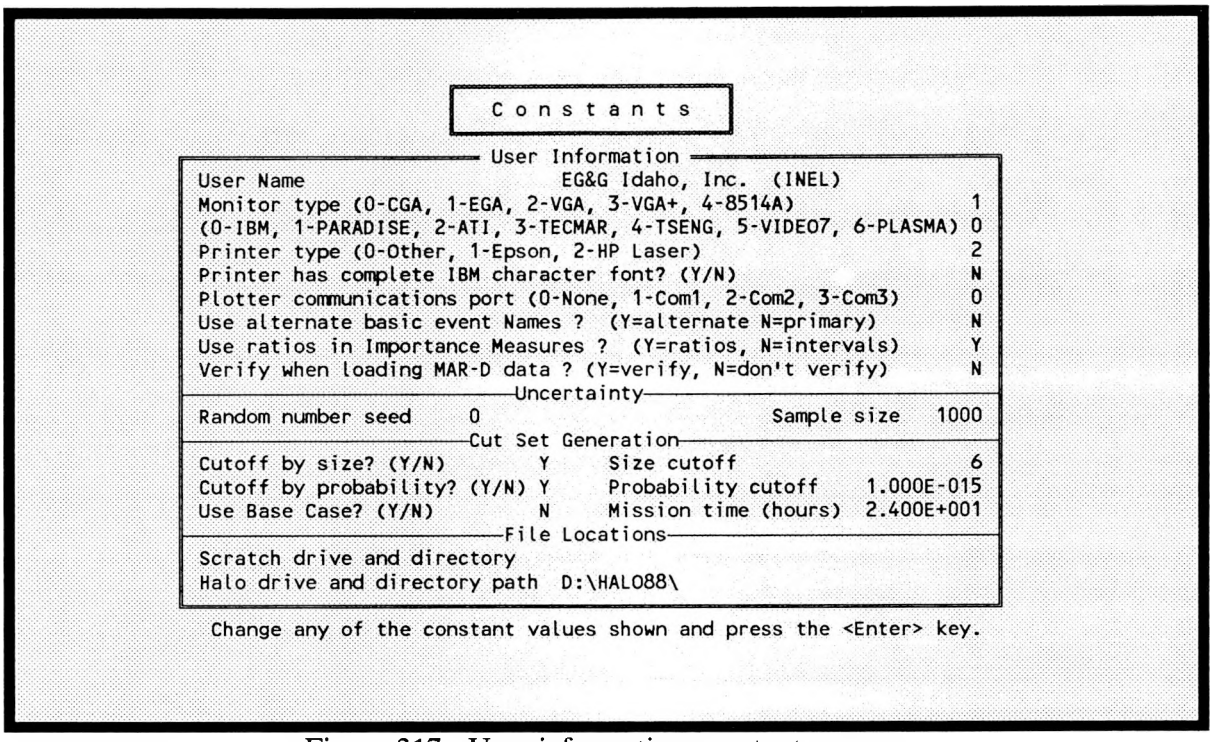


Figure 317. User information constants screen.

Table 1. User Information field descriptions for constants option

FIELD	DESCRIPTION
User Name	36 character user identification (optional) field
Monitor type	0 - Enhanced graphics monitor. 1 - DEFAULT - Standard color graphics monitor 2 - Video graphics monitor (2640 x 480) 3 - Video graphics monitor plus (800 x 600) 4 - 8514A
Card type	0 - IBM 1 - Paradise 2 - ATI 3 - TECMAR 4 - TSENG 5 - VIDEO-7 6 - PLASMA
Printer type	0 - Other 1 - Epson 2 - HP LaserJet (DEFAULT)
Printer has complete IBM character font?	Y - Yes. N - No (DEFAULT)
Plotter communications port	0 - No Plotter connected to port (DEFAULT). 1 - Plotter connected to Com1 port. 2 - Plotter connected to Com2 port. 3 - Plotter connected to Com3 port.
Use alternate basic event names?	Y - Alternate name will be used. N - Primary name will be used (DEFAULT).
Use ratios in Importance Measures?	Y - Ratios (DEFAULT) N - Intervals
Verify when loading MAR-D data?	Y - File dependency will be checked. N - No file cross checking will done. (DEFAULT)
Random number seed for uncertainty calculations	5 digit numeric field indicating the first random number in the seed to be used in the Monte Carlo calculation. 0 (DEFAULT) indicates that the random number will be the current value of the real clock.
Sample size	6 digit numeric field indicating the default number of Monte Carlo samples to be run in the uncertainty analyses. Sample size may range from 1 to 999999 (DEFAULT = 1,000).

Table 1 (cont.). User Information field descriptions for constants option

FIELD	DESCRIPTION
Cutoff by size?	Y - Do not generate fault tree or sequence cut sets containing more basic events than indicated in the Size cutoff field (DEFAULT). N - Generate all cut sets for the fault tree or sequence that meet the probability cutoff criteria (if in effect).
Size cutoff	The default maximum number of basic events allowed in cut set generation when size cutoff is in effect. DEFAULT = 6
Cutoff by probability?	Y - Do not generate fault tree or sequence cut sets that have a probability less than the cutoff indicated in the probability cutoff field (DEFAULT) N - Generate all cut sets that meet the size cutoff criteria (if in effect) regardless of the cut set probability.
Probability cutoff	The default minimum cut set probability allowed in cut set generation when probability cutoff is in effect. (DEFAULT = 000E-015)
Use Base Case	Y - Use base case values N - Don't use base case values (DEFAULT)
Mission time (hours)	The default mission time to be used in the calculation of basic event probabilities (when appropriate). DEFAULT = 2.400E+001
Scratch drive and directory	36 character field indicating the drive and path to the scratch directory where files will be stored (DEFAULT set to blanks)
Halo drive and directory path	36 character field indicating the drive and path to the Halo graphics that IRRAS 2.5 should use (/HALO88/)

After setting the User Information constants, press <Enter>. The next screen displays the Fault Tree Graphics Constants (Figure 318). Table 2 provides a brief description of each of the fields in Figure 318.

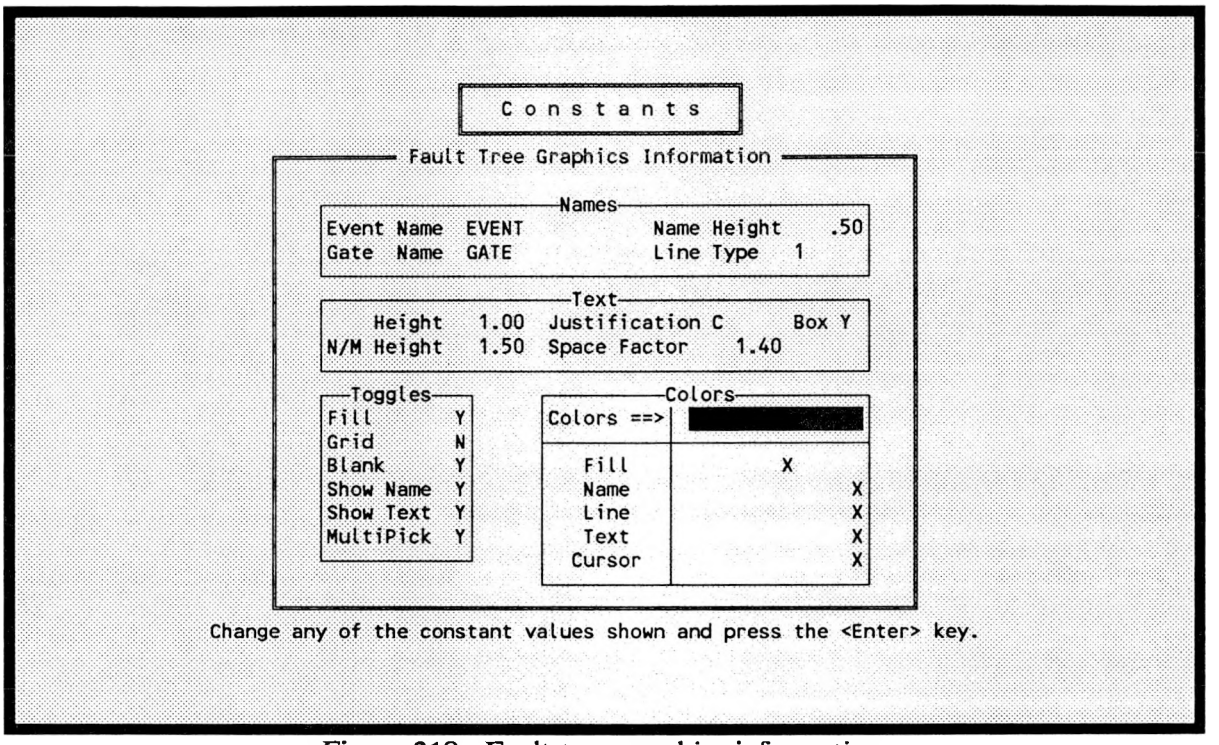


Figure 318. Fault tree graphics information.

Table 2. Fault tree graphics information field descriptions

FIELD	DESCRIPTION
Event Name	10-character field for the fault tree basic event default name. The default name is followed by a sequential number for each separate event, e.g., EVENT1, EVENT2, etc. (DEFAULT = EVENT)
Gate Name	10-character field for the fault tree gate default name. The default name is followed by a sequential number for each separate event, e.g., GATE1, GATE2, etc. (DEFAULT = GATE)
Name Height	The height of the event and gate names. This is a number between 0.01 and 66.00, where 66.00 represents the full 66 lines from the top of the screen to the bottom. (DEFAULT = 0.50)
Line Type	1 - Solid line (DEFAULT) 2 - Dashed line. 3 - Dotted line.
Text Height	The height of the text to be written. This is a number between 0.01 and 66.00 (see Name Height). DEFAULT = .50
N/M Height	The height of the numbers on an N/M OR gate showing the N and M values. This is a number between 0.01 and 66.00. (DEFAULT = 1.50)
Justification	Text justification. L - Left justified. C - Centered (DEFAULT). R - Right justified.
Space Factor	The spacing between lines of text written consecutively. This is a number between 1.00 and 10.00. A value of 1.00 will cause the top of the following line of text to touch the bottom of the preceding line. (DEFAULT = 1.40)

Table 2 (cont.). Fault tree graphics information field descriptions

FIELD	DESCRIPTION
Fill	Yes/No toggle turning the fill on/off for plotting. DEFAULT = No
Grid	Yes/No toggle turning a reference grid on/off. DEFAULT = No
Blank	Y - The immediate area surrounding a gate or event name will be blanked out. (DEFAULT) N - The gate and event names will be written over any lines drawn in the areas for the names.
Show Name	Yes/No toggle turning on/off the display of event and gate names when the SHOW command is used. DEFAULT = Yes
Show Text	Yes/No toggle turning on/off the display of descriptive text when the SHOW command is used. DEFAULT = Yes.
MultiPick	When building trees, multipick will generate multiple gates for each pick of a gate type. DEFAULT = Yes.
Fill Color	An X under the desired color selects the default color for filling in shapes. DEFAULT color = blue.
Name Color	An X under the desired color selects the default color for displaying names. DEFAULT color = white.
Line Color	An X under the desired color selects the default color for drawing lines. DEFAULT color = white.
Text Color	An X under the desired color selects the default color for writing text. DEFAULT color = white.
Cursor Color	An X under the desired color selects the default color for the cursor. DEFAULT color = white.

After setting the Fault Tree graphics information constants press <Enter>. The next screen displays Event Tree graphics information (Figure 319). Make any changes needed and press <Enter>. Table 3 provides a brief description of each of the fields in Figure 319

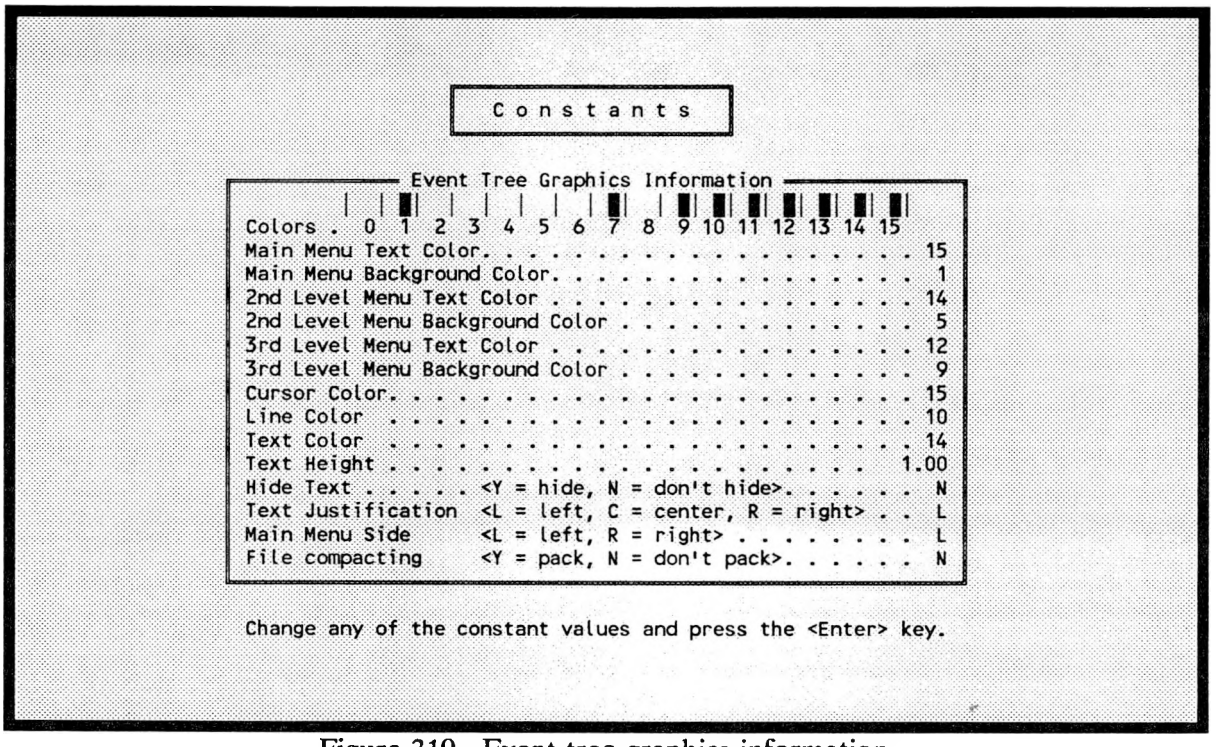


Figure 319. Event tree graphics information.

Table 3. Event tree graphics information field descriptions

FIELD	DESCRIPTION
Colors	Colors that can be used in event tree graphics and their associated reference numbers.
Main Menu Text Color	Color of main menu's text. DEFAULT = 15 (white).
Main Menu Background Color	Background color upon which text is written. DEFAULT = 1 (blue).
2nd Level Menu Text Color	Color of text in second level menus. DEFAULT = 14 (yellow).
2nd Level Menu Background Color	Background color of second level menus upon which text is written. DEFAULT = 5 (purple).
3rd Level Menu Text Color	Color of text in third level menus. (DEFAULT = 12 (cyan).
3rd Level Menu Background Color	Background color of third level menus upon which text is written. DEFAULT = 9 (light blue).
Cursor Color	Default color of cursor. DEFAULT = 15 (white).
Line Color	Default color of lines. DEFAULT = 15 (white).
Text Color	Default color of text. DEFAULT = 14 (yellow).
Text Height	Default text height. DEFAULT = 1.00.
Hide Text	Y/N Hide text when displaying tree. DEFAULT = N.
Text Justification	L = Left (DEFAULT) C = Center R = Right.
Main Menu Side	L/R - Side of screen to place main menu. (DEFAULT = left).
File Compacting	Y/N - Compact file when leaving editor. DEFAULT = No.

10.3 Load MAR-D Data Files

The Load MAR-D Data Files option facilitates loading of Probabilistic Risk Assessment (PRA) data from the Models and Results Data Base (MAR-D). The process converts information from the generic format found in the MAR-D data base to the IRRAS data base format. When you select this option, Figure 320 will be displayed.

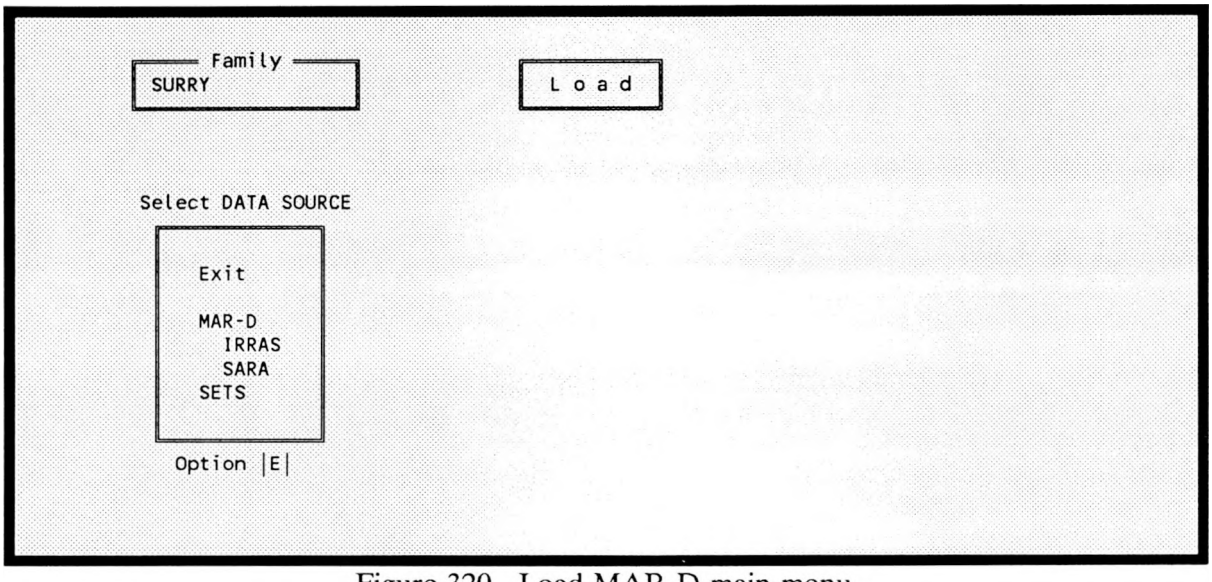


Figure 320. Load MAR-D main menu.

Prior to loading any data, a family must be created through the MODIFY Database Family option. Copy the files you wish to load into that family's directory (use the DOS copy command or the File Copy option under Select Family). Select that family and verify that the family name displayed in the top left corner of each menu is where the data should be loaded. If it is not correct, use the SELECT Family option again to choose the desired family.

Upon entering the LOAD module, Figure 320 will be displayed. As you cursor down through the data tools, autohelp menus will appear to the right listing the types of data which can be loaded (Figure 321). The right arrow or <Enter> will take you to this second menu (Figure 322). Again, as you cursor down through the data types, menus will appear listing the specifics of what types of data can be loaded (Figure 323). After choosing the data to load (Figure 324), the form in Figure 325 will appear listing the files which contain that data and have the proper extension.

Each of the subsections below contains additional information on loading various types of data. In general, new data loaded into the data base overwrites old data of the same name.

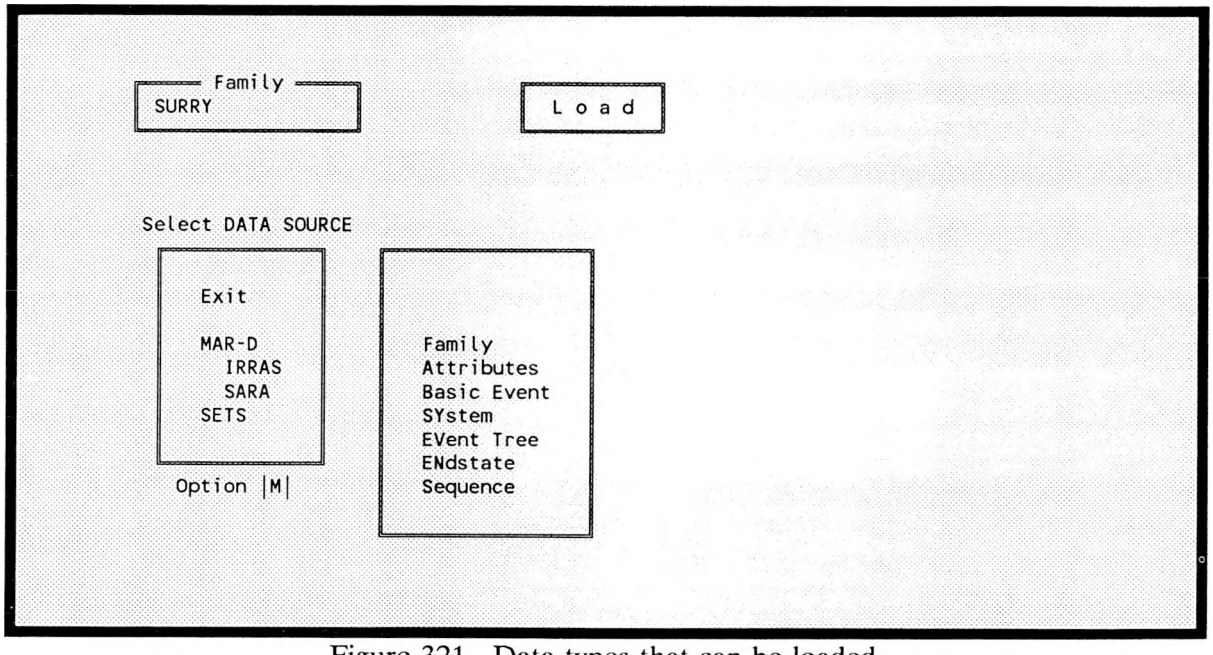


Figure 321. Data types that can be loaded.

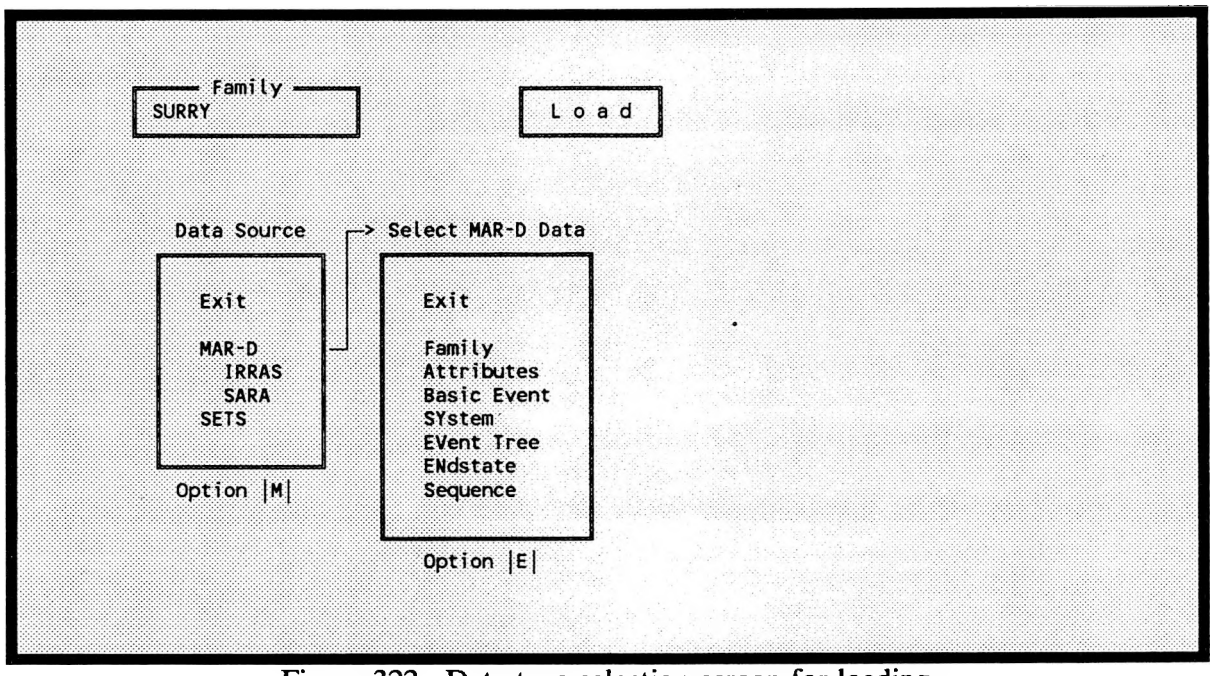


Figure 322. Data type selection screen for loading.

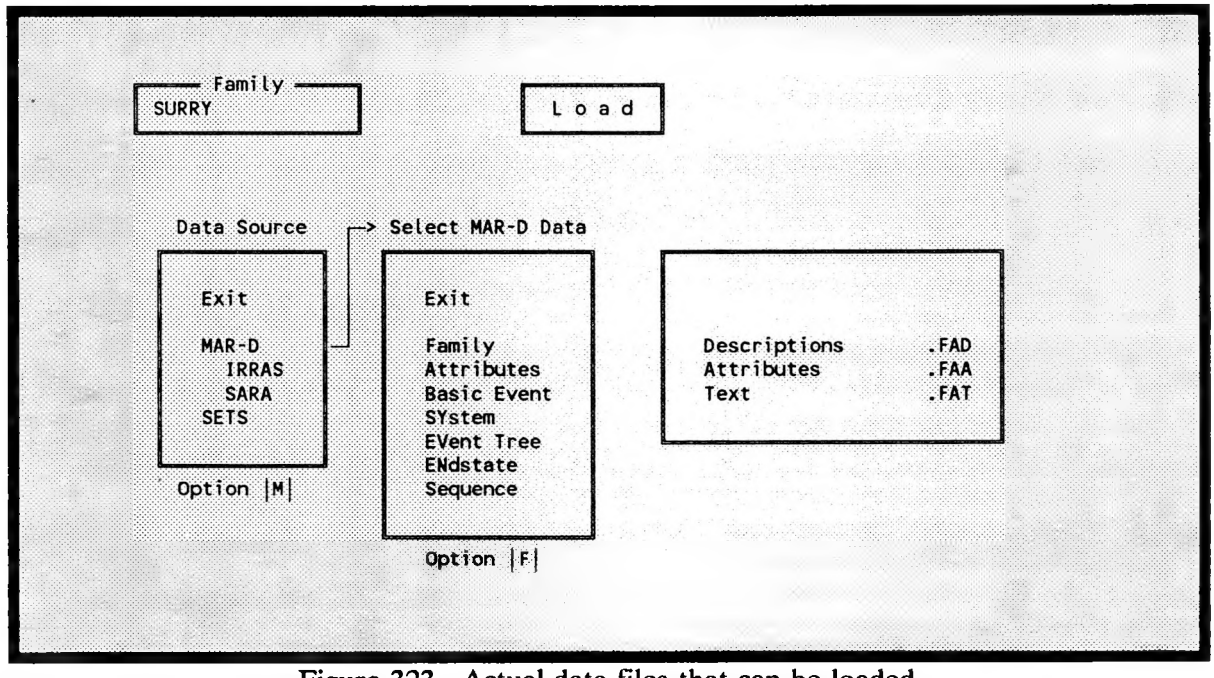


Figure 323. Actual data files that can be loaded.

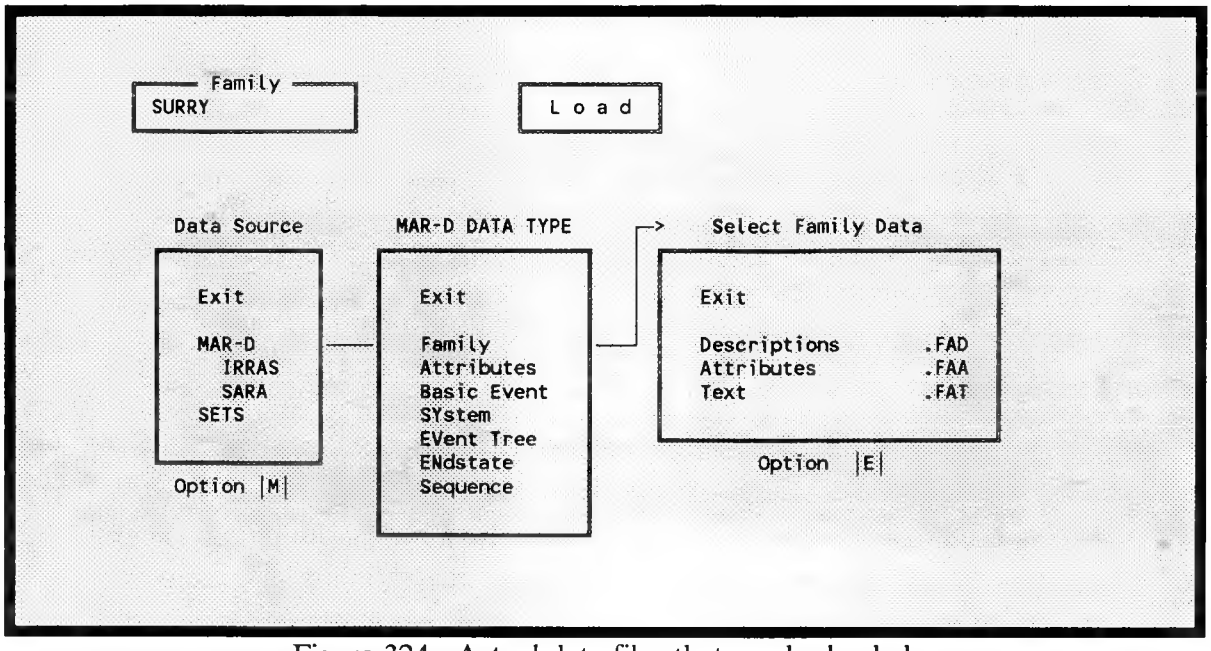


Figure 324. Actual data files that can be loaded.

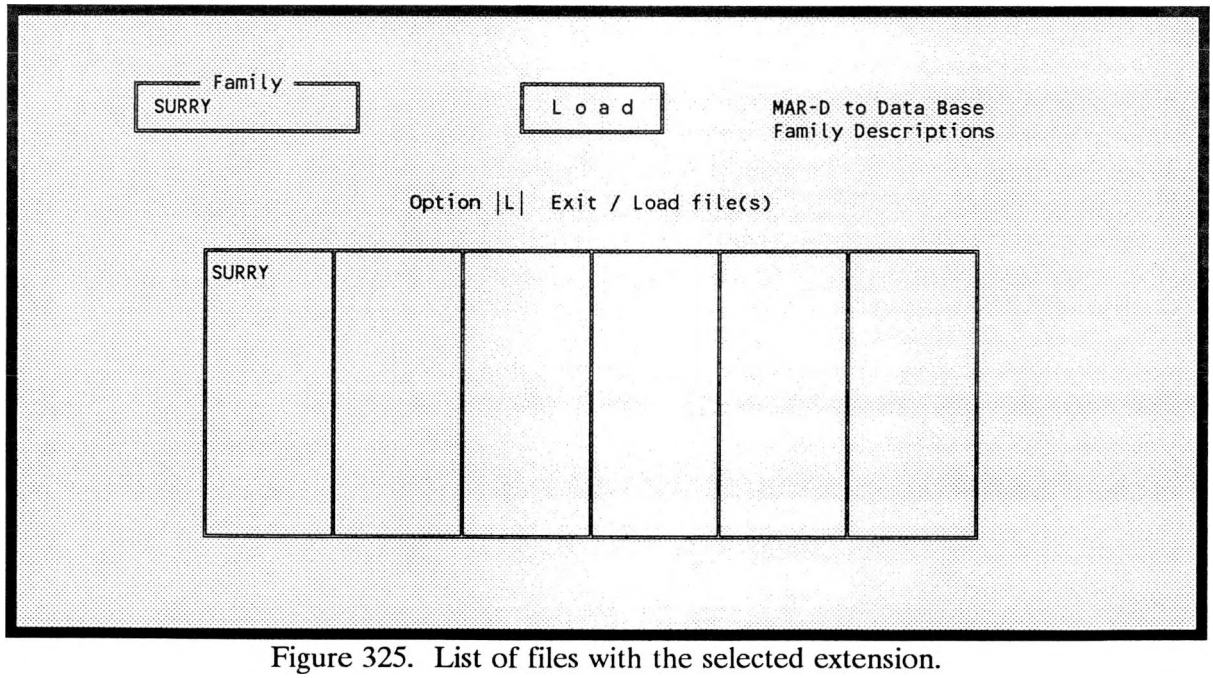


Figure 325. List of files with the selected extension.

10.3.1 Load Verification

Consistency checking for names contained in multiple files can be done by setting "Verify when loading MAR-D data?" to "Y" using the Utility Constants option (Figure 317). Data files which have no prerequisite loaded files (*.CTD, *.FTD, *.BED, etc.) are assumed to be correct and are loaded directly into the data base without any field checking taking place. Data files having prerequisite loaded files contain dependent fields referenced in those data files (e.g., the *.BEI file contains event names also contained in the *.BED file). See Table 4 for a listing of files and their prerequisite files and dependent fields.

Table 4. MAR-D files load order dependencies

Group	File	Prerequisite files	Dependent fields
Family			
	.FAD	----	----
	.FAT	----	----
	.FTT	----	----
NOTE: consistency checking for family names is active for all files.			
Attributes			
	.CAD	----	----
	.CTD	----	----
	.FMD	----	----
	.LCD	----	----
	.STD	----	----
Basic Events			
	.BED	----	----
	.BEI	.BED	Event Name
	.BEA	.BED	Event Name
		.CAD	Class Attr
		.CTD	Comp Type
		.FMD	Fail Mode
		.LCD	Location
		.STD	System Type
Systems			
	.FTD	----	----
	.DLS	----	----
	.FTL	.BED	Event Name
	.FTC	.FTD	System Name
		.BED	Event Name

.FTA	.FTD	System Name
.FTT	.FTD	System Name

NOTE: .DLS and .FTL files are put into graphic relation instead of system relation. No cross relational checking available for graphics name.

Event Trees

.ETD	----	----
.ETA	.ETD	Event Tree Name
	.BEI	Init Event
.ETG	.ETD	Event Tree Name
.ETL	.ETD	Event Tree Name
	.BEI	Init Event: unless a Top
	.FTD	System Name for TOPS
.ETT	.ETD	Event Tree Name

NOTE: .ETG is currently loaded as text. .ETL should look exactly like .ETG file.

Endstates

.ESD	----	----
.ESI	????	Not yet defined
.EST	.ESD	End State Name

Sequence

.SQD	.ETD	Event Tree Name
.SQC	.ETD	Event Tree Name
	.SQD	Sequence Name
	.BED	Event Name
.SQA	.ETD	Event Tree Name
	.SQD	Sequence Name
	.ESD	End State Name
.SQT	.ETD	Event Tree Name
	.SQD	Sequence Name

If a dependent field does not exist in the database at load time, that field will be displayed in a confirmation/add menu. Thus, if an event name contained in a *.BEI file does not match any event name previously loaded by the *.BED file, the new name will be displayed with the option to add the event name or simply abort the load process (see form). Note that the dependent field name cannot be edited at this point. If the name is not correct then exit, fix the mistake, and reload.

However, if you suspect your data files have multiple cross-reference errors, load the files and allow the load procedure to find the errors for you. As an error is displayed to the screen, write down the line number and file name and continue with the load. When the load is finished, make the necessary corrections to the data files, delete the database files for that family (i.e., the *.DAT, *.IDX, and *.BLK files), and restart the load procedure.

10.3.2 Family

Family descriptions, attributes, and text can be loaded into the database. This information is currently stored in only the MAR-D format. Note that each file contains data for only one family, and that a change in the data file family name will not change the database family name.

10.3.3 Event Attributes

Basic event attributes descriptions (locations, failure modes, class attributes, system types and component types) can be loaded using the MAR-D attributes option.

10.3.4 Basic Events

Event descriptions, failure rates, and attributes can be loaded into the data base. The alternate name of the event defaults to the value of the primary name if an alternate name is not specified.

10.3.5 Systems

System descriptions, graphics, logic, cut sets, attributes, text and piping and instrumentation diagrams (P&IDs) can be loaded into the database. System cut sets and attributes data can be loaded into either the base case (permanent) or alternate (temporary) field areas. MAR-D database applications will normally use the base case load option because only permanent data should be loaded into the database. Analysis software such as IRRAS or SARA will use alternate fields for comparisons of changed value results.

Any basic event found within the system logic or cut sets will be added to the Event relation.

10.3.6 Event Trees

Event tree descriptions, graphics, logic, attributes, rules, and text can be loaded into the database.

10.3.7 End States

End state names, descriptions, and text can be loaded into the database. Formats for end state information have not yet been determined.

10.3.8 Sequences

Sequence cut sets for MAR-D (IRRAS, SARA) file formats can be loaded. In the MAR-D format, sequence descriptions, attributes, text, and logic can be loaded as well. With cut sets and attributes, data can be loaded into either the base case or alternate field areas.

The event tree initiating event must have been entered into the database prior to loading sequence cut sets and, therefore, does not need to be included; any found will be removed from the cut set data.

10.4 Extract MAR-D Data Files

Data can be output in MAR-D (IRRAS, SARA) format using the EXTRACT MAR-D Data Files option. The extracted file is created in the current family subdirectory. The default output file name for description, information, and attribute data is the first eight characters of the family name plus the appropriate extension. For MAR-D cut set, logic, graphic, and textual information, if all files are selected for extraction, the file name will be the family name with the extension. Otherwise, the file name will be the first six characters of the name plus a 2-character ID number.

NOTE: If a file with this name already exists it will be overwritten.

The EXTRACT menus are identical with the LOAD menus (see Figure 326 through Figure 330). A data tool type is selected, then a data type, and finally the specific data to be output. In outputting some data, a fourth menu appears. Read the note at the bottom of the form as well as the appropriate section on outputting that data type.

10.4.1 Family

Family descriptions, attributes, and text can be output from the database. Note that each file will contain information for the selected family.

10.4.2 Attributes

Event attributes (locations, failure modes, class attributes, system types, and component types) can be output from the data base. Event attributes will be output for the entire family.

10.4.3 Basic Events

Event descriptions, failure rates, and attributes can be output for all the events in a family. If alternate basic event names are used, the constant is set to "Y", and the alternate name will be used instead of the primary name for descriptions and failure rates. Primary names will be output.

10.4.4 Systems

Descriptions and attributes can be output for all the systems in a family. System logic, graphics, and cut sets are selected from an output menu. If all logic or graphics is selected, a single

file will be created for each of the names; for all cut sets and text, the family name will be used, with systems separated by ^EOS.

10.4.5 Event Trees

Descriptions and attributes can be output for all the event trees in a family. Event tree logic, graphics, and rules are selected from an output menu.

10.4.6 End States

End state descriptions can be output for the whole family. Text is selected from an output menu.

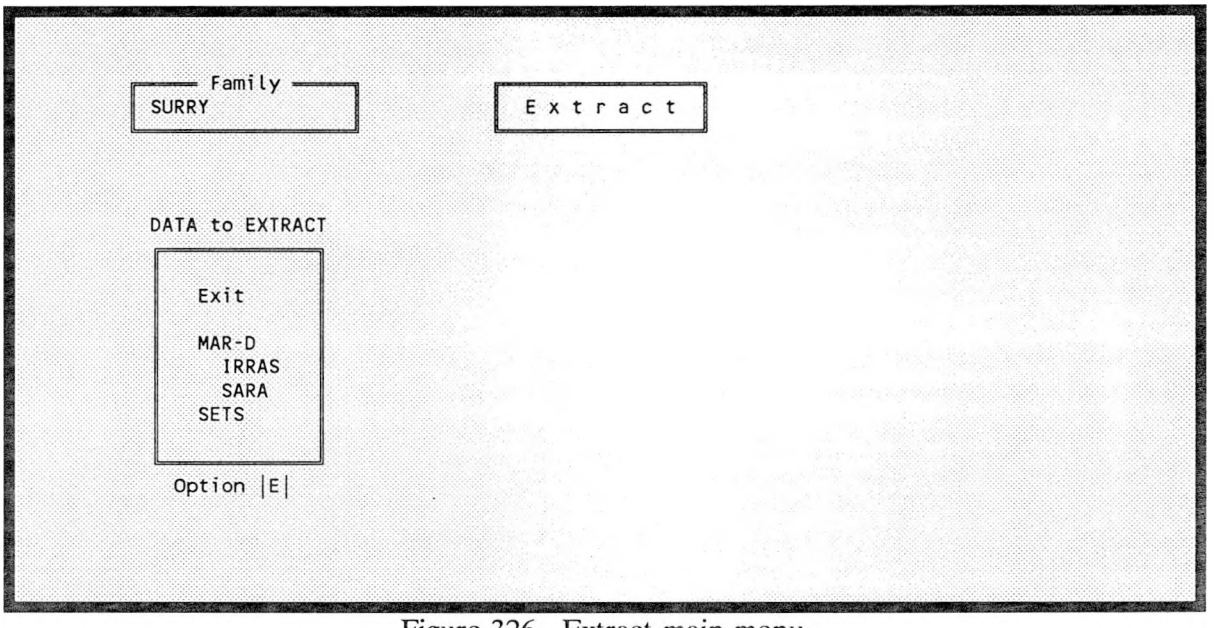


Figure 326. Extract main menu.

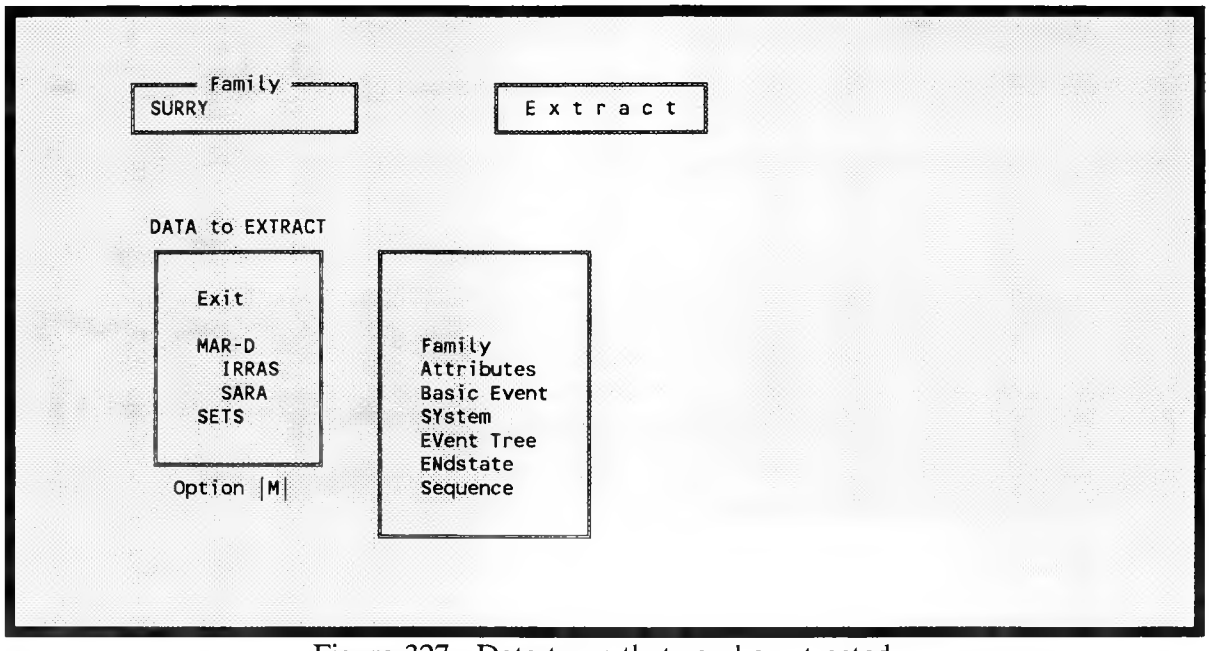


Figure 327. Data types that can be extracted.

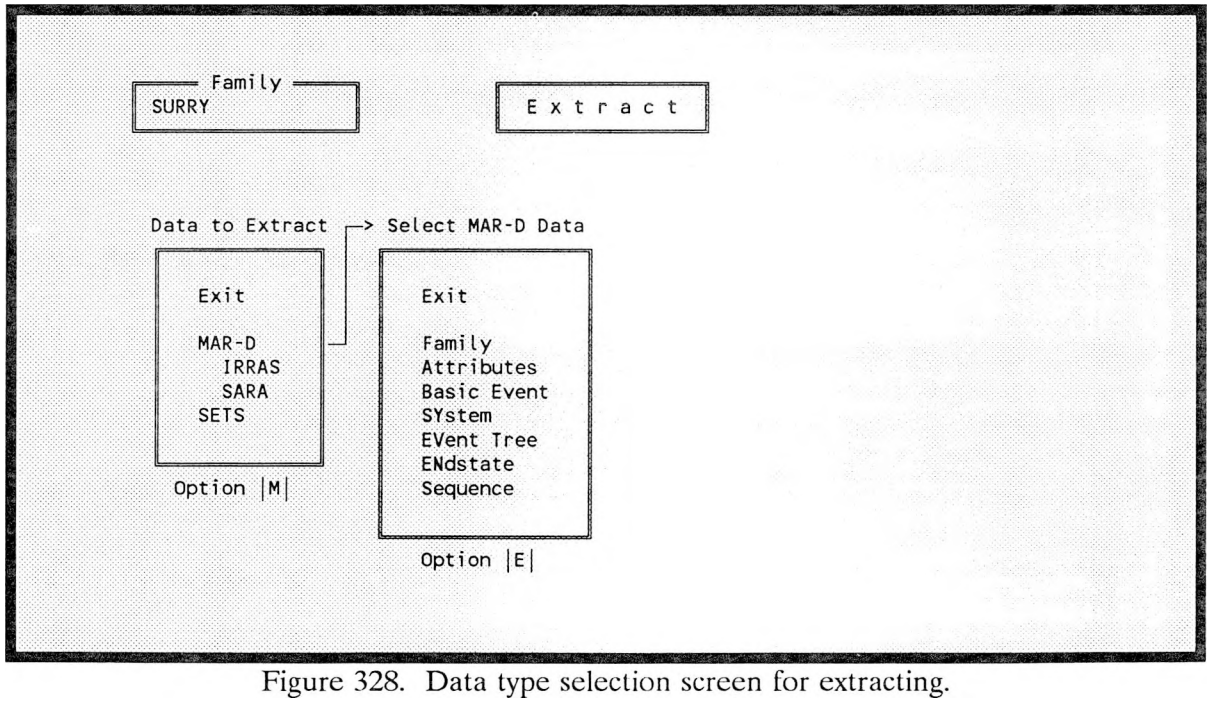


Figure 328. Data type selection screen for extracting.

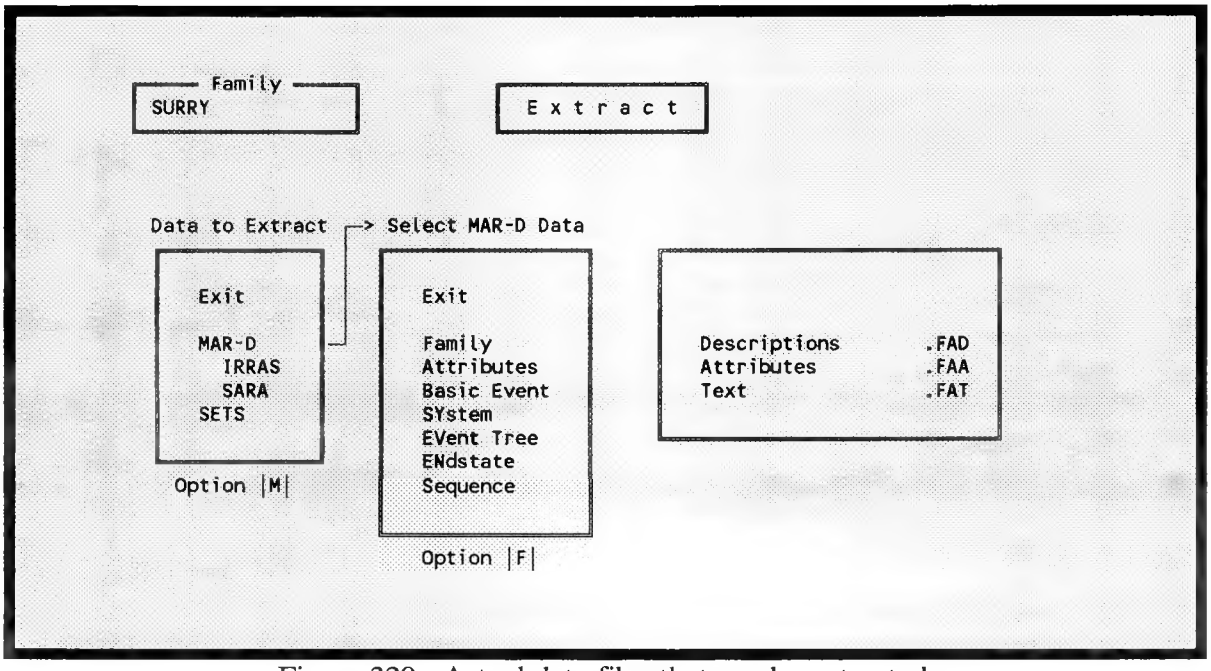


Figure 329. Actual data files that can be extracted.

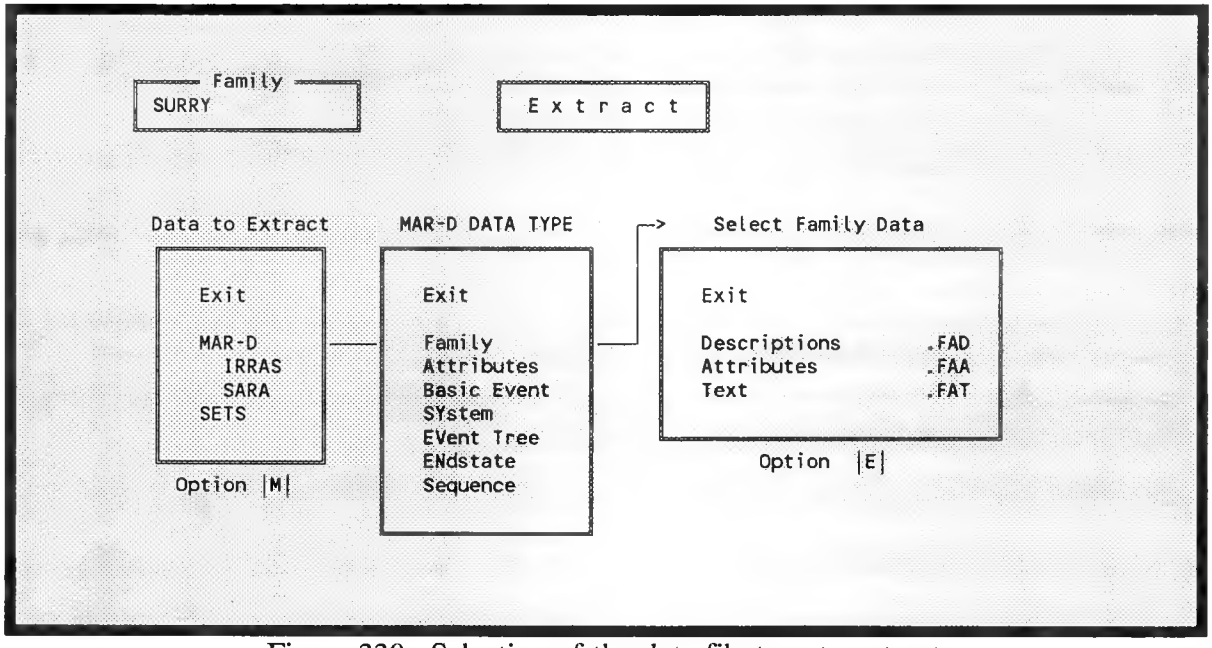


Figure 330. Selection of the data file type to extract.

10.4.7 Sequences

Sequence descriptions and attributes can be output for an entire family. Sequence cut sets, logic, and text must first have an event tree selected, then that event tree's sequences are displayed and can be output. If all event trees are selected, the sequences for each event tree will be output to a file with that event tree's name. If a single event tree is selected, the output sequence menu containing all of the sequences associated with that event tree will be displayed. If all of the sequences are selected, those sequences will be output to a single file with the event tree's name. If a single sequence is selected, it is output to a file with that sequence's name.

For further details see Models and Results Data Base User's Guide Ver. 2.0, October 1989, EGG-CATT-8249.

10.5 Version 1.0/2.5 Interface

This option allows you to convert data files created using IRRAS Version 1.0 software to IRRAS Version 2.5 or from Version 2.5 to Version 1.0. When you invoke this option, Figure 331 will be displayed. As shown, three options are available: Exit, 1 to 2, and 2 to 1. In addition, the following keys have special meaning:

<Esc> Returns to the Utilities Menu (Figure 316).

<←> Returns to the Utilities Menu (Figure 316).

<→> Selects the option currently highlighted (works like <Enter>).

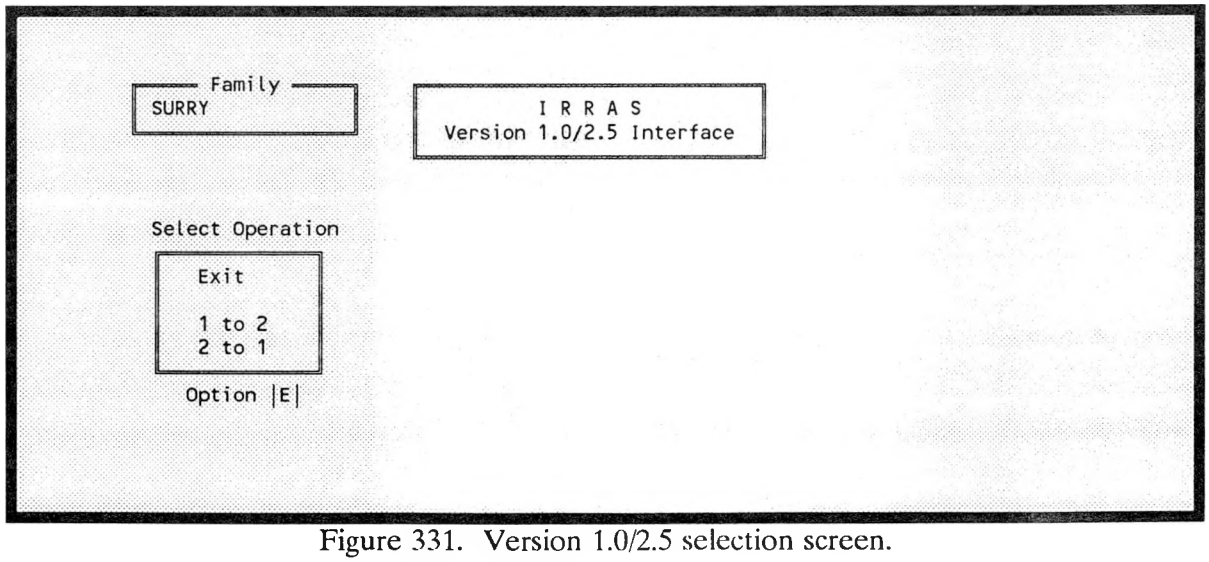


Figure 331. Version 1.0/2.5 selection screen.

10.5.1 Exit

This option returns you to the Utility Menu. To invoke this option, enter an <E> in the option field or highlight Exit and press <Enter>, or press the <Esc> key.

10.5.2 Convert 1.0 to 2.5

This option allows you to convert data files created with IRRAS version 1.0 into IRRAS version 2.5 data files. To invoke this option, type <1> in the option field, or highlight <1 to 2> and press <Enter> or <right arrow>. When you select this option, Figure 332 will be displayed. On this screen you must select what type of data to convert from Version 1.0 to Version 2.5. Five types of data files can be converted: Basic Event Failure Rates, Fault Tree Logic, System Cut Sets, Sequence Cut Sets, and Fault Tree Graphics.

10.5.2.1 Failure Rates. This option allows you to convert basic events and their failure rates generated in Version 1.0 to Version 2.5. Version 1.0 of IRRAS stored this information in files with a ".RAT" extension, one ".RAT" file per family. When you invoke this option, Figure 333 will be displayed, listing all 1.0 files with the ".RAT" extension. To invoke this option for a single ".RAT" file, enter an <L> in the option field, highlight the desired file name, and press <Enter>. To invoke this process for a group of files, mark the desired files using the function keys F2, F3, and F4, enter an <L> in the option field, and press <Enter>. To invoke this option for all ".RAT" files, clear all marked entries, enter an <L> in the option field, and press <Enter>. A message **Process all records? (Y/N)** will appear at the bottom of the screen. Type a <Y> to convert all files, or type an <N> to terminate the conversion.

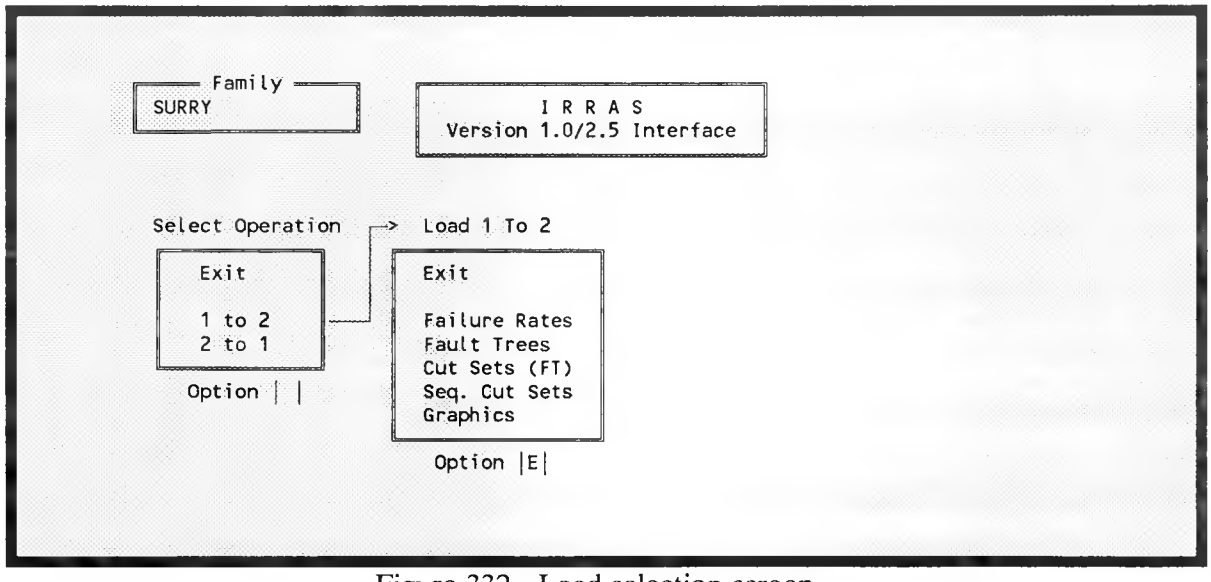


Figure 332. Load selection screen.

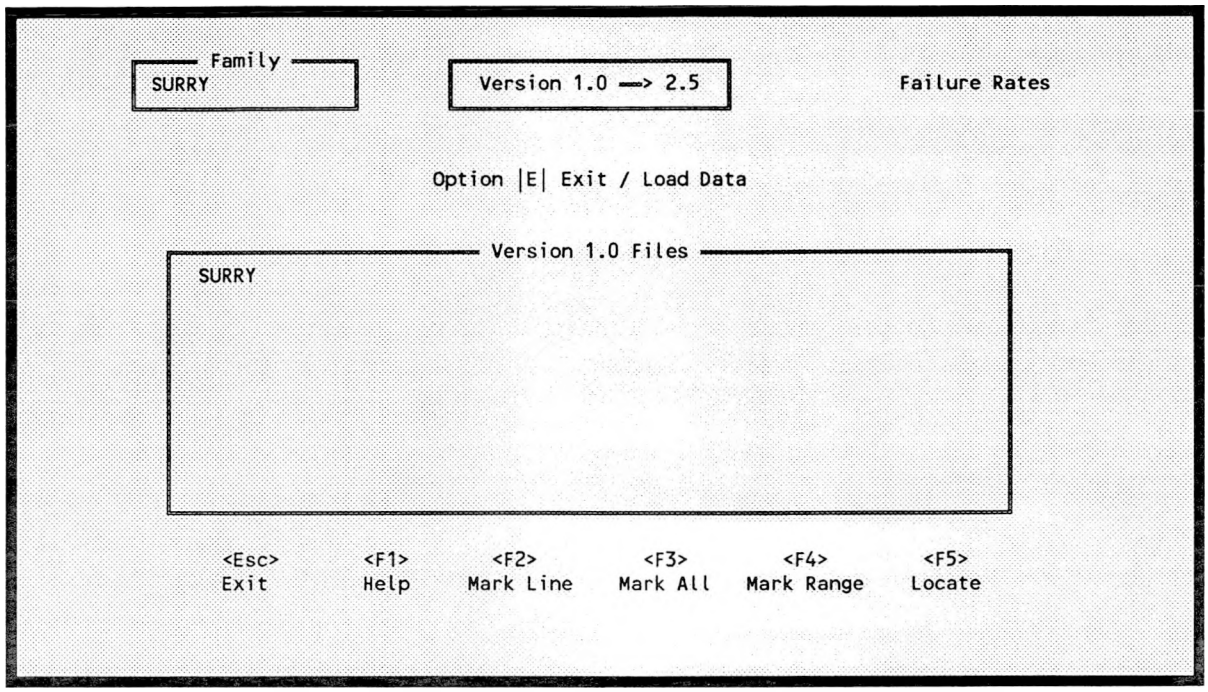


Figure 333. Family selection screen.

10.5.2.2 Fault Trees. This option allows you to convert fault tree logic generated in Version 1.0 to Version 2.5. Version 1.0 of IRRAS stored this information in files with a ".TRE" extension, one ".TRE" file per fault tree. When you invoke this option, Figure 334 will be displayed, listing all 1.0 files with the ".TRE" extension. To invoke this option for a single logic file, enter an <L> in the option field, highlight the desired file name, and press <Enter>. To invoke this process for a group of logic files, mark the desired files using the function keys F2, F3, and F4, enter an <L> in the option field, and press <Enter>. To invoke this option for all logic files, clear all marked entries, enter an <L> in the option field, and press <Enter>. A message **Process all records? (Y/N)** will appear at the bottom of the screen. Type a <Y> to convert all files, or type an <N> to terminate the conversion.

10.5.2.3 Cut Sets (FT). This option allows you to convert system cut sets generated in Version 1.0 to Version 2.5. Version 1.0 of IRRAS stored this information in files with a ".CUT" extension, one ".CUT" file per system. When you invoke this option, a screen similar to the one shown in Figure 334 will be displayed, listing all files with the ".CUT" extension. To invoke this option for a single cut set file, enter an <L> in the option field, highlight the desired file name, and press <Enter>. To invoke this process for a group of cut set files, mark the desired files using the function keys F2, F3, and F4, enter an <L> in the option field, and press <Enter>. To invoke this option for all cut set files, clear all marked entries, enter an <L> in the option field, and press <Enter>. A message **Process all records? (Y/N)** will appear at the bottom of the screen. Type a <Y> to convert all files, or type an <N> to terminate the conversion.

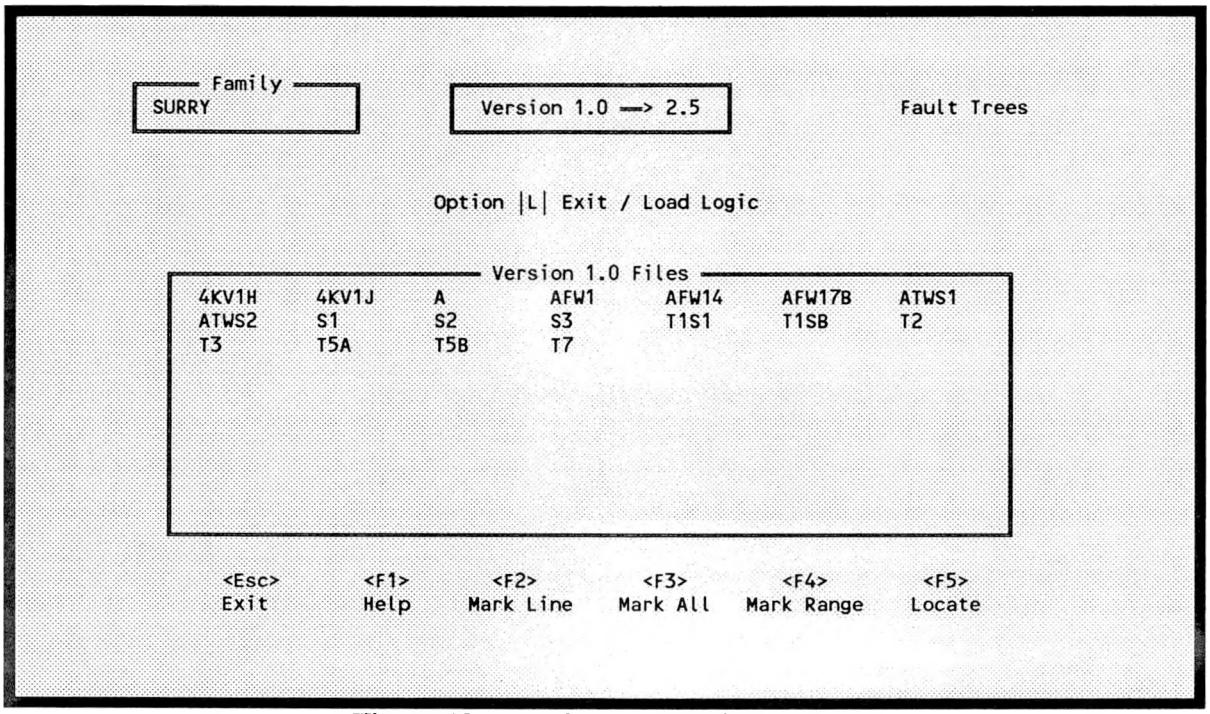


Figure 334. Fault tree selection screen.

10.5.2.4 Sequence Cut Sets. This option allows you to convert sequence cut sets generated in Version 1.0 to Version 2.5. Version 1.0 of IRRAS stored this information in files with a ".CUT" extension, one ".CUT" file per sequence. When you invoke this option, a screen similar to the one shown in Figure 334 will be displayed, listing all files with the ".CUT" extension. To invoke this option for a single cut set file, enter an <L> in the option field, highlight the desired file name, and press <Enter>. To invoke this process for a group of cut set files, mark the desired files using the function keys F2, F3, and F4, enter an <L> in the option field, and press <Enter>. To invoke this option for all cut set files, clear all marked entries, enter an <L> in the option field, and press <Enter>. A message **Process all records? (Y/N)** will appear at the bottom of the screen. Type a <Y> to convert all files, or type an <N> to terminate the conversion.

NOTE: **IRRAS Version 1.0 does not distinguish between system and sequence cut set files. They both have the same extension. Only those ".CUT" files that correspond to a system should be marked and loaded with the Cut Sets option. Also, only those ".CUT" files that correspond to a sequence should be loaded with the Sequence Cut Sets option.**

When you invoke this option you will be prompted to specify the event tree you wish to load the sequence cut sets under.

10.5.3 Convert 2.5 to 1.0

This option allows you to convert data files created with IRRAS version 2.5 into IRRAS version 1.0 data files. To invoke this option, type <2> in the option field, or highlight <2 to 1> and press <Enter> or <→>. When you select this option, Figure 335 will be displayed. On this screen you must select what type of data to convert from Version 2.5 to Version 1.0. Four types of data files can be converted: Basic Event Failure Rates, Fault Tree Logic, System Cut Sets, and Sequence Cut Sets.

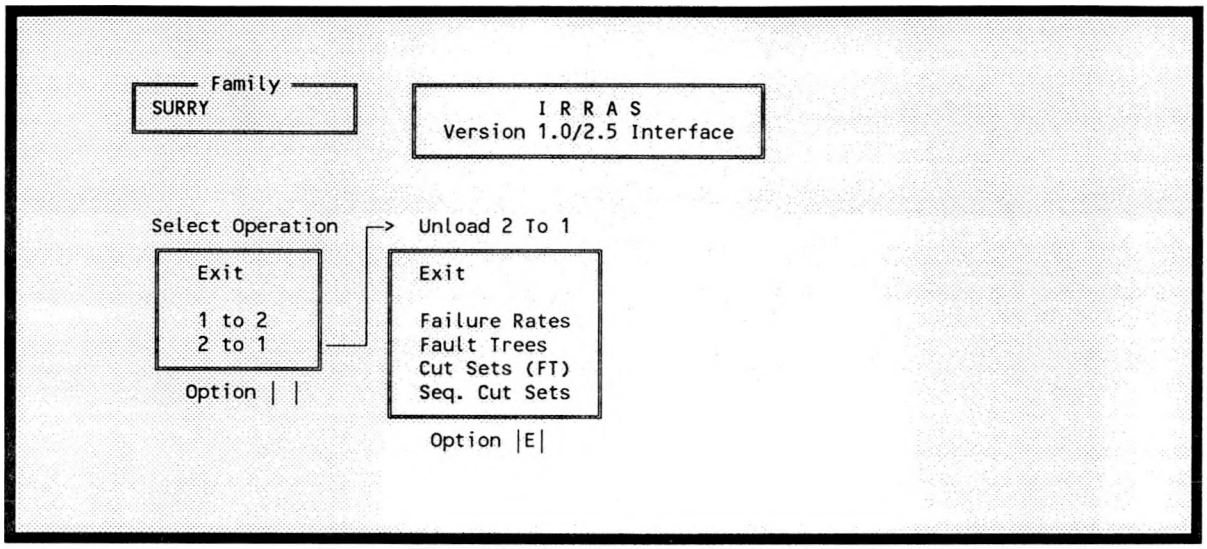


Figure 335. Version 2.5/1.0 selection screen.

10.5.3.1 Failure Rates. This option allows you to output basic event failure rates generated in Version 2.5 to a Version 1.0 compatible format (as ".RAT" files). To invoke this option, type an <F> in the option field, or highlight "Failure Rates" and press <Enter> or <→>. Figure 336 will be displayed. On this screen, you have three options: Exit, Current Probability Unload, or Base Probability Unload.

10.5.3.1.1 Exit. This option returns you to the 2 to 1 menu. To invoke this option type <E> in the option field and press <Enter>, or press the <Esc> key.

10.5.3.1.2 Current Probability Unload. This option unloads or outputs all the basic events of the current family along with the current probability for each of those events into the file specified by the output file name field with the ".RAT" extension. To invoke this option, enter a <C> in the option field, modify the output file name (if desired), and press <Enter>.

10.5.3.1.3 Base Probability Unload This option unloads or outputs all the basic events of the current family along with the base case probability for each of those events into the file specified by the output file name field with the ".RAT" extension. To invoke this option, enter a <B> in the option field, modify the output file name (if desired), and press <Enter>.

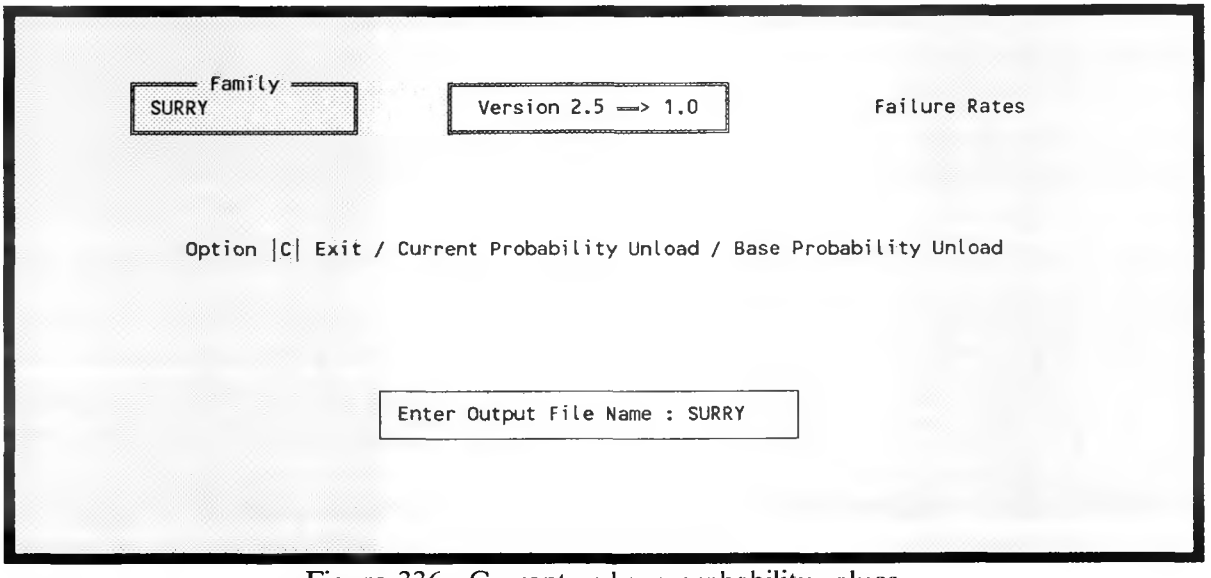


Figure 336. Current vs base probability values.

10.5.3.2 Fault Trees. This option allows you to output fault tree logic generated in Version 2.5 to a Version 1.0 compatible format (as ".TRE" files). To invoke this option, type a <T> in the option field, or highlight "Fault Trees" and press <Enter> or <→>. Figure 337 will be displayed listing all the fault trees in the current family. On this screen, you have three options: Exit, Logic, or Modified Logic.

10.5.3.2.1 Exit. This option returns you to the 2 to 1 menu. To invoke this option, type <E> in the option field and press <Enter>, or press the <Esc> key.

10.5.3.2.2 Logic. This option outputs the logic as it is stored in the Version 2.5 data base to a file with the ".TRE" extension appended to the first eight characters of the fault tree name. To invoke this option for a single fault tree, enter an <L> in the option field, highlight the desired fault tree, and press <Enter>. To invoke this process for a group of fault trees, mark the desired fault trees using the function keys F2, F3, and F4, enter an <L> in the option field, and press <Enter>. To invoke this option for all fault trees, clear all marked entries, enter an <L> in the option field, and press <Enter>. A message **Process all records? (Y/N)** will appear at the bottom of the screen. Type a <Y> to convert fault trees, or type an <N> to terminate the conversion.

10.5.3.2.3 Modified Logic This option outputs the modified logic from the Version 2.5 data base, to a file with the ".TRE" extension appended to the first eight characters of the fault tree name. The modified logic is the fault tree logic as it is modified by IRRAS Version 2.5 to generate minimal cut sets. To invoke this option for a single fault tree, enter an <M> in the option field, highlight the desired fault tree, and press <Enter>. To invoke this process for a group of fault trees, mark the desired fault trees using the function keys F2, F3, and F4, enter an <M> in the option field, and press <Enter>. To invoke this option for all fault trees, clear all marked entries, enter an <M> in the option field, and press <Enter>. A message **Process all records? (Y/N)** will appear at the bottom of the screen. Type a <Y> to convert fault trees, or type an <N> to

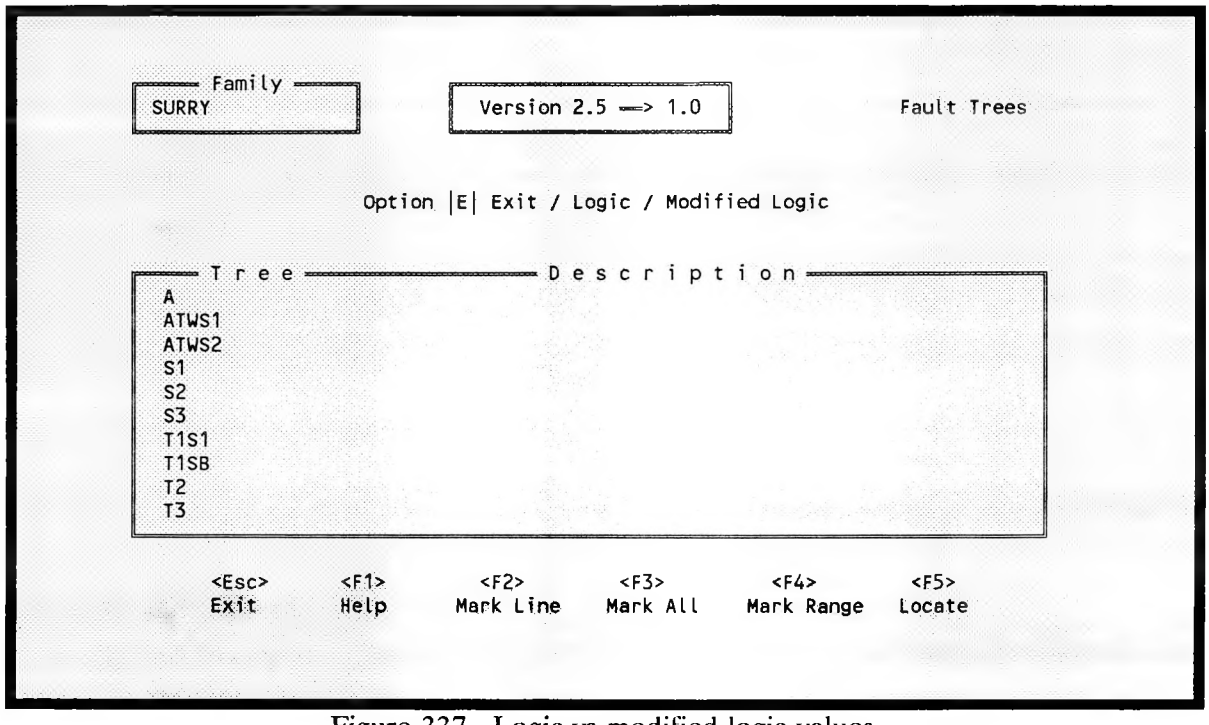


Figure 337. Logic vs modified logic values.

terminate the conversion.

10.5.3.3 Cut Sets. This option allows you to convert system cut sets generated by IRRAS Version 2.5 to Version 1.0 ".CUT" files. To invoke this option, type a <C> in the option field, or highlight "Cut Sets (FT)" and press <Enter> or <→>. Figure 338 will be displayed listing all the systems in the current family. On this screen, you have three options: Exit, Basecase, or Alternate.

10.5.3.3.1 Exit. This option returns you to the 2 to 1 menu. To invoke this option type <E> in the option field and press <Enter>, or press the <Esc> key.

10.5.3.3.2 Basecase. This option outputs the base case cut sets for the systems to files with the ".CUT" extension appended to the first eight characters of the system names. To invoke this option for a single system cut set, enter a <B> in the option field, highlight the desired system, and press <Enter>. To invoke this process for a group of system cut sets, mark the desired entries using the function keys F2, F3, and F4, enter a <B> in the option field, and press <Enter>. To invoke this option for all system cut sets, clear all marked entries, enter a <B> in the option field, and press <Enter>. A message **Process all records? (Y/N)** will appear at the bottom of the screen. Type a <Y> to convert all system cut sets, or type an <N> to terminate the conversion.

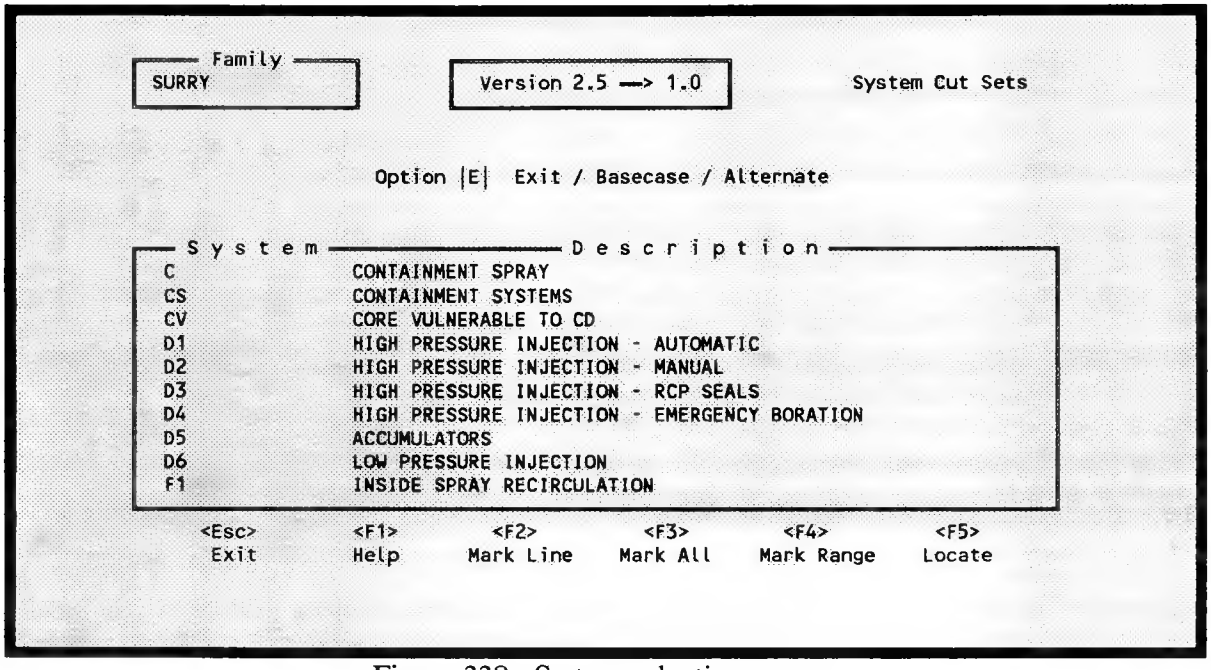


Figure 338. System selection screen.

10.5.2.3.3 Alternate This option outputs the alternate or temporary cut sets for the systems to files with the ".CUT" extension appended to the first eight characters of the system names. To invoke this option for a single system cut set, enter an <A> in the option field, highlight the desired system, and press <Enter>. To invoke this process for a group of system cut sets, mark the desired entries using the function keys F2, F3, and F4, enter an <A> in the option field, and press <Enter>. To invoke this option for all system cut sets, clear all marked entries, enter an <A> in the option field, and press <Enter>. A message **Process all records? (Y/N)** will appear at the bottom of the screen. Type a <Y> to convert all system cut sets, or type an <N> to terminate the conversion.

10.5.3.4 Sequence Cut Sets. This option allows you to convert sequence cut sets generated by IRRAS Version 2.5 to Version 1.0 ".CUT" files. To invoke this option, type an <S> in the option field, or highlight "Seq. Cut Sets" and type <Enter> or <→>. Figure 339 will be displayed listing all the sequences in the current family. On this screen, you have three options: Exit, Basecase, or Alternate.

10.5.3.4.1 Exit. This option returns you to the 2 to 1 menu. To invoke this option type <E> in the option field and press <Enter>, or press the <Esc> key.

10.5.3.4.2 Basecase. This option outputs the base case cut sets for the sequences to files with the ".CUT" extension appended to the first eight characters of the sequence names. To invoke this option for a single sequence cut set, enter a <B> in the option field, highlight the desired sequence, and press <Enter>. To invoke this process for a group of sequence cut sets, mark the desired entries using the function keys F2, F3, and F4, enter a <B> in the option field, and press

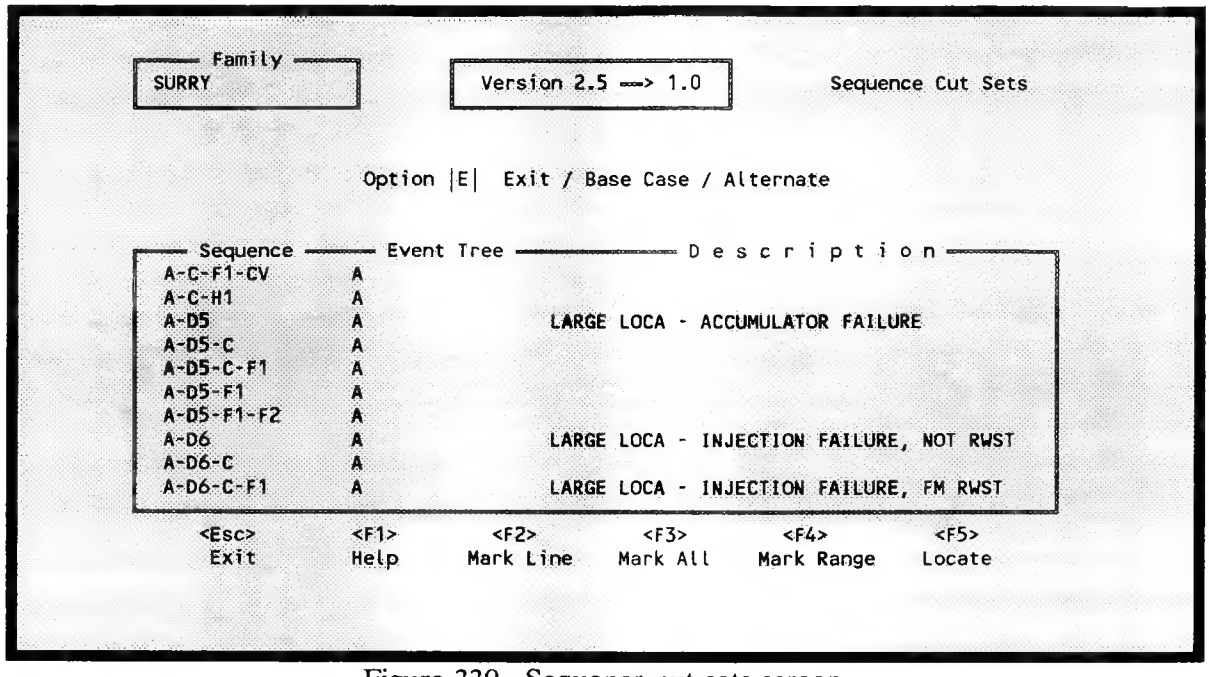


Figure 339. Sequence cut sets screen.

<Enter>. To invoke this option for all sequence cut sets, clear all marked entries, enter a <B> in the option field, and press <Enter>. A message **Process all records? (Y/N)** will appear at the bottom of the screen. Type a <Y> to convert all sequence cut sets, or type an <N> to terminate the conversion.

10.5.2.4.3 Alternate This option outputs the alternate or temporary cut sets for the sequence to files with the ".CUT" extension appended to the first eight characters of the sequence names. To invoke this option for a single sequence cut set, enter an <A> in the option field, highlight the desired sequence, and press <Enter>. To invoke this process for a group of sequence cut sets, mark the desired entries using the function keys F2, F3, and F4, enter an <A> in the option field, and press <Enter>. To invoke this option for all sequence cut sets, clear all marked entries, enter an <A> in the option field, and press <Enter>. A message **Process all records? (Y/N)** will appear at the bottom of the screen. Type a <Y> to convert all sequence cut sets, or type an <N> to terminate the conversion.

NOTE: **IRRAS Version 1.0 does not distinguish between system and sequence cut set files. They both have the same extension. If a sequence and a system have the same name (through the first eight characters), the last one unloaded will overwrite any of the same name.**

10.6 Recover Data Base

NOTE: **Before recovering the data base, it is suggested that you backup the *.DFL files and corresponding data files (*.IDX , *.DAT, and *.BLK) in the directory of the family to be rebuilt.**

The Recover Data Base <R> option allows you to restructure the data base and re-index the data. Some indications that a data base rebuild is necessary include:

1. Data elements such as events/systems have been deleted and seem to reappear
2. During cut set generation or update, the min cut upper bound seems surprisingly high
3. Cross Reference reports show/don't show events being used properly
4. Events/systems that don't appear to be referenced cannot be deleted, and
5. After a software version update.

You may rebuild the data base anytime because the rebuild process compacts the data and generally helps the software run faster. The screen shown in Figure 340 appears when this option is selected. As shown, several different recovery methods are available. Each method is discussed in the following paragraphs.

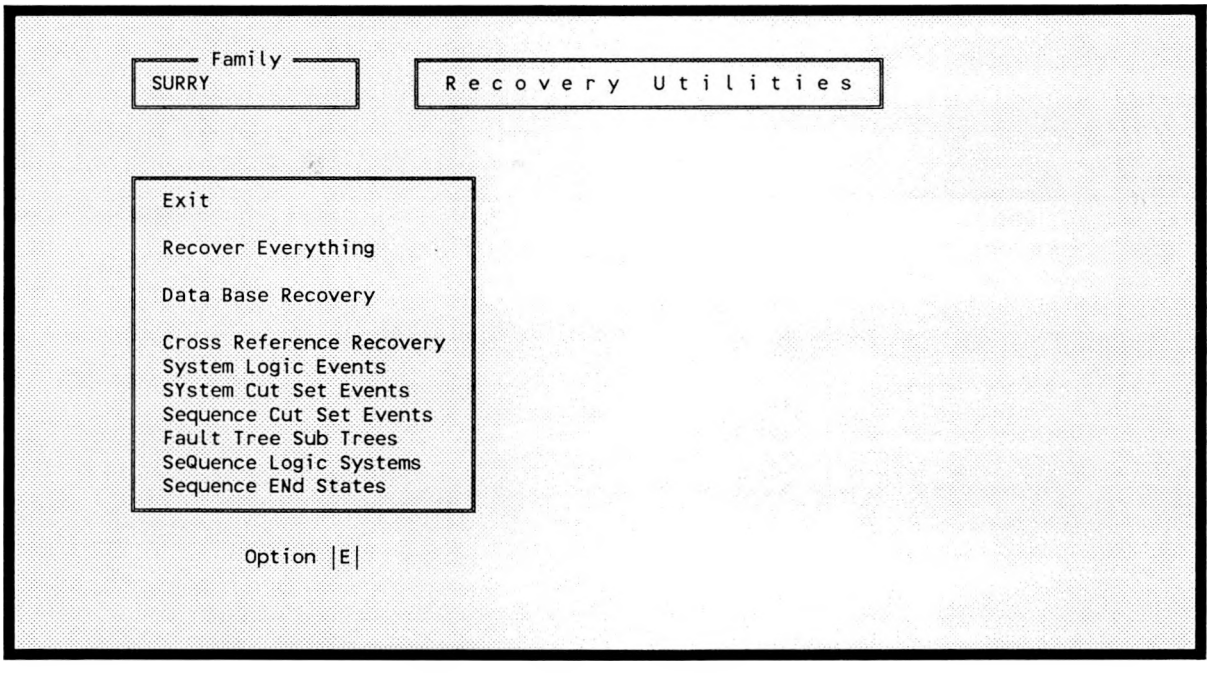


Figure 340. Recover data base selection screen.

10.6.1 Recover Everything

This option performs all the recovery methods shown on the screen. This option will recover all key indexes and then recover the cross references. This option will take several minutes to complete. If your data base has not been damaged, this option will restructure and optimize your data base.

To invoke this option, highlight Recover Everything or enter an <R> in the option field and press <Enter>. When you invoke this option, a warning screen will be displayed (see Figure 341). At the prompt, enter a <Y> and press <Enter> to continue with the recovery, or enter an <N> and press <Enter> to terminate the process.

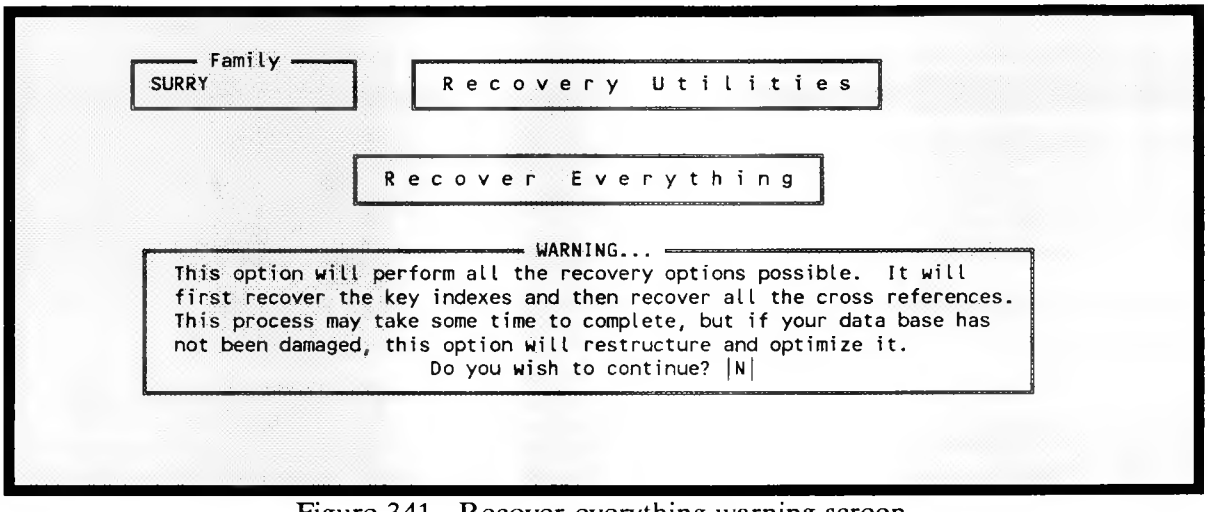


Figure 341. Recover everything warning screen.

10.6.2 Data Base Recovery

This option rebuilds all the files contained in your data base. If you think your data base has been damaged, use this option to recover all data files. If your data base has not been damaged, this option will restructure and optimize your data base.

To invoke this option, enter a <D> in the option field or highlight Data Base Recovery and press <Enter>. When you invoke this option, a warning screen will be displayed (see Figure 342). At the prompt, enter a <Y> and press <Enter> to continue with the recovery, or enter an <N> and press <Enter> to terminate the process.

10.6.3 System Logic Events

This option rebuilds the system logic events cross reference list. Each system's logic record is read and each event used is tracked. If no logic exists for a system, the list is cleared, and a message will be displayed on the screen, and the recovery process will continue. If an event is referenced, but not used, it will be added.

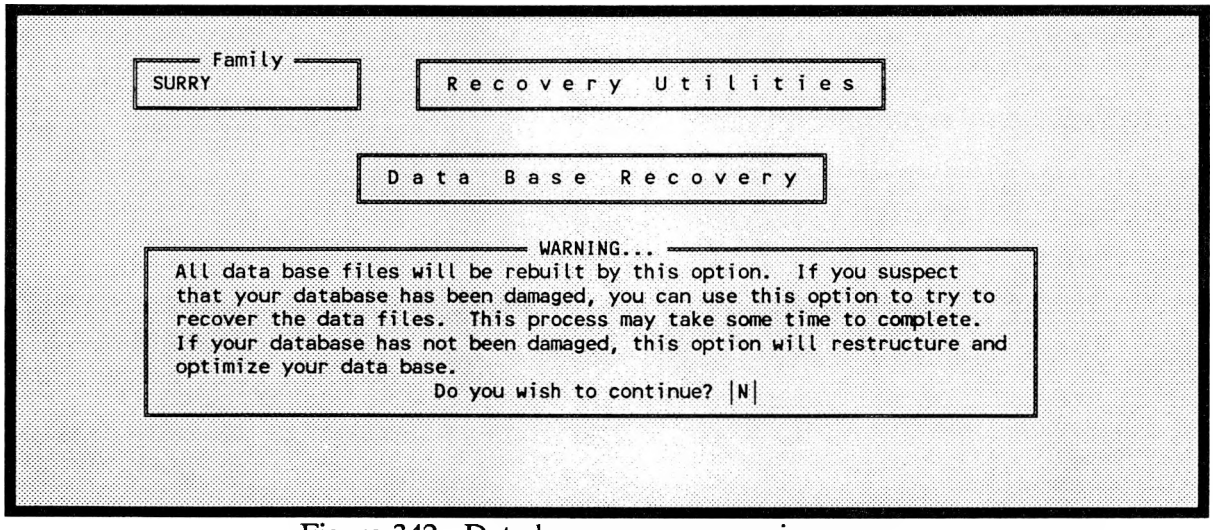


Figure 342. Data base recovery warning screen.

To invoke this option, enter an <L> in the option field or highlight System Logic Events and press <Enter>. When you invoke this option, a warning screen will be displayed (see Figure 343). At the prompt, enter a <Y> and press <Enter> to continue with the recovery, or enter an <N> and press <Enter> to terminate the process.

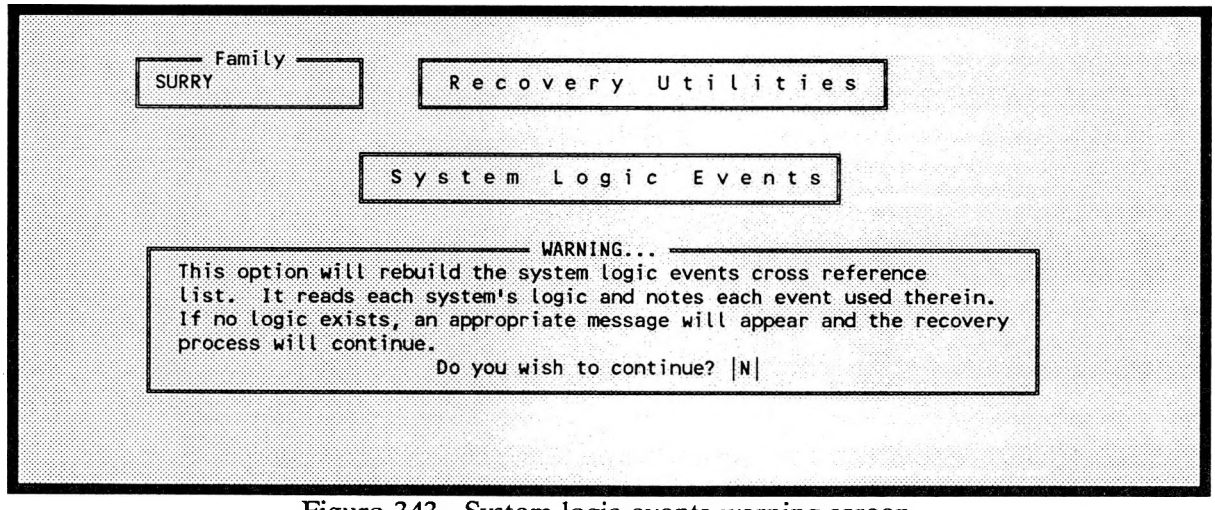


Figure 343. System logic events warning screen.

10.6.4 System Cut Set Events

This option rebuilds the system cut set events cross reference list. Each system's base and current cut sets are read. The program tracks each event used. If no cut sets exist for a system, a message will be displayed on the screen and the recovery process will continue. If an event is referenced but not used, it will be added.

To invoke this option, enter an <Y> in the option field or highlight System Cut Sets Events and press <Enter>. When you invoke this option, a warning screen will be displayed (see Figure 344). At the prompt, enter a <Y> and press <Enter> to continue with the recovery, or enter an <N> and press <Enter> to terminate the process.

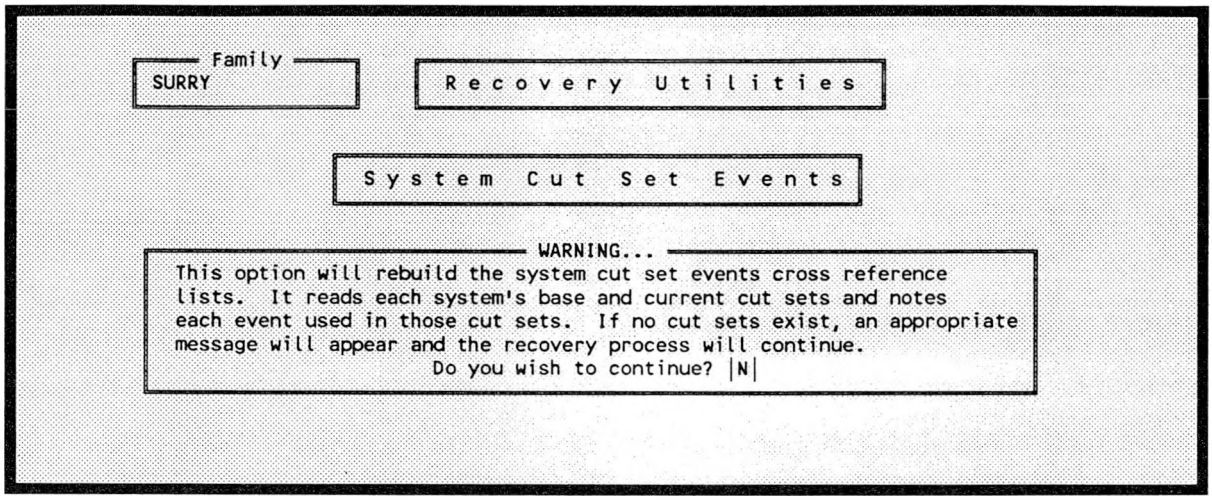


Figure 344. System cut set events warning screen.

10.6.5 Sequence Cut Set Events

This option rebuilds the sequence cut set events cross reference list. Each sequence's base and current cut sets are read. The program tracks each event used. If no cut sets exist for a sequence, a message will be displayed on the screen and the recovery process will continue. If an event is referenced but not used, it will be added.

To invoke this option, enter an <S> in the option field or highlight Sequence Cut Sets Events and press <Enter>. When you invoke this option, a warning screen will be displayed (see Figure 345). At the prompt, enter a <Y> and press <Enter> to continue with the recovery, or enter an <N> and press <Enter> to terminate the process.

10.6.6 Fault Tree Sub Trees

This option rebuilds the fault tree subtree cross reference list. Each fault tree graphic relation's logic is read. The program notes any transfer in that logic. If a subtree is referenced, but does not exists in the data base, that subtree will be added to the data base.

To invoke this option, enter an <F> in the option field or highlight Fault Tree Subtrees and press <Enter>. When you invoke this option, a warning screen will be displayed (see Figure 346). At the prompt, enter a <Y> and press <Enter> to continue with the recovery, or enter an <N> and press <Enter> to terminate the process.

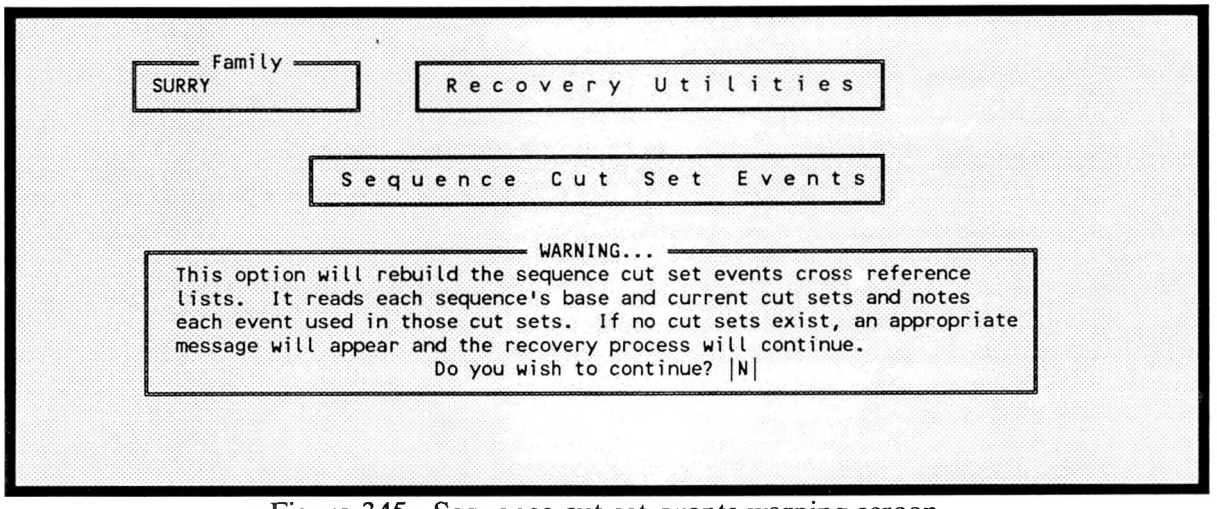


Figure 345. Sequence cut set events warning screen.

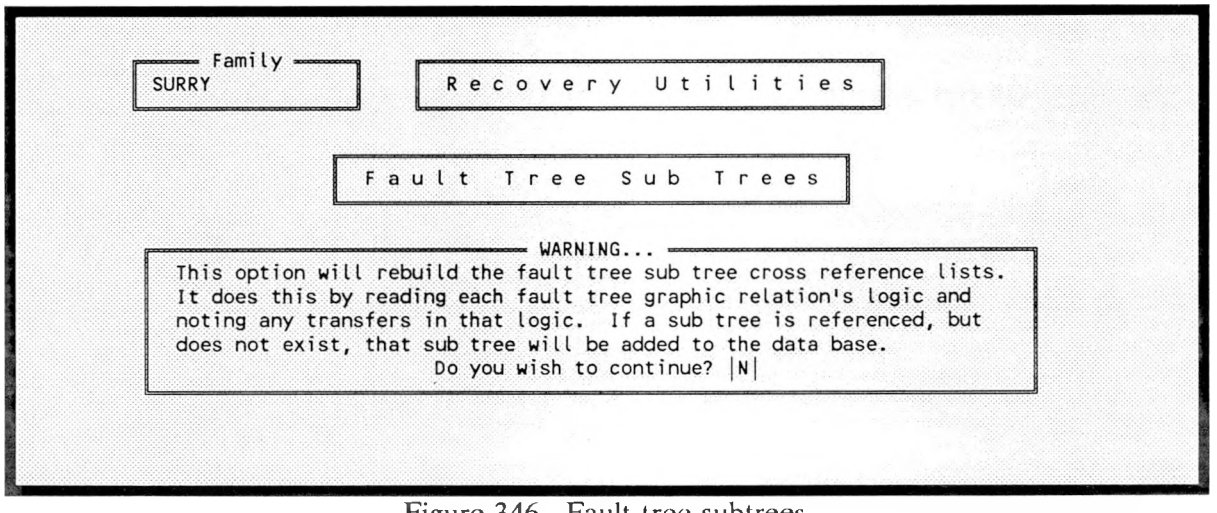


Figure 346. Fault tree subtrees.

10.6.7 Sequence Logic Systems

This option rebuilds the sequence logic systems cross reference list. Each sequence's logic is read and each system used is noted. If no logic exists a message will be displayed and the recovery process will continue.

To invoke this option, enter a <Q> in the option field or highlight Sequence Logic Systems and press <Enter>. When you invoke this option, a warning screen will be displayed (see Figure 347). At the prompt, enter a <Y> and press <Enter> to continue with the recovery, or enter an <N> and press <Enter> to terminate the process.

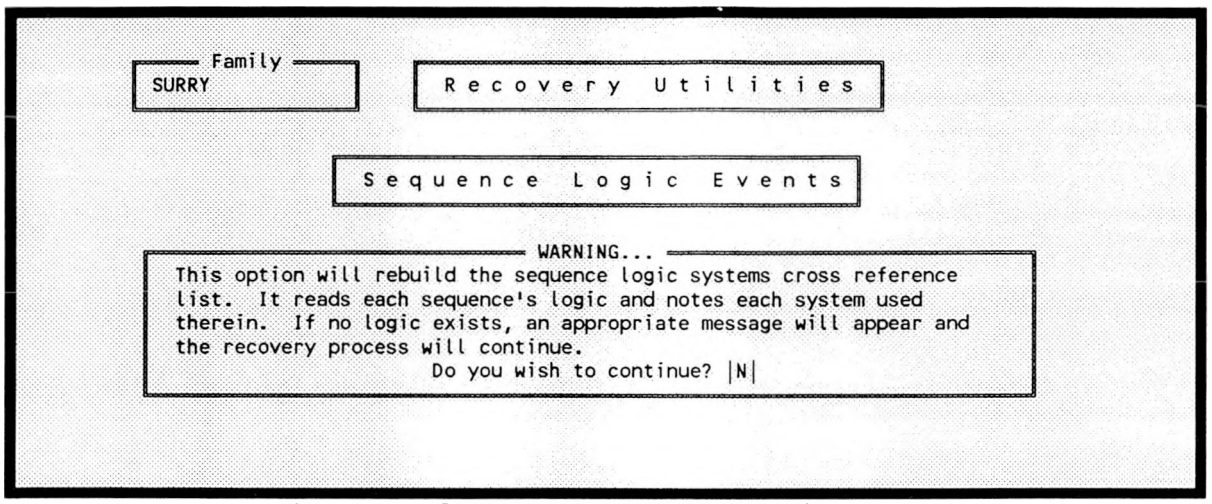


Figure 347. Sequence logic systems warning screen.

10.6.8 Sequence ENd States

This option actually checks that the end states for each sequence is contained in the end state relation. Each sequence is read and each end state is noted. If a referenced end state does not exists, it will be added to the end state relation and the recovery process will continue.

To invoke this option, enter a <Q> in the option field or highlight Sequence End States and press <Enter>. When you invoke this option, a warning screen will be displayed (see Figure 348). At the prompt, enter a <Y> and press <Enter> to continue with the recovery, or enter an <N> and press <Enter> to terminate the process.

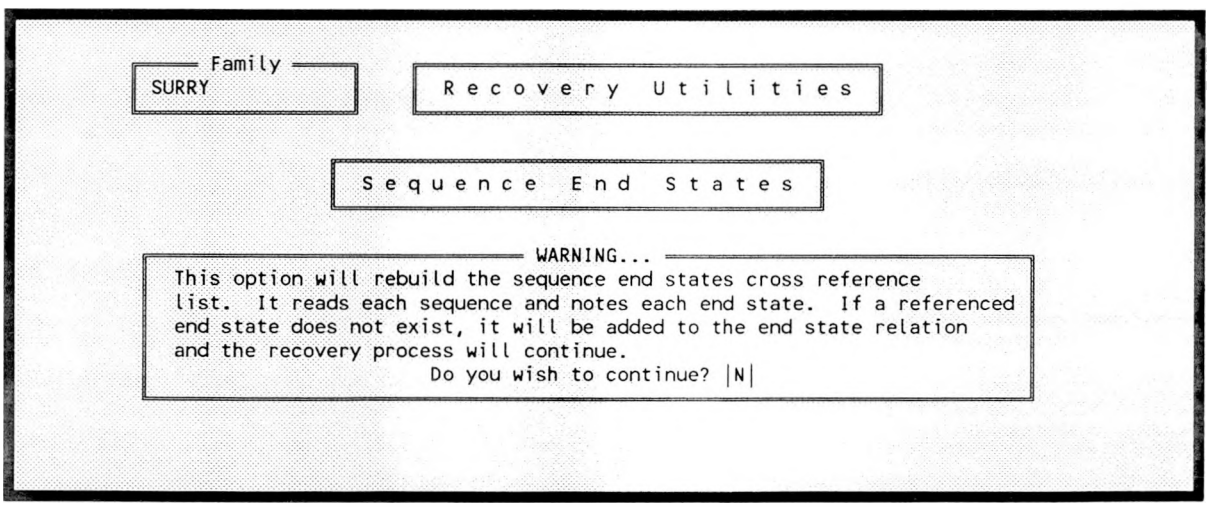


Figure 348. Sequence end states warning screen.

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APPENDIX A

HARDWARE REQUIREMENTS AND INSTALLATION PROCEDURE

APPENDIX A

HARDWARE REQUIREMENTS AND INSTALLATION PROCEDURE

The IRRAS 2.5 system requires the following hardware configurations:

IBM-PC/XT/AT PS2 or 100% compatible 640K main memory
DOS 3.3 or later
20M hard disk (minimum)
Math co-processor (optional)
16 color enhanced monitor (EGA or better)
graphics input devices - keyboard or mouse.

If an enhanced graphics adapter is used, it must have the memory expansion option to extend the standard 4 colors to 16. This option is an upgrade to the IBM EGA board, but is usually standard on boards manufactured by other vendors. IRRAS 2.5 does not support the 4-color mode on the EGA adapter.

The recommended configuration contains a VGA color monitor and adapter, a mouse as the graphics input device, and a math co-processor. The keyboard can serve as the graphics input device but is not nearly as user-friendly as the mouse. IRRAS will not run as fast if a math co-processor is not present.

NOTE: The IRRAS 2.5 system requires the above specified amount of random access memory (RAM). This memory must be available for the program and not used by memory resident programs, such as "Side-Kick". Also certain memory resident programs may interfere with the execution of IRRAS 2.5. These should be unloaded before using IRRAS 2.5. The MS/DOS command "CHKDSK" can be used to display the amount of memory available on your machine.

To install the system on your hard drive C, put the #1 diskette in drive A and type A:INSTALL C: <Enter>. For PS2 users with an external 5 1/4" drive, use the MS/DOS Command ASSIGN to assign your external drive as the A drive. You will be prompted when you should insert the remaining disks. Be certain to insert the disks in the order specified in the installation procedure. The directories \PRADATA\DEMO, and \HALO88 will be created and loaded with the appropriate software.

NOTE: You must have at least 6.5 megabytes of disk storage on your destination disk before installing IRRAS.

After the installation is completed, you need to locate and modify your CONFIG.SYS file. This file is in the root directory. If you do not have a file by this name, you must create one. In either case, the following parameters must be included in the file, if not already present.

```
FILES=20
BUFFERS=15
DEVICE=ANSI.SYS
```

The device driver ANSI.SYS must also be copied from the DOS directory to the root directory if it is not already there.

The installation procedure will create a batch procedure, IRRAS.BAT, for executing IRRAS 2.5 in the \PRADATA directory. This procedure may be used directly or adapted to meet your specific needs. If you choose not to modify the procedure, the following format is used to execute IRRAS 2.5. Type:

```
CD\PRADATA
IRRAS
```

This completes the installation of the IRRAS 2.5 software. The user must now ensure that the proper graphics input device is hooked up and ready for use. When this is done, the IRRAS 2.5 system is ready for use. Refer to Section 10.2 for a discussion on defining constants for your configuration.

APPENDIX B

DATA BASE RELATIONS

APPENDIX B

DATA BASE RELATIONS

This appendix contains a detailed description of each relation used by IRRAS 2.5. It contains the field names and their characteristics. This appendix also defines which fields serve as primary and alternate keys for the relations.

Both permanent and temporary relations are included. Permanent relations have non-zero file numbers and have .DAT, .IDX, and .BLK disk files associated with them. Temporary relations have a file number of zero and do not have any disk files.

RECORD REPORT FOR IRRAS

--- 1 ---

Record Name : EndState
Description : End state record
Fields : 8
Byte Length : 82
File Number : 9
Data File : ENDSTATE.DAT
Index File : ENDSTATE.IDX
Block File : ENDSTATE.BLK

Field Name	Description/Type	Length	Key Type	Sub-Fields	Repeat	Decimals
Des	End State Description 1 (Alphanumeric)	60	Non-keyed		1	
Free	Free endstate flag 2 (Upper Case Alphanumeric)	1	Non-keyed		1	
Name	End state name 2 (Upper Case Alphanumeric)	16	Non-keyed		1	
NameKey	End state name key 0 (Concatenated)	17	Primary		1	
NumKey	End State Number Key 0 (Concatenated)	5	Primary		1	
Number	End State Number 3 (Integer)	4	Non-keyed		1	
Success	End state success? (Y/N) 11 (Boolean) (Y/N)	1	Non-keyed		1	
Text	End state descrip. text 12 (Variable Block Data)	4	Non-keyed		1	

RECORD REPORT FOR IRRAS

--- 2 ---

Record Name : EvAttr
Description : Event attribute record
Fields : 4
Byte Length : 67
File Number : 1
Data File : EVATTR.DAT
Index File : EVATTR.IDX
Block File : EVATTR.BLK

Field Name	Description/Type	Length	Key Type	Sub-Fields	Repeat	Decimals
Des	Code description 1 (Alphanumeric)	60	Non-keyed		1	
Name	Alpha code for attribute 2 (Upper Case Alphanumeric)	5	Non-keyed		1	
NameKey	Event Attribute name key 0 (Concatenated)	6	Primary	Type	1	
Type	Attribute data type 1 (Alphanumeric)	1	Non-keyed		1	

RECORD REPORT FOR IRRAS

--- 3 ---

Record Name : EvenTemp
Description : Temp. change event data record
Fields : 19
Byte Length : 80

Field Name	Description/Type	Length	Key Type	Sub-Fields	Repeat	Decimals
Attribut	Event attributes 11 (Boolean) (Y/N)	2	Non-keyed		16	
CompId	Component identifier 2 (Upper Case Alphanumeric)	7	Non-keyed		1	
Failure	Event failure mode 2 (Upper Case Alphanumeric)	2	Non-keyed		1	
FdType	Failure data calc type 2 (Upper Case Alphanumeric)	1	Non-keyed		1	
GroupNam Non-keyed	 2 (Upper Case Alphanumeric)	Event group identifier 1			16	
Init	Initiating event y/n 11 (Boolean) (Y/N)	1	Non-keyed		1	
Lambda	Event lambda value 5 (Floating Point Scientific)	5 3	Non-keyed		1	
Location	Event location 2 (Upper Case Alphanumeric)	3	Non-keyed		1	
MissionT	Event mission time 5 (Floating Point Scientific)	5	Non-keyed		1	3
Name	Primary event name 2 (Upper Case Alphanumeric)	16	Non-keyed		1	

RECORD REPORT FOR IRRAS

Field Name	Description/Type	Length	Key Type	Sub-Fields	Repeat	Decimals
Number	Event number 3 (Integer)	4	Non-keyed		1	
Prob	Event failure probability 5 (Floating Point Scientific)	5	Non-keyed		1	3
System	Event system 2 (Upper Case Alphanumeric)	3	Non-keyed		1	
Tau	Event tau value 5 (Floating Point Scientific)	5	Non-keyed		1	3
Train	Event Train 2 (Upper Case Alphanumeric)	2	Non-keyed		1	
Type	Event type 2 (Upper Case Alphanumeric)	3	Non-keyed		1	
UdClass	Uncertainty dist. cor. class 2 (Upper Case Alphanumeric)	4	Non-keyed		1	
UdType	Uncertainty distribution type 2 (Upper Case Alphanumeric)	1	Non-keyed		1	
UdValue	Uncertainty dist. para. value 5 (Floating Point Scientific)	5	Non-keyed		1	3

RECORD REPORT FOR IRRAS

--- 4 ---

Record Name : Event
Description : Event data record
Fields : 26
Byte Length : 153
File Number : 2
Data File : EVENT.DAT
Index File : EVENT.IDX

Field Name	Description/Type	Length	Key Type	Sub-Fields	Repeat	Decimals
AltKey	Alternate name key 0 (Concatenated)	17	Primary		1	
AltName	Alternate event name 2 (Upper Case Alphanumeric)	16	Non-keyed		1	
Attribut	Event attributes 11 (Boolean) (Y/N)	2	Non-keyed		16	
CompId	Component identifier 2 (Upper Case Alphanumeric)	7	Non-keyed		1	
Des	Event description 1 (Alphanumeric)	60	Non-keyed		1	
Failure	Event failure mode 2 (Upper Case Alphanumeric)	2	Non-keyed		1	
FdType	Failure data calculation type 2 (Upper Case Alphanumeric)	1	Non-keyed		1	
Free	Free event status - "0/1" 1 (Alphanumeric)	1	Non-keyed		1	
GroupKey	Event group key 0 (Concatenated)	17	Alternate		1	
GroupNam	Event group identifier 2 (Upper Case Alphanumeric)	16	Non-keyed		1	

RECORD REPORT FOR IRRAS

Field Name	Description/Type	Length	Key Type	Sub-Fields	Repeat	Decimals
Init	initiating event y/n 11 (Boolean) (Y/N)	1	Non-keyed		1	
Lambda	Event lambda value 5 (Floating Pt. Scientific)	5	Non-keyed		1	3
Location	Event location 2 (Upper Case Alphanumeric)	3	Non-keyed		1	
MissionT	Event mission time 5 (Floating Point Scientific)	5	Non-keyed		1	3
Name	Primary event name 2 (Upper Case Alphanumeric)	16	Non-keyed		1	
NameKey	Name key 0 (Concatenated)	17	Primary		1	
NumKey	Number key 0 (Concatenated)	5	Primary		1	
Number	Event number 3 (Integer)	4	Non-keyed		1	
Prob	Event failure probability 5 (Floating Point Scientific)	5	Non-keyed		1	3
System	Event system 2 (Upper Case Alphanumeric)	3	Non-keyed		1	
Tau	Event tau value 5 (Floating Point Scientific)	5	Non-keyed		1	3
Train	Event Train 2 (Upper Case Alphanumeric)	2	Non-keyed		1	
Type	Event type 2 (Upper Case Alphanumeric)	3	Non-keyed		1	

RECORD REPORT FOR IRRAS

Field Name	Description/Type	Length	Key Type	Sub-Fields	Repeat	Decimals
UdClass	Uncertainty dist. cor. class 2 (Upper Case Alphanumeric)	4	Non-keyed		1	
UdType	Uncertainty distribution type 2 (Upper Case Alphanumeric)	1	Non-keyed		1	
UdValue	Uncertainty dist. para. value 5 (Floating Point Scientific)	5	Non-keyed		1	3

Record Name : EventCng
Description : Event changes
Fields : 7
Byte Length : 87
File Number : 3
Data File : EVENTCNG.DAT
Index File : EVENTCNG.IDX
Block File : EVENTCNG.BLK

Field Name	Description/Type	Length	Key Type	Sub-Fields	Repeat	Decimals
Date	Date of event changes 7 (Date) (yyyy/mm/dd)	10	Non-keyed		1	
Des	Event grp change desc 1 (Alphanumeric)	60	Non-keyed		1	
EvClass	Event class chnages 12 (Variable Block Data)	4	Non-keyed		1	
EvProb	Event probab changes 12 (Variable Block Data)	4	Non-keyed		1	
Name	Name of evt chnge grp 2 (Upper Case Alphanumeric)	16	Primary	20 5	1	
Order	Change applic order 3 (Integer)	2	Non-keyed		1	
OrderKey	Prime order key 0 (Concatenated)	20	Primary		1	

Record Name : Eventree
Description : Event tree information record
Fields : 10
Byte Length : 87
File Number : 4
Data File : EVENTREE.DAT
Index File : EVENTREE.IDX
Block File : EVENTREE.BLK

Field Name	Description/Type	Length	Key Type	Sub-Fields	Repeat	Decimals
Des	Event tree description 1 (Alphanumeric)	60	Non-keyed		1	
Free	Free event tree flag 1 (Alphanumeric)	1	Non-keyed		1	
Init	Initiating event num 3 (Integer)	4	Non-keyed		1	
InitKey	Init. event num key 0 (Concatenated)	5	Alternate	20 5 Init	1	
Links	Fault tree links 12 (Variable Block Data)	4	Non-keyed		1	
Name	Event tree name 2 (Upper Case Alphanumeric)	16	Non-keyed		1	
NameKey	Event tree name key 0 (Concatenated)	17	Primary		1	
NumKey	Event tree number key 0 (Concatenated)	5	Primary		1	
Number	Event tree number 3 (Integer)	4	Non-keyed		1	
Text	Event tree desc text 12 (Variable Block Data)	4	Non-keyed		1	

RECORD REPORT FOR IRRAS

--- 7 ---

Record Name : Family
Description : Family data record
Fields : 37
Byte Length : 223
File Number : 5
Data File : FAMILY.DAT
Index File : FAMILY.IDX
Block File : FAMILY.BLK

Field Name	Description/Type	Length	Key Type	Sub-Fields	Repeat	Decimals
AE	2 (Upper Case Alphanumeric)	10	Non-keyed		1	
AltName	Use alternate names 11 (Boolean) (T/F)	1	Non-keyed		1	
Attribut	Failure/uncert. attribs 12 (Variable Block Data)	4	Non-keyed		1	
Company	Company name 2 (Upper Case Alphanumeric)	10	Non-keyed		1	
Des	Family description 1 (Alphanumeric)	60	Non-keyed		1	
Design	Plant design 2 (Upper Case Alphanumeric)	10	Non-keyed		1	
ETChange	Event tree change map 12 (Variable Block Data)	4	Non-keyed		1	
EvFtMap	Event flt tree xRef map 12 (Variable Block Data)	4	Non-keyed		1	
EvFtSize	Event flt tree map size 3 (Integer)	4	Non-keyed		1	
EvSqMap	Ev seq cutset xref(base) 12 (Variable Block Data)	4	Non-keyed		1	

RECORD REPORT FOR IRRAS

Field Name	Description/Type	Length	Key Type	Sub-Fields	Repeat	Decimals
EvSqMap2	Ev seq cutset xref (crrnt) 12 (Variable Block Data)	4	Non-keyed		1	
EvSqSiz2	Ev seq cutset size (crrnt) 3 (Integer)	4	Non-keyed		1	
EvSqSize	Ev seq cutset size (base) 3 (Integer)	4	Non-keyed		1	
EvSyMap	Ev sys cutset xref (base) 12 (Variable Block Data)	4	Non-keyed		1	
EvSyMap2	Ev sys cutset xref(crrnt) 12 (Variable Block Data)	4	Non-keyed		1	
EvSySiz2	Ev sys cutset size (crrnt) 3 (Integer)	4	Non-keyed		1	
EvSySize	Ev sys cutset size (base) 3 (Integer)	4	Non-keyed		1	
FtChange	Fault tree change map 12 (Variable Block Data)	4	Non-keyed		1	
FtFtMap	Subtree X Sub-tree xref 12 (Variable Block Data)	4	Non-keyed		1	
FtFtSize	Subtree X Sub-tree size 3 (Integer)	4	Non-keyed		1	
Location	Plant location 2 (Upper Case Alphanumeric)	16	Non-keyed		1	
MissionT	Global mission time 5 (Floating Point Scientific)	5	Non-keyed		1	3
Name	Family name 2 (Upper Case Alphanumeric)	16	Non-keyed		1	
NewSum	New sequence freq sum 5 (Floating Point Scientific)	5	Non-keyed		1	3

RECORD REPORT FOR IRRAS

Field Name	Description/Type	Length	Key Type	Sub-Fields	Repeat	Decimals
OpDate	Operational date 7 (Date) (yyyy/mm/dd)	10	Non-keyed		1	
Prob	Current evt probabilities 12 (Variable Block Data)	4	Non-keyed		1	
QualDate	Qualification date 7 (Date) (yyyy/mm/dd)	10	Non-keyed		1	
ReadPW	Read password 2 (Upper Case Alphanumeric)	8	Non-keyed		1	
SeqSum	Base sequence freq sum 5 (Floating Point Scientific)	5 3	Non-keyed		1	
SqChange	Sequence change map 12 (Variable Block Data)	4	Non-keyed		1	
SqSyMap	Sequence X system xref 12 (Variable Block Data)	4	Non-keyed		1	
SqSySize	Seq X sys rec sz (~# sq) 3 (Integer)	4	Non-keyed		1	
Text	Family textual info 12 (Variable Block Data)	4	Non-keyed		1	
Type	facility type 2 (Upper Case Alphanumeric)	3	Non-keyed		1	
UdValue	Current evt uncert. vals 12 (Variable Block Data)	4	Non-keyed		1	
Vendor	Vendor name 2 (Upper Case Alphanumeric)	5	Non-keyed		1	
WritePW	Write password 2 (Upper Case Alphanumeric)	8	Non-keyed		1	

RECORD REPORT FOR IRRAS

--- 8 ---

Record Name : Graphics
Description : Graphical information
Fields : 9
Byte Length : 86
File Number : 6
Data File : GRAPHICS.DAT
Index File : GRAPHICS.IDX
Block File : GRAPHICS.BLK

Field Name	Description/Type	Length	Key Type	Sub-Fields	Repeat	Decimals
Des	Graphic description 1 (Alphanumeric)	60	Non-keyed		1	
Free	Graphic pict free flag 1 (Alphanumeric)	1	Non-keyed		1	
Graphic	Graphic picture 12 (Variable Block Data)	4	Non-keyed		1	
Logic	Graphical Logic 12 (Variable Block Data)	4	Non-keyed		1	
Name	Name of graphic page 2 (Upper Case Alphanumeric)	16	Non-keyed		1	
NameKey	Graphic page key 0 (Concatenated)	18	Primary		1	
NumKey	Graphic page key 0 (Concatenated)	6	Primary		1	
Number	Assigned graphic number 3 (Integer)	4	Non-keyed		1	
Type	Graphic type (P,F,E,etc) 1 (Alphanumeric)	1	Non-keyed		1	

RECORD REPORT FOR IRRAS

--- 9 ---

Record Name : Histgram
Description : Histogram Data
Fields : 10
Byte Length : 283
File Number : 11
Data File : HISTGRAM.DAT
index File : HISTGRAM.IDX

Field Name	Description/Type	Length	Key Type	Sub-Fields	Repeat	Decimals
Des	description of histogram 1 (Alphanumeric)	60	Non-keyed		1	
Free	Free Uncer Data Flg 0/1 2 (Upper Case Alphanumeric)	1	Non-keyed		1	
HistType	Hist Type - % or Range 2 (Upper Case Alphanumeric)	1	Non-keyed		1	
Name	Histogram name 16 (Alpha/Numbers)	16	Non-keyed		1	
NameKey	Name Key=Free+Name 0 (Concatenated)	17	Alternate		1	
NumKey	Number Key=Free+Num 0 (Concatenated)		5	Primary		1
Number	Histogram Number 3 (Integer)	4	Non-keyed		1	
Prob	Probab for histogram bin 5 (Floating Point Scientific)	5	Non-keyed			3
StartPos	Starting pos of 1st bin 5 (Floating Point Scientific)	5	Non-keyed		1	3
Value	End position or Percent 5 (Floating Point Scientific)	5	Non-keyed			3

RECORD REPORT FOR IRRAS

Field Validation Report

--- 9 ---

Record Name : Histgram
Description : Histogram Data

8) Prob Probability for histogram bin (Floating Point Scientific)

Minimum Value -> +0.000E+000
Maximum Value -> 9.999E+003

9) StartPos Starting position of 1st bin (Floating Point Scientific)

Minimum Value -> +0.000E+000
Maximum Value -> 9.999E+003

10) Value End position or Percentage (Floating Point Scientific)

Minimum Value -> +0.000E+000
Maximum Value -> 9.999E+003

RECORD REPORT FOR IRRAS

--- 10 ---

Record Name : Sequence
Description : Sequence data record
Fields : 32
Byte Length : 251
File Number : 7
Data File : SEQUENCE.DAT
Index File : SEQUENCE.IDX
Block File : SEQUENCE.BLK

Field Name	Description/Type	Length	Key Type	Sub-Fields	Repeat	Decimals
Cutset	Base case cutsets 12 (Variable Block Data)	4	Non-keyed		1	
Des	Sequence description 1 (Alphanumeric)	60	Non-keyed		1	
EndKey	Endst key:Free+EndState 0 (Concatenated)		17	Alternate		1
EndState	Sequence end state name 2 (Upper Case Alphanumeric)	16	Non-keyed		1	
Eventree	Associated event tree 3 (Integer)	4	Non-keyed		1	
Free	Free sequence flag 1 (Alphanumeric)	1	Non-keyed		1	
Logic	Sequence logic 12 (Variable Block Data)	4	Non-keyed		1	
MinCut	Basecase mincut up bnd 5 (Floating Point Scientific)	5	Non-keyed		1	3
Name	Sequence name 2 (Upper Case Alphanumeric)	16	Non-keyed		1	
NameKey	Sequence name key 0 (Concatenated)	21	Primary		1	

RECORD REPORT FOR IRRAS

Field Name	Description/Type	Length	Key Type	Sub-Fields	Repeat	Decimals
NumKey	Sequence number key 0 (Concatenated)	5	Primary		1	
Number	Sequence number 3 (Integer)	4	Non-keyed		1	
ProCut	Base probability cutoff 5 (Floating Point Scientific)	5	Non-keyed		1	3
SizCut	Base size cutoff 3 (Integer)	2	Non-keyed		1	
SortKey	Sequence name key 0 (Concatenated)	17	Alternate		1	
Text	Sequence descriptive text 12 (Variable Block Data)	4	Non-keyed		1	
TpCuts	Temp num of cutsets 3 (Integer)	5	Non-keyed		1	
TpCutset	Temporary cutsets 12 (Variable Block Data)	4	Non-keyed		1	
TpEvents	Temp number of events 3 (Integer)	5	Non-keyed		1	
TpMinCut	Temp mincut upperbound 5 (Floating Point Scientific)		5	Non-keyed		1 3
TpProCut	Tempo probability cutoff 5 (Floating Point Scientific)	5	Non-keyed		1	3
TpQuanti	Temp quantile levels 12 (Variable Block Data)	4	Non-keyed		1	
TpSamps	Temp number of samples 3 (Integer)	5	Non-keyed		1	

RECORD REPORT FOR IRRAS

Field Name	Description/Type	Length	Key Type	Sub-Fields	Repeat	Decimals
TpSeed	Temporary random seed 3 (Integer)	5	Non-keyed		1	
TpSizCut	Temporary size cutoff 3 (Integer)	2	Non-keyed		1	
TpValues	Tempo uncert values 5 (Floating Point Scientific)	5	Non-keyed		9	3
UdCuts	Base number of cutsets 3 (Integer)	5	Non-keyed		1	
UdEvents	Base number of events 3 (Integer)	5	Non-keyed		1	
UdQuanti	Base quantile levels 12 (Variable Block Data)	4	Non-keyed		1	
UdSamps	Base number of samples 3 (Integer)	5	Non-keyed		1	
UdSeed	Base random seed 3 (Integer)	5	Non-keyed		1	
UdValues	Base uncert values 5 (Floating Point Scientific)	5	Non-keyed		9	3

RECORD REPORT FOR IRRAS

--- 11 ---

Record Name : System
Description : System data record
Fields : 31
Byte Length : 247
File Number : 8
Data File : SYSTEM.DAT
Index File : SYSTEM.IDX
Block File : SYSTEM.BLK

Field Name	Description/Type	Length	Key Type	Sub-Fields	Repeat	Decimals
Cutset	Base case cutsets 12 (Variable Block Data)	4	Non-keyed		1	
Des	System description 1 (Alphanumeric)	60	Non-keyed		1	
Free	Free system flag 1 (Alphanumeric)	1	Non-keyed		1	
Level	Fault tree level (0=top) 3 (Integer)	2	Non-keyed		1	
MinCut	Basecase mincut up bnd 5 (Floating Point Scientific)	5	Non-keyed		1	3
MissionT	Base mission time used 5 (Floating Point Scientific)	5	Non-keyed		1	3
Name	System name 2 (Upper Case Alphanumeric)	16	Non-keyed		1	
NameKey	System name key 0 (Concatenated)	17	Primary		1	
NumKey	System number key 0 (Concatenated)	5	Primary		1	

RECORD REPORT FOR IRRAS

Field Name	Description/Type	Length	Key Type	Sub-Fields	Repeat	Decimals
Number	System number 3 (Integer)	4	Non-keyed		1	
ProCut	Base prob. cutoff 5 (Floating Point Scientific)	5	Non-keyed		1	3
SizCut	Base size cutoff 3 (Integer)	2	Non-keyed		1	
System	System code 2 (Upper Case Alphanumeric)	3	Non-keyed		1	
Text	System descriptive text 12 (Variable Block Data)	4	Non-keyed		1	
TpCuts	Temp number of cutsets 3 (Integer)	5	Non-keyed		1	
TpCutset	Temporary cutsets 12 (Variable Block Data)	4	Non-keyed		1	
TpEvents	Temp number of events 3 (Integer)	5	Non-keyed		1	
TpMinCut	Temp mincut upperbound 5 (Floating Point Scientific)		5	Non-keyed		1 3
TpMissT	Temoprary mission time 5 (Floating Point Scientific)	5	Non-keyed		1	3
TpProCut	Temp probability cutoff 5 (Floating Point Scientific)	5	Non-keyed		1	3
TpQuanti	Temp quantile levels 12 (Variable Block Data)	4	Non-keyed		1	
TpSamps	Temp number of samples 3 (Integer)	5	Non-keyed		1	
TpSeed	Temporary random seed 3 (Integer)	5	Non-keyed		1	

RECORD REPORT FOR IRRAS

Field Name	Description/Type	Length	Key Type	Sub-Fields	Repeat	Decimals
TpSizCut	Temporary size cutoff 3 (Integer)	2	Non-keyed		1	
TpValues	Temp uncert values 5 (Floating Point Scientific)	5	Non-keyed		9	3
UdCuts	Base number of cutsets 3 (Integer)	5	Non-keyed		1	
UdEvents	Base number of events 3 (Integer)	5	Non-keyed		1	
UdQuanti	Base quantile levels 12 (Variable Block Data)	4	Non-keyed		1	
UdSamps	Base number of samples 3 (Integer)	5	Non-keyed		1	
UdSeed	Base random seed 3 (Integer)	5	Non-keyed		1	
UdValues	Base uncert values 5 (Floating Point Scientific)	5	Non-keyed		9	3

RECORD REPORT FOR IRRAS

--- 12 ---

Record Name : UserInfo
Description : General system user info.
Fields : 54
Byte Length : 229
File Number : 10
Data File : USERINFO.DAT
Index File : USERINFO.IDX

Field Name	Description/Type	Length	Key Type	Sub-Fields	Repeat	Decimals
AltName	Use alt event names? 11 (Boolean) (Y/N)	1	Non-keyed		1	
BCut	Use Base case cutsets 11 (Boolean) (Y/N)	1	Non-keyed		1	
Blank	Blank under gate name 11 (Boolean) (Y/N)	1	Non-keyed		1	
Box	Box for small text 11 (Boolean) (Y/N)	1	Non-keyed		1	
CursorC	Cursor Color 11 (Boolean) (X/blank)	2	Non-keyed		16	
EditPath	Scratch Drive & Dir. 2 (Upper Case Alphanumeric)	36	Non-keyed		1	
EventNam	Event Name 2 (Upper Case Alphanumeric)	10	Non-keyed		1	
Fill	Fill on or off 11 (Boolean) (Y/N)	1	Non-keyed		1	
FillC	Fill Color 11 (Boolean) (X/blank)	2	Non-keyed		16	
GateName	Gate Name 2 (Upper Case Alphanumeric)	10	Non-keyed		1	

RECORD REPORT FOR IRRAS

Field Name	Description/Type	Length	Key Type	Sub-Fields	Repeat	Decimals
Grid	Grid on or off 11 (Boolean) (Y/N)	1	Non-keyed		1	
HaloPath	Halo drive & path 2 (Upper Case Alphanumeric)	36	Non-keyed		1	
IBMFont	Printer has IBM font 11 (Boolean) (Y/N)	1	Non-keyed		1	
LineC	Line Color 11 (Boolean) (X/blank)	2	Non-keyed		16	
LineType	Line type 3 (Integer)	1	Non-keyed		1	
MissionT	Mis. time-prob. calc. 5 (Floating Point Scientific)	5	Non-keyed		1	3
Monitor	Monitor(0-EGA, 1-CGA) 3 (Integer)		2	Non-keyed		1
Mouse	Mouse type 3 (Integer)	1	Non-keyed		1	
Multi	Multipick opt. on/off 11 (Boolean) (Y/N)	1	Non-keyed		1	
N/MHite	N/M Gate text Height 4 (Real)	6	Non-keyed		1	2
NameC	Name Color 11 (Boolean) (X/blank)	2	Non-keyed		16	
NameHite	Name text Height 4 (Real)	6	Non-keyed		1	2
PCut	Cutoff by probability? 11 (Boolean) (Y/N)	1	Non-keyed		1	
PlotPort	Pen plotter comm. port 3 (Integer)	1	Non-keyed		1	

RECORD REPORT FOR IRRAS

Field Name	Description/Type	Length	Key Type	Sub-Fields	Repeat	Decimals
PrinType	Printer Type 3 (Integer)	2	Non-keyed		1	
ProbCut	Probab. cutoff value 5 (Floating Point Scientific)	5	Non-keyed		1	3
Ratios	Ratios (not intervals) 11 (Boolean) (Y/N)	1	Non-keyed		1	
SCut	Cutoff by cutset size? 11 (Boolean) (Y/N)	1	Non-keyed		1	
SFamily	Current sel fam path 2 (Upper Case Alphanumeric)	60	Non-keyed		1	
Seed	Random number seed 3 (Integer)	5	Non-keyed		1	
ShowName	Show name of symbols 11 (Boolean) (Y/N)	1	Non-keyed		1	
ShowText	Show the text 11 (Boolean) (Y/N)	1	Non-keyed		1	
SizeCut	Cutset sz cutoff val 3 (Integer)	4	Non-keyed		1	
TextAlig	Text alignment 2 (Upper Case Alphanumeric)	1	Non-keyed		1	
TextC	Name Color 11 (Boolean) (X/blank)	2	Non-keyed		16	
TextHite	Test label Height 4 (Real)	6	Non-keyed		1	2
UserName	User's name 1 (Alphanumeric)	36	Non-keyed		1	
VSpace	Vertical text spacing 4 (Real)	6	Non-keyed		1	2

RECORD REPORT FOR IRRAS

Field Name	Description/Type	Length	Key Type	Sub-Fields	Repeat	Decimals
ValidRec	Remember part. load recs 11 (Boolean) (Y/N)		1	Non-keyed		1
cursorC	Current Cursor Color 3 (Integer)	2	Non-keyed		1	
fgndCol1	Menu foregrnd Color 1 3 (Integer)	2	Non-keyed		1	
fgndCol2	Menu foregrnd Color 2 3 (Integer)	2	Non-keyed		1	
fgndCol3	Menu foregrnd Color 3 3 (Integer)	2	Non-keyed		1	
hideText	Hide the ETE text 11 (Boolean) (Y/N)	1	Non-keyed		1	
lineCol	Current Line Color 3 (Integer)	2	Non-keyed		1	
menuSide	Side of the Menu 2 (Upper Case Alphanumeric)	1	Non-keyed		1	
mnuBCol1	Menu Backgrnd Color 1 3 (Integer)	2	Non-keyed		1	
mnuBCol2	Menu Backgrnd Color 2 3 (Integer)	2	Non-keyed		1	
mnuBCol3	Menu Backgrnd Color 3 3 (Integer)	2	Non-keyed		1	
pack	Pack the logic or not 11 (Boolean) (Y/N)	1	Non-keyed		1	
samples	No. of unc. cal. samps 3 (Integer)	6	Non-keyed		1	
textCol	Current text Color 3 (Integer)	2	Non-keyed		1	

RECORD REPORT FOR IRRAS

Field Name	Description/Type	Length	Key Type	Sub-Fields	Repeat	Decimals
textHite	Event tree text height 4 (Real)	6	Non-keyed		1	2
textJust	txt Just=lef,cen,rght 1 (Alphanumeric)	1	Non-keyed		1	

RECORD REPORT FOR IRRAS

Field Validation Report

--- 12 ---

Record Name : UserInfo
Description : General system user info.

15) LineType Line type (Integer)

Minimum Value ->1
Maximum Value ->3

18) Mouse Mouse type (Integer)

Minimum Value ->0
Maximum Value ->6

20) N/MHite N/M Gate text Height (Real)

Minimum Value -> .00
Maximum Value ->120.00

22) NameHite Name text Height (Real)

Minimum Value -> .00
Maximum Value ->120.00

24) PlotPort Pen plotter comm. port (Integer)

Minimum Value ->0
Maximum Value ->3

30) Seed Random number seed (Integer)

Minimum Value -> 0
Maximum Value ->65533

34) TextAlig Text alignment (Upper Case Alphanumeric)

Enumerated List - 3 value(s)

C L R

36) TextHite Test label Height (Real)

Minimum Value -> .00
Maximum Value ->120.00

38) VSpace Verticle text spacing (Real)

Minimum Value -> 1.00
Maximum Value -> 10.00

40) cursorC Current Cursor Color (Integer)

Minimum Value -> 0
Maximum Value ->15

41) fgndCol1 Menu foreground Color 1 (Integer)

Minimum Value -> 0
Maximum Value ->15

42) fgndCol2 Menu foreground Color 2 (Integer)

Minimum Value -> 0
Maximum Value ->15

43) fgndCol3 Menu foreground Color 3 (Integer)

Minimum Value -> 0
Maximum Value ->15

45) lineCol Current Line Color (Integer)

Minimum Value -> 0
Maximum Value ->15

47) mnuBCol1 Menu BackGround Color 1 (Integer)

Minimum Value -> 0
Maximum Value ->15

48) mnuBCol2 Menu BackGround Color 2 (Integer)

Minimum Value -> 0
Maximum Value ->15

49) mnuBCol3 Menu BackGround Color 3 (Integer)

Minimum Value -> 0
Maximum Value ->15

51) samples Number of samples for unc. cal (Integer)

Minimum Value -> 10
Maximum Value -> 5000

52) textCol Current text Color (Integer)

Minimum Value -> 0
Maximum Value ->15

53) textHite Event tree text height (Real)

Minimum Value -> .00
Maximum Value ->120.00

RECORD REPORT FOR IRRAS

--- 13 ---

Record Name : Util
Description : Irras Utility Record
Fields : 53
Byte Length : 777

Field Name	Description/Type	Length	Key Type	Sub-Fields	Repeat	Decimals
Alpha1	Alpha 1 Char Field 1 (Alphanumeric)	1	Non-keyed		1	
Alpha20	Alpha 20 Char Field 2 (Upper Case Alphanumeric)	20	Non-keyed		1	
Alpha48	Alpha 48 Char Field 1 (Alphanumeric)	48	Non-keyed		1	
Alpha53	Alpha 53 Char Field 1 (Alphanumeric)	53	Non-keyed		1	
Alpha7	Alpha 7 Char Field 1 (Alphanumeric)	7	Non-keyed		1	
Alpha8	Alpha 8 Char Field 1 (Alphanumeric)	8	Non-keyed		1	
AltCuts	Use Alternate Cutsets 11 (Boolean) (Y/N)	1	Non-keyed		1	
B	Boolean Y/N Field 11 (Boolean) (Y/N)	1	Non-keyed		1	
BaseCase	Use Base Case of Events 11 (Boolean) (Y/N)	1	Non-keyed		1	
Comp	+/- fields for seq. rpt 1 (Alphanumeric)	1	Non-keyed		4	
CutId	Cutsets Identification 3 (Integer)	4	Non-keyed		1	

RECORD REPORT FOR IRRAS

Field Name	Description/Type	Length	Key Type	Sub-Fields	Repeat	Decimals
CutPcnt	Cumulat. % of cutsets 4 (Real)	5	Non-keyed		1	1
DoAll	Use Cutset rpt const. 11 (Boolean) (Y/N)	1	Non-keyed		1	
ETime	Timer Field 13 (Time)(with microseconds)	12	Non-keyed		1	
FTName1	Name for FT Log. Edt 1 1 (Alphanumeric)	17	Non-keyed		1	
FTName2	Name for FT Log. Edt 2 1 (Alphanumeric)	17	Non-keyed		1	
FV	Fussell-Vesley Value 5 (Floating Point Scientific)	5	Non-keyed		1	3
FailRate	Fail Rate Prob. for Rpt 5 (Floating Point Scientific)	5	Non-keyed		1	3
FileName	File Name for out rept 1 (Alphanumeric)	32	Non-keyed		1	
Freq	Frequency of cutset 5 (Floating Point Scientific)	3	Non-keyed		1	1
GateName	Gate Name-Sys Log Rpt 1 (Alphanumeric)	16	Non-keyed		1	
GateType	Gate Type-Sys Log Rpt 1 (Alphanumeric)	4	Non-keyed		1	
H1	Input Field for Forms 2 (Upper Case Alphanumeric)	1	Non-keyed		1	
I2	Integer of length 2 3 (Integer)	2	Non-keyed		1	
LinkNum	Link Number 3 (Integer)	4	Non-keyed		1	

RECORD REPORT FOR IRRAS

Field Name	Description/Type	Length	Key Type	Sub-Fields	Repeat	Decimals
MainOptn	Main Menu Option 2 (Upper Case Alphanumeric)	9	Non-keyed		1	
MinCBins	Min cutsets upbound bin 5 (Floating Point Scientific)	5	Non-keyed		12	3
MinCut	Min cutsets upper bound 5 (Floating Point Scientific)	5	Non-keyed		1	3
MinCutSm	Min cutset upper bound 5 (Floating Point Scientific)	5	Non-keyed		1	3
NumCut	Number of total cutsets 3 (Integer)	4	Non-keyed		1	
NumEvent	Number of Events 3 (Integer)	5	Non-keyed		1	
QEvents	Qualified Events 3 (Integer)	4	Non-keyed		1	
QualNum	No. of Qual Events 3 (Integer)	5	Non-keyed		1	
Real	Real Number 5 (Floating Point Scientific)	5	Non-keyed		1	3
Resolut	Rasterize Resolution 2 (Upper Case Alphanumeric)	5	Non-keyed		1	
RiskAch	Risk Achieve Val for Rpt 5 (Floating Point Scientific)		5	Non-keyed		1 3
RiskRed	Risk Reduc Val for Rpt 5 (Floating Point Scientific)	5	Non-keyed		1	3
RptTitle	Title of requested rpt 1 (Alphanumeric)	60	Non-keyed		1	
SizeBins	Cut Set Size Bins 3 (Integer)	8	Non-keyed		12	

RECORD REPORT FOR IRRAS

Field Name	Description/Type	Length	Key Type	Sub-Fields	Repeat	Decimals
SliceP	Current Slice % 4 (Real)	7	Non-keyed		1	2
StrtGate	Starting Gate of logic 2 (Upper Case Alphanumeric)	16	Non-keyed		1	
SubTitl2	Sub Title (2nd) of rept 1 (Alphanumeric)	30	Non-keyed		1	
SubTitl3	Sub Title (3rd) of rept 1 (Alphanumeric)	30	Non-keyed		1	
SubTitl4	Sub Title (4th) of rept 1 (Alphanumeric)	30	Non-keyed		1	
SubTitle	sub Title of rept 1 (Alphanumeric)	30	Non-keyed		1	
TempName	Temporary Name (Gen) 2 (Upper Case Alphanumeric)	16	Non-keyed		4	
Title	Title of the req rpt 1 (Alphanumeric)	60	Non-keyed		1	
TotCuts	Total Cutsets 3 (Integer)	6	Non-keyed		1	
TotCuts1	Total Cutsets for seq 3 (Integer)	6	Non-keyed		1	
TotGates	Total Gates 3 (Integer)	6	Non-keyed		1	
TotPcnt	Total % of cutset 4 (Real)	5	Non-keyed		1	1
TreeName	Name of the fault tree 2 (Upper Case Alphanumeric)	16	Non-keyed		1	
Uncert	Uncertainty Values 5 (Floating Point Scientific)	5	Non-keyed		9	3

RECORD REPORT FOR IRRAS

Field Validation Report

--- 13 ---

Record Name : Util
Description : Irras Utility Record

26) MainOptn Main Menu Option (Upper Case Alphanumeric)

Enumerated List - 9 value(s)

ANALYZE BUILD CREATE EXIT FAULT MODIFY
REPORT SELECT UTILITY

RECORD REPORT FOR IRRAS

--- 14 ---

Record Name : Utility
Description : Temporary fields For PRA
Fields : 28
Byte Length : 709

Field Name	Description/Type	Length	Key Type	Sub-Fields	Repeat	Decimals
A1	Command field of choice 2 (Upper Case Alphanumeric)	1	Non-keyed		1	
A25	Data Type Description 1 (Alphanumeric)	25	Non-keyed		1	
A5	Data Source File 2 (Upper Case Alphanumeric)	5	Non-keyed		1	
B	Boolean field 11 (Boolean) (Y/N)	1	Non-keyed		1	
B1	Boolean field 1 11 (Boolean) (Y/N)	1	Non-keyed		1	
B2	Boolean field 2 11 (Boolean) (Y/N)	1	Non-keyed		1	
C1	Command field 2 (Upper Case Alphanumeric)	1	Non-keyed		1	
CopyDest	Copy dest. for select 2 (Upper Case Alphanumeric)	60	Non-keyed		1	
CopySour	Copy source for select 2 (Upper Case Alphanumeric)	60	Non-keyed		1	
CutId	Cutsets Identification 3 (Integer)	4	Non-keyed		1	

RECORD REPORT FOR IRRAS

Field Name	Description/Type	Length	Key Type	Sub-Fields	Repeat	Decimals
CutSet	Name for FT Editor1 2 (Upper Case Alphanumeric)	17	Non-keyed		1	
DeleDest	Delete dest. for select 2 (Upper Case Alphanumeric)	60	Non-keyed		1	
DeleYN	Delete Y/N for select 11 (Boolean) (Y/N)	1	Non-keyed		1	
EName	Temp evtnme-Cutset Edt 2 (Upper Case Alphanumeric)	17	Non-keyed		20	
EName2	Temp evtnme-Cutset Edt 2 (Upper Case Alphanumeric)	17	Non-keyed		1	
EName3	Temp evtnme-Cutset Edt 2 (Upper Case Alphanumeric)	17	Non-keyed		1	
EName4	Temp evtnme-Cutset Edt 2 (Upper Case Alphanumeric)	17	Non-keyed		1	
EName5	Temp evtnme-Cutset Edt 2 (Upper Case Alphanumeric)	17	Non-keyed		1	
EName6	Temp evtnme-Cutset Edit 2 (Upper Case Alphanumeric)	17	Non-keyed			1
H1	Highlight menu field 2 (Upper Case Alphanumeric)	1	Non-keyed		1	
VIPFam	Vip Fams on Main Menu 1 (Alphanumeric)	74	Non-keyed		1	
familyPW	password processing 2 (Upper Case Alphanumeric)	8	Non-keyed		1	
line78	78 character error line 2 (Upper Case Alphanumeric)	78	Non-keyed		1	
name	Family Name 2 (Upper Case Alphanumeric)	16	Non-keyed		1	

RECORD REPORT FOR IRRAS

Field Name	Description/Type	Length	Key Type	Sub-Fields	Repeat	Decimals
name1	Family Name (temporary) 2 (Upper Case Alphanumeric)		16	Non-keyed		1
readCry	read password encrypted 3 (Integer)	3	Non-keyed		8	
writCry	write password encrypted 3 (Integer)	3	Non-keyed		8	
writePri	Write Privilege flag 11 (Boolean) (T/F)	1	Non-keyed		1	

APPENDIX C

DATA INTERCHANGE FORMATS

IRRAS

PRA Models and Results Data Base
Data Interchange Formats. February 11, 1991

C.1 MAR-D (IRRAS, SARA)

C.1.1 General Format Rules

1. All name references (family names, event names, etc.) must be upper case alphanumeric. All lower case characters will be converted to upper case. Any alpha fields that are longer than the format specified will be truncated. No spaces are allowed in the middle of names.

2. Descriptions can have both upper-case and lower-case characters. No character checking will be done.

3. Commas are used as field delimiters in most formats, and can be used as placeholders for unknown fields. Any number of leading and trailing field spaces can be inserted. Exceptions to this format are detailed as needed.

4. Text rules:
    1. File is standard ASCII text, single spaced, upper and lower case.
    2. First line of paragraph is indented 5 spaces, with a blank line between paragraphs.
    3. ^EOS signals the End of Section so that multiple names in the same family can be collected in one file.

These rules apply to all files unless specifically stated otherwise.

C.1.2 Family (Plant) Information

C.1.2.1 Family Names and Descriptions.

File Name:
xxxxxx.FAD
File Format:
name,description
where

name	- 16 character	Family name (first 8 characters must be unique).
description	- 60 character	Family description

C.1.2.2 Family Attribute File.

File Name:
xxxxxx.FAA
File Format:
name,mission,newSum,co,loc,type,design,vendor,AE,OpDate
where

name	- 16 character	Family name
mission	- Floating point	Default mission time in hours
newSum	- Floating point	New sequence frequency sum
co	- 10 character	Company name
loc	- 16 character	Location name
type	- 3 character	Facility type
design	- 10 character	Facility design
vendor	- 5 character	Vendor name
AE	- 10 character	Architectural Engineer
OpDate	- (yyyy/mm/dd)	Operational date

C.1.2.3 Family Textual Information.

File Name:
xxxxxx.FAT
File Format:
family =
-- text --
where

family	- 16 character	Family name

C.1.3 Basic Event Information

C.1.3.1 Basic Event Names and Descriptions.

File Name:

xxxxxx.BED

File Format:

family =
name,description
. . . , . . .

where

family	- 16 character	Family name
name	- 16 character	Event name
description	- 60 character	Alphanumeric description

C.1.3.2 Basic Event Rate Information.

The basic event failure rates are stored in the Event relation. This information can also be entered through the modify option.

File Name:

xxxxxx.BEI

File Format:

family =
name, calc, udC, udT, udV, prob, lambda, tau, mission, init
. . . , . . . , . . . , . . . , . . . , . . . , . . . , . . . , . . . , . . . , . . .

where

family	- 16 character	Family name
name	- 16 character	Basic event name
calc	- 1 character	Calculation type

1 - Probability
2 - Lambda * Mission Time
3 - 1 - Exp(-Lambda * Mission Time)
4 - Lambda * Min(Mission Time, Tau)
5 - Operating component with full repair
6 - Lambda * Tau / 2.0
7 - 1+(EXP(-Lambda*Tau)-1.0)/(Lambda*Tau)
8 - Base Probability * Probability
9 - Base Probability * Probability
T - Set to House Event (Failed, Prob=1.0)
F - Set to House Event (Successful,Prob=0.0)

udC - 4 characters Uncertainty correlation class
Events in same class are 100% correlated.

udT - 1 character — Uncertainty distribution type
- L - Log normal, error factor
- N - Normal, standard deviation
- B - Beta, b of Beta(a,b)
- G - Gamma, a Gamma(a)
- E - Exponential, none
- U - Uniform, Upper end pt.

udV - Floating point Uncertainty distribution value
prob - Floating point Probability value
lambda - Floating point Basic event failure rate per hr.
tau - Floating point Time to repair in hours
mission- Floating point Mission time
init - Boolean (T/F) Initiating event

General Rules:

1. The name field is mandatory.

C.1.3.3 Basic Event Attribute Codes.

Basic event attributes are entered through MODIFY--Basic Event and stored in Event.

File Name:

xxxxxx.BEA

File Format:

family =
name,Aname,type,sys,fail,loc,compID,Gname,train,att1,..,att16
. . . , . . . , . . . , . . . , . . . , . . . , . . . , . . . , . . . , . . .

where

family	- 16 character	Family name
name	- 16 character	Event name
Aname	- 16 character	Alternate event name
type	- 3 character	Event component type
sys	- 3 character	Event component system
fail	- 2 character	Failure mode
loc	- 3 character	Component location
compID	- 7 character	Component ID
Gname	- 16 character	Event group identifier
train	- 1 character	Train identifier
att1..att16	- Class attribute flags--16 values of Y or N (yes or no) indicate whether the attribute described in the class attribute file is applicable.	

General Rules:

1. The name field is mandatory.

C.1.4 Event Attribute Descriptions

C.1.4.1 Failure Mode Descriptions.

File Name:
xxxxxx.FMD
File Format:
family =
fail,description
. . . , . . .
where

family	- 16 character	Family name
fail	- 2 character	Failure mode identifier
description	- 60 character	Failure mode description

C.1.4.2 Component Type Descriptions.

File Name:
xxxxxx.CTD
File Format:
family =
comp, description
. . . , . . .
where

family	- 16 character	Family name
comp	- 3 character	Component type identifier
description	- 60 character	Component type description

C.1.4.3 System Type Descriptions.

File Name:
xxxxxx.STD
File Format:
family =
sys,description
. . . , . . .
where

family	- 16 character	Family name
sys	- 3 character	Component system identifier
description	- 60 character	System description

C.1.4.4 Location Descriptions.

File Name:
xxxxxx.LCD
File Format:
family =
loc,description
. . . , . . .
where

family	- 16 character	Family name
loc	- 3 character	Component location identifier
description	- 60 character	Component location description

C.1.4.5 Class Attribute Descriptions.

File Name:
xxxxxx.CAD
File Format:
family =
Attr#,description
. . . , . . .
where

family	- 16 character	Family name
Attr#	- Integer 1..16	Attribute number
description	- 60 character	Attribute description

C.1.5 Fault Tree Information

C.1.5.1 Fault Tree Names and Descriptions.

File Name:
xxxxxx.FTD
File Format:
family =
name,description
. . . , . . .
where

family	- 16 character	Family name
name	- 16 character	Fault tree name
description	- 60 character	Fault tree description

C.1.5.2 Fault Tree Graphics.

Fault tree graphics are stored in the block data file of the Graphics relation. The MAR-D file (.DLS) is a display list sequence for the graphics in a binary format. It is loaded and output as-is with no conversion performed.

File Name:
xxxxxx.DLS
File Format:
IRRAS 2.0/3.0 Fault Tree Graphics file (DLS format)

C.1.5.3 Fault Tree Logic.

Fault tree logic is stored in the block data file of the Graphics relation.

File Name:
xxxxxx.FTL
File Format:
family, fault tree =
(logic output from IRRAS 2.0 in IRRAS 1.0 format.)
* gatename1,description
gatename1 gatetype input1 input2 . . . inputn
. . . .
* gatenamen,description
gatenamen gatetype input1 input2 . . . inputn
. . .
where

family	- 16 character	Family name
fault tree	- 16 character	Fault tree name

gatename	- 16 character	Gate name
gatetype	- 4 character	Gate type

AND = logical AND
OR = logical OR
TBL = table of events
TRAN = transfer--16-character name followed by a fault tree name
NAND = logical NOT AND
NOR = logic NOT OR
N/M = N out of M logic gate
CONT = continuation of inputs to the previous gate

input	- 16 character	inputs to the gate (event or gate names)
description	- 60 character	gate name descriptions included as comment

General Rules:

1. A gate definition cannot exceed 255 characters.
2. A line beginning with an asterisk ("*") is a comment.
3. For each gate name a comment should be included giving the gate description.

C.1.5.4 Fault Tree Cut Sets.

The fault tree cut sets are stored in the System relation in the block data file.

File Name:

xxxxx.FTC

File Format:

```
family, fault tree =
eventname * eventname +
eventname * eventname * eventname *
eventname +
eventname * eventname.
^EOS
family, fault tree2 =
```

where

family	- 16 character	Family name
fault tree	- 16 character	Fault tree name
eventname	- 16 character	Event names in the cut set

General Rules:

1. An asterisk ("*") separates cut set events. Spaces are ignored.
2. A plus sign ("+") separates cut sets.
3. A period (".") denotes the end of a sequence.
4. A slash ("/") precedes complemented events.
5. Event names are a maximum of 16 characters including the "/".
6. A line beginning with an asterisk ("*") is a comment.

C.1.5.5 Fault Tree Attributes.

File Name:

xxxxx.FTA

File Format:

family =
name,level,mission,mincut,proCut,sample,seed,sizCut,sys,cuts,
events,value1,..,value9
. . . , . . . , . . . , . . . , . . . , . . . , . . . , . . . , . . . , . . . ,

where

family	- 16 character	Family name
name	- 16 character	Fault tree name
level	- Integer 2	0 = top level tree
mission	- Floating point	Mission time
mincut	- Floating point	Mincut upper bound
proCut	- Floating point	Probability cut off value
sample	- Integer 4	Sample size
seed	- Integer 8	Random number seed
sizecut	- Integer 2	Size cut off value
sys	- 3 character	System identifier
cuts	- Integer 5	Base number of cut sets
events	- Integer 5	Base number of events
value	- Floating point	Base uncertainty values

C.1.5.6 Fault Tree Textual Information.

File Name:

xxxxxx.FTT

File Format:

family, fault tree =
-- text --
^EOS
family, fault tree2 =
. . .

where

family	- 16 character	Family name
fault tree	- 16 character	Fault tree name

C.1.6 Event Tree Information

C.1.6.1 Event Tree Names and Descriptions.

File Name:
xxxxxx.ETD
File Format:
family =
name,description
. . . , . . .
where

family	- 16 character	Family name
name	- 16 character	Event tree name
description	- 60 character	Event tree description

C.1.6.2 Event Tree Attributes.

File Name:
xxxxxx.ETA
File Format:
family =
name,init
. . . , . . .
where

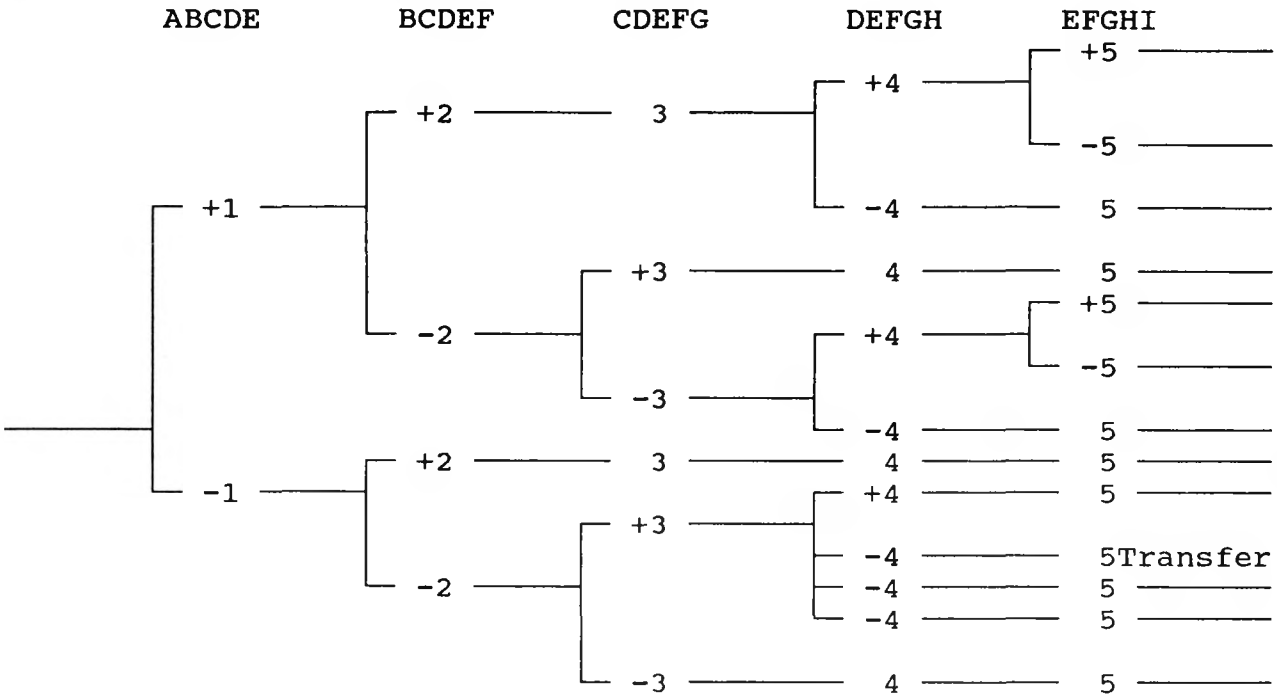
family	- 16 character	Family name
name	- 16 character	Event tree name
init	- 16 character	Initiating event name

C.1.6.3 Event Tree Graphics.

The IRRAS Event Tree Graphics file (*.ETG) is a display list sequence for the graphics in a binary format. It will be loaded and output as-is: no conversion will be performed.

File Name:
xxxxxx.ETG
File Format:
IRRAS 3.0 Event Tree Graphics file

SAMPLE GRAPHICAL EVENT TREE



C.1.6.4 Event Tree Logic.

File Name:

xxxxxx.ETL

File Format:

family, event tree, init event [,T] =
^TOPS
* 1 | 2 | 3 | 4 | 5 | this is a comment
ABCDE BCDEF CDEFG DEFGH EFGHI
^LOGIC

+1	+2	3	+4	+5
				-5
			-4	5
	-2	+3	4	5
		-3	+4	+5
				-5
			-4	5
-1	+2	3	4	5
	-2	+3	+4	5
			-4	5
			-4	5
			-4	5

-3 4 5

^SEQUENCES

Y/N, header#1,	Y/N, header#2,	Y/N, header#3,	Y/N,header#4
Y/N, sequence#1,	Y/N, end state#1,	Y/N, xdata1#1,	Y/N,xdata2#1
Y/N, sequence#2,	Y/N, end state#2,	Y/N, xdata1#2,	Y/N,xdata2#2
Y/N, sequence#3,	Y/N, end state#3,	Y/N, xdata1#3,	Y/N,xdata2#3
Y/N, sequence#4,	Y/N, end state#4,	Y/N, xdata1#4,	Y/N,xdata2#4
Y/N, sequence#5,	Y/N, end state#5,	Y/N, xdata1#5,	Y/N,xdata2#5
Y/N, sequence#6,	Y/N, end state#6,	Y/N, xdata1#6,	Y/N,xdata2#6
Y/N, sequence#7,	Y/N, end state#7,	Y/N, xdata1#7,	Y/N,xdata2#7
Y/N, sequence#8,	Y/N, end state#8,	Y/N, xdata1#8,	Y/N,xdata2#8
Y/N, sequence#9,	Y/N, tran file#9,	Y/N, xdata1#9,	Y/N,xdata2#9, T
Y/N, sequence#10,	Y/N, end state#10,	Y/N, xdata1#10,	Y/N,xdata2#10
Y/N, sequence#11,	Y/N, end state#11,	Y/N, xdata1#11,	Y/N,xdata2#11
Y/N, sequence#12,	Y/N, end state#12,	Y/N, xdata1#12,	Y/N,xdata2#12
Y/N, sequence#13,	Y/N, end state#13,	Y/N, xdata1#13,	Y/N,xdata2#13

^TEXT
SIZE s
JUST j
COLOR j
XY xvalue,yvalue
"60 character line of text"
XY xvalue, yvalue
"60 character line of text"
"60 character line of text"

^PARMS
START yvalue
WINDOW x1,y1,x2,y2
HEADER x1,x2,x3,x4
^EOS
family, event tree2 =

where

family	- 16 character	Family name
event tree	- 16 character	Event tree name
init event	- 16 character	Initiating Event
[,T]	- 1 character	Optional flag indicating init event name is a Top event system
TOPS	- 16 character	Top event/system names
Y/N	- Boolean	End state text displayed?
header	- 16 character	Sequence header
sequence	- 16 character	Sequence name
endstate	- 16 character	End state name
tran file	- 16 character	Name of transfer file
xdata1	- 16 character	Information (optional)

xdata2 - 16 character Information (optional)

General Rules:

1. A line beginning with an asterisk ("*") is a comment.
2. Literal "^TOPS", "^LOGIC", "^SEQUENCES" labels must be present.
3. Logic is built according to the position of the top event in the definition.
   Plus sign ("+")---the specified top event succeeded.
   Minus sign ("-")---the specified top event failed.
   Blank (" ")---the response of the indicated top event did not matter.
4. Header, Sequence name, End State name, Xdata1, Xdata fields associated with each sequence. "Y/N" indicates whether the specified field is visible. A "T" at the end indicates the sequence transfers to another tree.
5. User text is input following the ^TEXT command. Parameters include the size, justification, color, and location of the text block.
6. The ^PARMS command allows input of program control parameters.

C.1.6.5 Event Tree Rules

File Name:

xxxxxxxx.ETR

File Format:

```
family, event tree =
IF  top1 top2 top3
THEN top4 = sys1,
     top5 = sys2.
IF top3 top4 top5 THEN top3 = sys4.
     . . .
^EOS
family, event tree2
```

where:

family	- 16 character	Family name
event tree	- 16 character	Event tree name
tops	- 16 character	Top event/system names

C.1.6.6 Event Tree Textual Information.

File Name:

xxxxxx.ETT

File Format:

```
family, event tree =
        -- text --
^EOS
family, event tree2 =
        -- text --
```

where

family	- 16 character	Family name
event tree	- 16 character	Event tree name

C.1.7 End State Information

Each sequence can be tied to a single plant damage state. The end state probabilities are currently entered by the user. The name and description data are loaded with the SARA *.PDS file.

C.1.7.1 End State Names and Descriptions.

File Name:
xxxxxx.ESD
File Format:
family =
name,description
. . . , . . .
where

family	- 16 character	Family name
name	- 16 character	End state name
description	- 60 character	End state description

C.1.7.2 End State Information.

File Name:
xxxxxx.ESI
File Format:
family =
********** will be defined later **********

C.1.7.3 End State Textual Information.

File Name:
xxxxxx.EST
File Format:
family, end state =
-- text --
^EOS
family, end state2 =
where

family	- 16 character	Family name
end state	- 16 character	End State name

C.1.8 Sequence Information

C.1.8.1 Sequence Names and Descriptions.

File Name:

xxxxxx.SQD

File Format:

```
family,eventree =
name,description
. . . , . . .
^EOS
```

where

family	- 16 character	Family name
eventree	- 16 character	Event tree name
name	- 16 character	Sequence name
description	- 60 character	Sequence description

C.1.8.2 Sequence Cut Sets.

The sequence cut sets are the minimal cut sets for sequence logic as derived from the fault tree logic. The cut sets are stored in the block data file of the Sequence relation.

The MAR-D sequence cut sets (.SQC) are in a format similar to that of the fault tree cut sets described in Section 5.1.5.

File Name:

xxxxxx.SQC

File Format:

```
family, event tree, sequence =
eventname * eventname +
eventname * eventname * eventname *
eventname +
eventname * eventname.
^EOS
family, event tree2, sequence2 =
```

where

family	- 16 character	Family name
event tree	- 16 character	Event tree name
sequence	- 16 character	Sequence name
eventname	- 16 character	Event names in the cut set

General Rules:

1. An asterisk ("*") separates events in a cut set. Spaces are ignored.
2. A plus sign ("+") separates cut sets.
3. A period (".") denotes the end of the sequence.
4. A slash ("/") precedes complemented events.
5. Event names have a maximum of 16 characters including the "/" character for complemented events.
6. A line beginning with an asterisk ("*") is a comment.

C.1.8.3 Sequence Attributes.

File Name:

xxxxxx.SQA

File Format:

```
family, event tree =
name,endstate,mincut,mission,procut,sample,seed,size,cuts,
        events,value1, . . . ,value9
. . . , . . . , . . . , . . . , . . . , . . . , . . . , . . .
^EOS
family, event tree2 =
```

where

family	- 16 character	Family name
event tree	- 16 character	Event tree name
name	- 16 character	Sequence name
endstate	- 16 character	End State name
mincut	- Floating point	Mincut upper bound
mission	- Floating point	Mission time in hours
procut	- Floating point	Probability cut off value
sample	- Integer 4	Sample size
seed	- Integer 8	Random number seed
size	- Integer 2	Size cut off value
cuts	- Integer 5	Base number of cut sets
events	- Integer 5	Base number of events
value	- Floating point	Base uncertainty values
value1	- 5th percentile	
value2	- Median	
value3	- Mean	
value4	- 95th percentile	
value5	- Minimum sample	
value6	- Maximum sample	
value7	- Standard deviation	
value8	- Skewness	
value9	- Kurtosis	

C.1.8.4 Sequence Logic.

File Name:
xxxxxxxx.SQL
File Format:
family, event tree, sequence=
sys1 sys2 /sys3 sys4
. . .
^EOS
family, event tree2, sequence2=
where

family	- 16 character	Family name
event tree	- 16 character	Event tree name
sequence	- 16 character	Sequence name
sys	- 16 character	System name

General Rules:
1. Complemented systems are prefixed with "/".

C.1.8.5 Sequence Textual Information.

File Name:
xxxxxx.SQT
File Format:
family, event tree, sequence=
--- text ---
^EOS
family, event tree2, sequence2=
--- text ---
where

family	- 16 character	Family name
sequence	- 16 character	Sequence name
event tree	- 16 character	Event tree name

C.1.9 Piping and Instrumentation Diagrams

C.1.9.1 P&ID.

The piping and instrumentation diagrams is a graphics file in binary format. It will be loaded and output as-is: no conversion will be performed.

File Name:
xxxxxx.PID
File Format:
(P&ID Editor format)

C.2 SETS

C.2.1 Sequences

C.2.1.1 Sequence Cut Sets.

File Name:
xxxxxx.DNF.

The format of the SETS output cut sets file (.DNF) is dependent upon the command issued within SETS. The factored form is

$$A * (B + C)$$

The disjunctive normal form is

$$A * B + A * C.$$

ONLY the disjunctive normal form is accepted by the MAR-D at this time.

File Format:
sequence-name =
eventName * eventName +
eventName * eventName.
where
. . . . .

General Rules:
1. An asterisk ("*") separates event names. Spaces are ignored.
2. A plus sign ("+") separates cut sets.
3. A period (".") denotes the end of a sequence.
4. An asterisk ("*") in the first column denotes a comment.

C.2.2 Fault Trees

C.2.2.1 Fault Tree Logic.

File Name:
xxxxxx.SET.
File Format:
FAULT TREE$ fault-tree-name.
COMMENT$ descriptive material $

gate-type $ gate-name.	IN$ input-1, input-2, . . . , input-n.
	OUT$ output-1, output-2, . . . , output-n.
event-type $event-name.	OUT$ output-1, . . . , output-n.

where

fault-tree-name	- The name of the fault tree.
gate-type	- The type of gate being defined. AG = AND gate OG = OR gate EOR = Exclusive OR gate (converted to SG) EAG = Exclusive AND gate (converted to SG) SG = Special Gate
gate-name	- The name of the gate being defined (16 characters) input-n - The names of the gates or primary events that are the immediate inputs to the gate being defined (16 characters)
output-n	- The names of the gates that are the immediate outputs of the gate or primary event being defined (16 characters).
event-type	- The type of primary event being defined. BE = Basic Event CE = Conditional Event UE = Undeveloped Event DE = Developed Event EE = External Event
COMMENT$	- Defines a comment. Must follow a "." delimiter.

C.2.2.2 Fault Tree Cut Sets.

The fault tree cut sets are stored in the System relation in the block data file. The format of the cut set file (.DNF) is given above.

C.2.3 Basic Events

C.2.3.1 Basic Event Failure Rates.

File Name:

xxxxxxx.VBK.

File Format:

VALUE BLOCK$ value-block-name
prob $ name-list$
prob $ name-list$

where

prob	- point value probability estimate
name-list	- list of event names separated by commas

C.2.4 Output Reports

Output reports can be converted to other formats or loaded by the user. They are not stored intact in the database. The cut sets are stripped from the listing file (.LIS) and stored in the Sequence relation. A variable occurrence table is written to file "sequence-name.VOT" in the family directory.

File Name:

xxxxxx.LIS.

File Format:

. . . Header information
EXECUTE
LDBLK (sequence name, sequence name, . . .)
. . .
COMTRMVAL (sequence name)
-- blank line --
/OMEGA means empty cut set
-- 12 blank lines --
Variable Occurrence Table--Output as is
-- 5 lines to cut set table --
41 character leader + 1 space + basic event name

THE MAXIMUM TERM--ends the cut sets
. . .

General Rules:

1. A plus sign ("+") followed by a blank line separates cut sets.
2. Cut set terms can be continued on separate lines.
3. An asterisk ("*"), plus sign ("+"), or blank (" ") separates basic event names.
4. A period (".") denotes the last cut set.

C.3 TEMAC

C.3.1 Sequences

C.3.1.1 Sequence Cut Sets.

The sequence cut sets are stored in the Sequence relation in the block data file. Cut sets can be loaded from the TEMAC output file (.OUT).

File Name:

xxxxxx.OUT.

File Format (for cut set portion of file):

(THE FIRST COLUMN OF NUMBERS CONTAINS THE LINE NUMBERS FOR ...
-- blank line
-- blank line
nn mmm 0 x. xxE-xx x.xxE-xx namel * name2 * name3 *name4 *
nn name5 +
nn mmm 0 x. xxE-xx x. xxE-xx namel * name2 * name3 * name4 *
nn name5 +
-- blank line

where

nn	- line number
mmm	- cut set number (columns 20-22). If blank, this is a cut set continuation line.
0	- order number
X.XXE-xx	- frequency and normalized frequency
name	- basic and initiating event names. Separated by "*" within a cut set. A "+" follows the last name within a cut set. A "." follows the last name in the last cut set. namel begins in column 54.

C.3.2 Basic Events

C.3.2.1 Basic Event Failure Rates.

Basic and initiating events and their probabilities can be extracted from the TEMAC output file (.OUT).

File Name:

xxxxxx.OUT

File Format (for events portion of file):

BASE EVENT	OCCUR	PROB (RANK) . . .
-- blank line		
name	nnn	x.xxE-xx
. . .		
INIT EVENT	OCCUR	FREQ (RANK) . . .
-- blank line		
ie-name	nnn	y.yyE-yy
. . .		

where

name	- basic event name	(columns 7-22)
X.XXE-xx	- probability	(columns 30-37)
ie-name	- initiating event name	(columns 7-22)
y.yyE-yy	- frequency	(columns 30-37)

C.3.3 Output Reports

Output reports can be converted to other formats or loaded by the user. They are not stored in entirety in the database. The basic events and initiating events are stripped from the TEMAC report file (.OUT) and stored in the Event relation (see Section 5.3.2). The cut sets are stored in the Sequence relation (see Section 5.3.1). The output file is not stored intact in the database and therefore cannot be extracted from the database.

C.4 CAFTA

C.4.1 Fault Tree Information

C.4.1.1 Logic.

File Name:
xxxxxxxx.FTP
File Format:
<gateName> [+/*] <input1> <input2> . . .
. . .
ENDTREE
IMPORT
<probability> eventName
. . .
LIMIT <probability cutoff>
where
gateName - 16 character
[+/*] - "+" indicates OR gate, "*" indicates AND gate
input - 16 character event or gate name

C.4.1.2 Failure Rates, Cut Sets, and Logic.

File Name:
xxxxxxxx.OUT
File Format:
. . .
0FAULT TREE INPUT

<gateName> [+*] <input1> <input2> . . .
. . .
ENDTREE
. . .
IMPORT
<probability> <event name>
. . .
LIMIT <probability cutoff>
. . .
IMPLICANTS FOR EVENT REACTIVE
-- blank line --
<cut number> <prob> <event name> <event Name> <event name> . . .
1 5.4312E-10 CCFR2 K147A
2 5.4312E-10 CCFR2 K147B
. . .
MIN CUT UPPER BOUND : 2.13639E-09

C.5 NUPRA

C.5.1 Sequences

C.5.1.1 Cut Sets.

File Name:

xxxxxxxx.EQN

File Format:

sequence-name =
cut1name1 * cut1name2 * cut1name3 +
cut2name2 * cut2name2 * cut2name3 *
cut2name4 +
cut3name1 * cut3name2.

General Rules:

See SETS Sequence Cut Sets format, Section 4.2.1

1. If sequence-name = "TOPEVENT", the name of the file is substituted for the sequence-name.