ORAM-Sentinel™ Version 3.4
User's Manual

All Modes Maintenance and Safety Function Advisor

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Computer Manual, September 2001

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REPORT SUMMARY

EPRI's ORAM-Sentinel™ tools improve nuclear plant safety during outages and at-power operations by helping utilities assess and manage the risk associated with planned and unplanned maintenance activity configurations.

Background

Since 1992, EPRI has aggressively undertaken several Outage Risk Assessment and Management (ORAM) projects. These have included deterministic and probabilistic studies of shutdown conditions and development of shutdown risk management guidelines. EPRI developed the integrated ORAM software family to help utility personnel conduct safety and risk management assessments during nuclear plant outages in support of the Nuclear Energy Institute and the Institute of Nuclear Power Operations guidelines. In 1995, EPRI created a complementary tool, SENTINEL, to perform similar evaluations during at-power test and maintenance configurations. In 1997, EPRI combined these into the ORAM-Sentinel software. This tool supports utilities in their compliance with the Nuclear Regulatory Commission Maintenance Rule [a(4)] by allowing them to perform both outage and at-power configuration risk management evaluations. In addition to improvements in safety, this code will help increase productivity and minimize the risk of events that could lead to regulatory intervention.

Objective

To provide systematic computerized methods for planning, evaluating, and conducting plant maintenance and testing from risk, safety, and efficiency perspectives; to incorporate and apply lessons learned for effective outage and at-power configuration risk management; and to enhance the Work Release Mode functionality and user interface over previous versions.

Approach

Investigators developed deterministic criteria for defense-in-depth protection of plant safety functions and transients along with probabilistic approaches for shutdown and at-power safety assessments. Many utilities participated in pilot applications of the ORAM-Sentinel Version 3.4 software, and EPRI conducted a number of technology transfer workshops to explain these applications and provide hands-on training in software use.

Results

ORAM-Sentinel Version 3.4 addresses both shutdown and at-power conditions by providing:

- The ability to store as-worked activities into a separate schedule database via a significantly enhanced Work Release user interface
- A probabilistic safety assessment (PSA) results database in the online and outage modes

- Displays of safety function and integrated safety-plant transient status
- Automated shutdown safety assessment information addressing the probability of and key contributors to core boiling or damage during outages
- Automated at-power and outage core damage probability information, with return-to-service/remain-in-service priorities and compensatory measures based on plant-specific PSA models
- Extensive "what-if" capabilities in terms of equipment configurations, with comparative before and after displays
- An analysis of maintenance activities using both schedule and single configuration views
- Automated risk management guidelines that provide specific recommendations based on plant equipment configurations

This user's manual provides a complete tutorial and technical reference—describing concepts and objectives, model building and data importing, and associated procedures and reports.

EPRI Perspective

With the flexibility to accommodate essentially any plant configuration, the ORAM-Sentinel code will prove valuable to outage management, planning, scheduling, and operations personnel as well as nuclear safety analysts. The code provides comprehensive analyses of possible options during outages and at-power maintenance configurations when the period for decision making is limited. It will aid users in assessing and managing the risk of online and outage maintenance configurations, as required by the Maintenance Rule. At present, the ORAM-Sentinel code or its predecessors are being used at more than 65 domestic and international reactors for risk management. Software models of all U.S. reactor vendor designs are available from EPRI.

Platform and Special Requirements

Windows 98, Second Edition; requires a PC with a Pentium, Pentium equivalent, or better processor (133 MHz Pentium CPU or faster recommended); and 32 MB of RAM minimum (64 MB or more recommended). Also requires 40 MB of available hard disk space and a CD–ROM**.**

Platforms & System Requirements

Windows 98

This personal computer software is designed to run on the same computer where it has been installed. The software is not designed to reside on a machine (such as a server) where it is accessed by other computers.

Keywords

ORAM
Risk assessment
Configuration management
At-power maintenance

ABSTRACT

ORAM-Sentinel™ is a Windows-based computer program. EPRI designed it to help plant personnel analyze and manage plant configuration safety during nuclear power plant outages and at-power maintenance. It was developed in accordance with the recommendations delineated in NUMARC 91-06, *Guidelines for Industry Actions to Assess Shutdown Management*, INPO 92-005, *Guidelines for the Management of Planned Outages at Nuclear Power Stations*, and NUMARC 93-01, *Industry Guidelines for Monitoring the Effectiveness of Maintenance at Nuclear Power Plants.*

Below are listed the main modules that comprise this software:

Safety Function Assessment, which allows the user to apply safety functions to measure nuclear power plant defense-in-depth during an outage or at-power, and supply a list of recommended guidance for each plant configuration.

Plant Transient Assessment, which evaluates the effects of a potential plant transient or assesses the ability of the plant to mitigate the effects of a transient during power operations.

Integrated Safety Assessment (ISA), which evaluates the effects of high risk evolutions considering defense-in-depth across multiple safety functions during shutdown operations.

Probabilistic Safety Assessment (PSA), which stores and displays the quantitative results from at-power and shutdown probabilistic safety assessments (PSA).

Probabilistic Shutdown Safety Assessment (PSSA), which employs the basic principles of PSA to quantify accident sequence end-state frequencies during nuclear plant outages.

The methodologies developed to address these concerns are documented in other EPRI publications. By incorporating these methodologies into a computer program, credible, timely and consistent analysis of the safety aspects of complex plant configurations is assured. This version of ORAM-Sentinel is year 2000 ready. This manual describes the use of this software.

ORAM-Sentinel v3.4 is the latest revision of the software. The most significant enhancements to ORAM-Sentinel are an improved user interface for real-time risk assessments, the ability to store actual configuration information, and the ability to export results and database records.

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INTRODUCTION

EPRI initiated the Outage Risk Assessment and Management (ORAM™) project in 1992 to enable nuclear power plant personnel to assess and improve the level of safety and efficiency in managing outage periods. ORAM achieves these goals by addressing the initiatives in NUMARC 91-06 [1], *Guideline for Industry Actions to Assess Shutdown Management* and INPO 92-005 [2], *Guidelines for the Management of Planned Outages at Nuclear Power Stations*. Due to the success of this project for outage evaluations, the project was expanded in 1995 to supply similar capabilities to at-power conditions. SENTINEL™ was developed to enable personnel to assess and improve the level of safety and efficiency in managing periods of on-line testing and maintenance. It achieves these goals by addressing many of the requirements in 10CFR50.65 [3] and NUMARC 93-01, *Industry Guidelines for Monitoring the Effectiveness of Maintenance at Nuclear Power Plants*.[23] With the release of ORAM-Sentinel version 3.0 in 1997, both outage and on-line safety assessments can be performed with one software tool. ORAM-Sentinel v3.0 became an all modes maintenance and safety function advisor.

The methodology developed by EPRI to address these concerns is documented in the following publications. Plant application documentation and other important sources are listed in Appendix B - References.

NSAC-175L Safety Assessment of BWR Risk During Shutdown Operations.[6]

NSAC-176L Safety Assessment of PWR Risk During Shutdown Operations.[7]

NSAC-183L Risk of PWR Inadvertent Criticality During Shutdown and Refueling.[8]

NSAC-195L Safety Assessment of Diablo Canyon Risks During Shutdown Operations.[9]

TR-102969 Contingency Strategies for Diablo Canyon During Potential Shutdown Operations Events.[11]

TR-102970 Outage Risk Management Guidelines for PWRs.[12]

TR-102971 Outage Risk Management Guidelines for BWRs.[13]

TR-102972 Reflux Cooling: Application To Decay Heat Removal During Shutdown Operations.[14]

TR-102973 Generic Contingency Strategies for BWRs During Potential Shutdown Operations Events.[15]

TR-105396 PSA Applications Guide.[22]

ORAM-Sentinel software integrates the methodologies described in these documents into a package that plant personnel can run on a personal computer. ORAM-Sentinel enhances the planning, maintenance, and post-maintenance critique portions of all maintenance

configurations. This software uses a blended approach of deterministic (defense-in-depth) and probabilistic techniques to improve plant safety and decrease operation and maintenance costs.

ORAM-Sentinel provides assessments of plant safety based on availability of equipment important to safety and potential loss of equipment due to plant activities. These configurations are compared against station procedures, policies, regulatory requirements, and engineering and operational personnel expertise. The program accepts information translated from scheduling software and other databases to develop "plant configurations." Plant configurations are defined by equipment availability and unavailability, testing, and by evolutions that can potentially lead to plant transient conditions or have the potential to degrade defense-in-depth. The schedule can include variable time-periods.

These configurations are evaluated using both quantitative and qualitative techniques to develop overall assessments of safety. As shown in Figure 1-1, the assessments performed by ORAM-Sentinel include Safety Function Assessment, Plant Transients Assessment, Integrated Safety Assessment, PSA and PSSA Results.

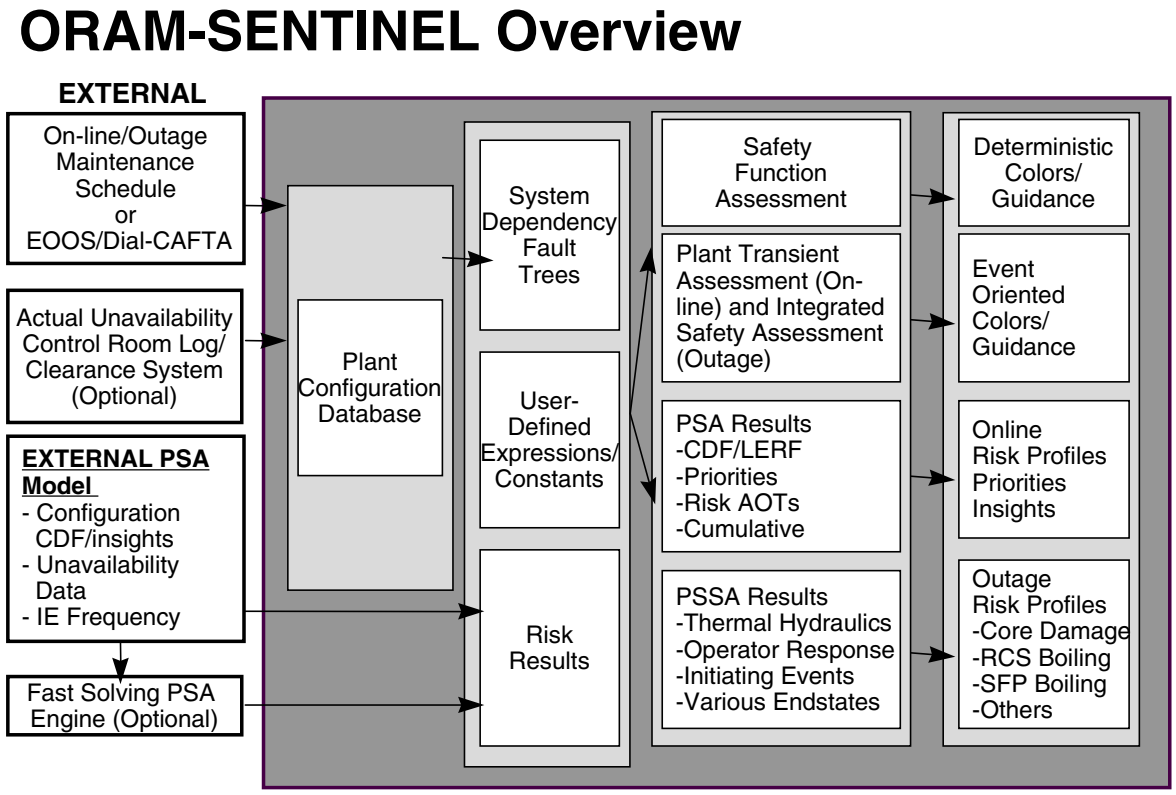

Figure 1-1
ORAM-Sentinel Overview

Safety Function Assessment

The safety function assessment measures defense-in-depth associated with a plant configuration. The assessment translates the plant configuration into a color representing a level of safety and guidance associated with the configuration. This assessment process is applicable to both at-power and outage conditions.

Plant Transient Assessment

The plant transient assessment tracks at-power activities that may lead to a plant transient or that may compromise the plant's ability to mitigate consequences of a plant trip or ATWS condition. The plant transient assessment provides guidance relevant to activities that are recommended for implementation or not recommended for implementation (do's and don'ts). Similar to the safety function assessment, this assessment translates the configuration into a color and provides associated guidance. This assessment is applicable to at-power conditions.

Integrated Safety Assessment

The Integrated Safety Assessment (ISA) applies the plant transient assessment methodology for outage configuration safety evaluations. This category can be used to deterministically evaluate safety aspects that may include several safety functions or that do not fit neatly into a safety function category (for example, shutdown fire safety). Similar to the plant transients assessments, this assessment translates the assessment results into a color that represents the relative level of safety and provides associated guidance.

PSA Results

The PSA Results Database stores results from probabilistic evaluations associated with the plant configuration. These results are end-state frequencies and insights from the probabilistic evaluations. Insights include a prioritized list of equipment to return to service, prioritized list of equipment to remain in service, and potential contingency considerations. The end-state is typically core damage frequency (CDF), but can be any end-state calculated by a PSA model. The results are displayed in tabular format, can be graphed as risk profiles and translated to a color which represents a relative risk level. This assessment process is applicable to both at-power and outage conditions.

Probabilistic Shutdown Safety Assessment

Probabilistic Shutdown Safety Assessment (PSSA) employs the basic principles of probabilistic risk assessment (PRA) to quantify accident sequence end-state frequencies during plant outages. The end-states typically evaluated include reactor coolant system (RCS) boiling, fuel pool boiling, and core damage from outage initiating events. Event trees, fault trees, and numeric variables are used to calculate these frequencies. The results are graphed as risk profiles.

Overall Plant Status Assessment

In addition to the assessments illustrated in Figure 1-1, ORAM-Sentinel includes an Overall Plant Status Assessment. The overall plant status allows a single color to represent the overall assessed configuration safety. For at-power evaluations, the overall status may be derived from the at-power safety function assessment, plant transient assessment, PSA results, or combinations thereof. For outage evaluations, the overall status may be derived from the outage safety function assessment, integrated safety function assessment, PSSA results, or combinations thereof.

New Features in Version 3.4

Modification of Schedule Database

The Schedule database has been divided into two "datasets," planned and actual. Both datasets can be calculated separately and are stored separately. The schedule and results can be viewed in both the Schedule Planning Mode and Work Release Mode.

The Planned Dataset contains schedule information imported through the Schedule Planning mode Maintenance Schedule Importing feature. When in the Work Release mode, the user can examine results of the Planned Schedule and perform what-if evaluations, but not modify the Planned Dataset. The user can copy a planned activity into the Actual Dataset.

The Actual Dataset contains activity information that was populated from one of the following methods: 1) Schedule Planning Mode Import feature, 2) Manual edits from the Work Release Screen, or 3) Integrated Plant Datasource (IPDS) Import. When in the Work Release mode, the user can examine results, perform what-if evaluations, and modify activities.

Enhancements to Work Release Mode

The Operations Plant Status View (or Work Release Mode) has been significantly modified. The user interface associated with performing what-ifs and viewing the status of model variables has been completely changed. The user now has the ability to perform what-if scenarios by adding, editing, or deleting activities. Additionally, activity data from the what-if scenario(s) can be saved to the Actual Dataset. The following features have been added:

Button Grid

The Work Release Grid Panel is the primary interface for viewing and changing the status of Plant Configuration Database (PCDB) variables. Multiple panels, or tabs, of user-defined button types and button colors allow the users to tailor the Work Release screens to their preference. Users can add, convert (from Planned to Actual), delete, and edit activities by interfacing with the user-defined buttons and the associated activities editor. The status of variables affected by activities can be determined by a color change of the button.

Two basic types of buttons are available, Single PCDB Buttons and Group Buttons. The single buttons represent one PCDB variable; the button color change can be affected by a user-defined variable in addition to the PCDB value. Group buttons allow the user to access a pick-list, which contains multiple PCDB variables, in a display similar to the v3.3 Work Release Mode.

Results Display Options

The user can customize, to some extent, the information seen in the Work Release Mode. This includes Safety Function Assessment Tree (SFAT), Plant Transient Assessment Tree (PTAT) and PSA results, as well as three new user-definable fields. Different settings can be used for Online and Outage Modes.

3 User-Definable Fields

The user has the option to display up to three user-definable fields below the results views; the outage model and the online model can each have their own display and logic definitions. For each field, the user can select the title of the field that appears on the screen and the numeric format (integer, decimal, or scientific). These display definitions and the logic are saved with the model. The variables that represent the color and numerical result are defined in the User Variable Database.

What-If Scenarios

The manner in which what-if scenarios are performed in Work Release mode has changed significantly from v3.3. The what-if scenarios now create activities in the appropriate dataset, rather then just changing the status of a variable for a single configuration.

What-if scenarios performed against the Actual Dataset in Work Release mode can be saved. Multi what-if scenarios may still be performed in the Schedule Planning Mode, but only with activities from the Planned Dataset.

Manual editing of activities from the Work Release screen is accomplished by interfacing with the PCDB variables in the Work Release Grid Panels. The Activity List Editor is the primary method for adding hammock activities in the Work Release mode. The activity editor can be accessed by primary clicking on a Single PCDB Button, or by double-clicking on a variable listed in a Group Button picklist.

A quick method of adding milestone activities to the data is using the "shortcut" methods: right-clicking on a Single PCDB Button, or using the drop-down box on a Group Button picklist. Adding an activity in this manner will add a milestone activity starting at the computer clock time; it will affect all configurations in the future.

Save What-Ifs to Actual Database

New features have been added to support the ability to save what-ifs from the Work Release Mode.

Transaction Log - The Transaction Log File is a text file that maintains an active log of all Actual Dataset modifications as they are saved. It records all manual activity saves, manual IPDS imports, auto-IPDS imports, and Schedule Planning Mode schedule imports to the Actual Dataset.

Shadow Database - The Shadow Database feature allows for users other than the user controlling the actual activities to view the latest Actual schedule information from their own workstations.

Work Release Report

The user can export the results data for the configuration being analyzed to a text file. The Work Release export text file contents will be based on the current data on the Work Release screen. Therefore, if the user is performing a what-if analysis, the export will include data for that analysis. The Work Release export includes results and PCDB variable status.

Access Schedule View

The Schedule View Gantt chart can now be accessed from the Work Release Mode. The Work Release Schedule View will display all activities for the selected Dataset within the Date Frame, including what-if activities.

Run External Applications

The user has the ability to define and launch external executables from within ORAM-Sentinel. Four unique command lines can be defined on the External Application Launcher window, and each one can be run.

Export Utility

An external utility application (ORAMKit) is provided with the installation. ORAMKit provides the user with the ability to export, in text format, various databases from the ORAM-Sentinel model. These databases include the Schedule, PCDB, Fault Tree, and User Variable databases.

Additionally, two results reports are provided in text format. The user can export the results of the assessment trees (Assessment Tree Report) or PSA/PSSA evaluations (Configuration Risk Report).

Open/Save Models

Because the user may want to protect the existing Actual Schedule information on both the local machine and in the Shadow Copy location, the user must select whether to overwrite the Actual Schedule information when opening a model. The ability to select whether to save Actual and/or Planned Dataset information and results when archiving models is also provided.

Additionally, any file type (other than *.trn) may now be archived with the model. These files must be placed in either the Files or Unit# directory before the model is saved. When the model is opened, all files previously archived with the model will be placed in the appropriate directory from which they were saved.

IPDS Polling and Import

The Integrated Plant Datasource (IPDS) import feature allows Work Release Mode users that have an external means of updating the status of plant equipment (such as an electronic log) to either manually or automatically update the ORAM-Sentinel Work Release Actual Dataset with that information and display the corresponding results. This feature is accomplished by importing a formatted text file, similar to the current Schedule Planning import process. The IPDS import can be accomplished in 3 ways: Manually from the Work Release screen Results menu, automatically at a user-defined polling interval from the Work Release mode, or by Command Line argument when starting the program.

Miscellaneous

Various bugs from previous software versions have been corrected. The most significant of these are listed in the README.TXT file. Additionally, the schedule import feature has been enhanced as described below.

Seven Additional Fields for Import

The Schedule Planning Mode import feature allows the user to include up to seven additional fields in the import file. These fields can be used for additional data which describes or categorizes the activity being imported.

Removed Features

As part of the Version 3.4 development, some features and functionality were removed from ORAM-Sentinel.

Maintenance Rule Performance Criteria (MRPC)

The databases, editors, graphs and reports associated with the MRPC module have been removed from ORAM-Sentinel. This is not expected to have an impact on any models, since the feature was not in use.

Tech Spec Log Import Feature

The ability to import from a Tech Spec log has been replaced by the IPDS import, which is a more versatile and robust method to import information to Work Release from an outside source.

Model Conversions

ORAM-Sentinel v3.4 will only convert models saved in v3.3 (*.um7 models). If a model is saved in a previous version of ORAM, SENTINEL or ORAM-Sentinel, it will need to be converted to a v3.3 model prior to opening it in v3.4. However, the software will automatically convert the version 3.3 model so that it can be used in version 3.4. Part of the conversion process includes the development of a default Work Release Mode grid, which allows the software to be used immediately without having to develop a custom grid.

Introduction Summary

ORAM-Sentinel is an integrated environment for performing safety assessments of plant configurations based on the availability of systems, trains, and/or components important to safety, as well as tests and other configuration changes. These assessments support evaluation of the safety and risk implications of planned maintenance activities and evaluate the influences of schedule activities on safety functions. These assessments pertain specifically to on-line or outage configurations. Because of these program characteristics, ORAM-Sentinel also is referred to as the All Modes Maintenance and Safety Function Advisor.

As distributed and licensed, ORAM-Sentinel is provided as a “stand-alone” product. The program provides a complete environment for evaluating risk and safety of various configurations within the framework of the hardware and software requirements defined in this manual.

ORAM-Sentinel, as distributed, is independent from other software product interfaces except schedule import, printer drivers, EOOS input, and external links and calls to a risk engine. The Schedule import accepts in ASCII format a schedule output from project management software such as PREMIS and PRIMAVERA or from binary processing of CAFTA fault trees in EOOS. The schedule information relevant to system and train availability or maintenance activities with the potential to cause a plant transient or degrade defense-in-depth is interfaced directly with ORAM-Sentinel.

ORAM-Sentinel software includes the following functions and features:

- Contains a plant database of equipment in and out of service due to maintenance or test.

- Uses existing databases (maintenance and test planning schedules) as input.
- Utilizes logic models and risk-based information to display data of value to maintenance planning and operations personnel.
- Results in color for key assessment functions, event types, and quantitative risk evaluations.
- Allows results to be traced through the model to understand the logic and scheduling data producing the results.
- Provides guidance to support operating and maintenance planning decisions.

This manual describes how to use ORAM-Sentinel software. This manual will assist two primary types of users. The first is the model builder. The model builder takes power plant design information along with administrative and regulatory requirements and creates and maintains a model for that plant. Once the model is refined, it is anticipated that it will need to be changed only when significant plant design changes are made or if major changes are made to administrative or regulatory requirements. The second user type are the planners, schedulers, and operators who make configuration risk management decisions. These personnel will take the previously developed model, import the schedule data or update the single-state configuration, evaluate (run) the model, and review results to assess and manage on-line or outage safety during equipment maintenance or tests. These personnel typically also perform what-if analyses on the schedule or the anticipated plant state. Henceforth, this manual refers to these personnel simply as the user. To get maximum benefit from this manual, users should review the entire manual (including the Guided Tour in Section 3) since some techniques are only described in one section. The sections in this manual include

Section 1, Introduction (this section).

Section 2, Getting Started, describes ORAM-Sentinel computer hardware requirements and how to install and uninstall the software.

Section 3, Guided Tour, is a tutorial of ORAM-Sentinel. It is highly recommended that both model builders and users review this section to help develop an understanding of the major software components.

Section 4, Model Building and Data Importing, describes how to build outage and on-line models. This is the primary section for model builders. The section also describes how to import specific outage information both automatically or manually. This portion of the section will be of interest to both model builders and users.

Section 5, Results Evaluation and Display, shows users how to evaluate the schedule data and how to display and review the results. This section describes the day-to-day operations that users will perform.

Section 6, Work Release Mode, provides a description of the features included in the Operational Plant Status View (Work Release Mode).

Section 7, Menu Items, provides a brief description of items on the main menu, drop-down menus, toolbar, viewbar, and status bar.

Appendix A is a list of definitions.

Appendix B is a list of references.

2
GETTING STARTED

The EPRI ORAM-Sentinel software is a powerful tool for analyzing nuclear power station equipment configurations from a safety and risk perspective. Like any software tool, this product must be properly installed, and the user must be shown how to use it. This manual assumes you have a working knowledge of the Microsoft Windows™ operating system. If you are unfamiliar with the basic Windows operating techniques, refer to a Windows manual for additional information.

Topics covered in this section include:

- ORAM-Sentinel Technical Support.
- Manual Conventions.
- Network, Workstation and Single Computer Installation in Windows 98.
- Starting ORAM-Sentinel.

ORAM-Sentinel Technical Support

For assistance using ORAM-Sentinel, contact ERIN Engineering and Research, Inc. or EPRI. Utilities contacting ERIN or EPRI are asked to indicate "ORAM-Sentinel Support Request" as the subject for any e-mail or fax correspondence.

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Manual Conventions

To help you locate and interpret information quickly, this manual uses consistent cues and standard formats for text. These are shown below.

This	Represents
bold	Text that you must type exactly as it appears. For example, if you are asked to enter the word **ORAMSENT**, you should type all bold characters exactly as they are printed.
italic	A place holder for information you must provide. For example, if you are asked to type *model name*, you would type the actual name for a model instead of the word(s) shown in italic type.
ALL CAPITALS	The names of directories, files, acronyms, icons, menu items, and button names.
Title Case	The names of dialog boxes, screens, graphs, editors, and fields.

Installation

The ORAM-Sentinel software program operates on a PC or compatible computer. ORAM-Sentinel Version 3.4 has been formally tested on Windows 98 Second Edition only. It may be possible, but not guaranteed, to work under other editions of Windows 98, Windows 95, Windows 2000, and Windows NT. The screens in ORAM-Sentinel are optimized for 800 x 600 resolution.

NOTE: If you are upgrading from a previous version of ORAM-Sentinel, you should use the setup program to ensure that proper files are installed on the computer. It is not recommended to manually extract and copy the executable and support files.

NOTE: When installing ORAM-Sentinel on a workstation following a network server installation, the "Workstation" installation can only performed from the ORAMSENT\SETUP directory.

Hardware and Software Requirements

Listed below are the minimum computer requirements:

- IBM© Personal Computer (or 100% compatible).
- Pentium (or equivalent) microprocessor (133 MHz Pentium CPU or faster recommended).
- 32MB RAM (64MB or more recommended).
- 40 MB hard disk space available.

- Microsoft© Windows 98™ Second Edition.
- HP LaserJet III Printer recommended. NOTE: ORAM-Sentinel printer compatibility is optimal with the HP LaserJet III. Some problems have been reported when printing to other printer types. These problems can generally be solved by closing other applications or configuring the printer (in the Windows 98 Control Panel) to emulate a LaserJet III and/or reduce the resolution (e.g., 600dpi to 300dpi). Additionally, ensure the latest driver is installed for the printer being used.
- Keyboard and mouse.
- Access to a CD drive.

Single User Installation

ORAM-Sentinel can be installed in any directory the user wishes. The directory name must be in DOS 8.3 format. The following subdirectories are automatically created in the directory where ORAM-Sentinel is installed:

- FILES
- IMPORT
- MODELS
- PRIVATE
- SYSTEM

The FILES directory contains all the model and results files generated or that will be generated as part of the model development and evaluation in ORAM-Sentinel, along with a subdirectory for every unit installed. The IMPORT directory generally contains the import files, such as schedule data generated by scheduling software. The MODELS directory contains the models that have been developed and archived within ORAM-Sentinel. The PRIVATE directory contains the files containing the users unique setup information. The SYSTEM directory contains all the ORAM-Sentinel support files. See Table 4-1 for a list of program files associated with these directories.

Installing on a Stand-Alone Computer

To install the ORAM-Sentinel software onto a standalone computer, perform the following:

NOTE: Prior to installing ORAM-Sentinel v3.4, it is recommended that any models or other needed files are stored in a directory other than ORAMSENT (or the directory that v3.4 is going to be installed in). Also, it is recommended that the v3.3 model which is going to be converted is archived in v3.3 with the Results check box NOT checked. This will prevent problems if the schedule files in the v3.3 model are corrupt. See the subsection “Converting Your Version 3.3 Model to Version 3.4” after the installation sections.

1. Start Windows. (If Windows was already running, close all other applications.)

2. Insert ORAM-Sentinel installation CD into the CD drive.
3. From the Desktop, click on START, then RUN. Type in *d*:**\SETUP** (where *d* is the drive containing the CD). Click on the OK button, the installation routine will start. Alternately, the SETUP.EXE file on the CD may be double-clicked.
4. Follow the on screen prompts until the Type of Installation dialog box appears. Click on the STANDARD INSTALLATION button.
5. Enter User and Company Name. Click on the CONTINUE button.
6. Determine the destination directories by using the NEW PATH button, i.e. c:\ORAMSENT. Select the application(s) you wish to install or update. Click on the CONTINUE button and follow the on screen instructions.
7. Select the number of nuclear plant units to be modeled and click on the NEXT button.

   NOTE: ORAM-Sentinel needs various system support files (DLLs, VBXs, etc.). If these files did not previously exist on your computer ORAM-Sentinel will install them. If any support files are already on your computer, ORAM-Sentinel will display a comparison of the version, date, time, file size and location between the previously installed support file and the ORAM-Sentinel supplied version. A choice will be given to overwrite the existing file or keep the existing file. In general, it is suggested that the newer version of the support file should reside on the computer. Newer versions are generally, but not always, backward compatible. Therefore, a newer version than the ORAM-Sentinel supplied version of the support file should, but is not guaranteed to work with ORAM-Sentinel. Regardless of the decision, ORAM-Sentinel will place a copy of the ORAM-Sentinel supplied version in the ORAMSENT\SYSTEM directory for future use. Finally, the README.TXT found in the ORAMSENT directory will be updated with the exact status of all of these files following installation. This README.TXT file will identify which files have been over written by ORAM-Sentinel.

   > WARNING - support file compatibility (DLLs, VBXs) is a generic Windows issue. Newer DLLs and VBXs are, in general, backward compatible, but may not always be compatible. BTRIEVE version 6.15 or greater must create files in pre-version 6.15 format to be compatible with ORAM-Sentinel.

8. When the install process is complete, the installation routine will have created a folder in Windows titled ORAM-Sentinel. There should be an icon for each application you installed, but none for the sample models
9. Be sure to read the README.TXT file for the latest information on the ORAM-Sentinel code not contained within this manual.

Network Server Installation

Use of the ORAM-Sentinel software in a network environment allows all users to have concurrent access to the most recent results (e.g., updated maintenance schedule, the most recent safety evaluation, etc.) performed by other users. ORAM-Sentinel is not a client/server application. When running on a network, the executable will run in memory on each workstation and the server will function as a file server. The concurrent network capability includes some constraints that should be considered.

Network Constraints

Write Access

ORAM-Sentinel must be installed on a drive that can be accessed by all users. All users need write access to the CFGRECRD.BTR file stored in the PRIVATE directory. It is recommended that this directory be placed on the local workstation during the installation process.

ORAM-Sentinel uses a standard windows installation process. For network systems configured to require all users to log off to install new software this requirement will also apply to ORAM-Sentinel.

Critical and Semi-Critical Activities

When a critical task is performed, only one user can be logged into ORAM-Sentinel. Multiple users may be logged on during semi-critical tasks. However, only one user can perform a semi-critical task at one time. The code generates error messages if users attempt to violate these constraints.

As an alternative to network installation and operations, stand-alone installations can be performed on each computer, with the model and schedule information made available on a common (network) drive. Thus the model and schedule can be downloaded to individual computers. With the addition of the Shadow Database feature (see Section 6), the actual configuration information can also be stored on a shared drive.

Critical Tasks include:

- Opening, creating or saving a model
- Importing schedule data
- Recalculation of results.

Semi-critical Tasks include:

- Plotting variable versus time (X vs T Graph) data
- Displaying the safety assessment worksheets (SAWs).

File Backups

The models and results stored on the network should be routinely backed up using new names for the saved models and results. A program for backing up and retaining specific backups for long term storage should be implemented consistent with sound software program management practices.

User IDs

Each user and model builder must be assigned a unique User ID and Password if using ORAM-Sentinel from a server (network operation). ORAM-Sentinel is not currently set up to handle multiple users with the same User ID and Password in the code at the same time. ORAM-Sentinel will not prevent this, but should provide a warning that the User ID and Password is already in the code. This enables a user (even in the standalone mode) who had inadvertently exited ORAM-Sentinel (without exiting through normal operations) to re-enter the code by acknowledging this warning.

Directories

ORAM-Sentinel can be installed either in the root directory of a shared drive or any other desired directory of a shared drive. Following network installation of ORAM-Sentinel, the following subdirectories are automatically created in the directory where ORAM-Sentinel is installed:

- FILES
- IMPORT
- MODELS
- SETUP

The FILES directory contains all the model and results files generated or that will be generated as part of the model development and evaluation in ORAM-Sentinel along with a subdirectory for every unit installed. The IMPORT directory contains the import files schedule data generated by scheduling software. The MODELS directory contains the models that have been developed and archived within ORAM-Sentinel. The SETUP directory contains the files needed to install ORAM-Sentinel on each workstation.

Installing on a Network Server

To install the ORAM-Sentinel software onto a network server perform the following:

1. Start Windows.
2. If you are performing a network installation from a workstation, map a Network Drive to the parent directory where ORAM-Sentinel is to be installed. (It is recommended that each workstation use the same map drive letter.)
3. Insert the ORAM-Sentinel CD into your CD drive.
4. From the Desktop, click on START, then RUN. Type in *d*:**\SETUP** (where d is the drive containing the CD). Click on the OK button, the installation routine will start. Alternately, the SETUP.EXE file on the CD can be double-clicked.
5. Follow the on screen prompts until the Type of Installation dialog box appears. Click on the NETWORK INSTALLATION button.
6. Determine the destination directories and select the application(s) you wish to install or update and click on the CONTINUE button. Follow the on screen instructions.

7. Be sure to read the README.TXT file for the latest information on the ORAM-Sentinel code.

Once the network installation is completed, the ORAM-Sentinel administrator must perform a workstation installation on the server to be able to run ORAM-Sentinel from the network drive. However, for others to use ORAM-Sentinel on their workstation, components must be installed on each workstation. The install process must be rerun from each workstation to accomplish this.

Network Workstation Installation

To run ORAM-Sentinel from a workstation off a network server, ORAM-Sentinel must first be installed on the server. If this has not already been performed see the previous discussion. To install the ORAM-Sentinel workstation components onto an individual workstation, go to that workstation and perform the following:

1. Start Windows.
2. Verify workstation's map drive letter for the network server ORAMSENT directory is identical to the drive letter chosen for the directories setup in the NETSET.INI file located in the \SETUP directory.
3. Perform the following and then continue:

   From the Desktop, click on START, then RUN. Type in ***d*:\ORAMSENT\SETUP\SETUP.EXE** where *d* is the network drive containing the ORAM-Sentinel code. ORAMSENT\SETUP is the default directory path and should be modified to meet your exact location. Click on the OK button, the installation routine will start. Alternately, the SETUP.EXE file in the folder described above can be double-clicked.

4. Follow the on screen prompts until the Workstation Install Options dialog box appears. Select the option(s) you wish to install or update and click on the CONTINUE button. Follow the on screen instructions.

   NOTE: Unless ORAM-Sentinel v3.3 has already been installed on the workstation, it is recommended to select the "ORAM-Sentinel support DLLs and VBXs" checkbox. ORAM-Sentinel needs various system support files (DLLs, VBXs, etc.). If these files did not previously exist on your computer ORAM-Sentinel will install them. If any or all of them were already on your computer, ORAM-Sentinel will display the version, date, time, file size and location of the previously installed version and the ORAM-Sentinel supplied version. If you choose to install the ORAM-Sentinel supplied version the previously installed version will be overwritten. If you choose not to install the ORAM-Sentinel supplied version, the previously existing version will be left alone and ORAM-Sentinel will place a copy of the ORAM-Sentinel supplied version in the ORAMSENT\SYSTEM directory. In addition, the README.TXT found in the ORAMSENT directory will be updated with the exact status of all of these files.

   WARNING - support file compatibility (DLLs, VBXs) is a generic Windows issue. Newer DLLs and VBXs are, in general, backward compatible, but may not always be

compatible. BTRIEVE version 6.15 or greater must create files in pre-version 6.15 format to be compatible with ORAM-Sentinel.

1. When the install process is complete, the installation routine will have created a folder titled ORAM-Sentinel. There should be an icon for each application you installed, but none for the sample models.

2. Be sure to read the README.TXT file for the latest information on the ORAM-Sentinel code.

Uninstalling ORAM-Sentinel

There is no uninstall program for ORAM-Sentinel. In order to remove ORAM-Sentinel and it's components from a Stand-Alone or Network Server Computer, the user will need to manually delete the following:

- The ORAM-Sentinel directory that contains the executable and subdirectories that are automatically created during the installation process. (Note: The default directory is C:\ORAMSENT, but can be changed by the user during installation.)

- ORAMSENT.INI (This file is placed in C:\Windows at installation)

- Support files, such as dll and vbx files, installed in the WINDOWS\SYSTEM.

  WARNING! Some of the support files installed with ORAM-Sentinel (for a list, see the end of the README.TXT file) are also used for other applications. Deleting these support files will cause those applications to fail or have errors. It is suggested that the only files deleted are those support files which are known not to be used for other applications on the computer. The two files OSBTRVCL.DLL and OSFPTAB.VBX are the only support files which are unique to ORAM-Sentinel and can be deleted without consequence.

- The ORAM-Sentinel icon group in the Windows START|PROGRAMS menu.

- Remove the Btrieve setting from the WIN.INI file. The Btrieve setting for ORAM-Sentinel will be similar to the following:
  options=/m:64 /p:4096 /b:16 /f:50 /l:50 /n:12 /u:2 /t:C:\ORAMSENT\FILES\btrv.trn

  WARNING! There is generally only one Btrieve setting in the win.ini file, even though there may be other applications on the computer which use Btrieve (for example, PRIMAVERA, Microsoft Office 97). Ensure there are no other applications that rely on Btrieve before removing this line.

Starting ORAM-Sentinel

If you have not yet loaded ORAM-Sentinel see the beginning of this section. If you have not started Windows, do so now. Click on START, then PROGRAMS, then ORAM-Sentinel, and

SUPERVISOR for the UserID. After typing **SUPERVISOR**, hit the <Enter> key or click on OK (no Password is required for this UserID). EPRI recommends that you perform the guided tour described in Section 3.

Figure 2-1
Logon Screen

Converting Your Version 3.3 Model to Version 3.4

After ORAM-Sentinel is running, the version 3.3 model (*.UM7 format) can be converted to the version 3.4 (*.UM8) format. This conversion will occur automatically upon opening the model in version 3.4.

Due to potential errors in the schedule databases in version 3.3 models, which will cause errors in version 3.4, it is recommended that the version 3.3 model to be converted is first archived (saved) with the Results checkbox NOT checked. This will save the model without the Schedule or Results databases. After the model has been converted, the schedule can be re-imported into the v3.4 model, recalculated and saved in *.UM8 format.

To convert the model, open the version 3.3 model in ORAM-Sentinel version 3.4, Schedule Planning Mode. The necessary modifications will automatically be made to the databases in the model at this time. After the conversions are complete, switch datasets (e.g., change from Planned to Actual) and another conversion should take place. When this is done, save the model in order to archive the files in the v3.4 format. To complete the conversion, switch to the Work Release Mode by closing ORAM-Sentinel and re-starting it in Work Release. Additional database conversions and creation will occur, and the model should be saved again. This completes the model conversion process. To take advantage of the new features in version 3.4, review the topics in Section 6.

The Security System

The ORAM-Sentinel software includes a security system intended to provide the program administrator with a means of controlling access to the various program features. It is also intended to provide EPRI a degree of protection against unauthorized software distribution. Figure 2-2 shows the Security Administration dialog box. The default User ID is **SUPERVISOR**, which does not require a password. Therefore, leave the password field blank. This UserID cannot be deleted, but use of it can be controlled by assigning a password, if desired. Anyone logging on with this ID can access all the ORAM-Sentinel features, including the User ID and password features. EPRI recommends that immediately after the initial setup, the ORAM-Sentinel administrator should change the password for this User ID.

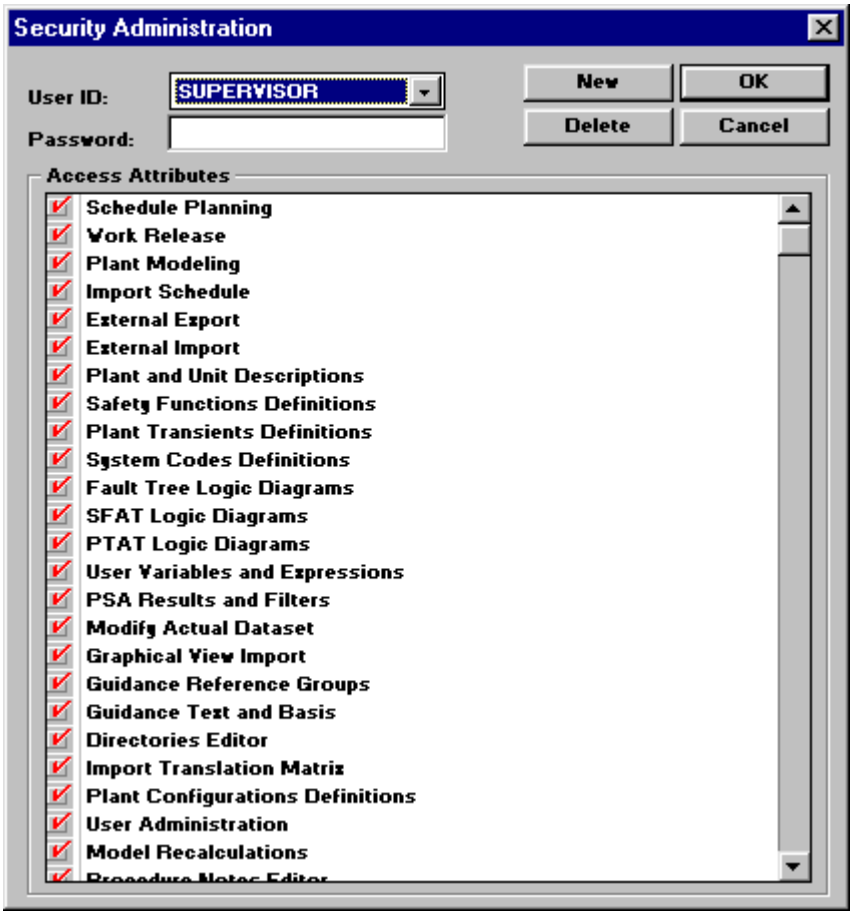


Figure 2-2
Security Administration

Security Features

These security features control access to the underlying data bases and editors. This prevents unauthorized access or modification of the model structure and decision logic used to assess safety and provide guidance. Additionally, it restricts the ability to modify the Actual Dataset to

a selected group of users. Security is developed to support or prevent access to the modules identified in Table 2-1, Security Modules.

In a network application, the ORAM-Sentinel users have the flexibility to perform all operations within their security access domain. ORAM-Sentinel system administration access to modify models or update and load new models should be performed when other users are off-line. Notifications to users of model updates and changes should be provided consistent with a sound software configuration management program.

Table 2-1
Security Modules

Modules
Schedule Planning
* Work Release
Plant Modeling
Import Schedule
* External Export
* External Import
Plant and Unit Descriptions
Safety Functions Definitions
Plant Transients Definitions
* System Codes Definitions
Fault Tree Logic Diagrams
SFAT Logic Diagrams
PTAT Logic Diagrams
User Variables and Expressions
PSA Results and Filters
Modify Actual Dataset
Graphical View Import
Guidance Reference Groups
Guidance Text and Basis
Directories Editor
Import Translation Matrix
Plant Configurations Definitions
User Administration
Model Recalculations
Procedure Notes Editor
Open, Save, and Create Models
Search and Replace variable names
Safety Assessment Worksheet editor
User Preferences-External Applications

* These security modules are not active.

The following will instruct the administrator how to establish security IDs and passwords for users and other model builders. Users should generally not have the ability to make changes to the ORAM-Sentinel model.

The security section in ORAM-Sentinel can be accessed by a user with the default ID of **SUPERVISOR**. The security section is located under FILE on the main menu and SECURITY PROFILES. Once in the screen titled Security Administration, a new user ID can be established by clicking on the NEW button. Establishing a new Password associated with the new User ID is optional.

After establishing a new User ID and Password (optional), it is necessary to select the areas within ORAM-Sentinel that the new ID will have access to. After establishing a new ID, select the appropriate sections for access. Model builders should have access to all modules.

For a maintenance scheduler or planner, the following security items should be selected to allow for needed access: SCHEDULE IMPORTING, MODEL RECALCULATIONS and OPEN, SAVE AND CREATE MODELS. Users with this access will be able to open models, import schedule data, recalculate the model (Safety Function, Plant Transient, PSA Results), trace the results back to the source schedule activities, and perform what-if scenarios and save models. These users will be able to see the applicable assessment trees, fault trees and user defined formulas during a trace. Only trees and formulas that are used to do the specific calculations based upon the related plant configuration can be viewed. The users with this access will not be able to alter any ORAM-Sentinel databases.

For Work Release Mode access, which may be given to a Control Room or Work Control operator, the following security items should be selected to allow for needed access: OPEN, SAVE AND CREATE MODELS and MODIFY ACTUAL DATASET. These settings will allow the user access to the Work Release Mode. The user will be able to perform what-ifs, save activities to the Actual Dataset, and import the IPDS. If the Use PSA Engine box is checked in Preferences, the user must also have MODEL RECALCULATIONS access.

Each user and each model builder should be assigned a unique User ID and Password if using ORAM-Sentinel from a server (network operation). ORAM-Sentinel is not currently set up to handle multiple users with the same User ID and Password operating in the code at the same time. ORAM-Sentinel will not prevent this, but will provide a warning that the User ID and Password is already in use. This warning message will allow a user who had improperly exited ORAM-Sentinel (without exiting through normal operations) to re-enter the code by acknowledging this warning.

3
GUIDED TOUR

This guided tour will introduce the user to the major features and functions of ORAM-Sentinel. As a prerequisite to performing this guided tour, ORAM-Sentinel must be installed successfully, including the example models provided on the installation disks. Refer to Section 2 for information on installing ORAM-Sentinel.

The guided tour will take about 1 hour and 15 minutes to complete. The guided tour is optimized for 800x600 resolution monitors. Window sizes may appear different on other resolution monitors. The figures in this manual were captured from an ORAM-Sentinel installation on a computer running Windows 98 Second Edition. If your computer is not running Windows 98 SE, your screen views may look somewhat different. At the completion of the guided tour, the user will be familiar with the location and basic functions of the following features:

- UserID and Password Screen
- Changing Date Frames
- Loading Models
- Plant Configurations Database (PCDB) Definitions
- Maintenance Schedule
- Safety Function Status
- Plant Transient Status
- Probabilistic Safety Assessment Status
- Variable versus Time Graphs
- Multi What-if Scenarios
- Operations Plant Status (Work Release)
- Safety Assessment Worksheet
- Outage and On-line Demarcation
- Outage Features
- Saving Models
- Changing Units

Features which are not necessarily described in this guided tour include the following:

- Interface with an external risk engine (launching and recovering results)
- Interface with a Control Room Log
- Changing User Preferences (some preference will be set at the beginning of the guided tour)
- Weighting Factors for SFAT/PTATs
- Allowed Outage Time (AOT) Tracking
- Accessing various ORAM-Sentinel processes from outside of the code (Command Line Arguments).

These features are explained in subsequent chapters.

UserID and Password Screen

Click on START, then PROGRAMS, then ORAM-Sentinel, and finally ORAM-Sentinel Version 3.4 to start ORAM-Sentinel.

Type **SUPERVISOR** for the UserID. No password is required with this UserID. This UserID cannot be deleted. This UserID can be controlled by assigning a password if desired. After typing **SUPERVISOR**, hit the <Enter> key or click on OK. The ORAM-Sentinel Application Mode screen will appear as shown in Figure 3-1.

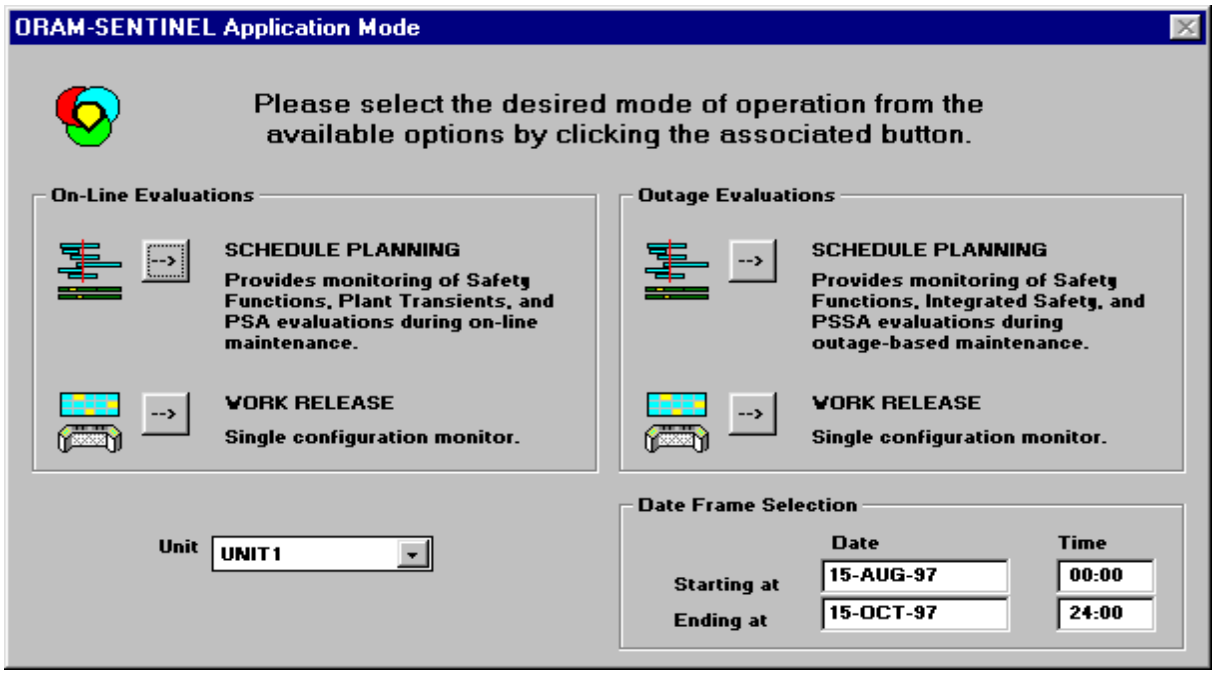


Figure 3-1
ORAM-Sentinel Application Mode Screen

The application mode screen allows the user to select which mode of operation to start in, which unit model to access and which Date Frame to load. For on-line evaluations the selection buttons

on the left side of the screen should be used. For outage evaluation the selection buttons on the right should be used. The selection buttons for each mode of operation include:

- SCHEDULE PLANNING - for evaluating schedules (multi-state)
- WORK RELEASE - for evaluating specific configurations (single-state).

Select UNIT1 in the Unit dropdown box and for the Date Frame Selection, enter a date frame of 15-AUG-97 00:00 to 15-OCT-97 24:00. Note that if no model is loaded, the Unit dropdown box will be empty.

For now select the SCHEDULE PLANNING button for On-line evaluations. If you just installed ORAM-Sentinel, you will get an indication that no model is currently loaded and prompted whether or not you wish to create a model. Select NO in this dialog. You will then be provided a list of available models. Select GTOUR_1.UM8, select YES to the Overwrite Actual option, and press OK; then select YES in the next dialog to continue loading this model.

The screen shown in Figure 3-2 should appear after model loading is complete. Once the base screen has loaded, ensure the Dataset dropdown box next to the Unit selection box in the upper left corner is set to PLANNED.

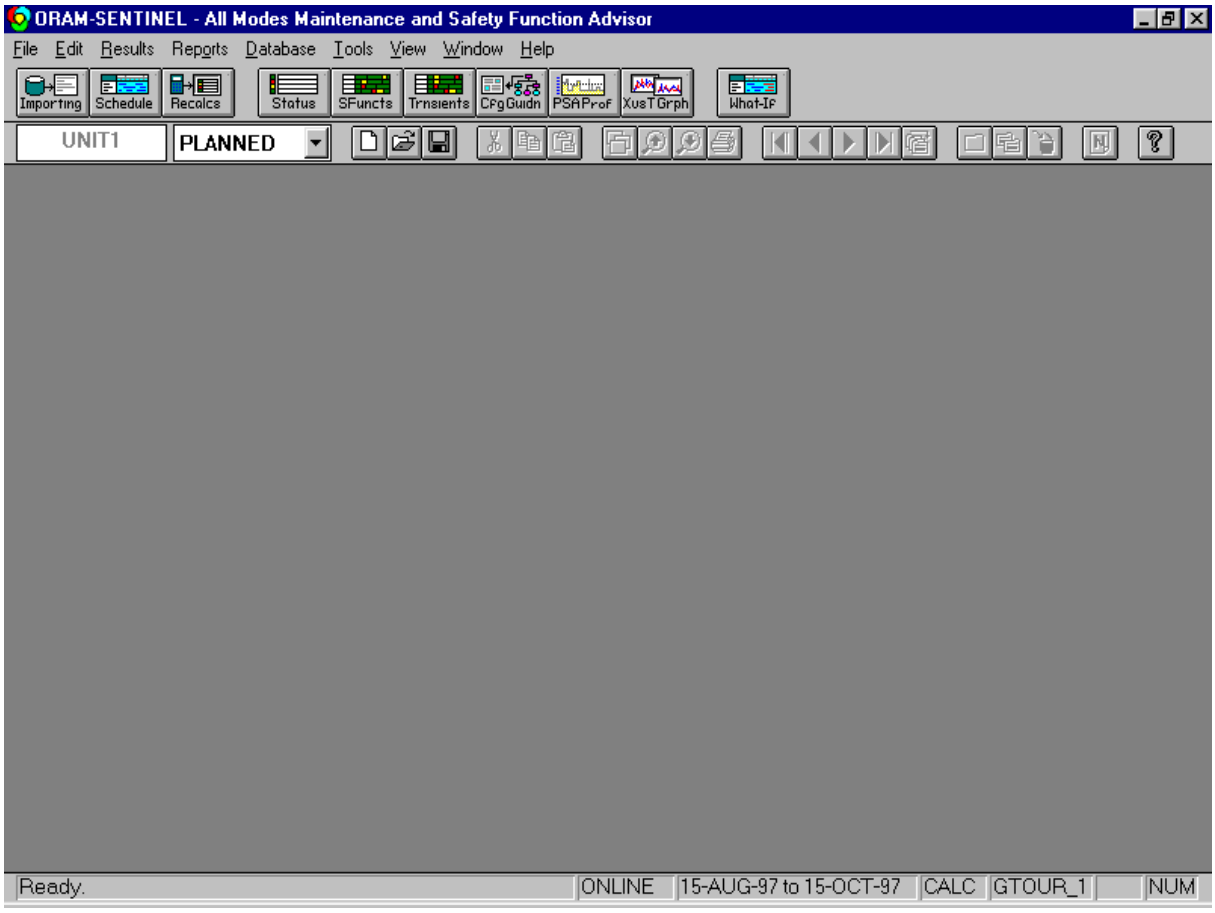


Figure 3-2
ORAM-Sentinel Base Screen

The base screen contains a menu bar with pull down menus (FILE, EDIT…). Below the menu bar is a set of larger icons, the viewbar. This viewbar provides shortcuts to frequently used processes or views. Below the viewbar is the toolbar. The toolbar supplies shortcut features for model operations, database editing and navigation, and view options. The toolbar features are enabled or disabled (grayed out) depending on the functionality of the view that has focus. Note that the toolbar and viewbar buttons have a tool tip that describes the button's function when the cursor is placed over them.

At the bottom of Figure 3-2 you will see the STATUS BAR. The STATUS BAR tells the user the following:

- Code status - what the code is currently doing (if it is waiting on the user, it will indicate READY).
- Mode status - which of two modes the code is in, ONLINE or OUTAGE.
- DATE FRAME status - what dates the code is currently working with.
- Recalculation status - if the model needs to recalculated. The code would need to be recalculated if input data or the date frame has changed, the model was opened, or a recalculation is done in the opposite Mode (ONLINE or OUTAGE. In Figure 3-2, CALC is seen in this field on the STATUS BAR, if the model was just opened. If a recalculation is not needed, this field would be blank).
- Current model - which model is currently loaded.
- Caps lock and number lock status - status of these two keyboard keys.

Changing Date Frames

The date frame may be changed by choosing DATE FRAME SELECTION under the RESULTS pull down menu or directly on the Application Mode Screen. In version 3.4, the Application Mode Screen can only be accessed when the software is started. Select the DATE FRAME SELECTION option from the RESULTS menu; the Date Frame Selection dialog box as shown in Figure 3-3 will appear. Verify the date frame is 15-AUG-97 00:00 to 15-OCT-97 24:00. Note: The Date Frame times are locked to 00:00 for the start time and 24:00 for the end time. A new ORAM-Sentinel installation defaults to this period. If no changes are made to the date frame, select the CANCEL button, otherwise, press OK.

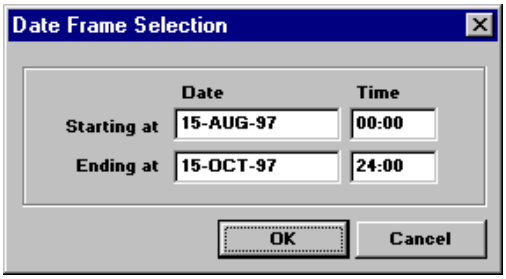


Figure 3-3
Date Frame Selection

Loading Models

If the current model is not GTOUR_1.UM8, load the GTOUR_1.UM8 model by choosing the OPEN option under the FILE pull-down menu. Figure 3-4 shows the Select And Load From Archive dialog box. Verify or select "Yes" for the Overwrite Actual option. Highlight the model GTOUR_1.UM8 in the listbox and press OK. Select YES in the dialog to continue loading model. A "Unit Model Loading" dialog will appear and the status bar indicates loading progress. When loading is complete the dialog disappears and READY appears in the status bar. Prior to continuing, calculate the model by selecting the RECALCS button in the viewbar and PROCEED in the Recalculations dialog.

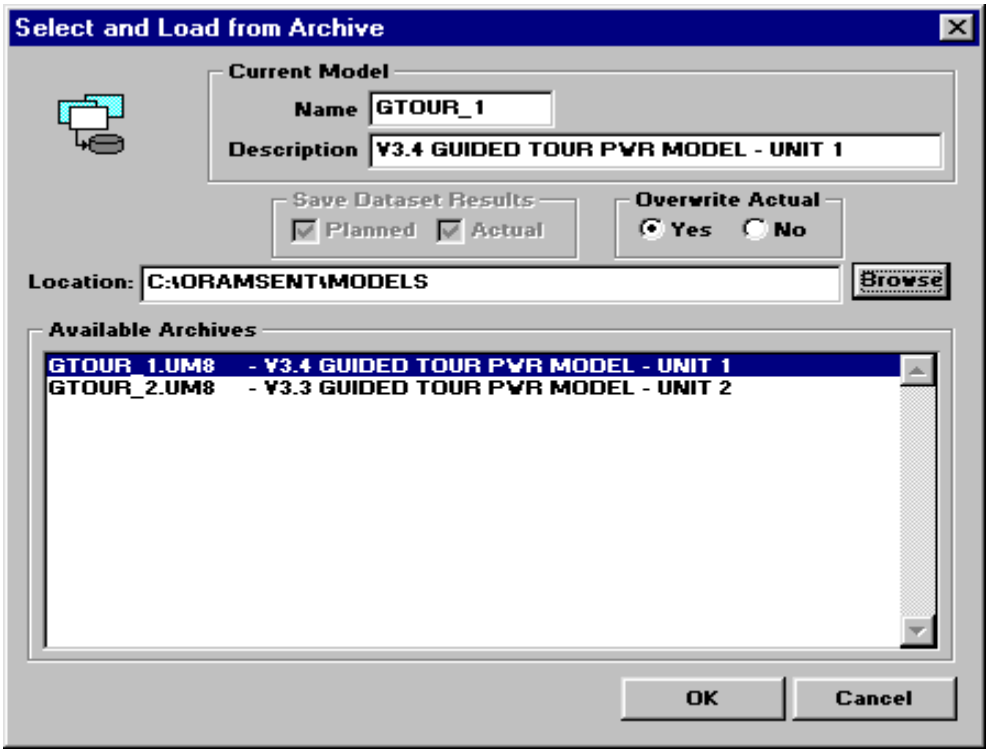


Figure 3-4
Select and Load from Archive

Plant Configurations Database Definitions

Under the FILE pull down menu, choose PREFERENCES. In the Application Preferences view, select the General tab and set the PCDB Variable Categories Enabled to "YES," set the Default Activity Duration to **24:00**, set the Overwrite Actual Default to "YES," in the Path to Log File type **C:\ORAMSENT\FILES\LOG_ACT.TXT** (this assumes that ORAM-Sentinel was installed in C:\ORAMSENT). Click OK.

Under the FILE pull down menu, choose CONFIGURATION and then choose PLANT CONFIGURATION DEFINITIONS. Select the variable, U1_SSPS_A, as shown in Figure 3-5. The Plant Configuration Definitions Editor, shown in Figure 3-5, contains the Components and

Trains, High Risk Evolutions, Configurations and Value Assignments that form the basic model definitions that are being tracked from the maintenance schedule. The descriptions of the variable names can be revealed by single clicking on the variable of interest and reading the details regarding that variable in the fields on the lower portion of the editor.

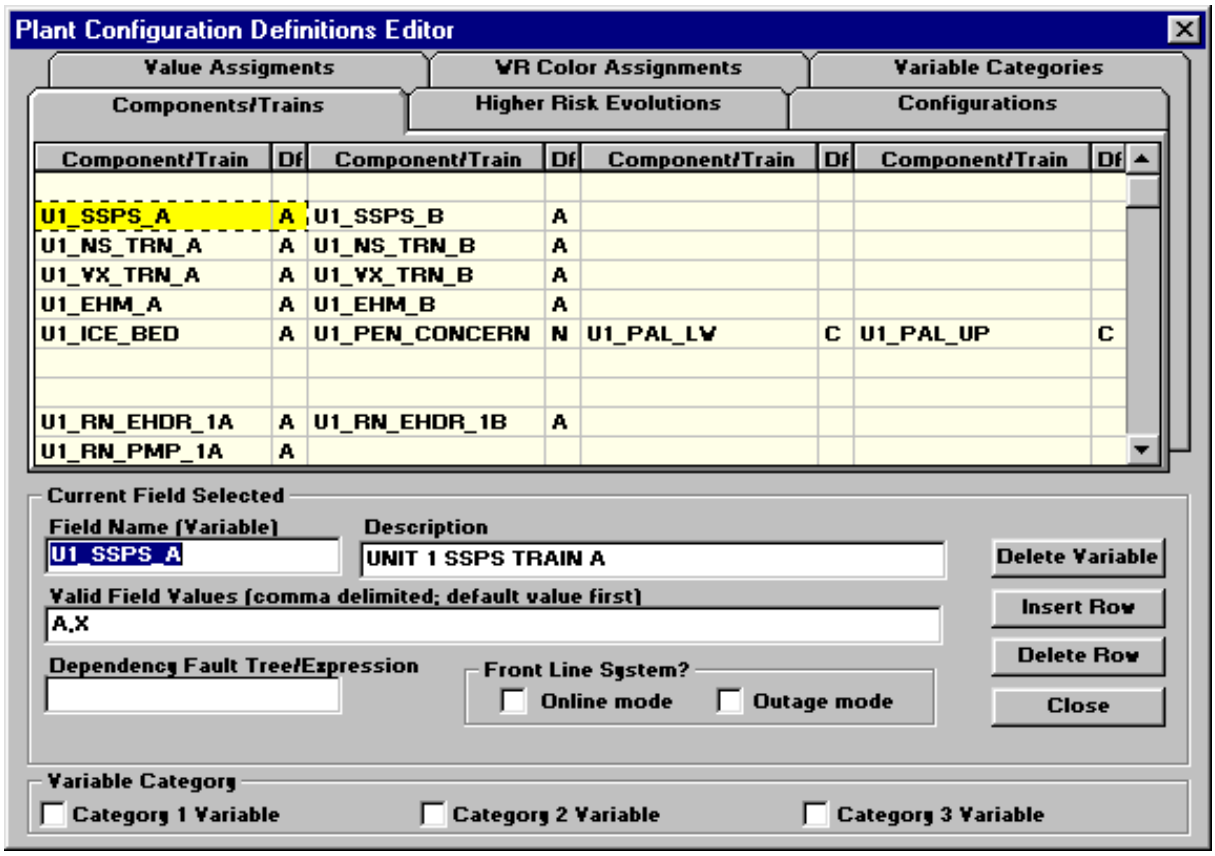


Figure 3-5
Plant Configuration Definitions Editor

Select the Value Assignments Tab. Notice the value "A" represents Available and is assigned a value of "0" for use in logic formulas and a color of GREEN for the Work Release mode. Similarly notice that "X" represents Unavailable and is assigned a value of "1" with a color of RED.

The Variable Categories tab allows for the user to define variable categories with their associated color/pattern combinations. These color/pattern combinations are used to display activities in the Schedule View. This feature is discussed in Section 4.

All color assignments made in the Plant Configurations Definitions Editor are used to define button colors on the user-defined Work Release grid panels. Select the WR Color Assignments Tab; notice the Support Variable Value of "0" is assigned GREEN and the Support Variable Value of "1" is assigned the color ORANGE. Select the Configurations Tab; notice the color assigned to the Default Color setting is GREEN and the Non-Default Color assignment is "BLUE."

Close the Plant Configuration Definitions Editor by choosing the CLOSE button in the lower right corner of the editor.

Maintenance Schedule

Next, view the maintenance schedule for the selected date frame by choosing MAINTENANCE SCHEDULE VIEW under the RESULTS pull down menu. The maintenance schedule can also be accessed by pressing the SCHEDULE button on the viewbar. The Gantt chart should appear as shown in Figure 3-6. The Schedule Legend window is also opened. A message box may appear informing the user that model changes have been made. Acknowledge the message by clicking on OK. If this message box appears, the OVERALL STATUS bar in the Maintenance Schedule View will display white. The model will need to be recalculated in order to display the OVERALL STATUS color.

The Maintenance Schedule View displays two columns of data on the left side of the window. The data (e.g. PCDB Variable, activity code, activity description), Sort Order (Chronological, Left Column, Right Column) and Sort Direction (Ascending, Descending) are selected by the user. To change the data display, click the OPTIONS button on the toolbar or select OPTIONS under the VIEW pull-down menu.

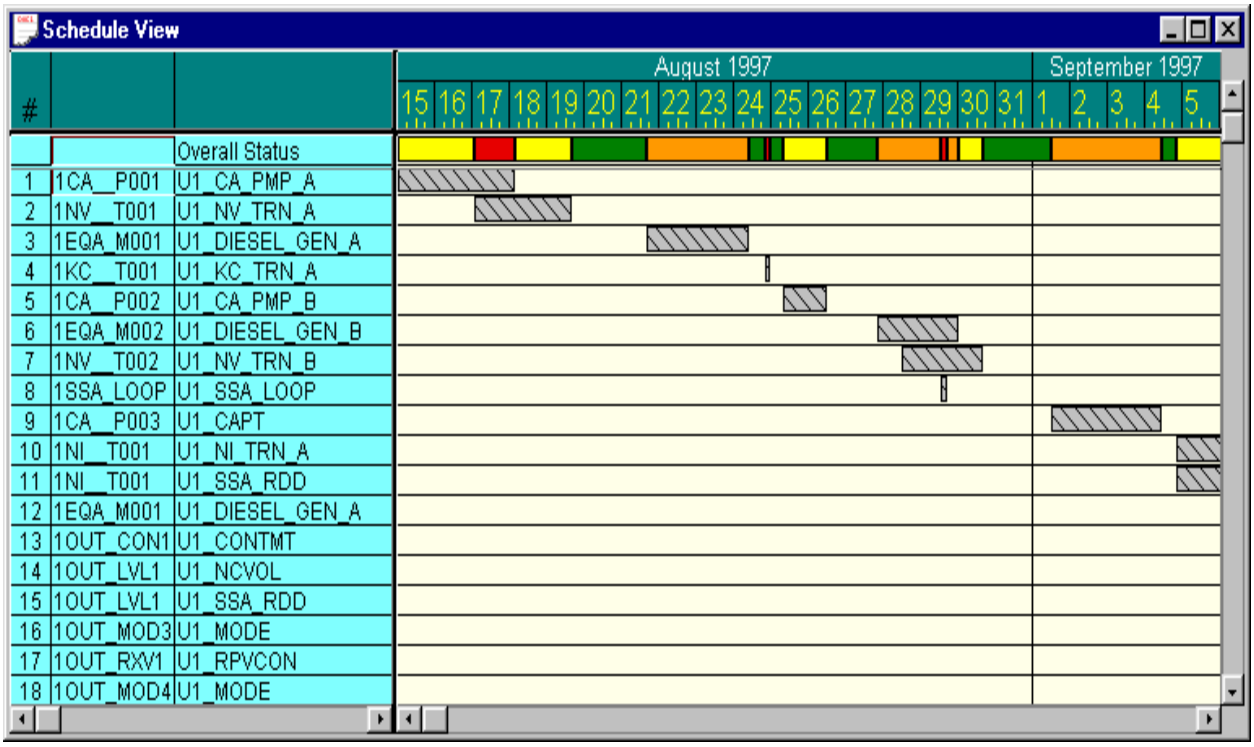


Figure 3-6
Schedule View

In Figure 3-6, the left column displays the Schedule Activity Code (Activity ID) and the right column displays the PCDB Variable affected. The schedule is sorted chronologically by the scheduled start dates. An activity code that is listed more than once in the same period (but with

a different PCDB Variable) indicates this activity affects more than one PCDB variable. The scheduled activities are represented by the shaded areas. The Overall Status is displayed at the top of the Schedule View. If any changes are made to the schedule, the Overall Status will display white or alternate mode (i.e. cross-hatched) until the model is recalculated. While the Schedule View is open, the PRINT VIEW button on the tool bar can be used to provide a Schedule View report. To access more information on the scheduled activity, double-click on the activity name or the shaded bar. The Planning Schedule Task dialog box includes the Schedule/Task Identifier, Start Date/Time, End Date/Time, Duration, Task Description/Reference and Systems/ Trains affected. Date/Time fields may be edited from this screen to permanently change the activity schedule. Note: If a maintenance activity commences prior to the start date and time of the Date Frame, the maintenance activity start date and time is listed as the start date and time of the Date Frame. For Schedule View editing capabilities, refer to Section 4 under Schedule View Editing.

Select CANCEL to close the Planning Schedule Task window, and also close the Schedule View by clicking on the "X" box in the upper right hand corner of the schedule view.

Safety Function Status

View the corresponding Safety Function Status shown in Figure 3-7 by either using the SFUNCTS button on the viewbar or choosing SAFETY FUNCTIONS STATUS under the RESULTS pull down menu.

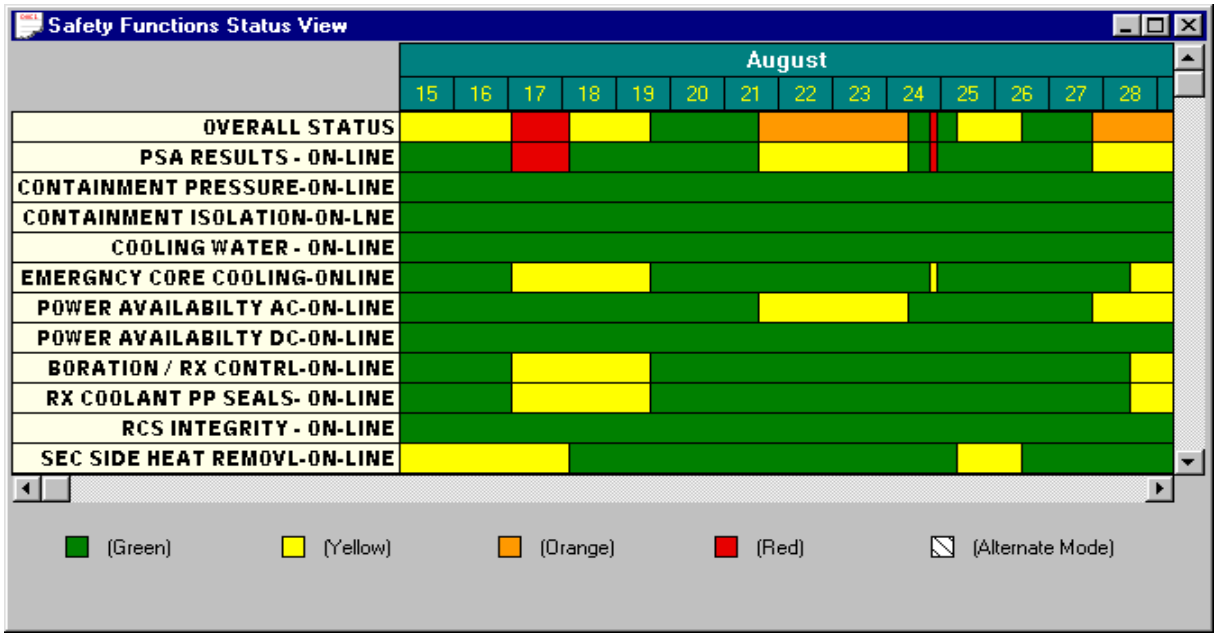


Figure 3-7
Safety Functions Status View

The Safety Function Status View lists each of the safety functions in the left column. A calendar exists in the upper horizontal axis. Each safety function status is represented by the adjacent

color bar under the calendar. The colors green, yellow, orange and red represent the best to worst condition, respectively, in terms of the safety function status.

Print a report of the Safety Function Status View by selecting SAFETY FUNCTIONS STATUS under the REPORTS menu. You may set various printer options by selecting the PRINTER... button. Select the SAFETY FUNCTIONS STATUS REPORT option and then OK to print the report.

On screen, the schedule shows a red condition during the day of 17 August and a small period on the 24th of August for the overall status. For this demonstration we will investigate the red condition on the 17th of August.

Trace the safety function status by double-clicking in the red area on the 17th of August. This action presents the Overall Plant Status View shown in Figure 3-8.

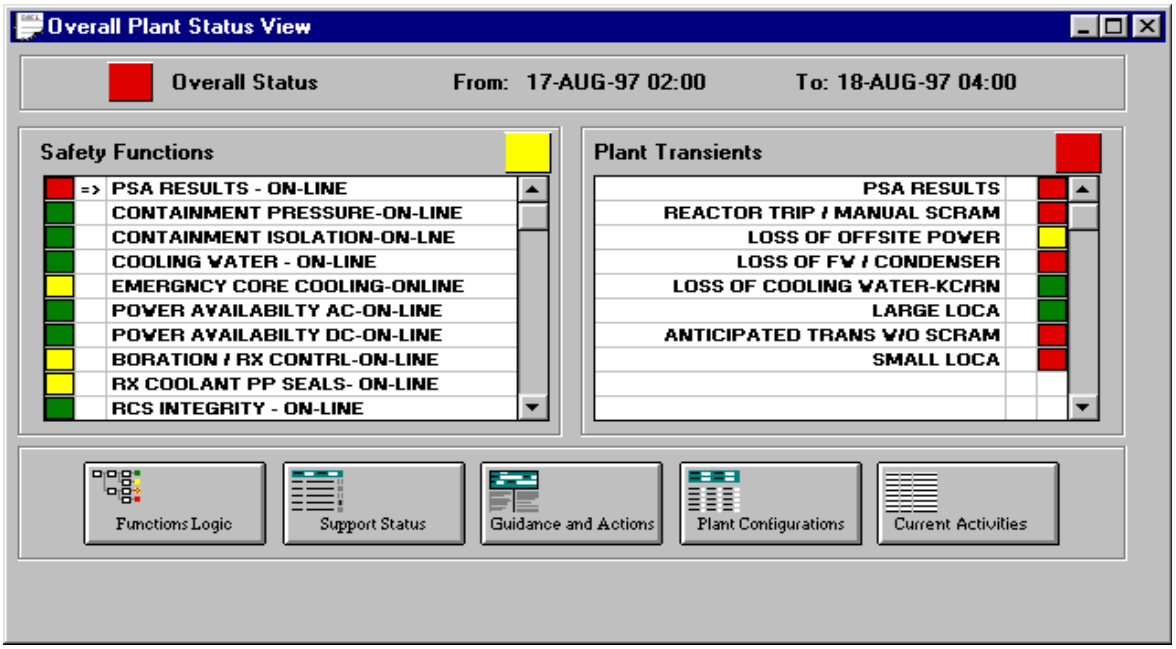


Figure 3-8
Overall Plant Status View

This view presents the Safety Functions and their status in the left column, the Plant Transients and their status in the right column and the overall status in a single color block at the top. Next to the overall status color are the dates that the configuration results apply to. This view summarizes the major results for this configuration. Note that you can also access the Overall Plant Status results from the RESULTS pull down menu or by clicking on the STATUS button in the viewbar. The five buttons on the lower part of the Overall Plant Status View provide further information regarding this configuration.

Click the CURRENT ACTIVITIES button in the lower right corner of the view. This presents a dialog showing the active scheduled items, the associated activity codes and descriptions of the schedule activities causing this equipment to be out of service, as shown in Figure 3-9.

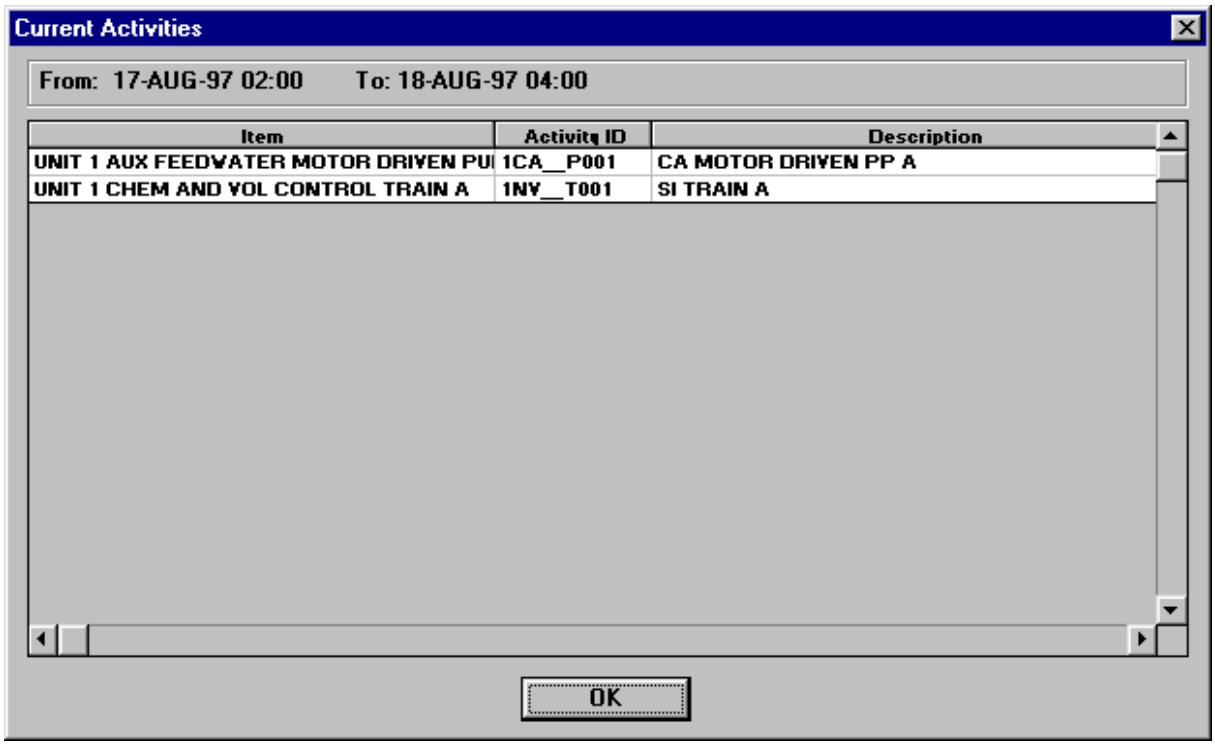


Figure 3-9
Current Activities

Press the OK button or use the windows dialog close feature in the menu bar to close this window. Now press the PLANT CONFIGURATIONS button (to the left of the CURRENT ACTIVITIES button).

The Plant Configurations View shows the status of PCDB variables (component and trains, configurations and high risk evolutions) for the configuration we are investigating. Those PCDB variables that are not in their default values are highlighted yellow. This can be observed by scrolling down the component and train status (lower scroll area) until the PCDB variable U1_NV_TRN_A is revealed, as shown in Figure 3-10. Whereas other equipment have a status of "A" for available, this variable representing chemical volume control system (CVCS) Train A has a status "X" for unavailable. Scrolling down further, the Auxiliary Feedwater Train A Pump (U1_CA_PMP_A) is also highlighted yellow. Close the dialog window by clicking on the "X" button in the upper right hand corner of the window.

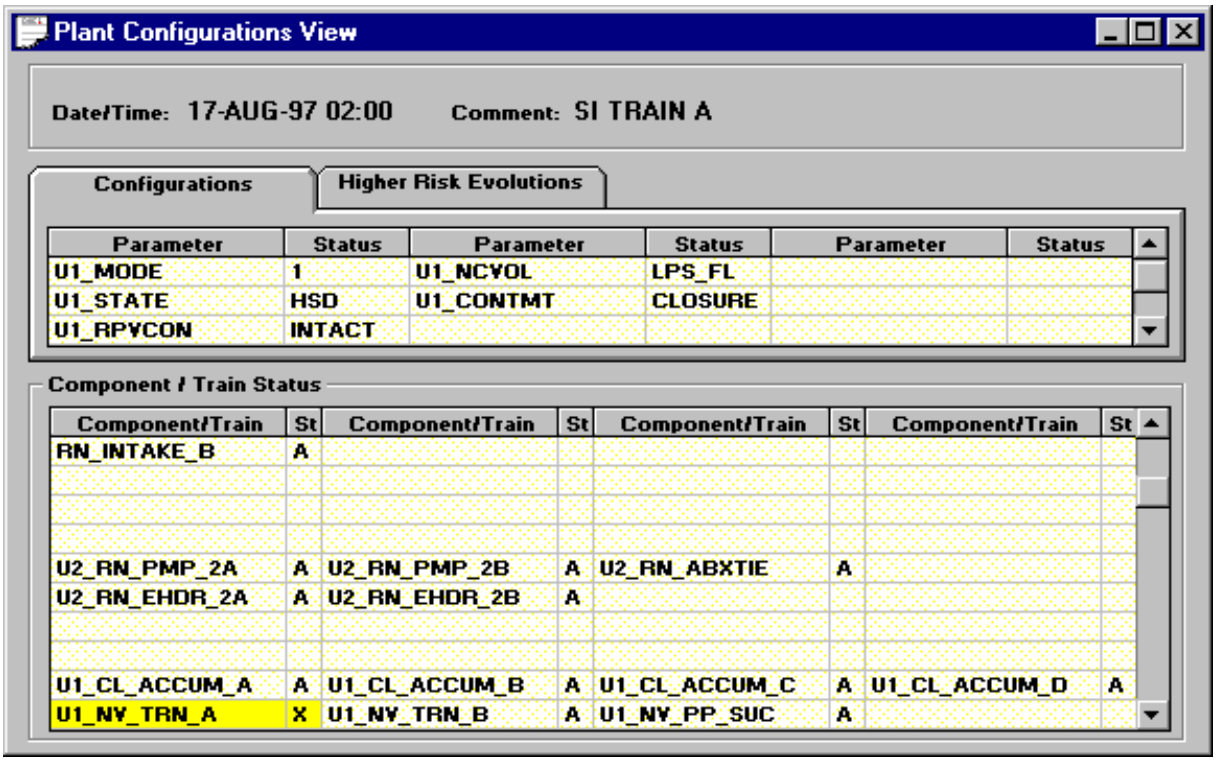


Figure 3-10
Plant Configurations View

We will now investigate the reason for the yellow status in the Emergency Core Cooling safety function and exercise the remaining three Overall PlantStatus View buttons. Move the selection arrow in the Safety Function results by performing a single click on the yellow box next to the "EMERGNCY CORE COOLING-ONLINE" description. (Note if you double-click, tracing of the function logic will be invoked). The selection arrow (=>) will move to the cursor location on a click. Next select the GUIDANCE AND ACTIONS button in the lower part of the Overall Plant Status View. This reveals the Guidance And Actions View as shown in Figure 3-11.

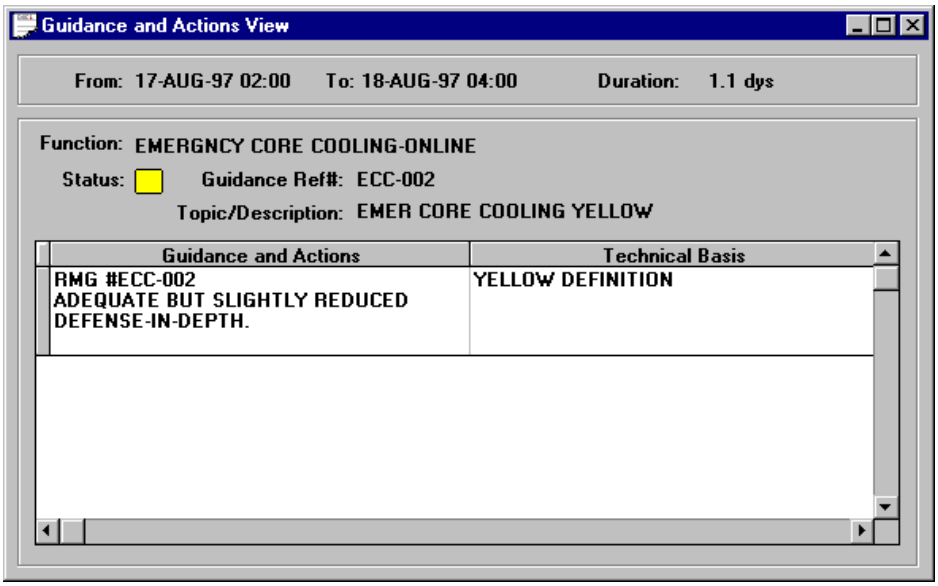


Figure 3-11
Guidance and Actions View

The Guidance and Actions View provides the user with configuration specific information. This view also indicates the duration of the configuration in the upper portion of the dialog. Close this dialog by using the window dialog close feature in the menu bar.

Select the SUPPORT STATUS button in the lower portion of the Overall Plant Status View. This reveals the Support System Status screen, which shows the status of systems important to this safety function as seen in Figure 3-12.

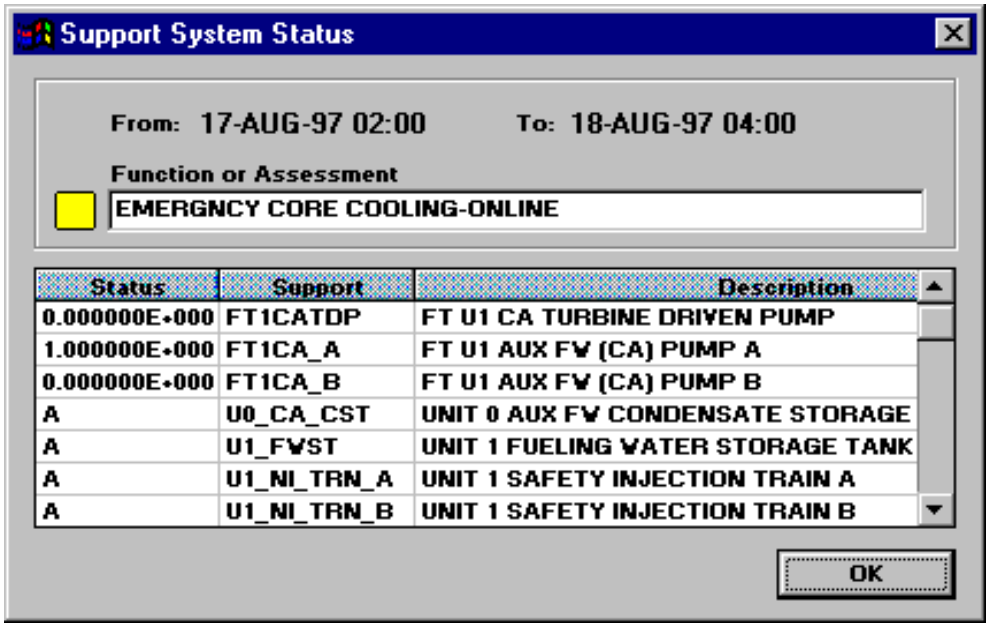


Figure 3-12
Support System Status

The Support System Status may include PCDB variables affected directly by the scheduled event or fault tree references which include affects of support systems being out of service on front-line systems or other supported systems. In this example the train A auxiliary feedwater pump fault tree (FT1CA_A) has a value of 1.0 indicating the fault is true (fault tree has failed). Hence, AFW train A or one of its supports has caused it to be unavailable. The other fault tree references (variables beginning with FT) are 0.0 in value or false (fault tree has not failed). This indicates that these trains have the necessary supports to operate. Scrolling down to the CVCS (chemical and volume control system) train A variable U1_NV_TRN_A shows this variable has an "X" or unavailable status. This indicates CVCS train A is specifically out of service, with no reference to any supports. Close the Support System Status view by pressing the OK button or using the windows dialog close feature in the menu bar.

We will now trace through the logic model for the Emergency Core Cooling safety function. From the overall plant status view begin the tracing by pressing the FUNCTIONS LOGIC button on the bottom of the Overall Plant Status View or simply double-click on the Emergency Core Cooling safety function. This reveals the Safety Function Assessment Decision Path window for the safety function as illustrated in Figure 3-13.

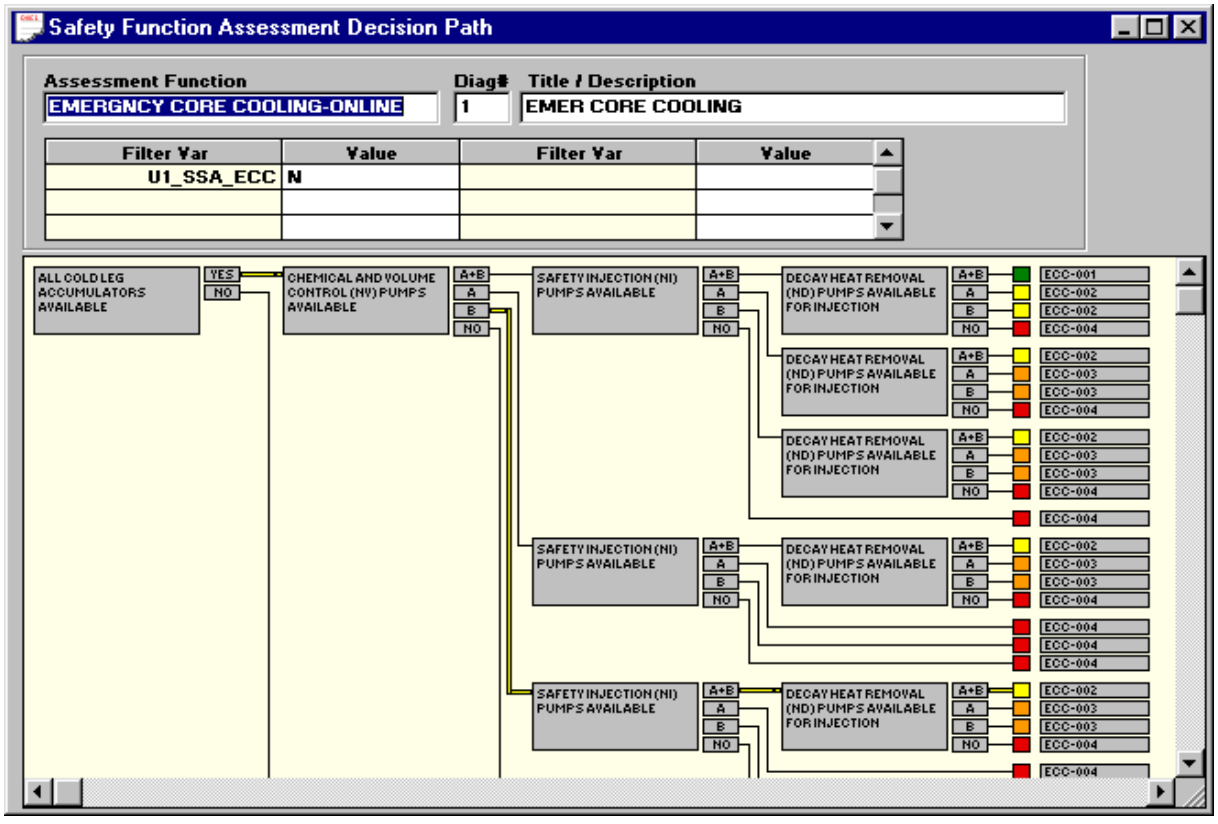


Figure 3-13
Safety Function Assessment Decision Path

The Safety Function Assessment Tree (SFAT) shows blocks representing systems or trains, logical outputs from each block representing a decision output and paths linking the logic blocks. At the terminal point of the logic are blocks with colors representing the assessed status of the

safety function based on the path. Next to each color and state is a gray box with text which represents the guidance and advice associated with the path.

Maximize the screen for easier viewing. The highlighted yellow path indicates the results path for this particular configuration. Scrolling down the SFAT view you can observe the path terminates at a yellow color end-state. In general, top paths out of a logic block represent the better conditions (more equipment available) and bottom paths out of the block represent less favorable conditions. Scrolling back to the top of the SFAT you observe the first block indicates all cold leg accumulators are available. The second block indicates only B train of CVCS is available. Scrolling down you further observe that both A and B trains of Safety Injection and Decay Heat Removal are available.

We will now investigate the reasons for the CVCS status. Scroll to the top of the SFAT and double-click on the Chemical and Volume Control decision block. This reveals a Calculation Tracing Window showing the logic in the block and the status of variables as shown in Figure 3-14. Since "1" indicates unavailable and "0" indicates available, double-click on the variable FT1NV_A line (highlighted in black). Alternately, you can single click on the variable of interest, and then click the TRACE button. A Fault Tree Logic Tracing dialog now appears as shown in Figure 3-15.

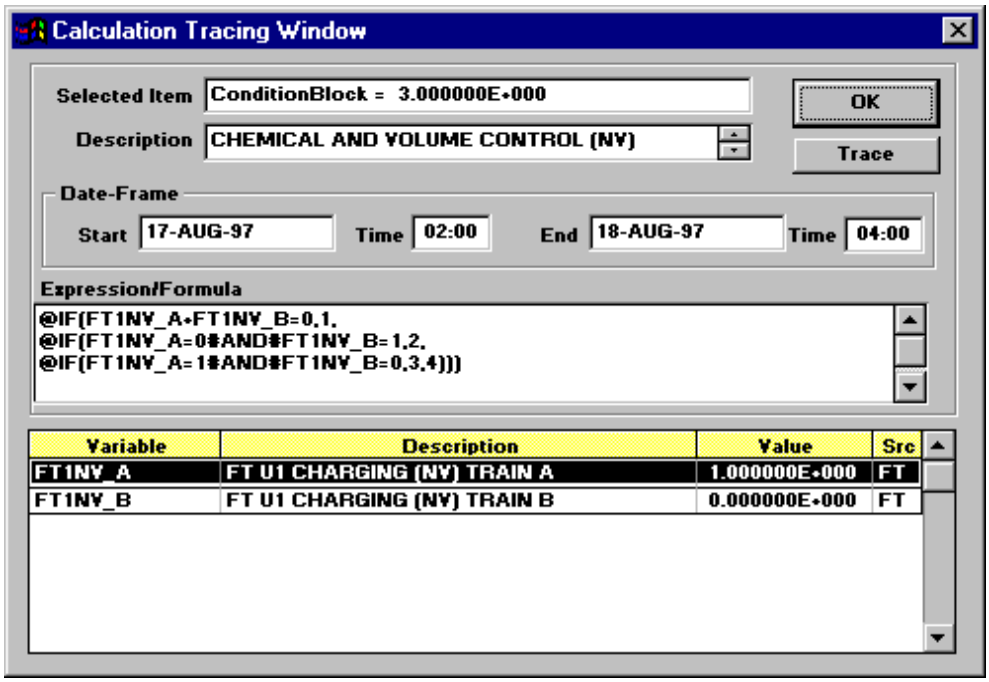


Figure 3-14
Calculation Tracing Window

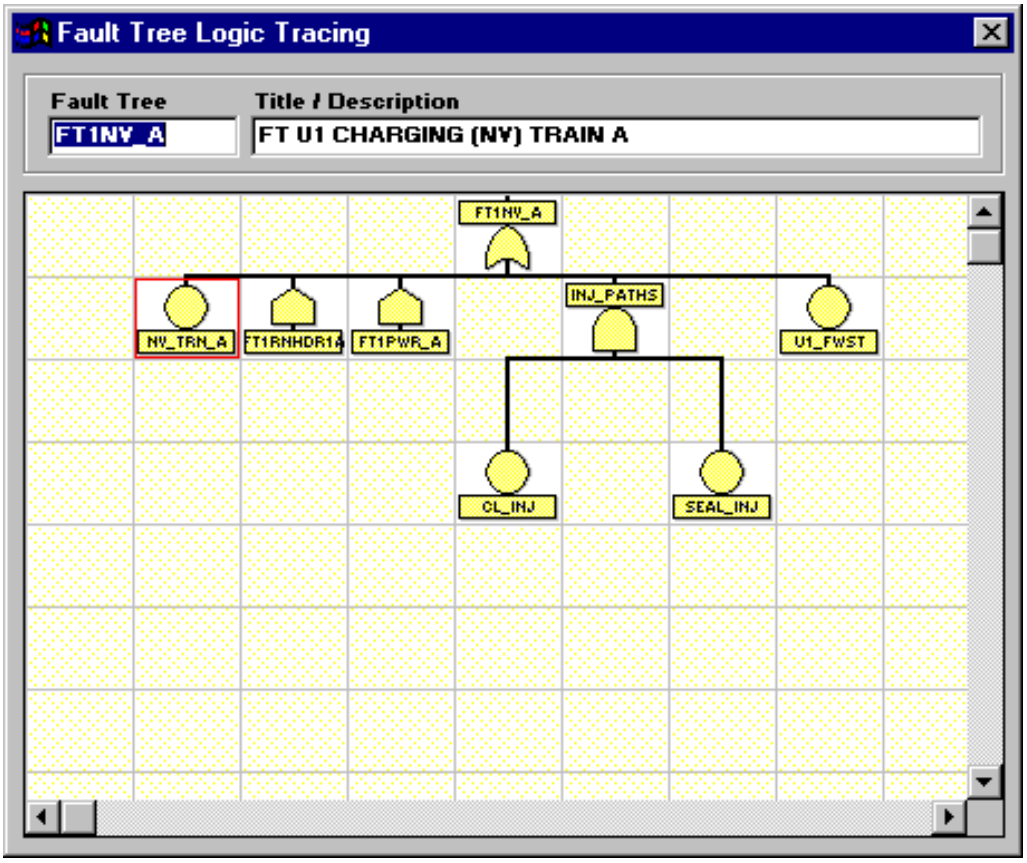


Figure 3-15
Fault Tree Logic Tracing

The fault tree diagram depicts the logical relationship between equipment necessary for a system or train to function. This fault tree for Charging Train A illustrates the train dependency on power and flow paths. The red box surrounding the NV_TRN_A symbol indicates this PCDB variable is out of service. Since this is connected to the top gate with "OR" logic, it results in the fault tree being true (hence, the value of 1.0 for FT1NV_A). Double-clicking on the red box yields another Calculation Tracing Window with one variable, U1_NV_TRN_A. This indicates the variable U1_NV_TRN_A or UNIT 1 CVCS Train A has a value of "1" (unavailable).

Double-clicking on this highlighted black field reveals the relevant outage activity which caused the equipment to be out of service, as shown in Figure 3-16.

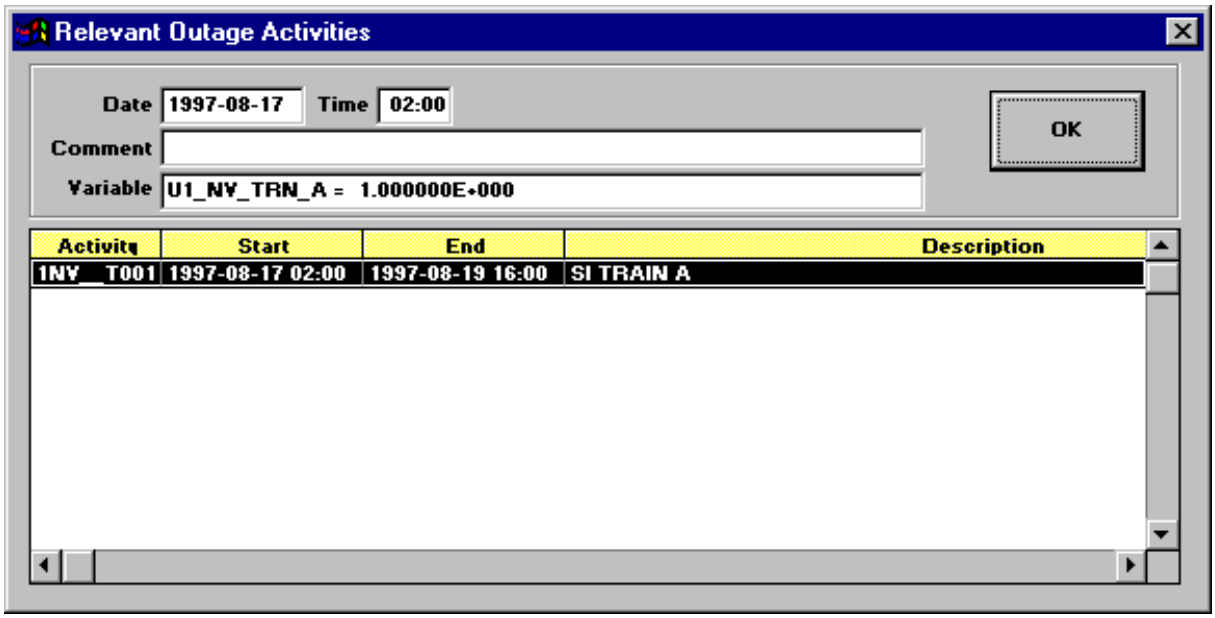


Figure 3-16
Relevant Outage Activities

In this part of the tour we have demonstrated the ability to view information regarding analysis of a configuration's safety function status result and trace through the model logic to identify the source activity contributing to the result. We will now investigate the Plant Transient Status feature. Before proceeding, close all open dialogs and return to the base ORAM-Sentinel screen shown in Figure 3-2.

Plant Transient Status

Access the Plant Transient Assessment Tree (PTAT) results by either using the TRNSIENTS button in the viewbar or by choosing PLANT TRANSIENTS STATUS under the RESULTS pull down menu.

The Plant Transients Status View, as shown in Figure 3-17, lists each of the Plant Transients in the left column with the date period in the upper horizontal axis. Each Plant Transient status is represented by the adjacent color bar under the calendar period. The colors green, yellow, orange and red represent best to worst conditions, respectively, in terms of the potential for a plant transient and the availability of equipment necessary to mitigate the event.

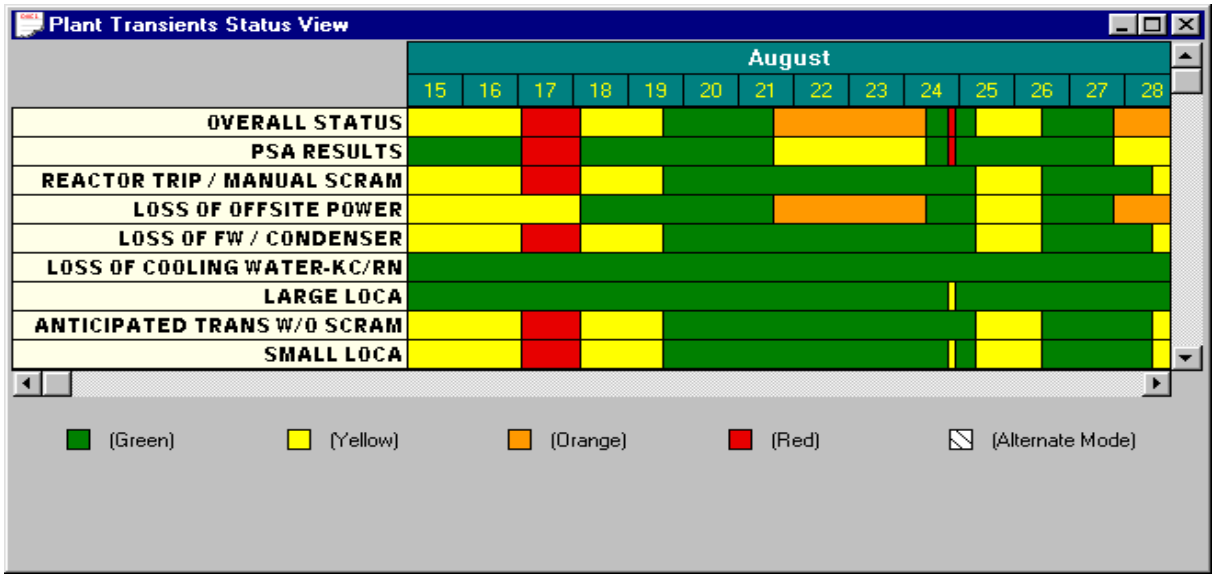


Figure 3-17
Plant Transient Status View

Using the horizontal scroll bar arrow, scroll the schedule to the right until the red overall status condition on August 29th is revealed. Trace on this configuration by double-clicking the red area. This reveals the Overall Plant Status View. Note this is the same view that was presented when you traced on the Safety Function Status View. The functionality for this view is to the same as that demonstrated previously. To invoke these features for analyzing a Plant Transient status, simply single-click on the Plant Transient to get the selection arrow (<=) focused on the transient of concern. In this configuration, you would click on the Loss of Offsite Power Plant Transient.

Since the features for tracing an assessment tree have been demonstrated, they will not be repeated here. All five buttons in this view operate as demonstrated previously. From a technical perspective, however, note in these results that all colors are green and yellow except the loss of offsite power and the overall status. Safety functions and the PSA indicate this configuration is acceptable. One plant transient, however, indicates a condition of concern. Click on the CURRENT ACTIVITIES button and the Current Activities window appears as shown in Figure 3-18 (the columns in this window can be sized differently by the user). You will note that a diesel generator is unavailable at the same time an activity is being performed that is considered a potential plant transient for Loss of Offsite Power. This demonstrates how the Plant Transient analysis can reveal a configuration that could lead to a degraded safety condition. Close the Current Activities dialog box and the Overall Plant Status View dialog box, and return to the Plant Transients Status View.

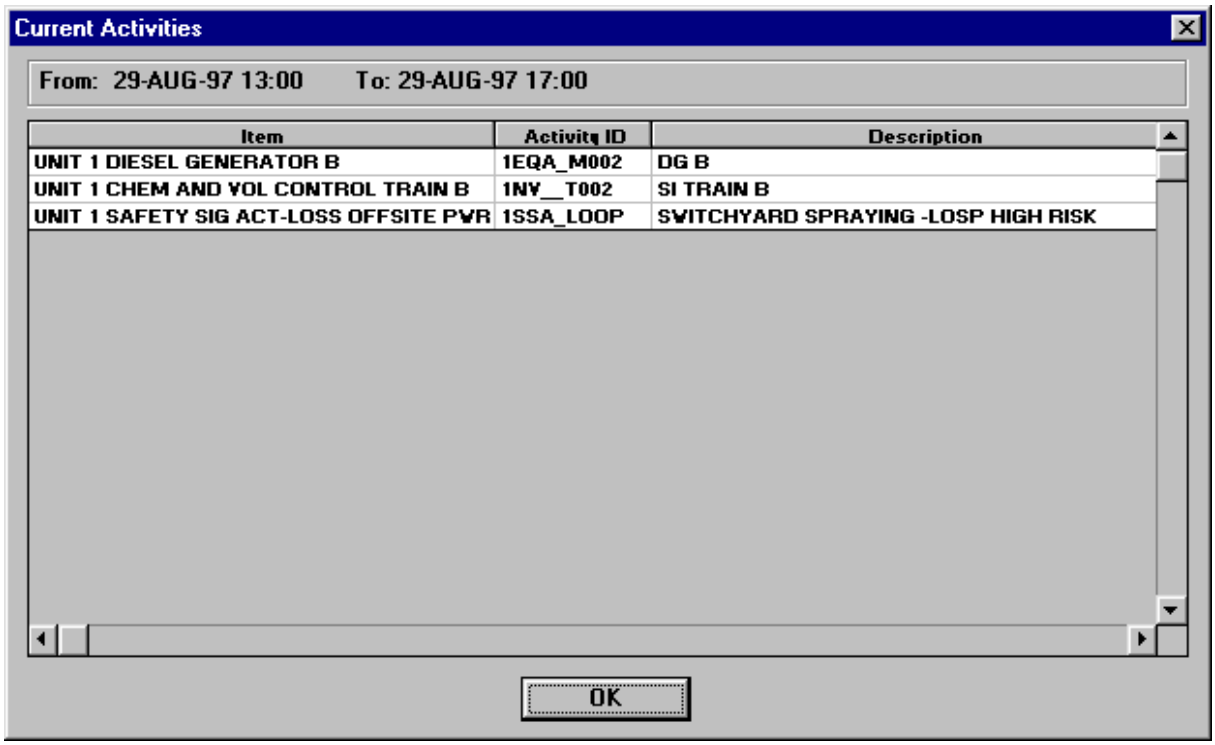


Figure 3-18
Current Activities (29-AUG-97 13:00 to 29-AUG-97 17:00)

Now trace the Plant Transient status on the red conditions appearing on the 17th of August by double-clicking on any of the red color blocks on this date. This reveals the Overall Status View for the period 17-AUG-97 02:00 to 18-AUG-97 04:00. Note in this view that the Safety Function status for individual Safety Functions are acceptable (yellow or green). For the Plant Transient results, five Plant Transients are red (also note that the PSA status is red as shown in the top SFAT and PTAT status). If you click on CURRENT ACTIVITIES, you will observe that train A of Auxiliary Feedwater and train A of CVCS are both out of service as previously shown in Figure 3-9 for this time period. The CVCS unavailability causes a yellow status in Emergency Core Cooling, Boration and Reactor Coolant Pump Seal Safety Functions. The Auxiliary Feedwater status causes a yellow condition for the Loss of Offsite Power Transient Assessment. Since these Safety Functions are generally needed to mitigate transients, having multiple slightly degraded Safety Functions collectively produce unacceptable red conditions in the Plant Transient model. This again demonstrates the analysis capability of Plant Transients evaluations by assessing safety associated with multiple slightly degraded safety functions. Close all dialogs and return to the base ORAM-Sentinel screen as depicted in Figure 3-2.

Probabilistic Safety Assessment Status

ORAM-Sentinel provides the Probabilistic Safety Assessment (PSA) status in several forms:

- Status Views - the PSA results can be displayed as color bars in the Safety Function Status and Plant Transient Status views.
- Configuration Guidance - the PSA results include guidance for equipment to remain-in-service, equipment to return-to-service and any compensatory measures (such as highlighting important operator actions). It also includes the PSA Status Box which can display a color and a number based on user-defined logic formulae.
- Risk Profile - provides a graphical view of instantaneous, cumulative and normalized (relative to no maintenance) risk.

We will now investigate each of these.

PSA Status View

From the base ORAM-Sentinel screen, select the Safety Function Status by either using the SFUNCTS button in the viewbar or choosing SAFETY FUNCTIONS STATUS under the RESULTS pull down menu. Note the second bar in the Safety Function Status view is the PSA Results. This presents the risk result occurring over the schedule period. On the 24th of August, a small red region appears for the overall status and PSA Results. The ZOOM-IN button on the toolbar can be used to provide more resolution. The ZOOM-IN button is the one with the magnifying glass with an up-arrow in it. Trace on this configuration by double-clicking on this red area. This reveals the Overall Plant Status View.

This results view shows that all Safety Functions and Plant Transient conditions for this configuration are acceptable (yellow or green). The PSA Result, however, indicates an unacceptable condition based on the risk analysis. This serves to highlight the Status View method as a means of identifying PSA-derived risk for configurations.

Trace on the PSA Result by either double-clicking on the red box next to PSA Results On-Line or by pressing the Functions Logic button in the lower portion of the Overall Plant Status View. This reveals the PSA Result represented as an SFAT with four condition outputs, one for each of the status colors.

The highlighted red line indicates the path for the current configuration. Double-click on the PSA Results condition block. This reveals a Calculation Tracing Window indicating a result of 4.00E+00. This represents the fourth path as the result of the expression FM1_ISAR. Double-click on the highlighted black box for this variable to reveal a calculation trace window.

This dialog indicates a core damage value for this configuration of 6.62E-04. This dialog also reveals the criteria to select path 4 was at least 25 times the base core damage frequency as observed in the expression segment @IF(ISAR_CDF>=(25*2.2E-5), 4. Close all trace dialogs and return to the Overall Plant Status View.

PSA Configuration Guidance

We will now investigate the PSA Guidance for this configuration. To do this, either press the CFGGUIDN button on the viewbar or choose CONFIGURATION GUIDANCE under the RESULTS pull down menu. The PSA Configuration Guidance View is presented in Figure 3-19.

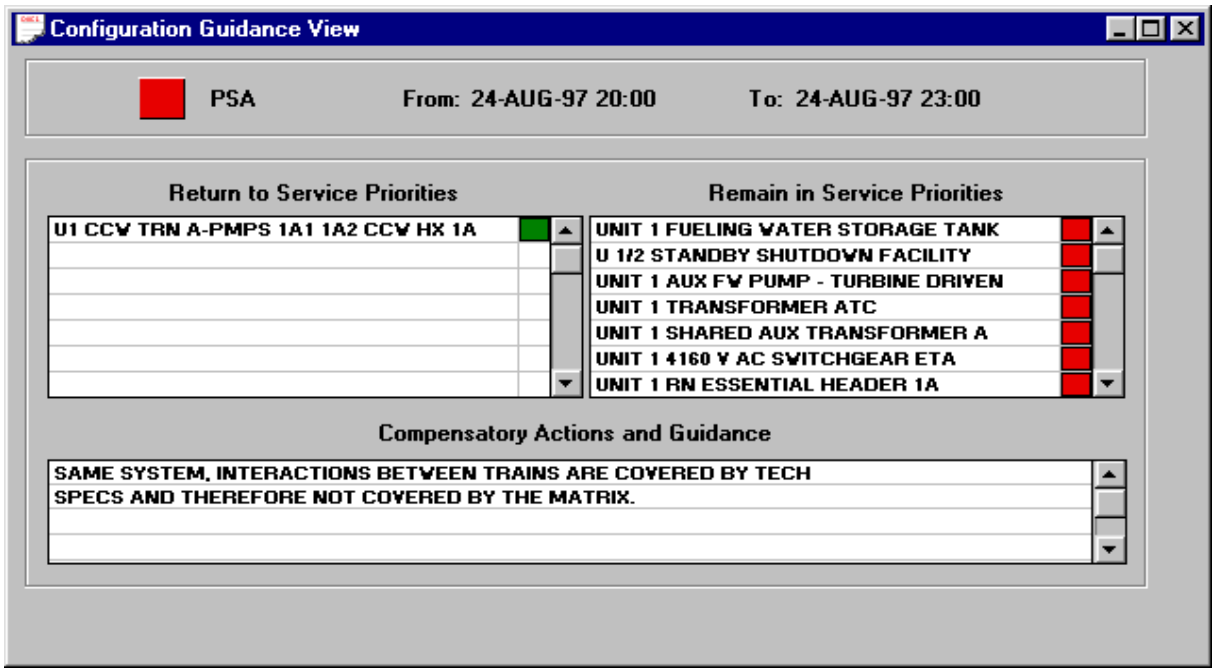


Figure 3-19
PSA Configuration Guidance View

The PSA Status color is presented in a box at the top of the Configuration Guidance View. Tracing (double-clicking) on the PSA Status box and selecting Status and the OK button will reveal the Calculation Tracing Window for this result. If this trace is performed, close the Calculation Tracing Window to continue. The Configuration Guidance View lists PSA important equipment that is out of service (under Return to Service Priorities) in the left column and equipment that is in service and important to safety based on the current configuration (under Remain in Service Priorities). The lower part of the dialog lists guidance relevant to the current configuration.

To the right of the Return To Service Priorities is the anticipated color status if the equipment is restored. In this case, the overall status would be green if the equipment is restored. This feature is important when multiple components, systems or trains are out of service because it highlights which equipment to restore first to most improve the plant risk as calculated by the PSA. To the right of the Remain-in-Service Priorities is the color anticipated if the equipment, currently available, is made unavailable. Close the open dialogs and return to the base ORAM-Sentinel screen shown in Figure 3-2.

PSA Safety Profile

Select the PSA Safety Profile by either pressing the PSAPROF button in the viewbar or selecting PSA SAFETY PROFILES under the RESULTS pull down menu. A PSA Graph View dialog appears listing parameters for the graph. If it is not already selected, select the graph titled, PSA PROFILE - INSTANTANEOUS and press OK to display the graph. The profile presented in Figure 3-20 shows the profile for the scheduled period.

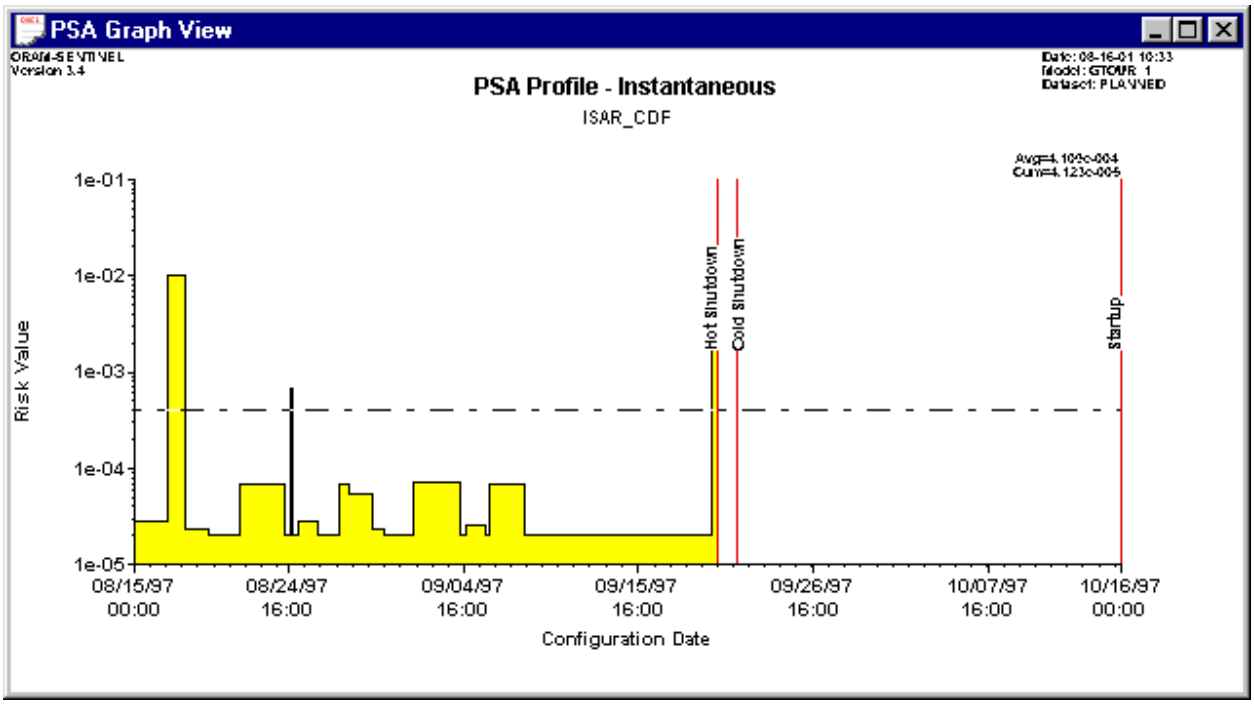


Figure 3-20
PSA Profile - Instantaneous Screen

Maximize this screen for better viewing. The graph shows the risk on a logarithmic scale with the dates along the horizontal axis. The lower bound that the graph reaches in several instances represents the zero maintenance risk. Several large spikes reveal configurations of high risk. Average risk of 4.109 E-4/yr. and cumulative risk of 4.123 E-5/yr. is presented in the upper right portion of the graph. The dashed line on the graph indicates the Average Risk value.

The graphs can be traced to reveal risk related information. Double-click on the risk area between the 21st and 24th of August (note you can hold down the left mouse button on the graph to yield the date and time of the cursor location). This tracing reveals a Core Damage risk value of 6.84E-05. Double-clicking on the black-highlighted variable reveals the PSA Results Tracing view indicating diesel generator A is out of service. Close this dialog and return to the graph shown in Figure 3-20.

Other PSA graph types can be selected by right clicking on the graph to reveal the PSA Graph View dialog. Select the list box arrow for Graph Title to reveal the other graphs available.

Select PSA PROFILE - CUMULATIVE and press the OK button to show the graph. This profile shows the cumulative plant risk on a logarithmic scale. The same tracing functionality is possible from this view. For now, right click on the graph and select PSA PROFILE - NORMALIZED from the Graph Title and press the OK button.

This profile shows the risk normalized against the base zero maintenance risk on a logarithmic scale. Hence, risk equal to the base value has a normalized value of 1.0. Risk three times greater than the base risk would have a normalized value of 3.0.

Each of the risk views presented provides the risk information in a form of interest to the risk analyst (instantaneous), the risk manager (cumulative) and the person not familiar with risk values (normalized). Close the dialog window by clicking on the "X" button in the upper right hand corner of the window.

Variable versus Time Graph

The X versus T Graph feature allows a user to plot the value of any numeric ORAM-Sentinel variable or expression versus the time identified in the Date Frame Selection. This feature allows the user to view important parameters over the selected time period. One such example is the time to boil or time to core damage in the outage mode.

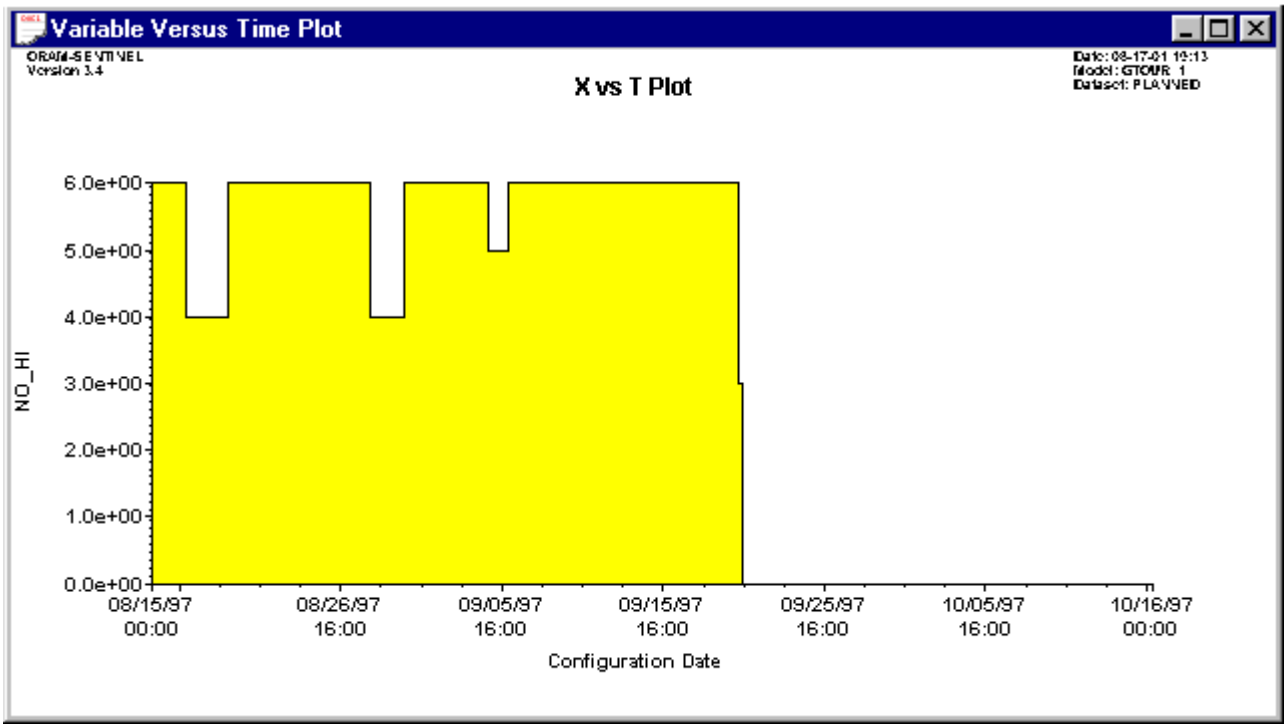


Figure 3-21
Variable Versus Time Plot for NO_HI

Select the X versus T graph by either pressing the XvsT GRPH button in the viewbar or select the X VERSUS T GRAPHS menu option under the RESULTS pull down menu. Selecting this

option presents a dialog defining the parameters for the default graph. Enter **NO_HI** for the Variable to Plot and the Vertical Axis Title. Press OK, and a progress gauge showing the calculation of the variable (NO_HI) over time is displayed. After the progress bar completes, the graph is displayed as shown in Figure 3-21. If an error message appears, acknowledge it by clicking on the OK button.

In this example, the expression variable representing the number of High Pressure Injection trains available is plotted. A maximum of six trains are possible. This value drops to four in two instances, and five in one instance. At the very end of the graph this value drops to three, shortly before an outage begins.

The X versus T graph has functionality is similar to the PSA graphs. Single clicking and holding the mouse reveals a line and the date and time of the mouse position. Double-click on the period on August 29th between 13:00 and 17:00, when four trains are available, to yield the calculation tracing window.

This trace window indicates the variable expression NO_HI has a value of 4. Double-clicking on the highlighted line reveals two NI (Injection) trains and two NV (CVCS) trains are available. Double-click on the two NV trains (NO_NV) variable.

This trace view shows four trains of charging are possible. Two trains represented by FT1NV_A and FT1NVBATA are available (value of zero) and the remaining two trains are unavailable (value of 1.0). Tracing the unavailable trains leads to the fault tree model and back to the source schedule activity, similar to the manner demonstrated for the Safety Function Status.

Close the trace windows and the Variable Versus Time Plot using the windows dialog close feature in the menu bar, and return to the base ORAM-Sentinel screen.

Multi What-if Scenarios

The Multi What-if Scenario capabilities allow the user to dynamically change the schedule and evaluate schedule alternatives in the Planned Dataset. This feature is not available when viewing the Actual Dataset. The Multi What-if feature can be accessed by clicking on WHAT-IF on the viewbar or by selecting WHAT-IF SCENARIO CONTROLS under the RESULTS pull down menu. Depending on when the last recalculation was performed, a message box may appear which needs to be acknowledged by clicking OK.

The Multi What-if display will appear similar to Figure 3-22. Note the location of the Schedule Based What-If Scenarios dialog may be in a different position in the Schedule View window on your screen.

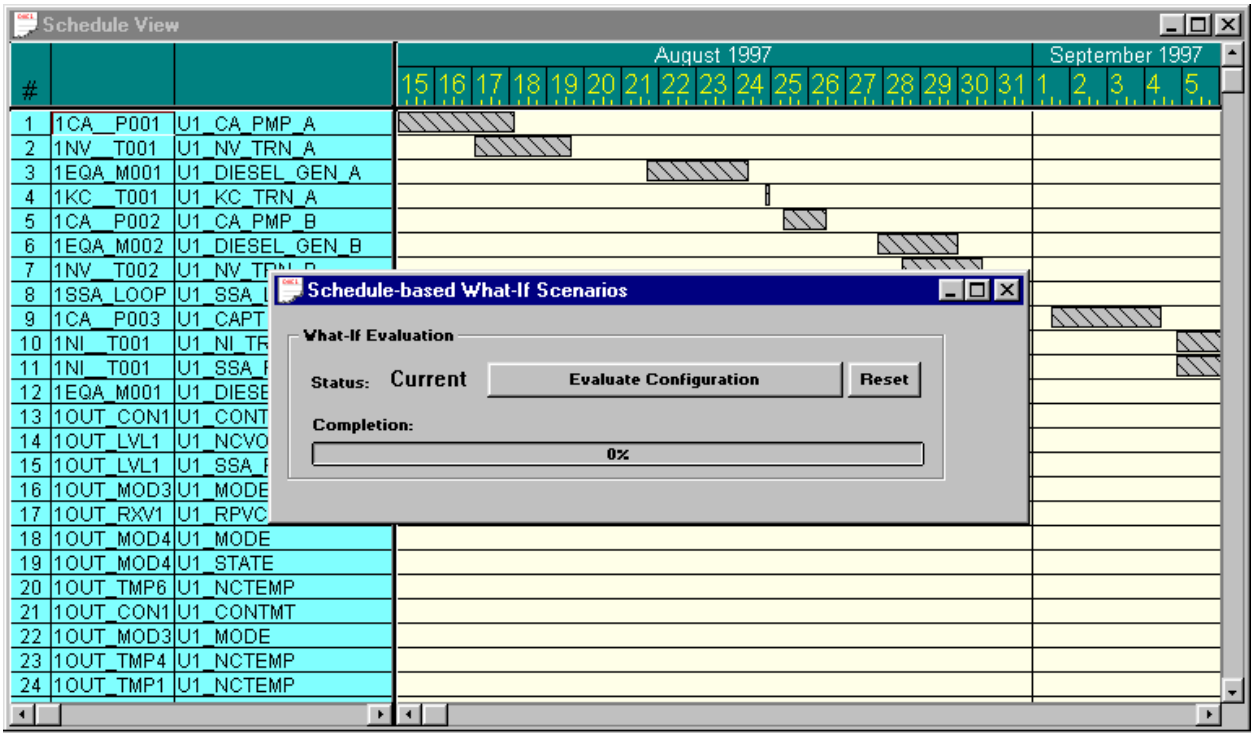


Figure 3-22
Multi What-if Scenarios

Begin by clicking on the Schedule View window to bring it to the foreground. What-if scenarios allow the user to edit and delete existing activities, add new activities, and compare the changes to the current results. The maintenance activities may be edited by either double-clicking on the maintenance activity code in the left column or the shaded bar within the Gantt chart. In addition, the shaded bars may be dragged with the mouse to extend, shorten, or move the maintenance windows. New activities may be added by right clicking on the screen to reveal a pop-up menu and then choosing ADD MAINT TASK.

Select the second schedule activity, 1NV__T001, by double-clicking on the shaded bar. Change the 17 AUG date to 19 AUG and the 19 AUG date to 21 AUG. Select the OK button and observe that the bar moved to the new period and changed shape and color. Click on the Schedule-based What-if Scenarios dialog to bring it to the foreground (you may need to minimize the Schedule View) and press the EVALUATE CONFIGURATION button. After the calculation is complete, select COMPARATIVE SAFETY FUNCTIONS STATUS under the RESULTS pull down menu (note the what-if dialog and schedule must be open to view What-if results). Each Safety Function contains an upper and lower colored bar. This What-if scenario comparison is shown in Figure 3-23. The upper bar represents results based on the last schedule imported (the Base Case) and the lower bar shows the results of the What-if scenario. For the change performed on August 17th, the base Overall Status of red is changed to yellow and the

PSA Results status is changed from red to green. You can trace from this window to view the base case only (not the "what-if") results. Close this window and select COMPARATIVE PLANT TRANSIENTS STATUS under the RESULTS pull down menu. This view also shows status improvements for the 17th of August.

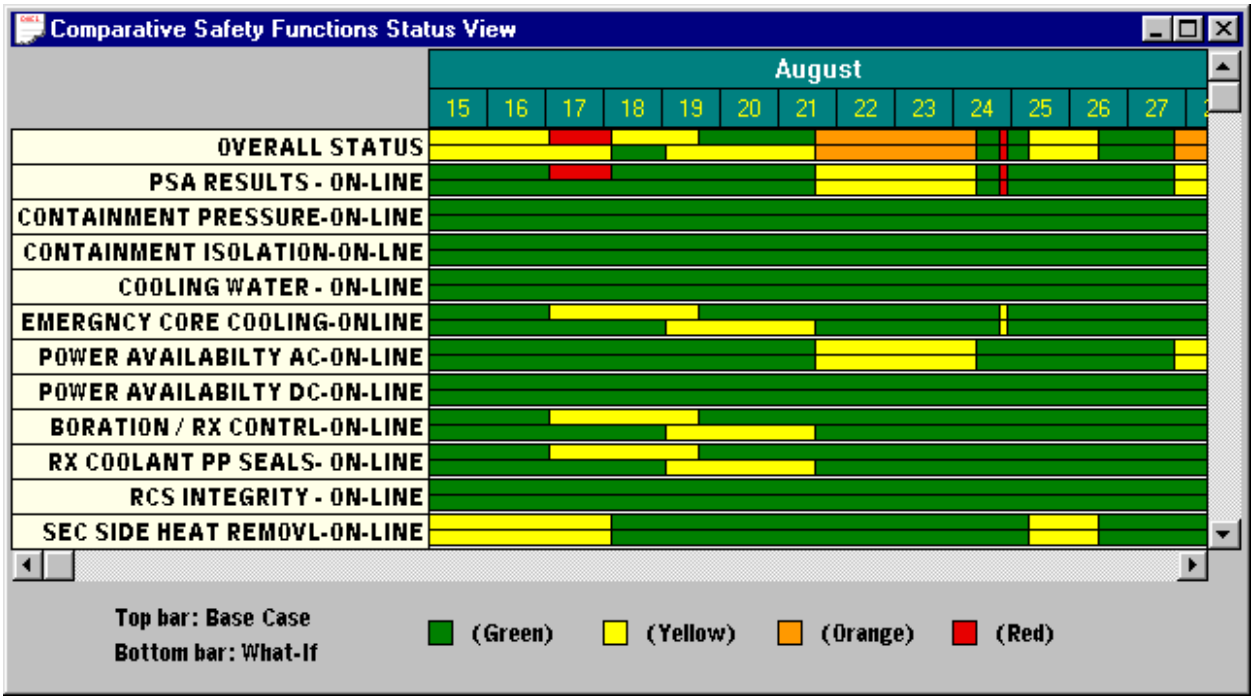


Figure 3-23
Safety Function Status What-if Scenario Comparison

Close this window and select the COMPARATIVE PSA SAFETY PROFILE under the RESULTS pull down menu. If it is not already selected, select the graph, "PSA Profile - Instantaneous" and then select OK.

The graph depicts the base risk as the yellow bar graph observed previously. The What-if risk is depicted as a red line over this graph. For the period on the 17th of August, the risk spike is eliminated in the what-if. This is replaced by a slight risk increase around the 20th of August where the activity was moved to. The cumulative and average values in the upper right hand corner of the graph represent the values for the What-if scenarios.

Close the open screens and return to the base ORAM-Sentinel screen. Note: You must first close the Schedule-based What-If Scenarios dialog prior to closing the Schedule View.

Operations Plant Status

The Operations Plant Status View (Work Release Mode) provides an analysis of the plant for a single configuration. Only single configuration calculations are done in the Work Release Mode of ORAM-Sentinel. To switch to the Work Release Mode, close ORAM-Sentinel and re-open in Online Work Release mode. Log on using **SUPERVISOR** as the USERID with no

PASSWORD, then from the ORAM-Sentinel Application Mode screen select the lower left button to enter the on-line Work Release Mode. The Operations Plant Status View will appear as shown in Figure 3-24. Note: If you enter the dialog before August 15th, 1997 or after October 15th, 1997 you will get a warning message since there is no configuration for the current date. If you receive this message, click OK to continue.

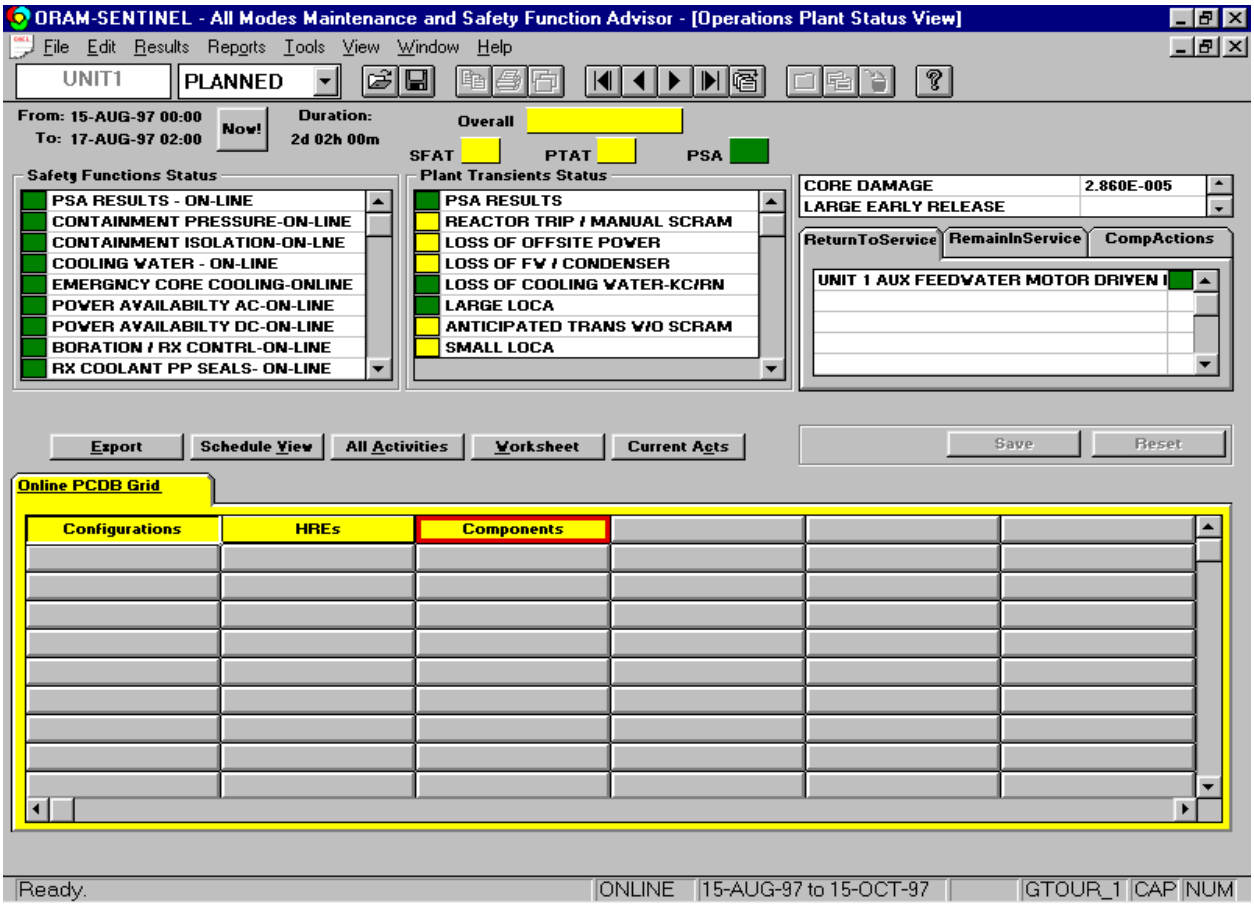


Figure 3-24
Operations Plant Status View

Note: The Work Release mode will initially display the configuration which contains the current date, if the current date is within the Results Date Frame. Otherwise, if it is outside the date frame, the initial display will be the first configuration in the Result Date Frame accessed. The Work Release mode is designed primarily for plant operations use. The plant operator has access to the Safety Function Status, Plant Transient Status, and PSA Results, along with the current plant configuration database on a single screen. What-if scenarios and tracing may be performed in this mode.

If the Operations Plant Status View window is not maximized, maximize the window for optimal viewing. On the Grid Panel labeled "Online PCDB Grid," select the button labeled "Components" to display the components picklist. On the tool bar above the work release view, choose the SELECT RECORD FROM LIST button to the immediate right of the arrow buttons. Note: Placing the mouse cursor over the button provides a description of the button. A list

appears with configuration records. Select the second record in the list (labeled 1997-08-17 02:00) by double-clicking it or highlighting it and pressing SELECT. The Operations Plant Status View should be similar to that depicted in Figure 3-24. The result selected applies to the configuration from 17 August 02:00 to 18 August 04:00 with a duration of "1d 02h 00m" (1 day, 2 hours and 0 minutes). The Overall Status is red during this time. If not currently open, open the components picklist by selecting the button labeled "Components" to display the components picklist. The equipment currently out of service is listed at the top of the components picklist and is highlighted in yellow. Also notice that the button labeled components has a Red border during this configuration; this red border indicates that a variable in this list is not in its default state.

We will restore the auxiliary feedwater train and evaluate the new condition. Double-click on the unavailable Auxiliary Feedwater Motor-driven Pump. The Activities List window for variable U1_CA_PMP_A (Schedule Code 1CA__P001) appears, which lists all activities associated with this component within the results date frame, as shown in Figure 3.25.

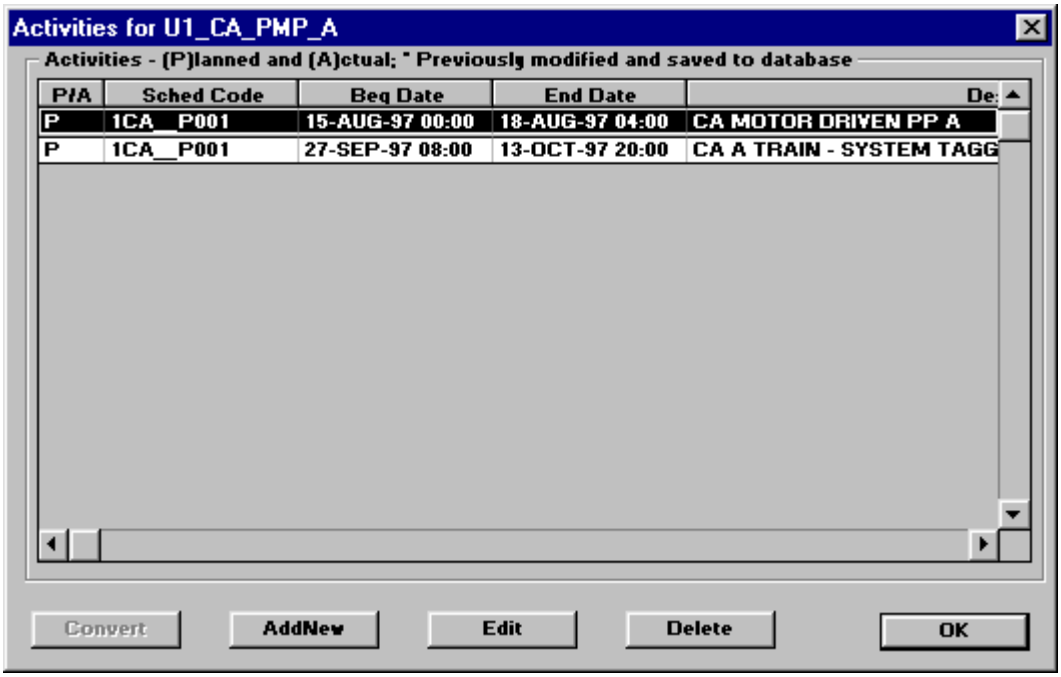


Figure 3-25
Activity List for Variable U1_CA_PMP_A

NOTE: While performing this section, the user will encounter message windows indicating that "There is no configuration record defined for the current date and time." This message will appear whenever the Results Date Frame does not encompass the computer clock time. The user should acknowledge these messages as they occur.

Highlight the Planned (P) activity 1CA__P001, 15-AUG-97 00:00 - 18-AUG-97 00:00, and select the DELETE button; select YES to complete deleting this activity. Note that this activity is deleted from the activity list window and that the new configuration is automatically evaluated. On the right side of the Work Release screen, the WhatIf indicator is lit in bold red letters. Select OK to close the activities list window. On the Components picklist, the auxiliary

feedwater variable returns to its location in the list as available. The new results show the improved status from returning the Auxiliary Feed Pump to service; the Overall Status changes from red to yellow. Note: You can trace on the Safety Functions, Plant Transients, and Overall Status by double-clicking on the color buttons. Tracing in this manner traces the what-if result (or the last calculated configuration). Do not click on RESET yet. Clicking on RESET will restore the configuration to the original status. Close the Components picklist window using the Close button.

Safety Assessment Worksheet

The Safety Assessment Worksheet (SAW) is a user definable text-oriented form that highlights information of importance for configuration safety management. It can be printed and used for daily status reporting. You can access the SAW by clicking the WORKSHEET button in the Operations Plant Status View. The Safety Assessment Worksheet will appear as shown in Figure 3-26.

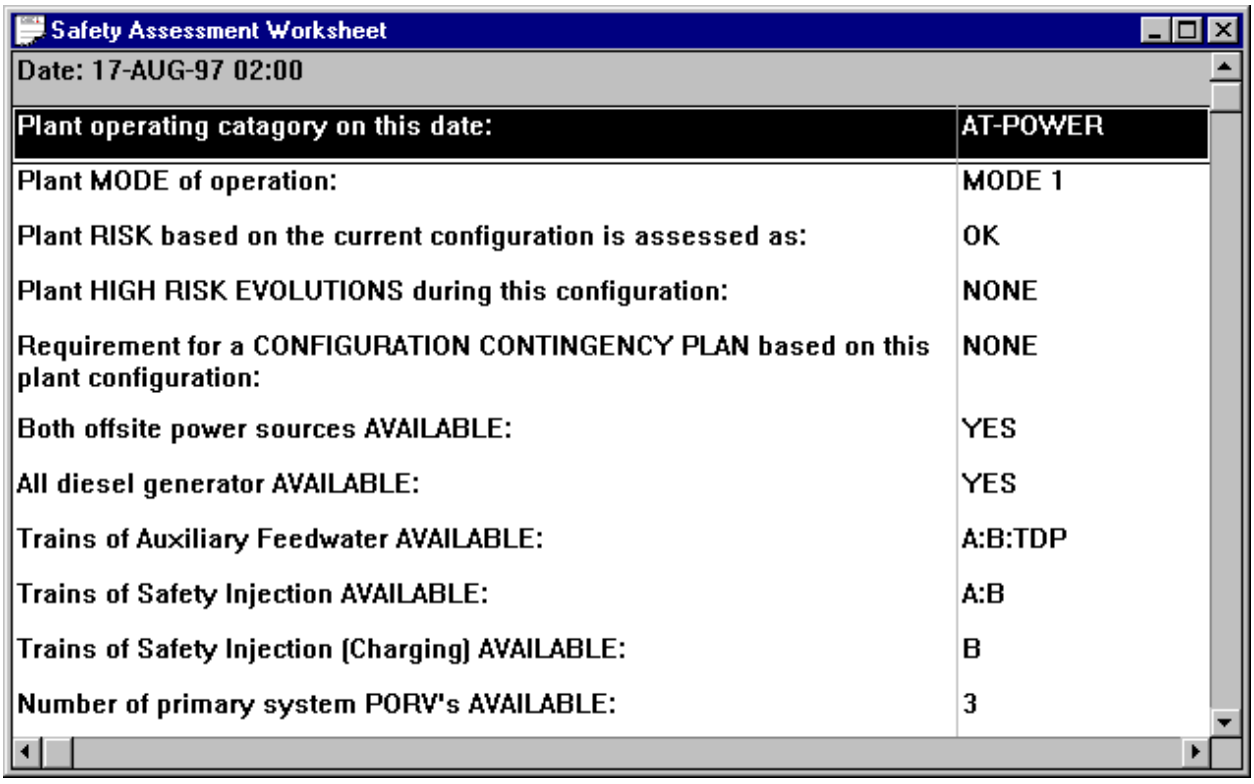


Figure 3-26
Safety Assessment Worksheet

The worksheet lists, in the left column, user-definable text describing information important to configuration safety. The right column lists the answer to the configuration text. The answer is based on a user-definable expression solved by the model. Recall in the last what-if scenario Charging Train A was unavailable after Auxiliary Feedwater Train A was restored. In the worksheet all three trains of Auxiliary Feedwater (A, B, and turbine driven) are available and

only train B of charging is available. Close the worksheet using the windows close dialog feature in the upper right-hand corner.

Select the RESET button on the Work Release screen.

Actual Dataset Modifications and PCDB Grid Importing

Change the Results Date Frame to a date frame that encompasses your computer clock time by selecting DATE FRAME SELECTION under the RESULTS menu. Switch to the Actual Dataset using the Dataset dropdown box in the upper left corner of the screen.

Under the tools menu, select IMPORT PCDB BUTTONS; browse and import the file GTOURGRD.DAT located in the C:\ORAMSENT\FILES directory (this file was archived with model) as shown in the Figure 3-27. Notice that the previous Grid Panel is replaced with the Grid Panel defined in the import file. It should be noted that importing a new Grid Panel definition is not expected to be a common occurrence, and is generally reserved for model builders or administrators.

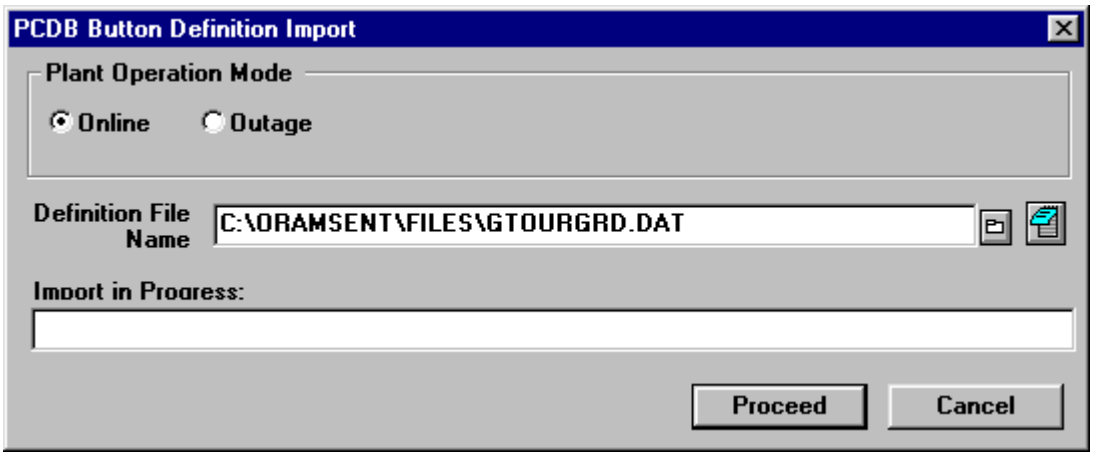


Figure 3-27
PCDB Button Definition Import Window

On the Grid Panel, select the Tab labeled RN Equip (it is on the first tab). Primary click (left-click) on the button RN PUMP 1B W/FT. Select the ADDNEW button to add a new activity as shown in Figure 3-28: Change the value to UNAVAILABLE, leave the Start Date/Time as read from the computer clock, leave the End Date/Time as determined by the Default Activity Duration preference in the Preferences editor, enter a Description and select OK.

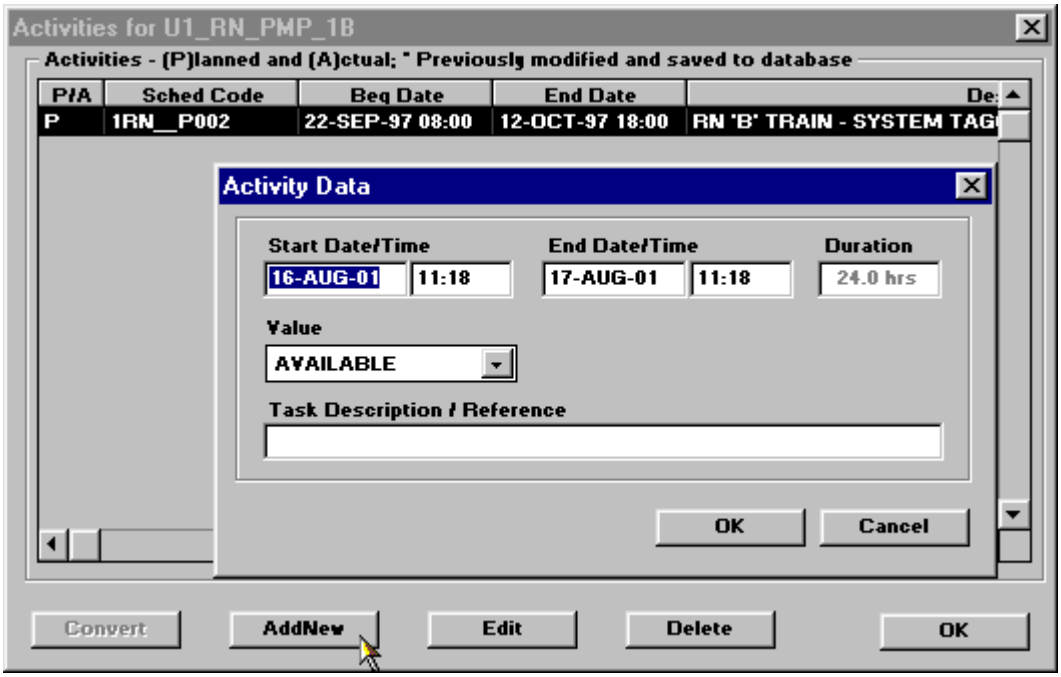


Figure 3-28
Work Release Activity Window When AddNew is Selected

Note that an activity with an "A" was added to the Activity List for the variable U1_RN_PMP_1B. The letter "A" is colored to indicate that this activity has not been SAVED yet. Close the editor by selecting OK. Notice that the button RN PUMP 1B W/ FT has changed to RED as defined in the PCDB editor, and notice that the Group button RN PMP PICKLIST now has a red border. Select the button RN PMP PICKLIST, notice that the variable UNIT 1 NUCLEAR SERVICE WATER PUMP 1B is highlighted in YELLOW and listed first, indicating that it is not in its default state. This variable is the same as the variable attached to the button "RN PUMP 1B W/ FT." Use the dropdown box under the Value column to change the state of variable UNIT 1 NUCLEAR SERVICE WATER PUMP 1A to UNAVAILABLE. Note that this item is now highlighted in Yellow and moves to the top of the list. Close this window by selecting CLOSE.

Select the SCHEDULE VIEW button above the Grid Panel and note the activities added in the previous steps. Close the Schedule View. Select the RESET button on the right side of the screen to return the configuration to its original state.

Add a milestone activity by right-clicking on the button labeled, U1_ETA, and selecting the state UNAVAILABLE. The Work Release screen automatically updates as a milestone activity for the variable U1_ETA was added. In addition to the U1_ETA button changing to RED, notice that button "RN PUMP 1A W/ FT" changed to the color ORANGE as defined for the support variable when it has a value of 1. Select the SAVE button on the right side of the panel to store the milestone activity to the Actual Dataset. Note - If the “Path to Log File” setting in Preferences is not valid, the user will receive a message stating ORAM-Sentinel “Could not write to the Preferenced Log Path…” This message will appear each time modifications to the Actual Dataset are saved until a valid “Path to Log File” is set in Preferences.

Select the EXPORT button to export the results of this configuration to the text file WREXPORT.TXT located in the directory setting defined for Export File Path in the Directories editor (the default path is C:\ORAMSENT\IMPORT). View this file by opening it with any text editor; it contains all the results information from this configuration as well as the Non-Default Value PCDB Variables (in this case "U1_ETA," "X"). Close this file and return to ORAM-Sentinel Work Release screen.

Select the ALL ACTIVITIES button, select the activity with the SchedCode labeled U1_ETA_X (it is an activity marked with A*), delete using the DELETE button and click YES to complete the deletion. Close the All Activities list by selecting OK. Select SAVE to update the Actual Dataset.

Change the Results Date Frame to back to 15-AUG-97 00:00 to 15-OCT-97 24:00 by selecting DATE FRAME SELECTION under the RESULTS menu. Switch to the Planned Dataset using the Dataset dropdown box in the upper left corner of the screen. Close ORAM-Sentinel and re-open in the Schedule Planning mode. Log on using **SUPERVISOR** as the USERID with no PASSWORD. From the Application Mode screen select the upper left button to re-enter the On-line Schedule Planning Mode.

Outage and On-Line Demarcation

Now that you are back in the On-line Schedule Planning Mode, select the Safety Functions Status view by clicking on SFUNCTS. Scroll the view using the horizontal arrows until the 20th of September is in the middle of the view as shown in Figure 3-29. Note the cross-hatched pattern starting approximately mid-day on the 20th. NOTE: If the user does not see the proper results for the Online safety function status, Recalculate the model and proceed.

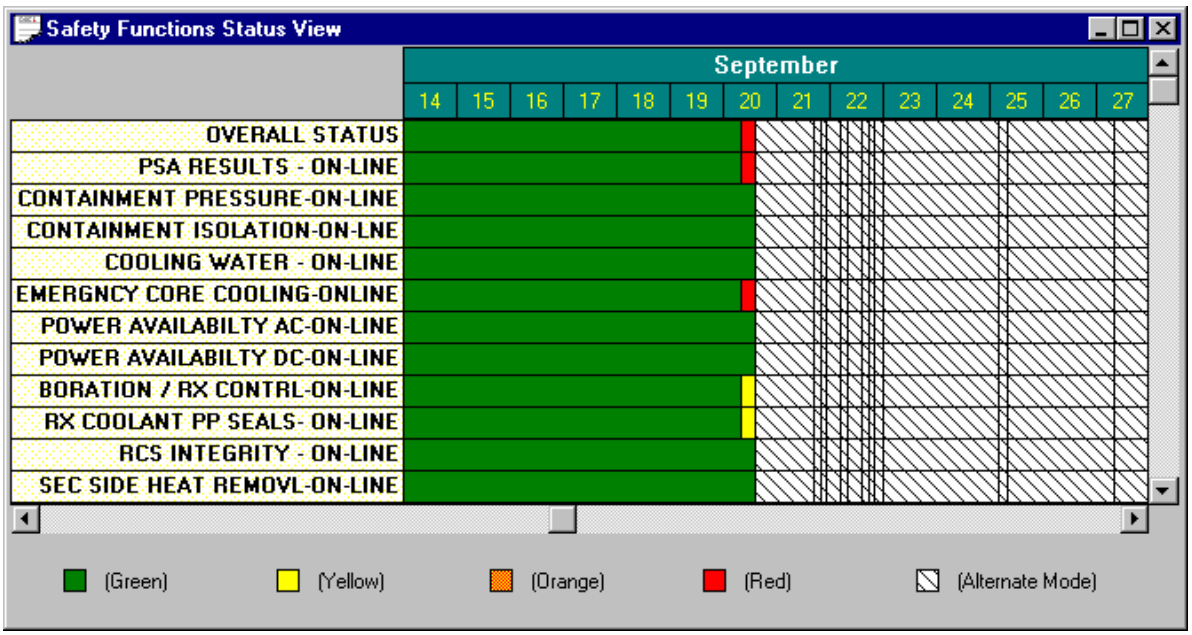


Figure 3-29
Safety Functions Status View

This indicates a period of time in which the plant is in an outage configuration. The same effect is observed in the Plant Transient Status View. The risk profiles can also be observed as terminating (indicating zero) on this date and time. This demonstrates that on-line SFAT, PTAT and PSA results are observed only in the On-line Mode. Similarly, as will be demonstrated, only outage SFAT, ISAT and PSSA results are displayed in the Outage Mode.

Close all open dialogs and return to the base ORAM-Sentinel screen. Close ORAM-Sentinel and re-open in the Outage Schedule Planning Mode. Log on using **SUPERVISOR** as the USERID with no PASSWORD. Select the upper right button in the Application Mode screen to enter the Outage Schedule Planning Mode. Observe that the STATUS BAR now reflects that you are in the OUTAGE mode of ORAM-Sentinel.

Select the Safety Functions Status View using the SFUNCTS button in the viewbar. NOTE: If the user does not see the proper results for the Outage safety function status, Recalculate the model and proceed. Observe that the results are cross-hatched due to the plant being in on-line mode during this period. Scroll to the right using the horizontal arrow until the 20th of September is in the view. Note that the colors appear when the outage period begins. You will also note some white color regions in the area beginning on the 22nd of September. This represents a situation in which the code could not calculate the results.

To investigate why this happened, double-click on the white area to begin tracing. Note that there are five white safety functions. Press the PLANT CONFIGURATIONS button and the Plant Configurations View is displayed as shown in Figure 3-30.

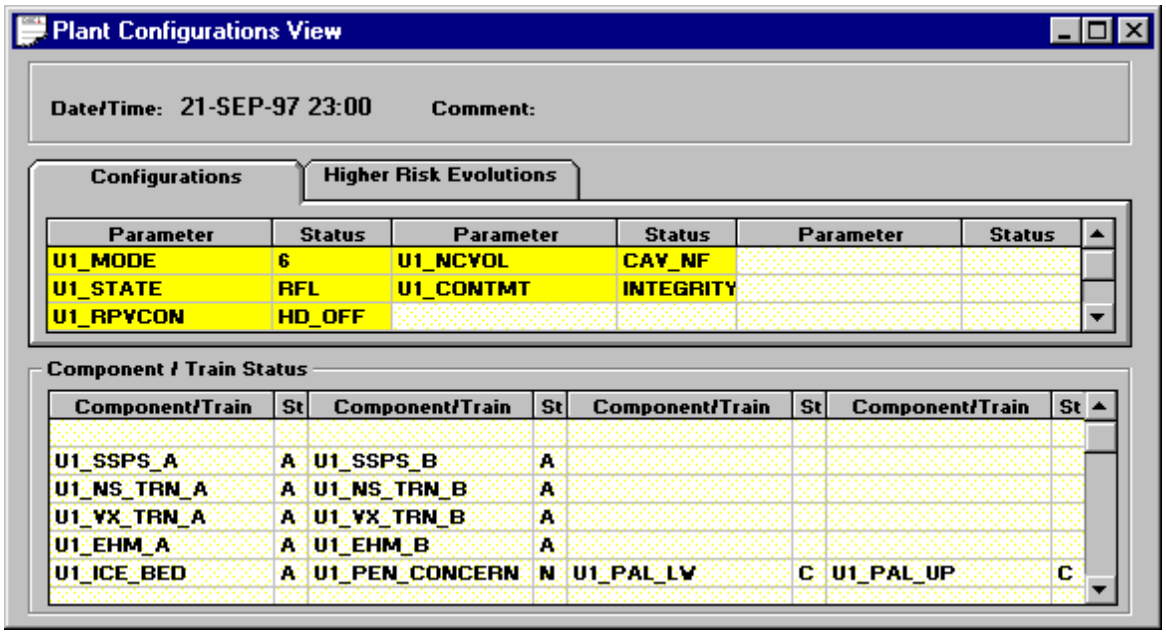


Figure 3-30
Plant Configurations View

The Configurations tab highlights in yellow the PCDB variables that are not in their default state. In this case the plant is in Mode 6 (U1_MODE) in the state of refueling (RFL) with the vessel

head off (HD_OFF) and the cavity not full (CAV_NF)… What? How can the plant be refueling if the cavity is not full? The imported schedule incorrectly indicated the cavity as not being full. The lesson here is that white conditions are basis for research of the data input (and in some cases even the model) to ensure the logical relationships of the plant are represented appropriately and that the model is receiving correct status information.

Close the open windows.

Outage Features

The Outage Mode includes the same features as the On-line Mode demonstrated previously in this guided tour. The exceptions are as follows:

- Plant Transient Assessments are referred to as Integrated Safety Assessments in the Outage Mode, but are functionally identical.
- The PSA Graphs are based on PSSA event tree results rather than the PSA Results Database . However, the PSA Results Database values can be used in the PSSA event trees (see Section 4, under Event Tree Sequences Database).

Outage Recalculations

Open the Recalculations dialog by selecting the RECALCS icon on the toolbar or selecting RECALCULATE MODEL under the RESULTS pull down menu.

In the outage mode of ORAM-Sentinel, an option exists to include or exclude the PSSA module during the recalculation of the model. Ensure the CALCULATE PSSA option is not checked and the SHOW TIMER ON COMPLETION option is checked as shown in Figure 3-31.

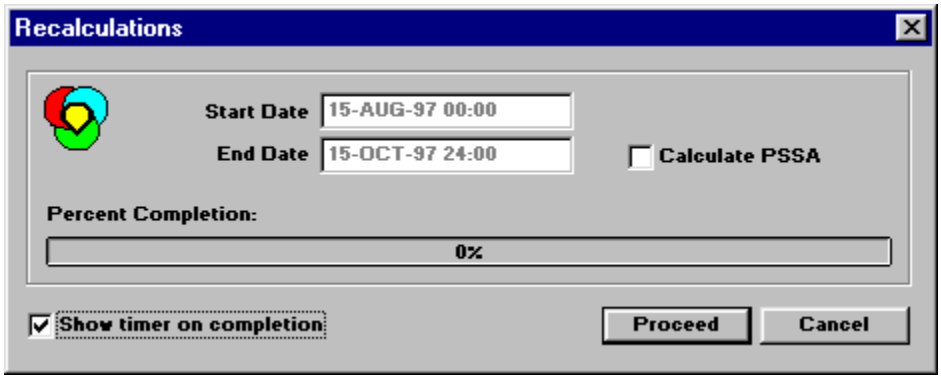


Figure 3-31
Recalculations Dialog Box

Select the PROCEED button. When the recalculation process is complete, a dialog will display the total elapsed time for the recalculation. Click OK and the Recalculation will automatically close.

PSA Tracing

Open the PSA Graph View by either pressing the PSAPROF button in the viewbar or selecting PSA SAFETY PROFILES under the RESULTS pull down menu. Note: You may get a message stating the last selected graph is not found if the last selected PSA profile was for online mode. If you receive this message, press OK. Select the "Outage – Core Damage" graph and press OK. A dialog will appear indicating that the model must be recalculated and that results are zero. This follows with an empty graph. Close this window. Press the RECALCS button, ensure the Calculate PSSA option is checked, and then select the PROCEED button in the Recalculations dialog. The percent completion and status bar indicates the status of the calculation progress. When the recalculation is complete, select the PSAPROF button again. If it is not already selected, select the "Outage - Core Damage" graph and press OK in the PSA Graph View dialog. Upon completion of the calculation, the resulting profile is presented in Figure 3-32.

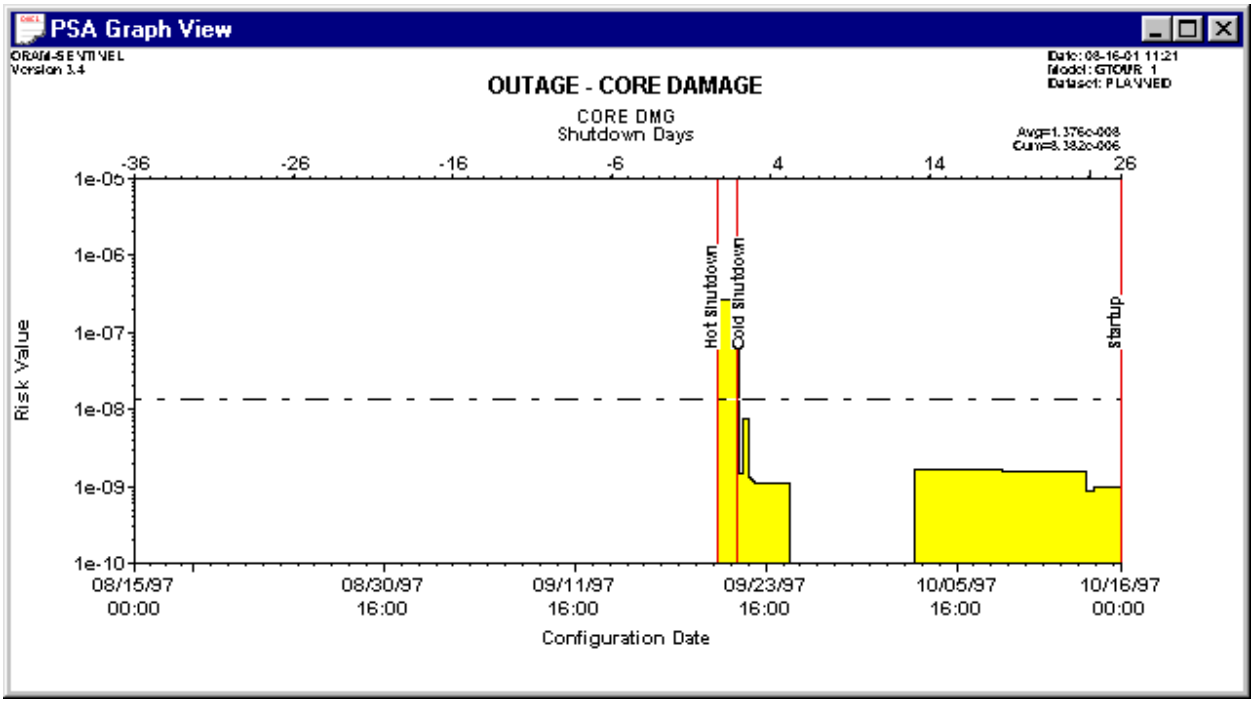


Figure 3-32
PSA Profile Outage

[Note that the profile up to the period of the outage is zero. The view of this profile before the outage was presented in Figure 3-20. Also note the vertical lines indicating the occurrence of the shutdown dates.] In addition, a new horizontal scale is on the top x-axis indicating shutdown days.

Double-clicking on the first peak reveals the Calculation Tracing Window. This trace window shows the Core Damage Frequency is 2.7E-07/hr. as represented by the sum of eleven initiators. These initiators are listed in the lower block with their description and value. This enables the most important contributors to be traced and evaluated. Note tracing beyond this point is similar to that demonstrated previously. Close all open windows.

Saving Models

Save the current Unit 1 model by selecting the SAVE MODEL/RESULTS icon on the toolbar or selecting SAVE under the FILE pull down menu.

In the Select and Save to Archive dialog as shown in Figure 3-33, enter characters of your choice for a new model name (8 characters maximum), and enter a description for the model. The Planned and Actual "Save Dataset Results" options allow the user to save either or both of the schedule database files with the model when selected. Therefore, checking both options will save all files in the C:\ORAMSENT\FILES and the respective UNIT sub-directory. The default option is to save both datasets. For this example, save both dataset results by choosing OK.

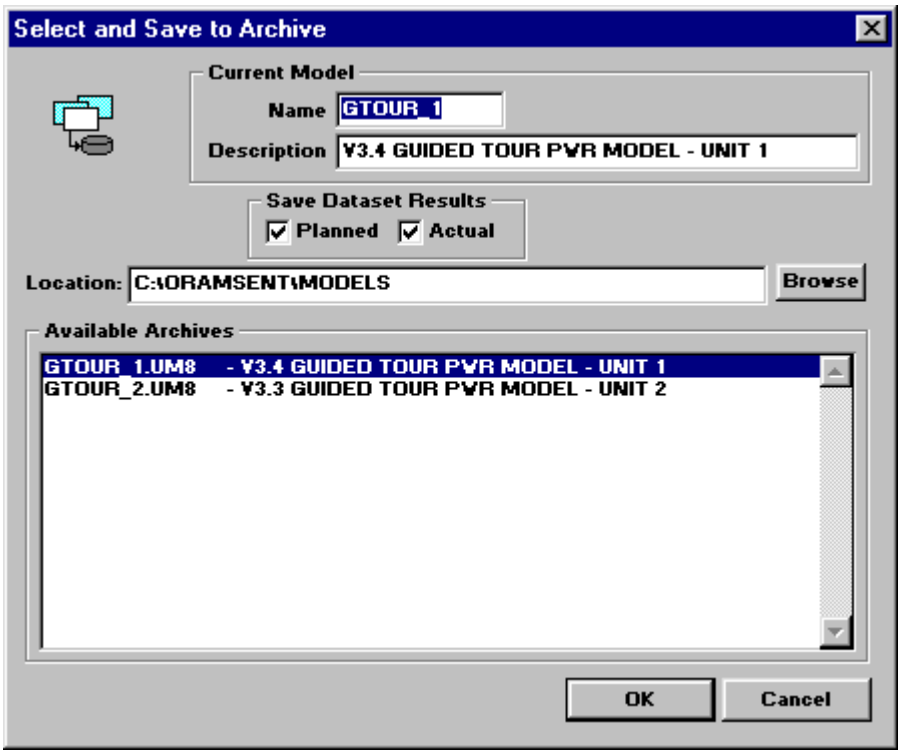


Figure 3-33
Select and Save to Archive

Changing Units

In order to change to a different Unit model, the user will need to open the model from FILE, OPEN on the main menu. It is necessary to ensure any model changes have been saved before opening a different unit model. The user will get a warning message before opening pertaining to saving the current model.

You may now work on your own with the guided tour model. When you have finished, exit ORAM-Sentinel by closing all dialog boxes (if you continued on your own). Click FILE/EXIT to go to the desktop.

Congratulations! You have completed the ORAM-Sentinel Guided Tour!

4
MODEL BUILDING AND DATA IMPORTING

This section describes the techniques necessary to build an ORAM-Sentinel model based on the function of ORAM-Sentinel and a perspective of the design and administrative and regulatory requirements of nuclear power plants. First we will discuss database manipulations in order to form an understanding of the concepts used to work with the databases within ORAM-Sentinel. With an understanding of database manipulations, the model builder will be able to build the required databases, and move, copy, and delete data.

The figures used in section 4 are from the model titled GTOUR_1.UM8.

Databases

Information processing systems typically utilize and manipulate one or more sources of data, referred to as databases. The ORAM-Sentinel directories and database files are identified in Table 4-1, ORAM-Sentinel Directories and Files.

The ORAMSENT directory is the location for application programs and utilities. The FILES directory is the location for files that contain information that may be applicable to more than one unit. The UNIT? directory, where "?" represents the unit number (e.g., 1,2.), is the location for files that contain information that is specific to one unit. This is a subdirectory of the FILES directory. The directory for the first unit is UNIT1. The directory for the second unit is UNIT2. Others are numbered as UNIT followed by the numeric equivalent. Note: Unit names must follow the UNIT? convention and must include sequential reference (e.g., a UNIT1 should be created as the first unit, UNIT2 as the second…etc.) If only a UNIT2 exists, simply create UNIT1 and do not develop further. If this convention is not used, program errors may occur.

Table 4-1
ORAM-Sentinel Directories and Files

Directory	File	Description
		Program
ORAMSENT	ORAMSENT.EXE	ORAM-Sentinel application
ORAMSENT	ORAMSENT.HLP	ORAM-Sentinel application help
ORAMSENT	README.TXT	Release and Installation information
		Utilities
ORAMSENT	ORAMKIT.EXE	ORAM-Sentinel data export program (not in beta)
		Utility Plant and Unit Definitions
FILES	UTILPLNT.BTR	Utility and Plant information (utility name, plant name and location)
FILES	NUCUNITS.BTR	Plant Unit (number designation, type, manufacturer)
FILES	ENDSTATE.BTR	Plant Unit End-states (on-line and outage) and PSA values
		Schedule Related
FILES	SCHDOPT.BTR	Schedule View Options
FILES	SCHEDUL1.BTR	Planned Maintenance schedule
FILES	SCHEDUL2.BTR	Actual Maintenance schedule
FILES	SCHDMST1.BTR	Planned Maintenance schedule activity descriptions
FILES	SCHDMST2.BTR	Actual Maintenance schedule activity descriptions
FILES	SIGACTIV.BTR	Maintenance schedule significant activities
FILES	IMPMATRX.BTR	Import translation matrix
		Security
ORAMSENT	USERPROF.BTR	User access profiles
		User's Specific Preferences
PRIVATE	CFGRECRD.BTR	User defined preferences (file paths, printer definition) This will be in the FILES directory if installed with standard installation.

Directory	File	Description
		Plant Definition
UNIT*	PCFGDEFS.BTR	Plant configuration definitions (component trains, high risk evolutions, configurations, value assignments)
FILES	CATEGORY.BTR	Variable Categories color/pattern combination definitions.
UNIT*	VAREXPRS.BTR	User-defined variable expressions
		Fault Trees
UNIT*	FTREEHDR.BTR	Fault Tree header information
UNIT*	FTREELGC.BTR	Fault Tree logic
		Event Trees
UNIT*	ETREEHDR.BTR	Event Tree header information
UNIT*	ETREENOD.BTR	Event Tree nodes
UNIT*	ETREESEQ.BTR	Event Tree sequences
		Safety Function Assessment Trees
UNIT*	SFUNCTNS.BTR	Safety Function definitions
UNIT*	SFATHDRS.BTR	SFAT header information
UNIT*	SFATCOND.BTR	SFAT condition blocks (logic)
UNIT*	SFATDEFS.BTR	SFAT filters
UNIT*	SFSUPPRT.BTR	Safety Function Support Systems
		Plant Transient and Integrated Safety Assessment Trees
UNIT*	PTRANSNT.BTR	Plant Transient and Integrated Safety definitions
UNIT*	PTATHDRS.BTR	PTAT header information
UNIT*	PTATCOND.BTR	PTAT condition blocks (logic)
UNIT*	PTATDEFS.BTR	PTAT filters
UNIT*	PTSUPPRT.BTR	Plant Transient and Integrated Safety Support Systems

	Probabilistic Safety Assessment	
UNIT*	ISARESLT.BTR	PSA results configuration and description
UNIT*	FREQNCY.BTR	PSA frequency database
UNIT*	REMSSRVC.BTR	PSA remain-in-service priorities
UNIT*	RETSSRVC.BTR	PSA return-to-service priorities
UNIT*	COMPACTS.BTR	PSA compensatory actions
UNIT*	PSAFLDEF.BTR	PSA filter definitions
UNIT*	PSAFLVAL.BTR	PSA filter values
	Risk Management Guidelines	
UNIT*	GUIDANCE.BTR	Guidance text
UNIT*	GUIDASSC.BTR	Guidance association to function
UNIT*	GUIDREFN.BTR	Cross reference to guidance
	Results	
UNIT*	VPCEVAL1.BTR	Configuration evaluation results for Planned schedule
UNIT*	PSAEVAL1.BTR	PSA evaluation results for Planned schedule
UNIT*	VPCEVAL2.BTR	Configuration evaluation results for Actual schedule
UNIT*	PSAEVAL2.BTR	PSA evaluation results for Actual schedule
	Work Release Grid	
UNIT*	PCDBGRID.BTR	WR Grid definitions
UNIT*	PCDBBTNS.BTR	WR Button definitions
	Miscellaneous	
FILES	BTRV.TRN	BTRIEVE transaction file (sometimes named BTRIEVE.TRN). This file does not necessarily have to be located in ORAMSENT/FILES directory, but it should exist on the computer.
UNIT*	MODELNAM.BTR	Model Name and End-state definitions
UNIT*	DBNOTES.BTR	Database notes
UNIT*	PSAINITS.BTR	PSA initiators for PSA graphs
UNIT*	OUTAGE.BTR	Plant outage definition

UNIT*	PSAGHS.BTR	PSA graphs definition
FILES	USERALOG.BTR	Transaction log indicating whether key functions are in operation
FILES	USERNOTE.BTR	Import guidance regarding significant activities
UNIT*	WRKSHEET.BTR	Safety Assessment Worksheet records
UNIT*	WIPEVALS.BTR	What-if PSA evaluations results
UNIT*	WRPEVALS.BTR	Work release PSA evaluation
UNIT*	WRVEVALS.BTR	Work release plant configuration evaluation results

Note: There are several *.btr files that may exist when converting a *.um7 file to a *.um8 file that are not needed and may be manually deleted. These files are SYSCODE.BTR, SYSTVARS.BTR, OLDETSEQ.BTR, and MRULEPCS.BTR.

File building and file maintenance requires the ability to access a database in an interactive mode. To support this effort, the program provides the user with functions such as Select, Copy, Create New, or Delete. These editing functions are provided on the main tool bar for many of the databases in a consistent, easy-to-use manner to facilitate the building and maintenance effort.

Data Record Editing Options

The buttons displayed in Figure 4-1, Editing Options, provides an easy method to edit database files. These buttons are displayed on the toolbar and can be used once a database editor is opened. (Note: Not all databases require these buttons to manipulate data; examples include the PCDB and TRANSLATION MATRIX. When these buttons are not required, they will be gray instead of black.)

Figure 4-1
Editing Options

A B C D E F G H I

A - MOVE TO BEGINNING OF FILE - allows access to the first record in the open database.

B - MOVE TO PREVIOUS RECORD - allows access to the record proceeding the one currently being viewed.

C - MOVE TO NEXT RECORD - allows access to the record succeeding the one currently being viewed.

D - MOVE TO END OF FILE - allows access to the last record in the open database.

E - SELECT FROM RECORD LIST - allows the model builder to view the list or records associated with the open database.

F - CREATE NEW RECORD - allows the model builder to create a new record in the open database.

G - COPY THIS RECORD - allows the model builder to duplicate the record being viewed within the database that is open.

H - DELETE THIS RECORD - allows the model builder to delete the record being viewed.

I - DATABASE NOTES FOR THIS RECORD - allows the model builder to record user specific information about the record being viewed.

Field Naming

There are two important rules that must be followed when naming fields. Some examples of fields include: PCDB names, event tree and fault tree names, event tree and fault tree node names, and user defined variables. The following rules are required:

- Start a field name with an alpha character, do not start with a number. If a field name begins with a number, then the computer code identifies the field as a number rather than as a field name. The code does not check for, or prevent this condition. It is up to the model builder to prevent this.
- Do not use special characters within a field name (including: +, -, /, *, or @). The code treats these characters within a field name as a mathematical operator. If these characters are used, the program tries to perform the mathematical operation on the two segments of the field name. The code does check for and prevent this unacceptable condition in the plant configuration database. You can, however, use the underscore character "_."

Below are listed examples of unacceptable and acceptable field names:

Unacceptable Field Names	Acceptable Field Names
23EDG	EDG23 or EDG_23 or _23EDG
RHR-A	RHRA or RHR_A or _RHRA
DHR/B	DHRB or DHR_B or _DHRB

Database Building Requirements

The following sections describe the requirements for building databases.

Plant and Unit Descriptions

The PLANT AND UNIT DESCRIPTIONS database can be accessed from DATABASE on the main menu. The utility name, plant name, and location are entered in the Plant and Unit Descriptions Editor as shown in Figure 4-2. The Unit Id, Type, and Unit Manufacturer are entered in this editor for each unit at the plant. The entry input in the Unit Id field will be displayed in the drop-down field on the toolbar (in the upper left corner under the MODE button).

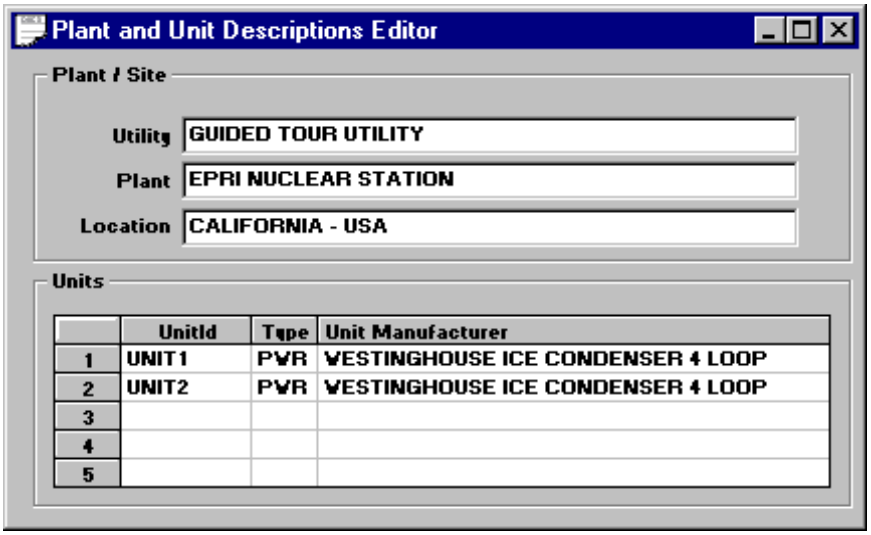


Figure 4-2
Plant and Unit Descriptions Editor

As described previously, the UNIT? Format must be used for the Unit ID and the units must be created sequentially beginning with UNIT1.

Outage Records

The Outage Database Editor shown in Figure 4-3 must be completed prior to running the SFAT evaluations or the Probabilistic Shutdown Safety Assessment (PSSA) analysis in outage mode. To enter this editor, ORAM-Sentinel must be in the outage mode. This editor is located under DATABASE on the main menu and OUTAGE RECORDS on the dropdown menu.

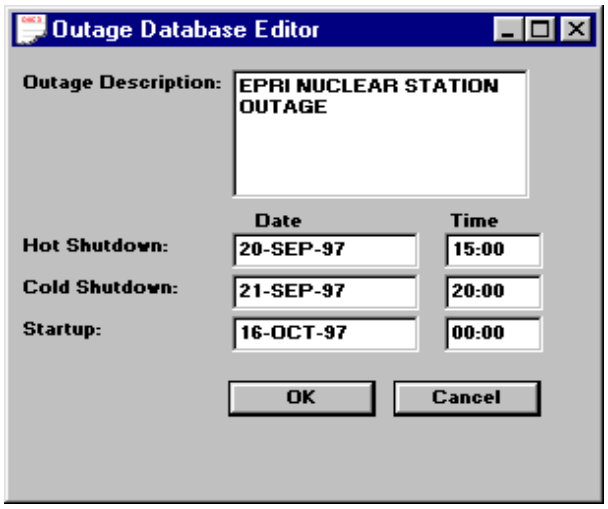


Figure 4-3
Outage Database Editor

Of specific importance to the outage model are the three dates and times required in this editor. The Hot Shutdown field defines the time of reactor shutdown. Sometimes, this occurs up to a day after the outage starts, because some plants consider the outage start as the point when the generator output breaker opens. This is important since the internal parameter "SD_DAYS" starts incrementing at the hot shutdown date and time. SD_DAYS is typically used to calculate decay heat level after shutdown. The Cold Shutdown field defines the date at which the reactor enters that condition (typically Mode 5 at a PWR and Mode 4 for a BWR). The Startup field defines the date at which the reactor exits the cold shutdown condition. It is important to understand these fields, and ensure that they reflect the correct dates.

The dates are used to span the x-axis for the plotting routines. The Startup time signifies the end of the outage and the internal parameter "SD_DAYS" is reset to 0 at Startup. "SD_DAYS" is typically utilized in the thermal-hydraulic analyses. Therefore, it is imperative that these dates be appropriately adjusted for changes.

Security Administration

The SECURITY PROFILES menu item is located under FILE on the main menu. Selecting SECURITY PROFILES brings up the Security Administration dialog box which is used to establish new User IDs and Passwords. The Security Administration section in ORAM-Sentinel can be accessed with the default ID of **SUPERVISOR**. Figure 4-4 shows the Security

Administration dialog box with the Access Attributes for the supervisor profile. Once in the screen titled Security Administration, establish a new User ID by clicking on the NEW button. Establishing a new password associated with the new User ID is optional.

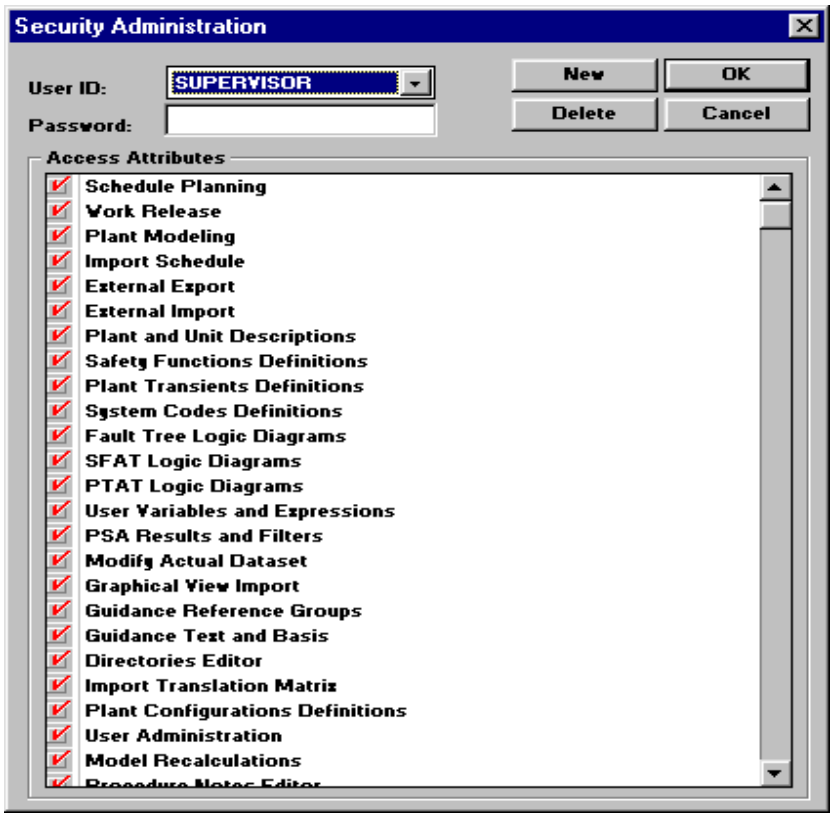


Figure 4-4
Security Administration

After establishing a new User ID it is necessary to select the areas within ORAM-Sentinel that the new ID will have access to.

Application Preferences

The Application Preferences section is used to set various user-specific settings. The Application Preferences dialog box can be accessed from FILE on the main menu and PREFERENCES on the drop-down menu.

In the General tab, Figure 4-5, users can enter preferences for the following:

Date Format - Matches the date format with the configuration of the computer clock. The U.S. Date Format is: Month/Day/Year. The Non-U.S. Date Format is: Day/Month/Year.

PCDB Variable Categories Enabled – The user can select "Yes" or "No." Choosing "Yes" will allow the Variable Categories tab to appear in the PCDB Definitions Editor, will display the variable categories check boxes at the bottom of each of the variable tabs (Components/Trains,

High Risk Evolutions and Configurations), and allows the variable categories to be printed in the report. See Section 4, Plant Configuration Database.

Duration - The Default Activity Duration setting defines the default duration of all new activities added from the Activity Editor in the Work Release mode. The default start date/time for new activities in the Work Release is the computer clock date/time when the AddNew button is selected from the Activity Editor. The end date/time for the activity is calculated by adding the default duration to the start date/time. The format for the setting is HHHHH:MM; for a maximum duration of 10,000 hours and zero minutes. The minimum duration is 00:01 (1 minute).

Overwrite Actual Default - This setting allows the user to pre-select the "Overwrite Actual" option on the Select and Load from Archive (open model) dialog. When NONE is selected in this preference, the user will be required to select YES or NO to the Overwrite Actual option each time before a model can be opened.

Path to Log File - this setting defines the path to the Transaction Log File that records all Actual database transactions.

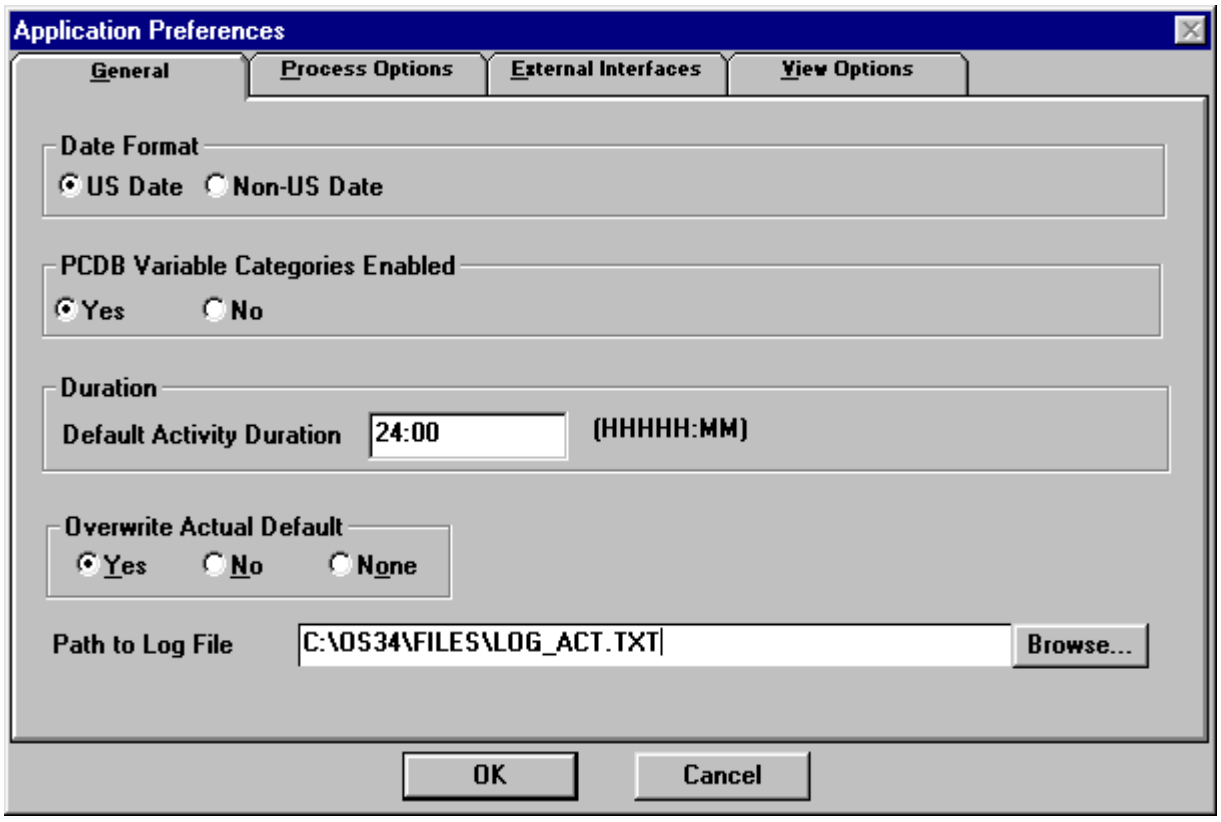


Figure 4-5
General Tab for Application Preferences

In the Process Options tab, Figure 4-6, three features can be actuated.

Function Weighting Factors allows the user to assign Weighting Factors to each Safety Function and Plant Transient category and use the Weighting Factors in calculations. See Section 4, System and Internal Variables for further information.

Time Tracking allows the user to enter a time-based variable into the PSA Results database which is intended to be used for risk-based Allowed Outage Times (see Section 4, PSA Results). Enabling Time Tracking also creates an internal variable which tracks the time that each front-line configuration exists (see discussion in Section 4, System and Internal Variables). The user is able to define the name and description of the PSA Results variable (i.e., ISAR_?????), in a similar manner to the PSA Results variables defined in the Plant and Unit Descriptions End-states Editor.

Shadow Actual Database - When this feature is enabled, the Actual database files will be copied to the Shadow Directory chosen by the user after Actual database modifications. A drive letter must be used as part of the location setting; network locations must be a mapped drive. See Section 6 for more details on the Shadow database.

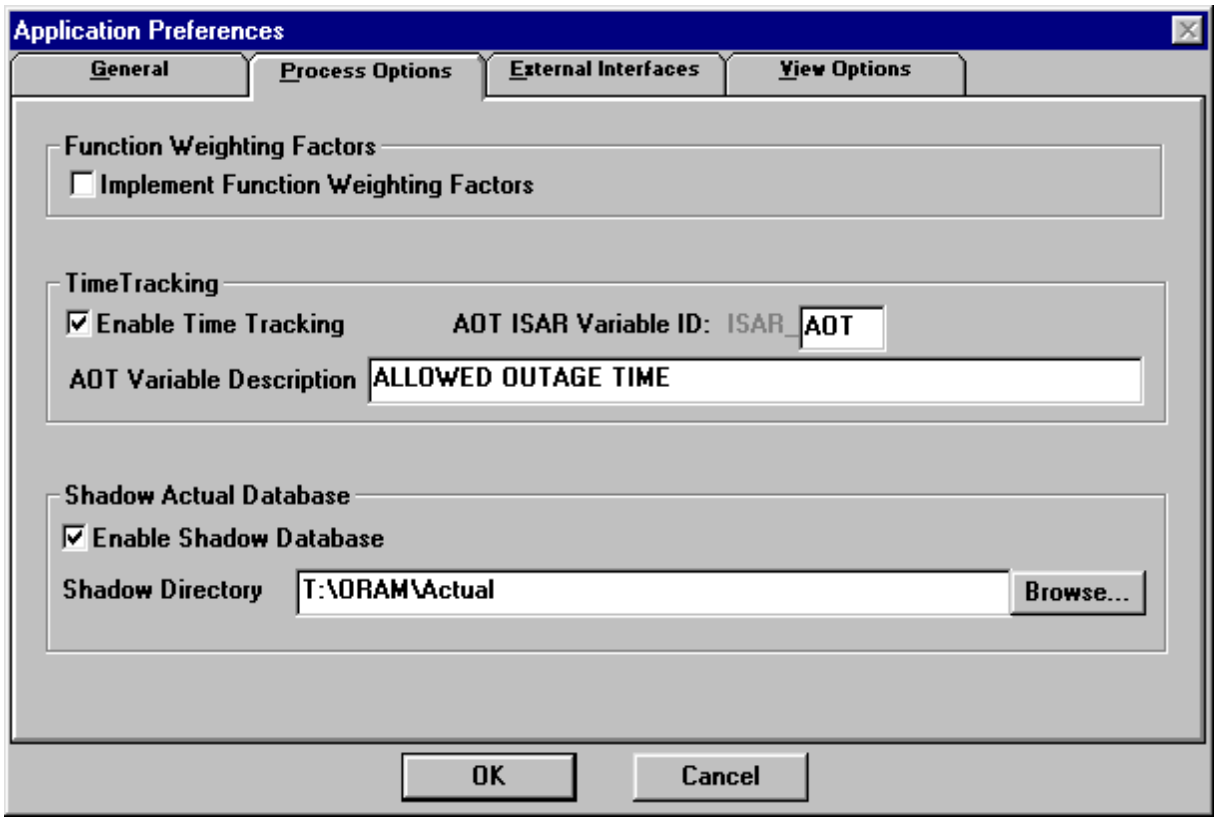


Figure 4-6
Process Options for Application Preferences

In the External Interfaces tab, Figure 4-7, the user can establish a link to EOOS for analyzing on-line plant configurations using the EPRI Risk and Reliability Work Station. Additionally, by checking the Use PSA Engine box, a link to a PSA engine can be made for calculating the risk of on-line plant configurations and storing this information in the PSA Results Database. Instructions on connecting to each of these external tools are described separately in Section 5 of this manual. Refer to Contents in this manual for sections titled Dial CAFTA and EOOS Fault Tree Interface, External Link and Call to Risk Engine.

Additionally, the IPDS preferences can be set in this screen. The Path to IPDS field defines the location of the IPDS import file. When performing a manual IPDS import from the Work Release mode, this file location will populate the IPDS import file name. If this portion of the preference is not competed, the user can browse from the IPDS import screen to locate the correct file. See Section 6 for more details on IPDS importing.

The View Options Tab is described in detail in Section 6 (see Figure 6-6). The settings on this tab only affect the Work Release Mode displays.

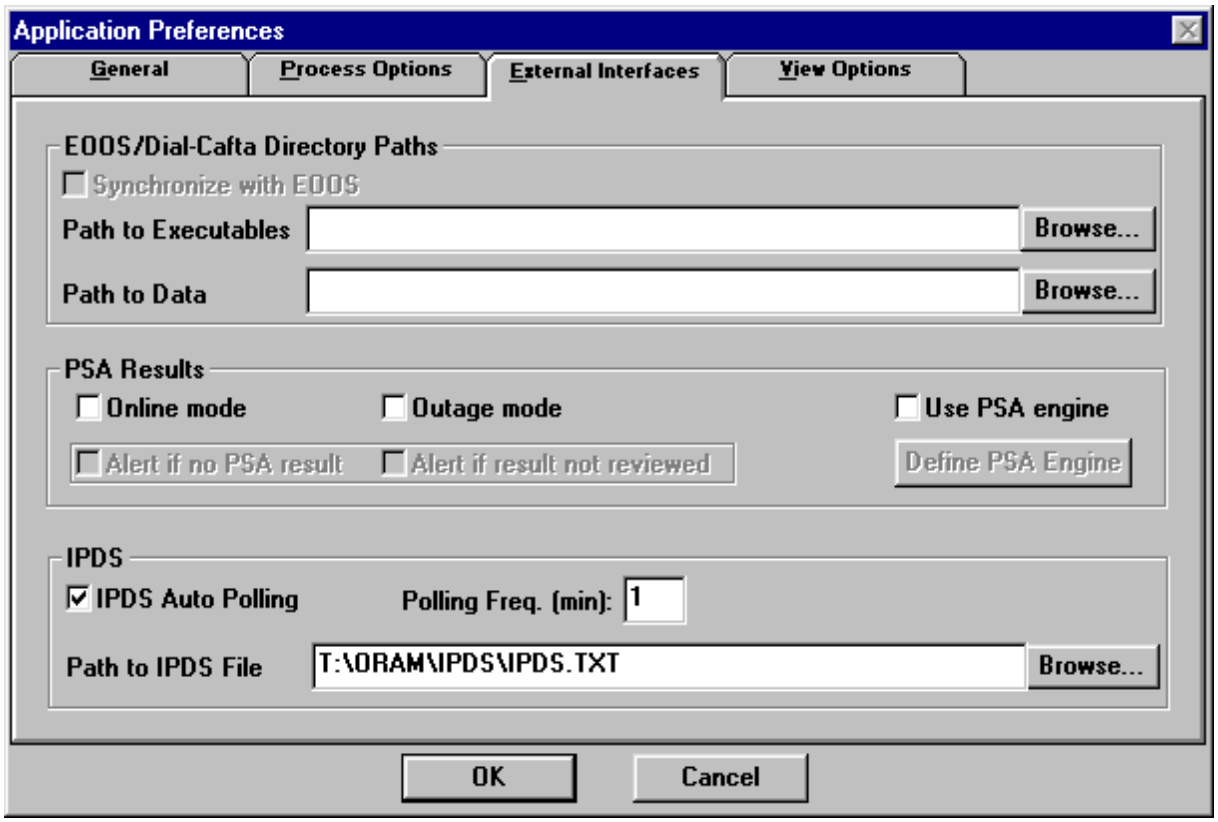


Figure 4-7
External Interface Tab for Application Preferences

Configuration

Plant Configuration Database

The plant configuration database (PCDB) is the primary data source of each model. The PCDB contains the variables which represent plant mode, reactor configurations, and system, train, and component status.

The plant configuration database is one of several user definable files supported by ORAM-Sentinel and can be accessed from FILES, CONFIGURATION, PLANT CONFIGURATION DEFINITIONS. Each model builder will need to establish the plant specific variables necessary to model each of the plant's modes, RCS configurations, system, train and component status, and (if used) any conditions that are considered a higher risk evolution or safety significant activity. The Valid Values entry can accommodate up to 60 characters. This editor has six tabs for COMPONENTS/TRAINS, HIGHER RISK EVOLUTIONS, CONFIGURATIONS, VALUE ASSIGNMENTS, VARIABLE CATEGORIES and WR COLOR ASSIGNMENTS.

The code will use the PCDB to keep track of the scheduled information. This is accomplished by duplicating the PCDB for each plant configuration. A plant configuration is a static picture of all of the items in the PCDB. Each time the status of one or more valid field values in the PCDB change, a new record of all of the items in the PCDB is created.

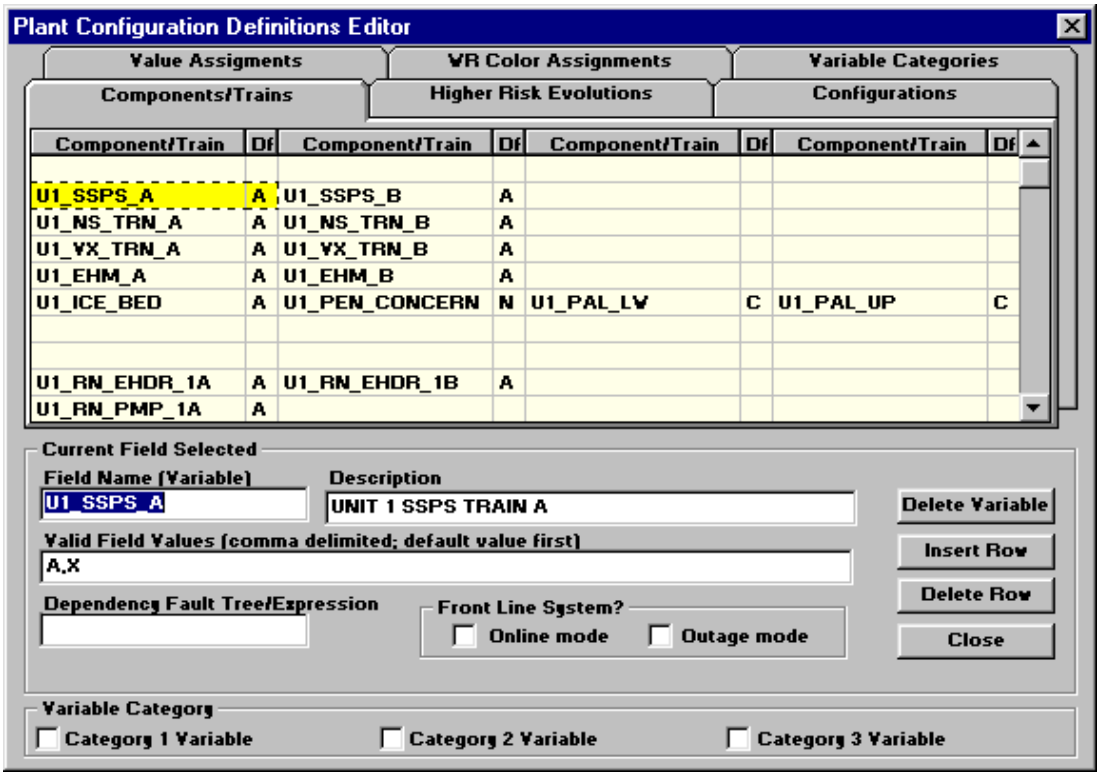


Figure 4-8
Components & Trains Tab of Plant Configuration Definitions Editor

Components and Trains

Figure 4-8 displays the Components/Trains section of the Plant Configuration Definitions Editor. This section must contain all of the plant components, trains and/or systems which are needed to perform analyses. These variables will be used in the model to compare the actual equipment availability to the required equipment availability. The information for each variable includes the Field Name (Variable), Description, Valid Field Values, Dependency Fault Tree/Expression, Front Line System (Online and Outage modes). Three check boxes will also appear if the PCDB Variable Categories Enabled field is set to "Yes" in Preferences. A new variable is created by positioning the cursor on a blank cell and completing the information fields in the bottom portion of the Plant Configuration Definitions Editor.

The Field Name length must be less than 16 characters and in accordance with the variable naming requirements described previously in this section. The Description is free form and must be less than 40 characters. The Valid Field Values must be a single character and be defined under VALUE ASSIGNMENTS. Typical Valid Field Values are:

- A for available
- X for unavailable
- O for open
- C for closed
- Y for yes
- N for no

These are suggested allowable values. The model builder is free to set the allowable value for each field as described subsequently under Value Assignments. The default value must be listed first and each value must be separated by a comma. The default value is the value that ORAM-Sentinel uses until the import file provides a different status.

The Dependency Fault Tree/Expression field enables the status of the PCDB variable to be determined based on the results of a fault tree or an expression. This applies only to PCDB variables which are marked as Front Line Systems. The PCDB variables with this association are indicated with an asterisk in the plant configurations view.

The purpose of the Front Line System boxes is to identify to ORAM-Sentinel that a component is important to risk as represented by the PSA Results database.. If the Front Line System Online mode or Front Line System Outage mode box is checked, ORAM-Sentinel will access the PSA Results Database when the PCDB Variable is not in its default state (in the applicable mode). See PSA Results Database for the use of this data. It is not necessary to use the Dependency Fault Tree/Expression if a Front Line System box is checked. If the Dependency Fault Tree and Expression box is completed by entering the name of a valid fault tree or expression, ORAM-Sentinel considers the PCDB variable unavailable with respect to the PSA Results Database only, when the Variable or the associated fault tree has a status of unavailable.

One or any combination of the Variable Category boxes should be checked if the Variable is to be assigned to a certain category. This allows activities to be displayed with color/pattern combinations in the Schedule View (see Variable Categories for use of this feature).

Higher Risk Evolutions

Figure 4-9 displays the Higher Risk Evolutions section of the Plant Configuration Definitions Editor. This section contains each plant higher risk evolution (HRE) or safety significant activity (SSA) for which status will be stored. An example of a higher risk evolution is isolation logic surveillance testing. This can be considered higher risk because if it is incorrectly performed, it could cause a shutdown cooling system isolation. Another example is work in the switchyard which, if not performed correctly could potentially cause a loss of offsite power. These activities are generally categorized into broader high risk evolution groups such as loss of offsite power, loss of shutdown cooling or plant trip. The general use of HREs or SSAs is for work that has the potential to cause an undesirable condition but does not necessarily cause an undesirable condition (plant trip or equipment unavailable) if performed correctly.

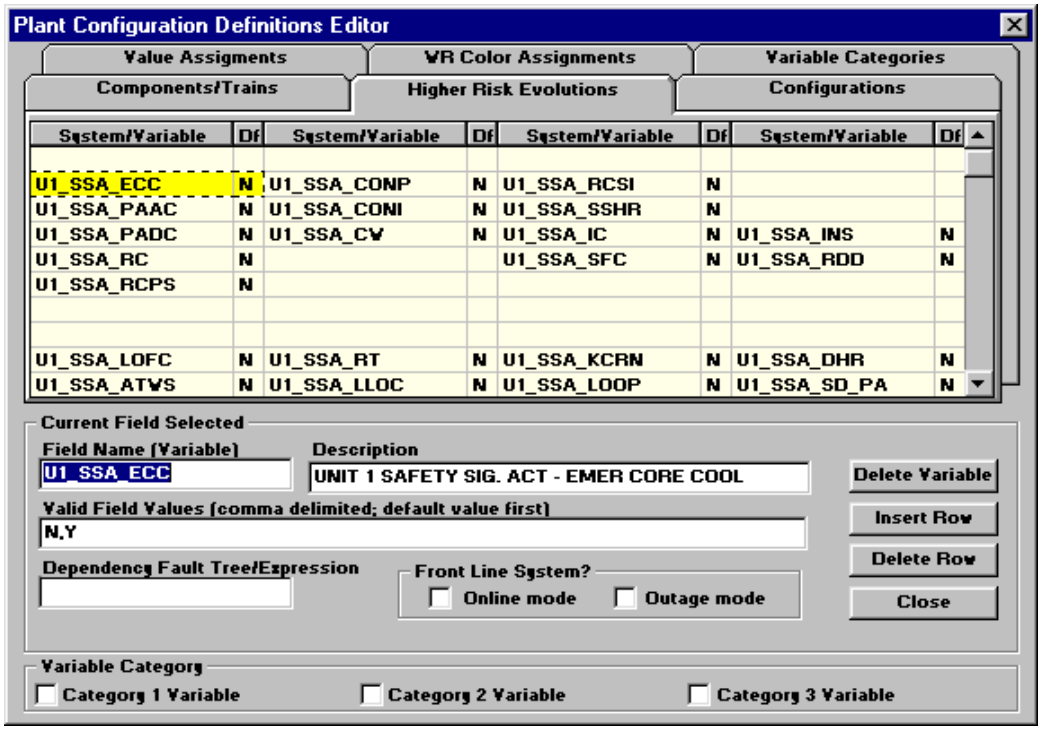


Figure 4-9
Higher Risk Evolutions Tab of the Plant Configuration Definitions Editor

The variables are established in the same manner as variables in the Components/Trains section. Typical allowable values are:

- Y for yes
- N for no

Configurations

Figure 4-10 displays the Configurations section of the Plant Configuration Definitions Editor. This section contains the configuration variables for the plant. The major difference between these variables and the Components/Trains and Higher Risk Evolutions variables is that the length of the Valid Field Values is not limited to one character for Configurations. The Valid Field Values must be maintained less than eight characters for Configurations Variables to be fully displayed, because the default displays at most eight characters. In addition, the values assigned to these variables remain alpha and are not converted to numerical values (see Value Assignments). Therefore, use of these valid field values in logic expressions must contain quotes for the value (e.g. @IF(LEVEL="LOW,"). The purpose of the Configurations section is to capture plant conditions. Examples may include the various plant conditions associated with vessel level, mode, or containment integrity. Each of these variables may have multiple values; for example, vessel level may have Valid Field Values of LOW, NORMAL, FLANGE, or FLOODED and containment integrity may have Valid Field Values of OPEN, CLOSED or INTEG (Note: INTEGRITY cannot be a valid field value since it is greater than eight characters.) As with the other sections of the PCDB, the default Valid Field Value is listed first and each value must be separated by a comma.

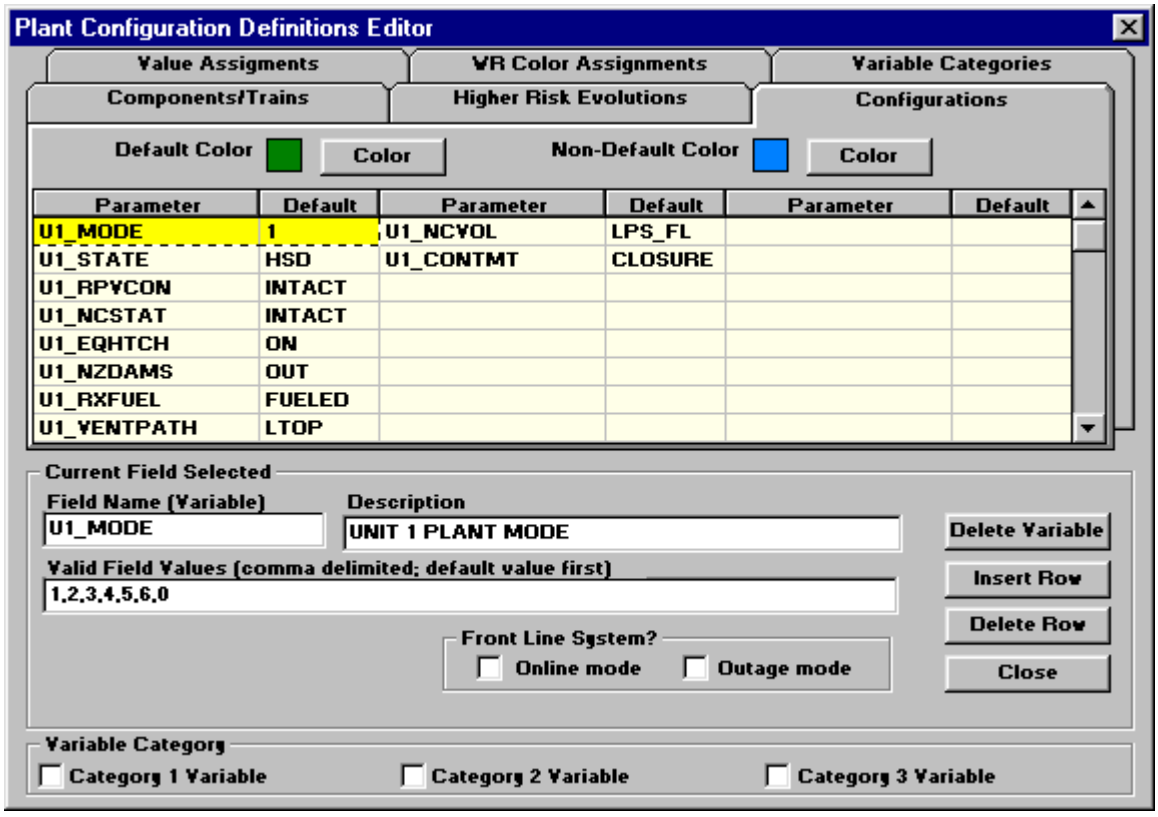


Figure 4-10
Configurations Tab of the Plant Configuration Definitions Editor

The Configurations fields may be used in SFAT filters (a discussion of SFAT filters will follow later in this section). SFAT filters are displayed on the SFAT diagrams in a similar manner as

these multi-character PCDB fields, however, filters are defined in a separate place and they may contain totally independent data from Configurations fields. These configurations may be used as filters for assessment trees and in user variables and expressions.

The Default Color and Non-Default colors are used for the Work Release Grid Panel. If a Grid Panel button is used to represent a Configuration Variable, the button color will display the Default Color when the variable is in its default state, and the Non-Default Color otherwise. See Section 6 for a more detailed explanation of this feature.

Value Assignments

Figure 4-11 displays the Value Assignments section of the Plant Configuration Definitions Editor. The Value Assignments section must contain the list of Valid Field Values used in the Components/Trains and Higher Risk Evolutions sections. The required information for each variable includes the Character, Numeric Assignment and Description of Usage. The Numeric Assignment is used in the model when calculations are performed. Therefore, the numeric assignment must be used in establishing all logical expressions.

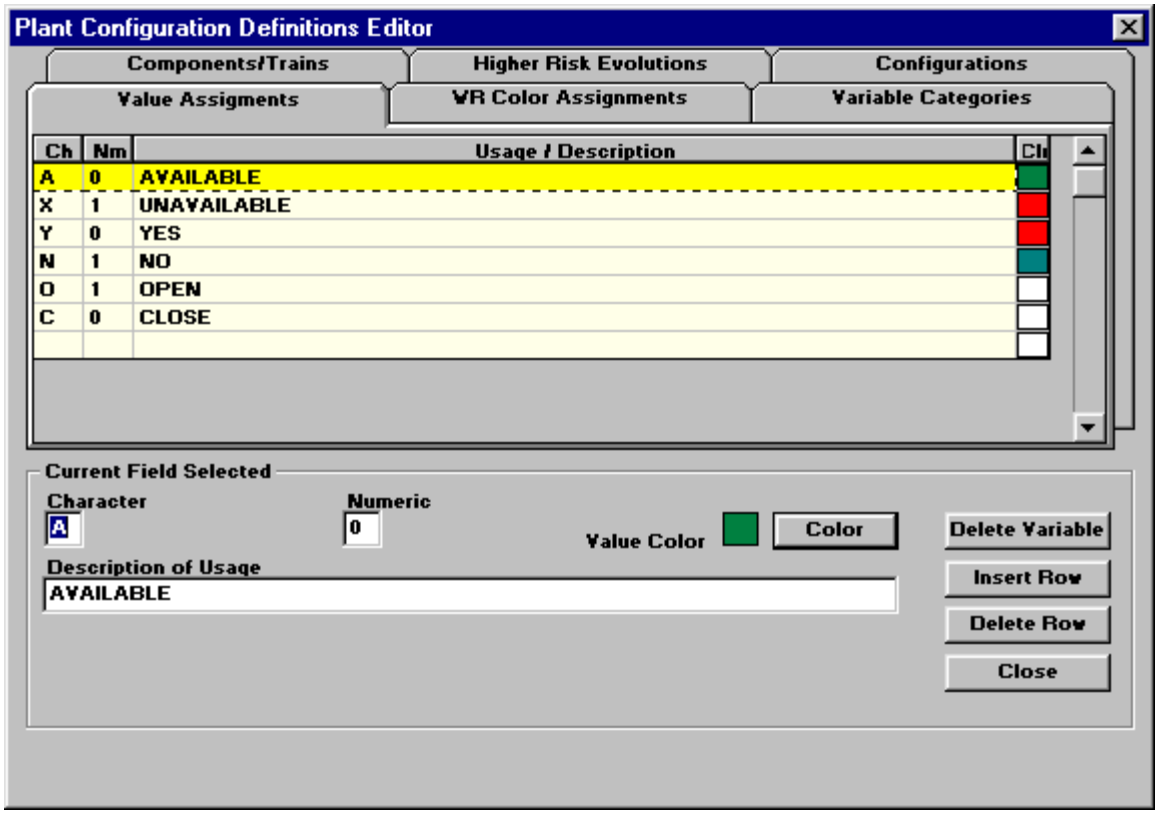


Figure 4-11
Value Assignments Tab of the Plant Configuration Definition Editor

The Value Color is used in the Work Release Grid Panel buttons. A button which represents a single PCDB Variable (from the Components/Trains or Higher Risk Evolutions tab) will display

the color of the value assigned to the variable in each configuration. More details of this functionality are provided in Section 6.

The Value Assignments section does not require the list of Valid Field Values used in Configurations. The values assigned to Configurations variables remain in alpha form and are not converted to numerical strings (see Configurations).

Variable Categories

The Variable Categories tab of the Plant Configuration Definitions Editor (Figure 4-12), allows the user to define up to three activity/Variable Categories in addition to the default, "No Variable Category Defined." The user can also define descriptions and color/pattern combinations for the four combinations that are derived from the three basic categories.

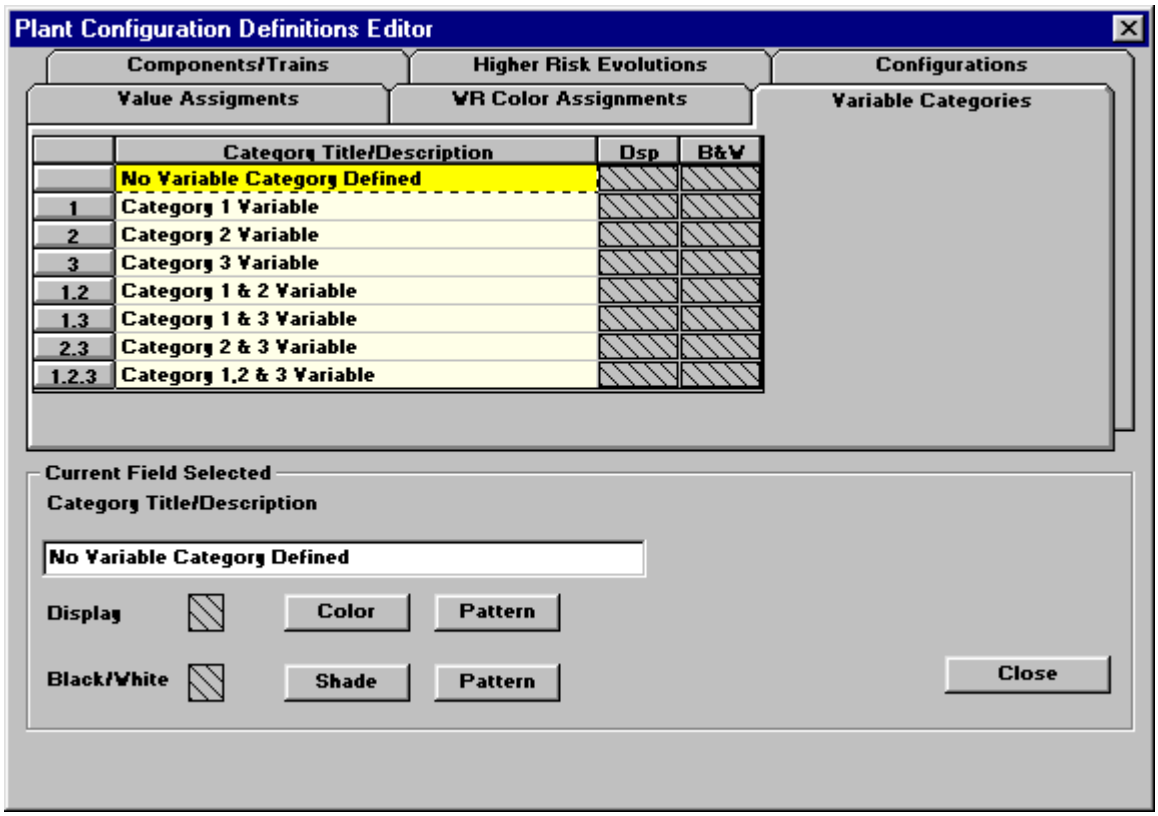


Figure 4-12
Variable Categories Tab of the Plant Configuration Definitions Editor

Associated with each category are five fields.

- The Category Title/Description field is limited to 40 characters.
- The Display Color and Pattern fields allow the user to assign a color/pattern combination that will be displayed for all activities assigned to that category in the Schedule View. The Display Color and Pattern are used for the on-screen Schedule View and Color Maintenance Schedule reports.

- The Black/White Shade and Pattern fields allow the user to assign a shade/pattern combination that will represent the specific category in a black and white report. (Note: The shade/pattern display in a black and white report varies with printer type. The shade/pattern may not appear the same when using different printers. The user should adjust the shade and pattern combination until the desired output is obtained.)

It is recommended that upper and lower case characters be used in the description field so as to allow more of the description to be displayed in the PCDB editor, adjacent to the check boxes in each of the Plant Configuration Definitions Editor tabs.

To select a certain color, shade or pattern, click on the corresponding button. Select a color, shade or pattern and click the OK button. To implement the field changes performed, select a different Category Title/Description and the changes will be displayed. To assign a variable to a certain category, select one or any combination of the category check boxes in the Components/Trains, High Risk Evolutions or Configurations tab.

WR Color Assignments

The Work Release Color Assignments section is used to assign colors for to Title Buttons, Group (picklist) Buttons, and Single PCDB Buttons whose color is dependent on a support variable. See Section 6 for more details on color assignments to these buttons.

Importing Data From a Schedule

Once established, the plant Maintenance Schedule Importing feature is the primary means for establishing the planned schedule in ORAM-Sentinel. The preferred method of importing data for the planned schedule is from the scheduling software via an ASCII text file. A second means to import data is to create this ASCII text file manually with any ASCII text editor. Manually developing the import file is especially useful during the initial model building process prior to establishing the link to the station scheduling software. Both of these methods will be discussed below. However, there are several prerequisites to importing including:

- Developing the PCDB,
- Developing the IMPORT TRANSLATION MATRIX, and
- Developing the data IMPORT FILE

It is important to note that all PCDB variables should be readily available from the station planning software (schedule) so that changes to the station schedule can be followed automatically in ORAM-Sentinel.

Import Translation Matrix

The model builder must develop the data import translation matrix. There are two ways to do this. The first is to create the file with ORAM-Sentinel, the second is to create the file externally (possibly with an ASCII text editor) and import it.

To build in ORAM-Sentinel, click on FILE, then CONFIGURATION, and then IMPORT TRANSLATION MATRIX. The required information includes Schedule Code, Value and System Variables Affected. An example of a portion of the matrix is included in Figure 4-13, Translation Matrix Editor.

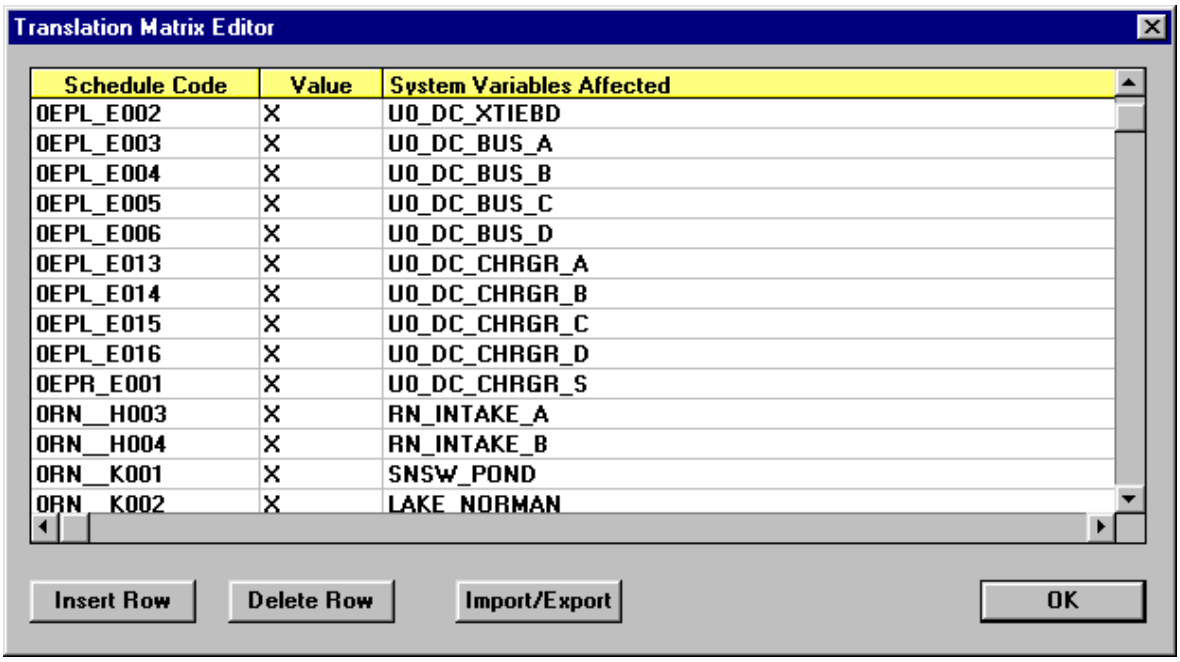


Figure 4-13
Translation Matrix Editor

The purpose of this file is to provide a translation between the station scheduling software codes and the Variable names used in the PCDB. This allows the schedule code field in the scheduling tool to differ from the PCDB Variable names in ORAM-Sentinel. This also allows one activity to affect multiple PCDB variables. It is acceptable for the Schedule Codes to match the System Variables in the translation matrix if the model builder prefers. All characters in this file must be capitalized.

The Schedule Code, located in the left column of the Import Translation Matrix Editor, is used in the station scheduling tool. In the schedule, this code identifies that the schedule activity is required for ORAM-Sentinel and identifies the activity in station specific language. The System Variables Affected, located in the right column, lists the ORAM-Sentinel PCDB variables related to each Schedule Code. The Value, located in the center column, is the new value that the PCDB Variable will have when the Schedule Code is imported.

The Schedule Code must be maintained less than 28 characters (ASCII file limit), the Value must be maintained less than 10 characters (10 being the limit to the number of characters that will be imported), the System Variables Affected should be maintained less than 60 characters (including multiple items separated by commas). These field lengths will permit easy viewing in the Translation Matrix Editor.

It is acceptable for one Schedule Code to affect multiple PCDB variables. If there are multiple PCDB Variables affected by one Schedule Code, then enter each Variable in the Systems Variables Affected (right) column separated by a comma on the same line in the Translation Matrix Editor. It is acceptable to have the Schedule Code repeated to affect multiple lines of the matrix.

If the import translation matrix is created in an ASCII file and imported, then the file being imported must be semicolon delimited. There is an IMPORT/EXPORT button on the Translation Matrix Editor to support the import effort. The import translation matrix is automatically sorted by Schedule Code after the matrix is saved by clicking on the OK button. If the model builder would like to sort the table by System Variable, then the matrix must be exported and manipulated external to ORAM-Sentinel. The same IMPORT/EXPORT button can be used for the export process. Note that once the matrix is imported it will be automatically sorted again by Schedule Code.

If a particular PCDB Valid Field Value is not filled with a value from the import file, ORAM-Sentinel will supply the field with its default value for the given configuration. The default value is the first Valid Field Value listed in the PCDB. For example, if a PCDB system for the unit two fueling water storage tank was defined as: U2_FWST with allowable values of A, X (for available or unavailable, respectively) then the default value would be A. The default value will be placed in the PCDB for each plant configuration where no status is imported from the schedule for U2_FWST. If an outage for U2_FWST occurs, then the model builder must establish the Schedule Code or Maintenance Activity in the import file and enter this in the translation matrix indicating an unavailability (“X”) for U2_FWST.

It is important that the Import Translation Matrix is correct, as there is no validation in the editor. It is up to the user to ensure that each PCDB variable and value listed in the matrix are valid. If not, ORAM-Sentinel will perform the translation from the Schedule Code to an invalid variable or value. The export utility, ORAMKit, can be used to help build the translation matrix and verify that it is correct.

Import File

An example of this file is included with the various generic plant models in the IMPORT sub-directory. The model builder may view these generic files as references. The separate pieces of information required for schedule windows or hammocks in the import file are the schedule code, begin date, begin time, end date, end time, task description/ reference, user-defined ID and six comment fields. The user-defined ID and six comment fields are seven additional fields that have been added in ORAM-Sentinel v3.4. For schedule milestones, the end date and time are not required. Except for the activity description, UPPERCASE must be used for all other entries (including month, such as OCT). Each of these fields must be separated by at least one space. Note: The dates in the file should have a format of DDMMMYY (Example: 31SEP97), or DDMMMYYYY (Example: 31SEP1997). ORAM-Sentinel automatically reads either data format, even within the same import file. The times should have a format of HH:MM (Example: 23:00). The task description/ reference (65 characters) can be information of the user’s choice, including numbers, text, spaces, special characters and upper or lower case.

The user-defined ID (25 characters) and the six comment fields (65 characters each) have been added new since version 3.3. Similar to the schedule/ task identifier,) these fields can contain text including numbers, characters, spaces, special characters and upper or lower case. The task description/ reference and additional fields are designed to contain specific fields from the station schedule such as work order number, sub-task number or work description. The delimiter for the seven additional spaces is a double pipe "||" as opposed to spaces (since the Description field and the new fields can contain spaces. If it is desired to use the additional fields, the double pipe must be placed after the Activity Description field, and in between each of the seven new fields. If the seven additional fields are not used, the import file format is unchanged from version 3.3.

When an activity is imported, the affected PCDB variable is assigned the value in the import translation matrix for the period between the start date and time and the end date and time. For components and trains, this field will typically contain a value of "X" (unavailable) during schedule system outage windows. For higher risk evolutions, this field will typically contain a value of "Y" for yes. For configurations, such as Fuel Status, Reactor Water Level, etc., the Valid Value will contain any of the allowable values.

After the PCDB, import translation matrix and import file are developed, the user can perform data importing. The data import process should be tested to verify that the actual station schedule and the ORAM-Sentinel schedule are the same. This can be done by comparing the schedule before importing (paper copy) to the schedule after importing (on the screen).

Schedule Milestones

The import file may be setup to also receive milestones. Milestones in the station schedule may be imported in addition to hammocks/windows. A milestone requires only one date and time, which ORAM-Sentinel treats as the start date and time. To import a hammock requires start and end dates and times. ORAM-Sentinel will maintain the status of the associated variable until a milestone with a different Valid Value for the variable is imported.

The example below indicates how the import file would look for the PCDB variable called U1_MODE when importing milestones for plant mode during a refueling outage.

```
1OUT_MOD1    01JAN97  00:00  PLANT IN RUN MODE
1OUT_MOD3    01AUG98  12:00  HOT SHUTDOWN
1OUT_MOD4    02AUG98  00:00  START OF COLD SHUTDOWN
1OUT_MOD5    06AUG95  12:00  REFUEL (MODE 5)
```

The associated import translation matrix must have a new Value for each Schedule Code. An example of this is using milestones to define the plant operating mode as indicated below. Therefore when each Schedule Code is imported the System Variable Affected changes to the new Value associated with the Schedule Code.

Schedule Code	**Value**	**System Variables Affected**
1OUT_MOD1	1	U1_MODE
1OUT_MOD2	2	U1_MODE

1OUT_MOD3	3	U1_MODE
1OUT_MOD4	4	U1_MODE
1OUT_MOD5	5	U1_MODE
1OUT_MOD6	6	U1_MODE

Note, it is important not to mix milestones and windows affecting the same PCDB variable.

Comment Lines

ORAM-Sentinel will ignore any lines (records) in the import file that start with a double asterisk (**). Therefore, the double asterisk can be used to enter comment lines in the import file.

Scheduling Software Date Query

It is the responsibility of plant personnel to setup the data query and extraction procedures utilizing the query and report generation capabilities of their particular scheduling software. This process must result in an ASCII text file of schedule activities formatted per the requirements of ORAM-Sentinel. If the user has access to a program which performs the data extraction, it can be run from within ORAM-Sentinel using the Run External Program feature.

Data Importing

The Data Importing process moves the schedule (ASCII flat file) into ORAM-Sentinel and is performed by selecting IMPORTING on the viewbar. The Import File name, start date and time and end date and time (DD-MMM-YY format for date and HH:MM format for time) should be entered in the Maintenance Schedule Importing dialog box, Figure 4-14. These dates and times should encompass the range of schedule dates being imported.

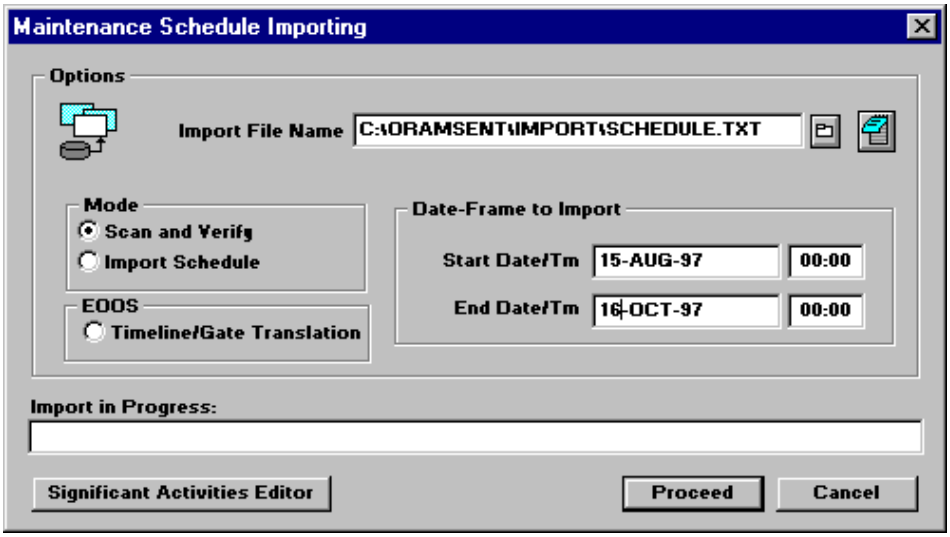


Figure 4-14
Maintenance Schedule Importing

The model builder can specify the import mode as either "Scan and Verify" or "Import Schedule." The Scan and Verify checks that the schedule codes in the Import File have matching Schedule Codes in the Import Translation Matrix. No importing occurs if the Scan and Verify is selected. The Import Schedule mode performs the import. It is recommended but not required that the schedule be scanned before importing to check for any discrepancies. If there is a discrepancy, a message will appear indicating which code(s) are in the schedule but not in the Import Translation Matrix.

The Import File will be filtered through the Import Translation Matrix to convert the codes used in the station schedule to PCDB names used by ORAM-Sentinel. The scheduled data is now stored in ORAM-Sentinel and can be viewed by selecting SCHEDULE on the viewbar.

Activities pre-existing in ORAM-Sentinel that start before the Date-Frame To Import are retained in ORAM-Sentinel after the new import. Activities pre-existing in ORAM-Sentinel that start within the Date-Frame To Import are deleted during the import. This also includes pre-existing activities scheduled to start within the date frame but are scheduled to end after the date-frame. Activities pre-existing in ORAM-Sentinel that are scheduled to start after the Date-Frame To Import are retained after the new import.

Schedule importing can be performed on both the Actual and Planned Datasets. It is important to ensure that the correct Dataset is selected prior to performing the import. A schedule import in the Actual Dataset uses different rules for overwriting data than an import into the Planned Dataset. See Section 6 for a discussion of IPDS importing, which is similar to the Actual Dataset Schedule Import feature in the Schedule Planning Mode.

Significant Activities Editor

The SIGNIFICANT ACTIVITIES EDITOR button on the Maintenance Schedule Importing screen is used to add data during the import process. Figure 4-15 shows the Significant Activities editor. After import, the data stored in the PCDB and visible in the Schedule View will include the activities in this editor. These additional activities will be treated as if they were part of the original import file. This option can be used if there is a piece of equipment that is unavailable for a period of time but not in the station schedule or for emergent work that is yet to be scheduled. The seven additional fields added to the import process for version 3.4 can not be populated using the Significant Activities editor.

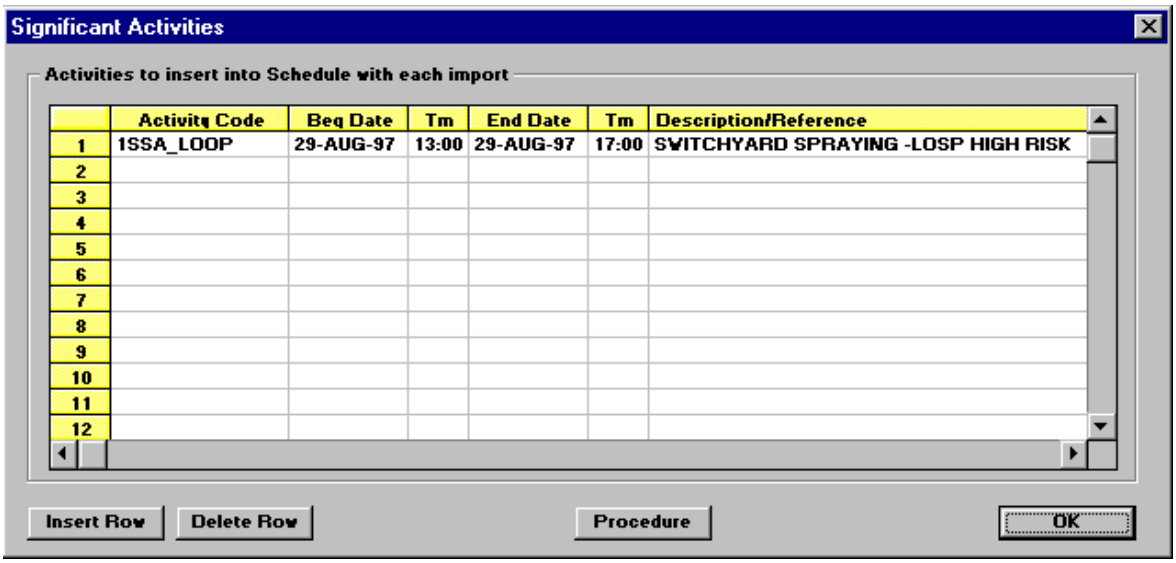


Figure 4-15
Significant Activities Editor

The PROCEDURE button in the Significant Activities editor is a reference for entering information. This can include guidance regarding what is a higher risk evolution.

Schedule View Editing

ORAM-Sentinel allows the user to add, delete, or edit a schedule activity directly from the Schedule View. To edit or delete a maintenance task, double click on that activity's description or Gantt bar to access the Planning Schedule Task Editor, Figure 4-16. This editor will allow the user to input the new Start Date and Time and End Date and Time. A button is provided to allow the user to delete the activity. To add a schedule activity, right click anywhere in the schedule view and select ADD MAINT TASK. An ACTIVITY INFO button will appear for any activity that contains information in any of the seven additional fields.

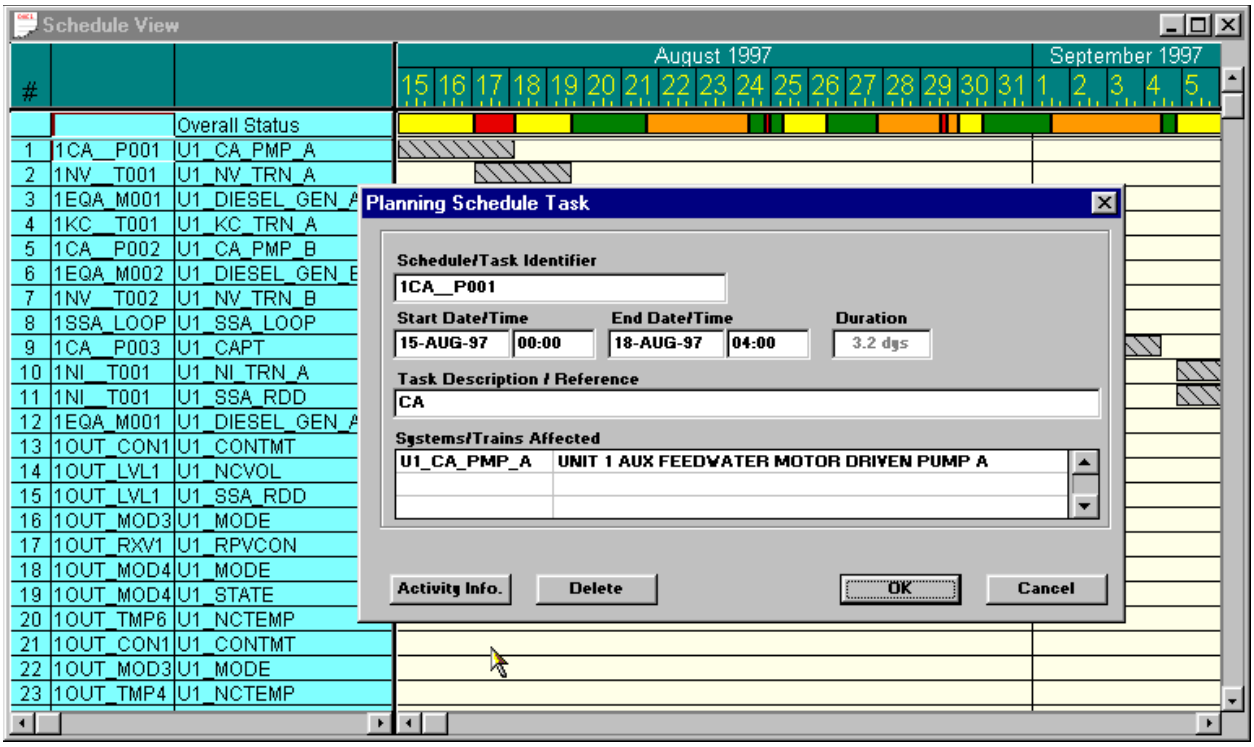


Figure 4-16
Planning Schedule Task Editor

After an activity is added or edited, the Schedule View will display that activity with a purple-colored Gantt bar and the Overall Status will display white or cross-hatched (Alternate mode) until the model is recalculated. Once the Schedule View is closed, the manually edited activities will have the standard Gantt bar color, or Variable Categories and pattern, when applicable.

The Schedule View can be accessed for both the Planned and Actual Datasets, in both the Schedule Planning and Work Release Modes. There are some differences in the functionality of the Schedule View in the different modes and datasets.

- In the Work Release Mode, the Schedule View is for viewing only. The Planning Schedule Task dialog is not active, so the details provided in it are not available, and the activities cannot be edited.

- In the Actual Dataset, some activities can not be modified (edited or deleted) in the Schedule View. If an activity is manually added via the Work Release Grid Panel interface, the Schedule View will not allow the activity to be edited, unless the schedule code created by the Work Release Mode Activity Editor is also in the Import Translation Matrix. See Section 6 for a discussion of the Activity Editor in Work Release. Note that activities added via the IPDS import can be edited in the Actual Dataset Schedule View, since the IPDS uses Schedule Codes that are in the Translation Matrix.

Schedule View Notes

While in the Schedule View it is possible to access the Schedule Notes Editor, Figure 4-17 by clicking on the DATABASE NOTES button. Each entry in the Schedule Notes Editor has a unique Entry ID and corresponding Schedule Notes field which contains user entered text. The editor allows the user to input a new database note entry by placing the cursor in the desired cell under the Entry ID. Each Entry ID must be unique. To enter text into Schedule Notes field, place the cursor in the desired cell and enter the text, or double click in the desired Schedule Notes entry for the Description of Action window to appear. In the Schedule Notes Editor window the INSERT button is used to insert a new Entry ID above the selected entry. The DELETE button is used to delete a selected entry. The Schedule View Notes database will not be overwritten when a new import file is imported. There is only one Schedule View Notes database; there is no distinction made between the Actual and Planned Dataset schedules.

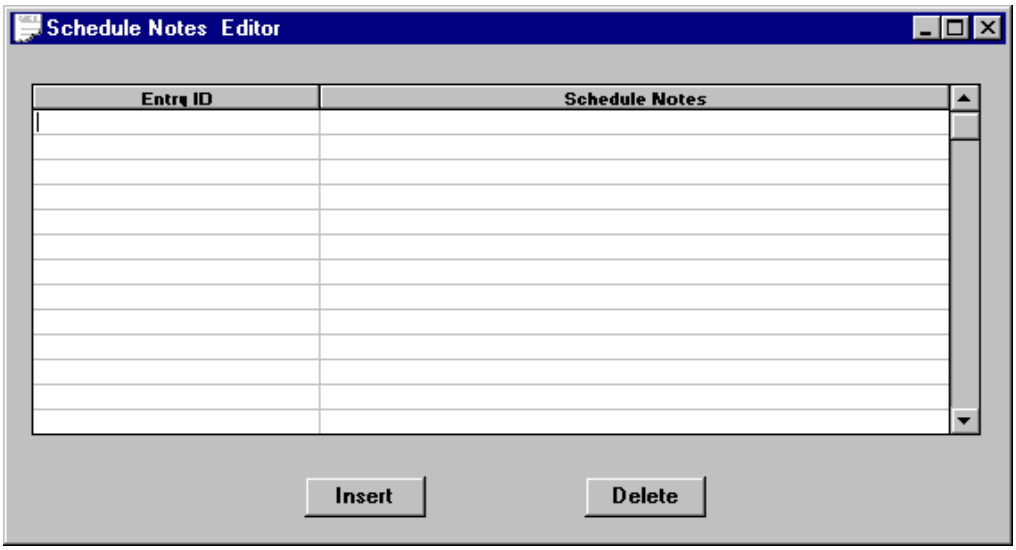


Figure 4-17
Schedule Notes Editor

Assessment Trees

SFATs, PTATs, and ISATs

ORAM-Sentinel provides qualitative and quantitative techniques to develop overall assessments of safety. The Safety Function Assessment Trees (SFATs), Plant Transient Assessment Trees (PTATs), and Integrated Safety Assessment Trees (ISATs) are qualitative engines that perform the Safety Function Assessment, Plant Transient Assessment, and Integrated Safety Assessment, respectively, within ORAM-Sentinel. These assessments are described in Section 1. This section on assessment trees applies to each type. The subsequent instructions refer only to SFATs for consistency and ease of presentation in this manual; however, the SFAT instructions apply equally to PTATs and ISATs. The SFATs and PTATs are used in the on-line model while SFATs and ISATs are used in the outage model. The access to these three functions is from DATABASE on the main menu.

The Safety Functions section of the ORAM-Sentinel code allows model builders to setup a series of assessment trees. The Safety Function Assessment Trees (SFATs) evaluate data input from the Plant Configuration Database (PCDB), fault trees, PSA and PSSA database, and user defined variables. The process compares the actual equipment availability against the required equipment for the actual plant condition. The result of the SFAT analysis is a set of colors. There are also guidance reference groups which are specific to each end-state encountered within each safety function.

The two databases associated with Safety Functions can be accessed from DATABASE on the main menu and SAFETY FUNCTIONS DEFINITIONS and SFAT LOGIC DIAGRAMS on the drop-down menu. The safety functions definitions database allows the model builder to identify the safety functions, assign their usage to the outage or on-line or both modes, assign the order and position in which they are displayed, assign valid filters and identify support systems. The SFAT logic diagrams database allows the model builder to develop the decision logic for the assessment trees in each safety function, assign filters for each of the trees, and assign colors and guidance to each end-state.

Safety Functions Definitions

Database Editor

The first step in developing SFATs is to enter the Safety Functions Database Editor shown in Figure 4-18. This is done by clicking on DATABASE from the main menu and SAFETY FUNCTIONS DEFINITIONS. (There are also INTEGRATED ASSESSMENTS DEFINITIONS and PLANT TRANSIENT DEFINITIONS buttons that perform a similar function to the SAFETY FUNCTIONS DEFINITIONS button.) The edit buttons on the tool bar are active for this database.

In the database editor each function must be defined. This requires entering a new function code (four characters maximum) and description (28 characters maximum).

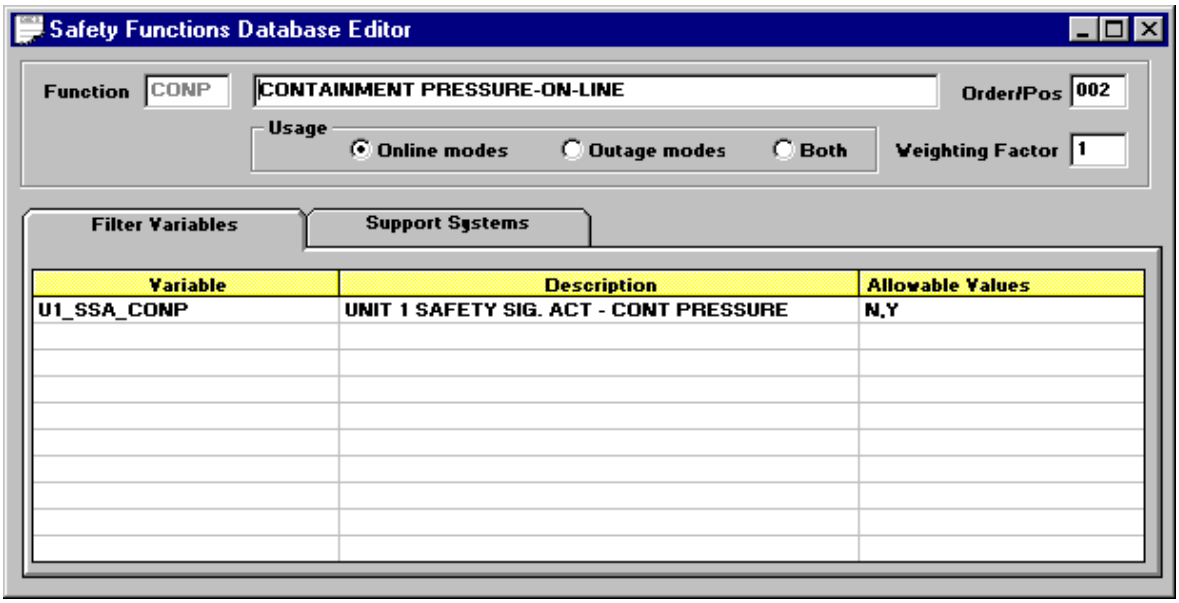


Figure 4-18
Safety Functions Database Editor

Filter Variables

The purpose of the filters is to tell the code which assessment tree to use for a given safety function (or plant transient assessment or integrated safety assessment) for a given plant configuration. The Filter Variables fields allow the user to choose variables from the PCDB, fault tree or user variables and expressions databases. The entire list of filters (maximum of 10 for each tree) should be listed in this editor. These Filter Variables will be displayed on all assessment trees in that function. The Order/Pos field will determine the order that the safety functions will be displayed in the view mode. In this version of the code it is now possible to assign different filters to each safety function.

Support Systems

Within the Overall Plant Status View is a SUPPORT STATUS button. The user is able to view the status of specific systems and components and trains for any safety function. These should be systems, components and trains directly related to the defense-in-depth of the safety function. The setup of these support systems is done in the Safety Functions Database Editor by clicking on the SUPPORT SYSTEMS button and double clicking on any of the items listed in the Systems Defined drop down list. Fault Trees and user-defined variables may also be used as filters.

Weighting Factors

Each Safety Function can have a Weighting Factor (WF) assigned to it, if the Implement Function Weighting Factors option is selected in Application Preferences. Weighting Factors allow the user to rate the importance of a Safety Function. The Weighting Factor for each Safety

Function is assigned to a variable SFATWF_????, where "????" is the function code for the specific Safety Function. This variable can be used as any other ORAM-Sentinel variable (i.e., in formulas and expressions) and is intended to be used in the ORAM-Sentinel variable SFAT_SCORE. The weighting factor must be an integer between 1 and 99. The default value for the WF is 1.

In a similar manner, Weighting Factors can also be applied to Plant Transient categories. In the case of Plant Transients, the Weighting Factor is assigned to a variable PTATWF_????.

Logic Diagrams Database Editor

After defining the Safety Functions, the model builder can develop one or more assessment trees for each Safety Function. The SFAT Logic Diagrams Database Editor can be accessed by clicking DATABASE from the main menu and SFAT LOGIC DIAGRAMS. Figure 4-19 displays the SFAT Logic Diagrams Database Editor with an SFAT diagram. The tool bar edit buttons are active for this database. The CREATE NEW RECORD button can be used to start a new SFAT.

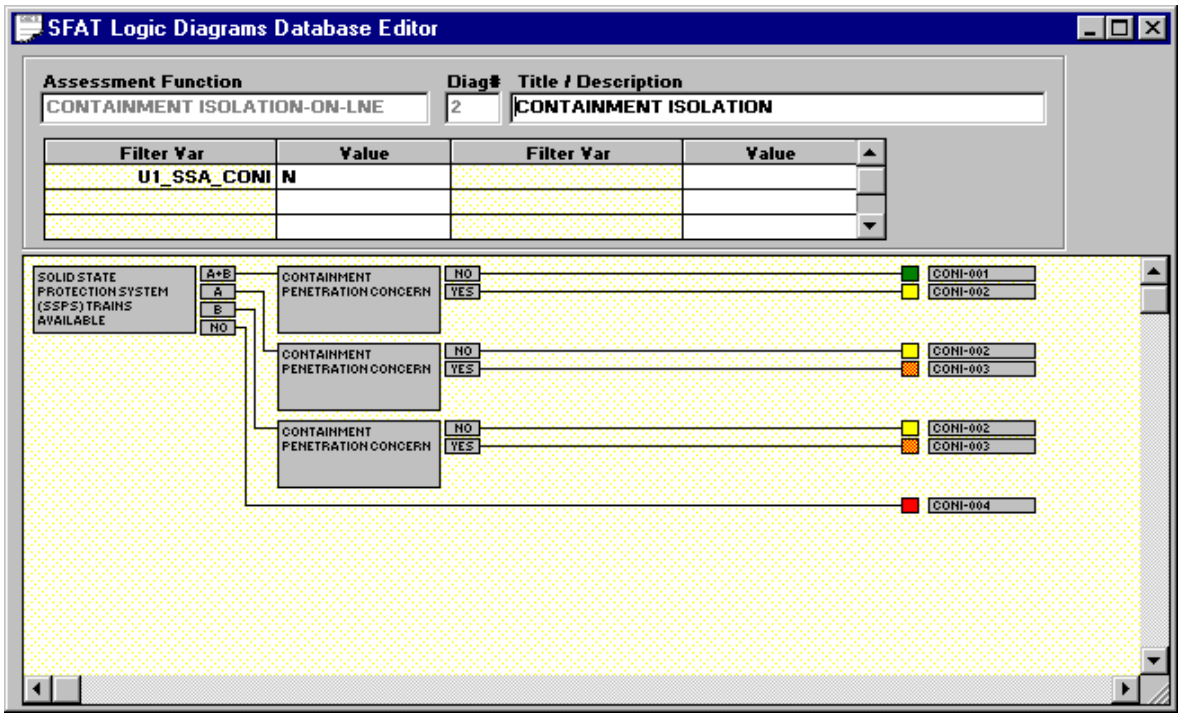


Figure 4-19
SFAT Logic Diagrams Database Editor with SFAT Diagram

Filters

To complete the SFAT header information, select a Safety Function from the drop down list labeled Assessment Function, the Filter Variables defined in the Safety Functions Database

Editor for that function are displayed. The next step is to assign Values to each of the Filter Variables. These filter values will instruct the code to use that specific assessment tree only when the actual plant conditions exactly match the filters. If any value is acceptable, then an asterisk (*) may be used in the Value field associated with the Filter Variable.

The order of the assessment trees within a safety function is important. During the assessment process the program checks the actual plant conditions against the filters in the first tree before checking the filters in the second tree. The program then checks the second tree before the third tree etc. When a match is found, that tree is used and the remaining trees in that function are not checked. This process is repeated for each safety function.

When creating several assessment trees within one safety function, it is important to ensure that all the SFATs for any given safety function encompass all possible situations (combination of filters). If the plant condition does not match any of the assessment tree filters, then a white color will be displayed on the Safety Functions Status View. Refer to the guided tour in Section 3 for an example of this.

The Title and Description field should be completed as preferred by the model builder. The Diag# field will automatically be completed as assessment trees are developed.

Condition Block Editor

After the header information is completed, the diagram portion of the assessment tree can be developed by double clicking in the gray decision box. This displays the Condition Block Editor, Figure 4-20. This editor is used to identify the Assessment Condition, Condition Expression, output options (Optn), end-state color (Clr) and the guidance reference numbers (Guidance Ref#).

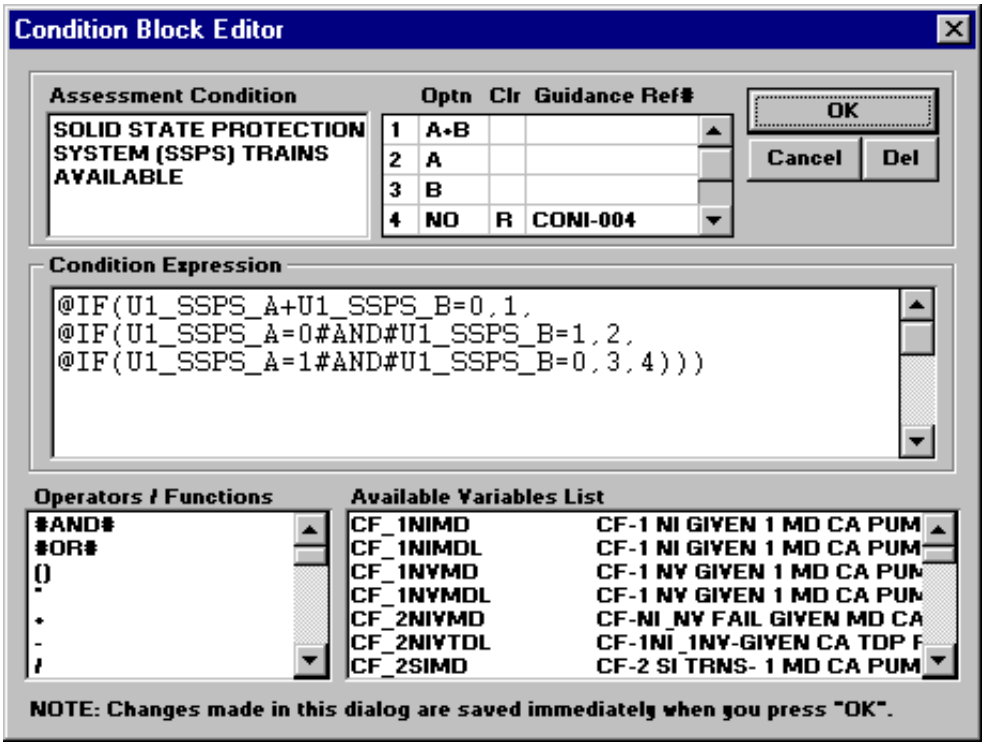


Figure 4-20
Condition Block Editor with Data

The Assessment Condition allows for a free form description (80 characters) of the what the decision box is to do. The Condition Expression allows for a formula used to decide which one of the output options is selected. The Operators and Functions and the Available Variables List may be used in the Condition Expression. The result of the Condition Expression is a number from one to five representing the desired output options one to five (top to bottom). If there is mathematical error or an invalid variable used in the Condition Expression, then an error message will be displayed after clicking on OK.

A variety of variables could be used to populate the candidate expressions. These could include a PCDB Fault Tree, User-Defined, ISAR (PSA Results variables), and even a SFAT result variable. The SFAT result variables are more appropriately used to populate the PTAT or ISAT condition blocks.

Standard “IF-THEN-ELSE Logic” as used in spreadsheets is used in the Condition Expressions. Reference the generic models supplied with the code for examples of information used in the Condition Block Editor.

End-states

The output options (Optn), end-state color (Clr) and the guidance reference group (Guidance Ref#) can be input. A new condition block is developed for each output option unless the end-state color is input. The end-state color is only input for the last condition block. There are maximum of 10 horizontal condition blocks for each assessment tree and each condition block

permits a maximum of five output options. Reference the generic models supplied with the code for examples of completed assessment trees.

Guidance Reference Numbers

The guidance reference groups must first be developed before entry of the guidance reference numbers. Refer to the section on Guidance for details on establishing the link between the assessment tree end-states and the associated guidance. If the guidance reference groups have been created, they can be entered in the Condition Block Editor under Guidance Ref#.

Editing Diagrams

To edit an existing assessment tree logic diagram, click on DATABASE, then SFAT LOGIC DIAGRAMS. The modeler should then pick the desired SFAT for editing by clicking on SELECT RECORD FROM LIST button and choosing the correct SFAT from the Database Record Selection, Figure 4-21. Selection of a diagram will immediately display the header and as much of the diagram as can be seen in the current window. To edit a particular decision block, move the mouse pointer to the condition block, then double click. ORAM-Sentinel will display the Condition Block Editor. Reference the previous information under Condition Block Editor for details on the function of this editor.

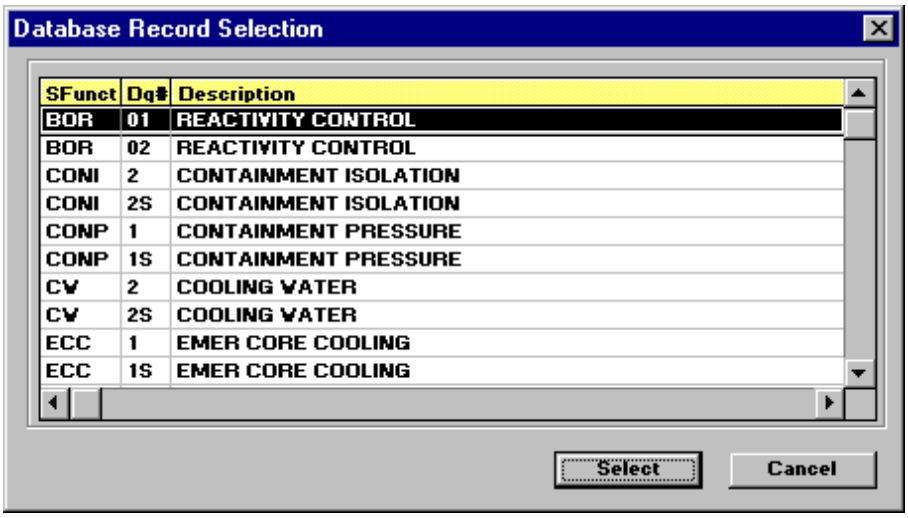


Figure 4-21
Safety Function Diagrams Database Record Selection

Upon completion of editing, click on OK. The Condition Block Editor will clear, and the assessment tree will be redrawn to include the edited information. This drawing capability allows the user to easily create or modify logic diagrams.

Copying Diagrams

To make a copy of an existing SFAT logic diagram, first select the SFAT to be copied. Then click on the COPY THIS RECORD button on the tool bar. ORAM-Sentinel will open the Copy to New Assessment Tree Diagram dialog box, Figure 4-22. This action will display the header information of the selected record, and allow the model builder to enter header information for a new, unique SFAT record. When ready, click on OK. The new SFAT is displayed for the model builder to edit.

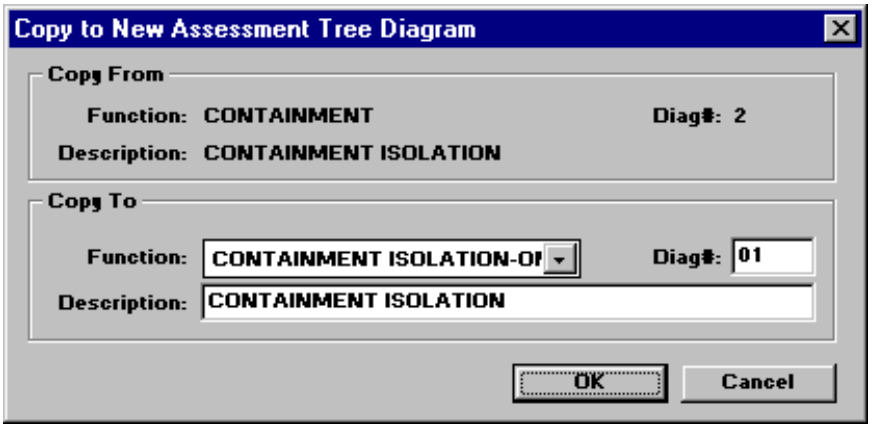


Figure 4-22
Copy to New Assessment Tree Diagram

To delete an SFAT logic diagram, select the desired SFAT and then click on the DELETE THIS RECORD button on the tool bar. The model builder must then respond to the deletion warning message. Select YES to delete the selected record, or NO to cancel the deletion process.

Guidance

The guidelines provide a list of do's and don'ts that a utility places on itself to help manage configuration specific risk. These guidelines can start from NUMARC positions, Regulatory requirements, INPO guidance, station outage policies, operating procedures, Technical Specifications, Independent Safety Evaluations Group (ISEG) outage review procedures and plant personnel expertise. As a utility implements ORAM-Sentinel, the station personnel may update these guidelines based upon insights gained from outage and operating experience. This on-going process thereby incorporates the knowledge gained, creating an even more useful set of guidelines.

The two databases associated with guidance have buttons labeled GUIDELINES TEXT AND BASIS and GUIDANCE REFERENCE GROUPS both of which are accessed from the main menu under DATABASE. GUIDELINES TEXT AND BASIS displays the Guidance Text Database Editor which is used to assign each paragraph of guidance a guidance number (Guidance No.), write paragraphs of guidance and record a Technical Basis for each paragraph. Clicking on GUIDANCE REFERENCE GROUPS displays the Guidance Reference Groups

Editor which allows the model builder to establish guidance reference numbers and assign one or more paragraphs from the guidelines text and basis database.

The Edit buttons on the main tool bar are functional for these two databases. The Guidance Reference Numbers are used in the assessment trees in the Condition Block Editor.

The guidelines text must be established before the text is connected to the guidance number. The guidance number must be established before it can be connected to the assessment tree end-state.

Guidelines Text And Basis

Creating and editing the guidance is performed using the Guidance Text Database Editor, Figure 4-23. There will be one record for each paragraph of guidance. Clicking on the CREATE NEW RECORD button from the tool bar establishes a blank record when the editor is open. The Function Reference on the editor includes a drop-down menu to assign the new guidance paragraph to a specific group of SFAT (or PTATs or ISATs). The Guidance Number, Topic and Description, Guidance and Actions and Technical Basis can then be completed. The Guidance Number must be unique for each paragraph. Each paragraph should be maintained less than 350 characters.

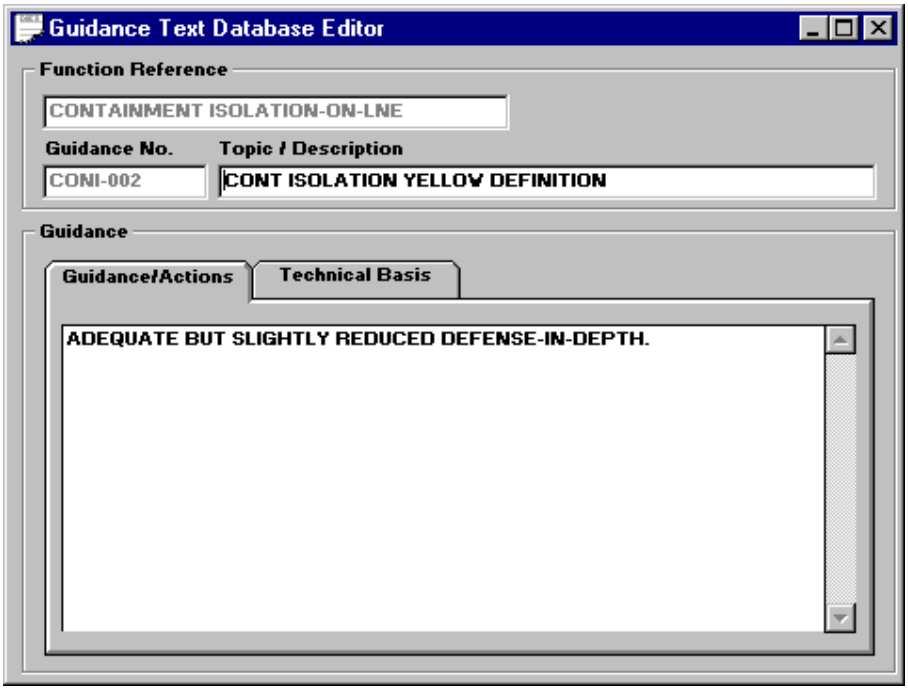


Figure 4-23
Guidance Text Database Editor

Editing and Deleting Guidelines

With the editor open the model builder should select the required record using the SELECT RECORD FROM LIST button. The model builder may move through each field using the

mouse or the TAB key. The model builder will be prompted to save changes when a new record is selected or the editor is closed. To delete a Guidance Text, use the DELETE THIS RECORD button on the main tool bar. ORAM-Sentinel will request confirmation before deletion so the user must either continue by selecting YES or avoid the deletion by selecting NO.

Guidance Reference Groups

The Guidance Reference Groups are used to group together paragraphs of guidance related to a given assessment tree end-state. This cross-reference minimizes the need to input the guidance repeatedly. Each Guidance Reference Group will have one or more paragraphs of guidance.

Building Reference Groups

The model builder must access the Guidance Reference Groups Editor by clicking on DATABASE, then GUIDANCE REFERENCE GROUPS. Figure 4-24 displays a Guidance Reference Groups Editor with the Available Guidance tab information shown. To begin building the reference groups, select the CREATE NEW RECORD button from the tool bar.

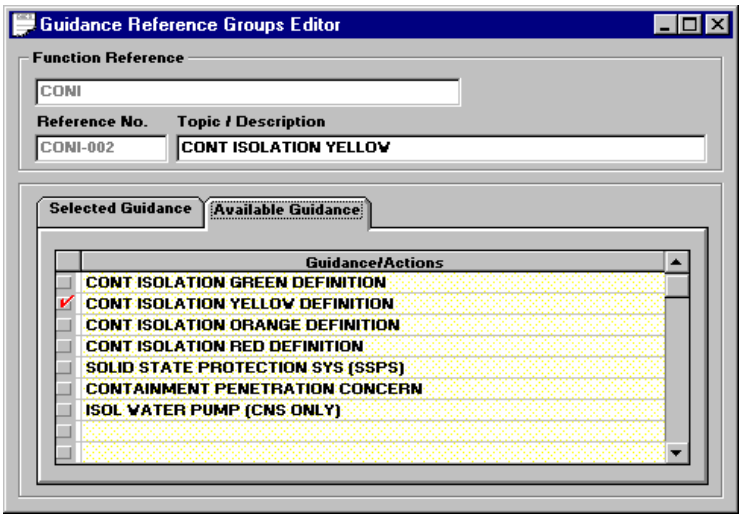


Figure 4-24
Guidance Reference Groups Editor with Available Guidance

Next select the desired assessment function from the pull down pick list in the Function Reference section of the editor. Complete the Reference Number and Topic and Description (38 characters maximum). At this point the Selected Guidance list will be empty. Click on the Available Guidance tab to display all the available guidelines for this assessment function. Only the Guidelines associated with chosen assessment function will be available for selection. Click on the individual guidelines in the list that will be associated with the reference group. When a guideline is selected a red check mark will appear on the left side. Next click on the SELECTED GUIDANCE button to make the association. When the editor is closed or another record is selected, the model builder will be prompted to save the changes.

The required Guidelines Text and Basis are now linked to the appropriate Guidance Reference Groups and the Guidance Reference Groups can now be linked to the appropriate assessment trees. Guidance Reference Group numbers are entered into the individual end-states in the Condition Block Editor of the assessment trees.

Editing and Deleting Reference Numbers

The editing buttons on the tool bar are available for use with the guidance databases. ORAM-Sentinel will ask for confirmation before a delete is performed.

EndStates Editor

The EndStates Editor, Figure 4-25, is used to identify end-states (core damage, large early release, RCS Boil, etc.) titles and descriptions, the applicable mode for the end-state, the base PRA value and IPE value. The EndStates Editor is accessed under DATABASE from the main menu and PLANT AND UNIT DESCRIPTIONS from the drop-down menus. With the Plant and Unit Description Editor displayed, double click on one of the UNITS buttons. (Note: the Unit ID must be completed.) End-states are required to be assigned to utilize the PSA Results database and the PSSA Event Tree Sequences.

NOTE: Prior to adding a new end state in this editor, click in the Title/Description column of the first black row (where the new end state will be added) to initialize the editor.

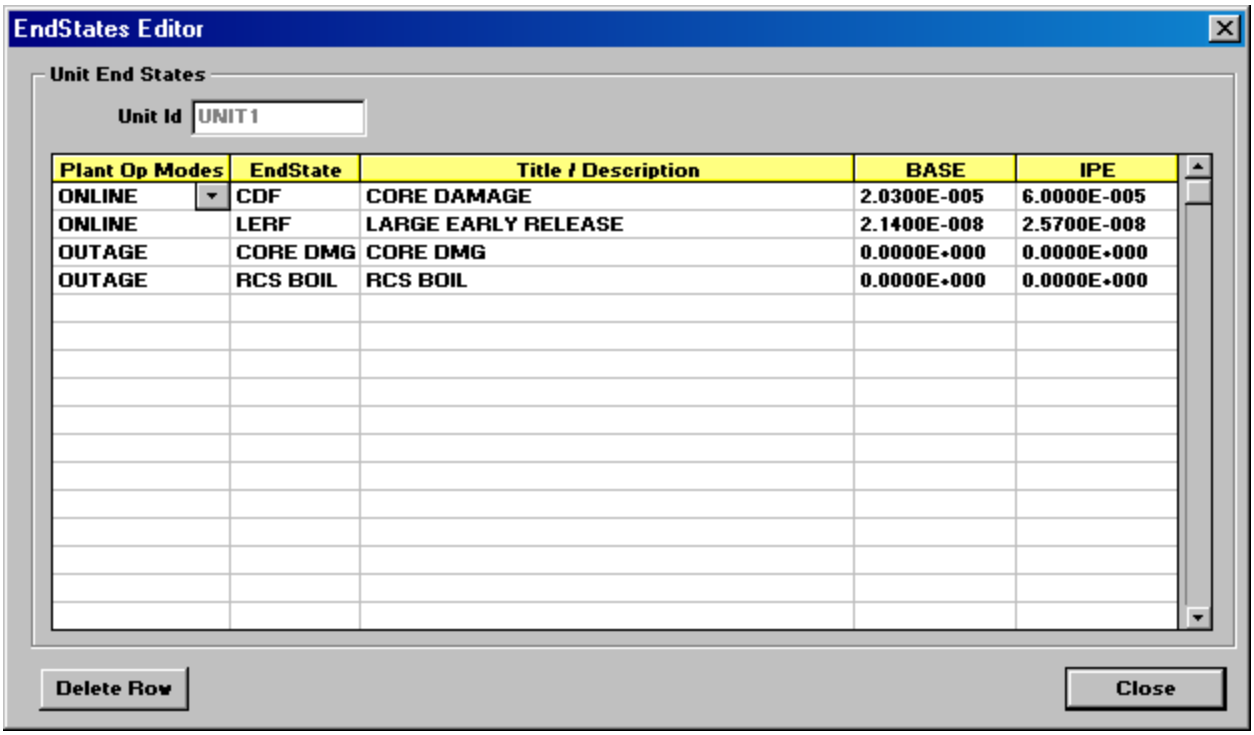


Figure 4-25
End-states Editor

Event Tree Sequences Database

Event trees (ET) are PRA tools that quantify the risk of reaching a specific end-state based on a given initiating scenario. Event trees delineate the accident sequence(s) from the start of the scenario (i.e., initiating event) to the specified end-states. ORAM-Sentinel uses an event tree database to quantify the risk associated with the end-states defined in the End-states Editor during outage conditions. Therefore, the event tree database is considered as the risk engine in the PSSA module of ORAM-Sentinel. The event trees obtain input from fault trees, the PCDB, and user defined variables databases, and the PSA Results Database.

The event tree database is comprised of tabular format event trees, with each containing one or more "event nodes," and one or more critical "failure sequences." The description "tabular" is used because traditional PRA-based event trees are graphically represented by lines and branches. All of the common editing options from the main menu are available for the event tree database. The Event Tree Sequences Database Editor can be accessed by selecting DATABASE and EVENT TREE SEQUENCES. ORAM-Sentinel must be in the outage mode for the model builder to select this editor.

Upon entering the database, an event tree sequence, such as the one in Figure 4-26, is shown.

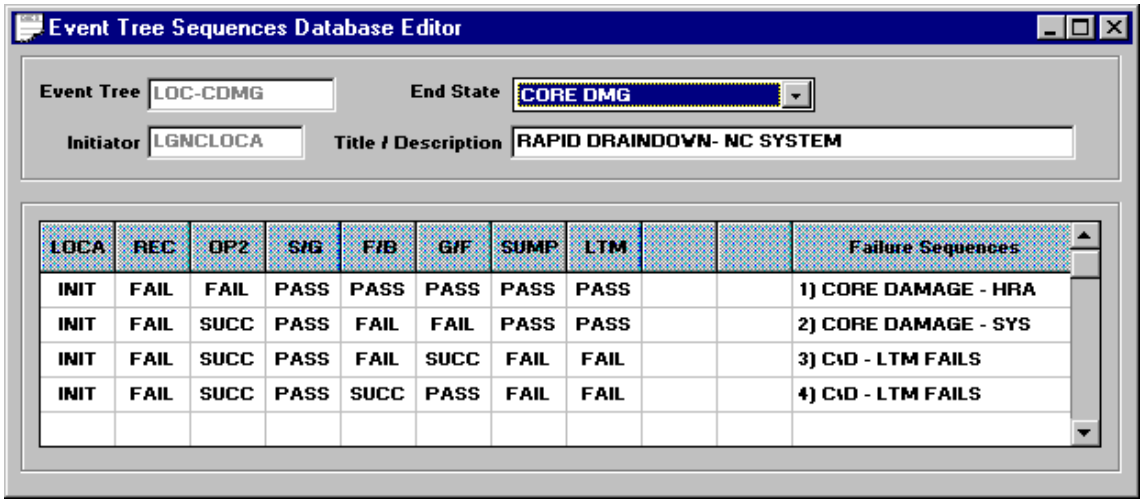


Figure 4-26
Event Tree Sequences Database Editor

At this point the model builder can select the Event Tree type. The options are:

- LOC-CDMG - Core damage from LOCA/drain-down
- RCS-CDMG - Core damage from RCS boiling
- OTH-CDMG - Core damage from "other"
- RCS-BOIL - RCS boiling
- SFP-BOIL - SFP boiling
- OTH-BOIL - Other (user defined)

The Event Tree type is used for sorting purposes only. The user must assign an EndState from one of the outage end-states assigned in the EndStates Editor.

Each event tree represents the sequences for a specific initiating event within an end-state. The typical end-states supported are core damage, RCS boiling, and SFP boiling. The user can model any combination of one or more end-states for the purposes of the PSSA calculations. Each event tree is limited to ten (10) event nodes and five (5) failure sequences. The actual number of sequences can in practice be greater than this. ORAM-Sentinel accomplishes this by using an equation as an initiating event. For example, the initiating event node equation may test for the mid-loop condition and use one initiating event frequency. The same initiating event node equation can also test for a cavity flooded condition and then use a different frequency. Each end-state may have up to fifteen (15) event trees.

Adding Event Trees

To add (create) a new initiating event tree, select the CREATE NEW RECORD button, with the Event Tree Sequences Database Editor open. This will generate an empty record. The model builder must now select the Event Tree type. The pull down Event Tree list provides for the selection. The rest of the event tree header information can now be completed. The model builder must enter a unique Initiator (or name for the event tree), an End-state, and a Title/Description.

NOTE: When entering the Initiator variable name (as with any ORAM-Sentinel field name) do not use the minus sign (-) in the variable name. Reference the section titled Field Naming at the beginning of this section for details.

Upon completion of the event tree header record, the model builder can begin to enter sequence information.

The next step in creating a new event tree is to create the “event nodes” that are used to define the failure sequences. Event nodes are the blue and gray boxes at the top of each column, from left to right on the screen. To access and define a node, point at the node box and click with the mouse. ORAM will display the Event Tree Node dialog box. Figure 4-27 shows an example of a completed Event Tree Node. PSA Results database variables may be used in the event tree node expressions. When the entry is complete, click on OK to deselect the event node. Note: Once the OK button is selected, the Variable field name is saved to the database. Do not edit the Variable field name after the original Variable field name is set.

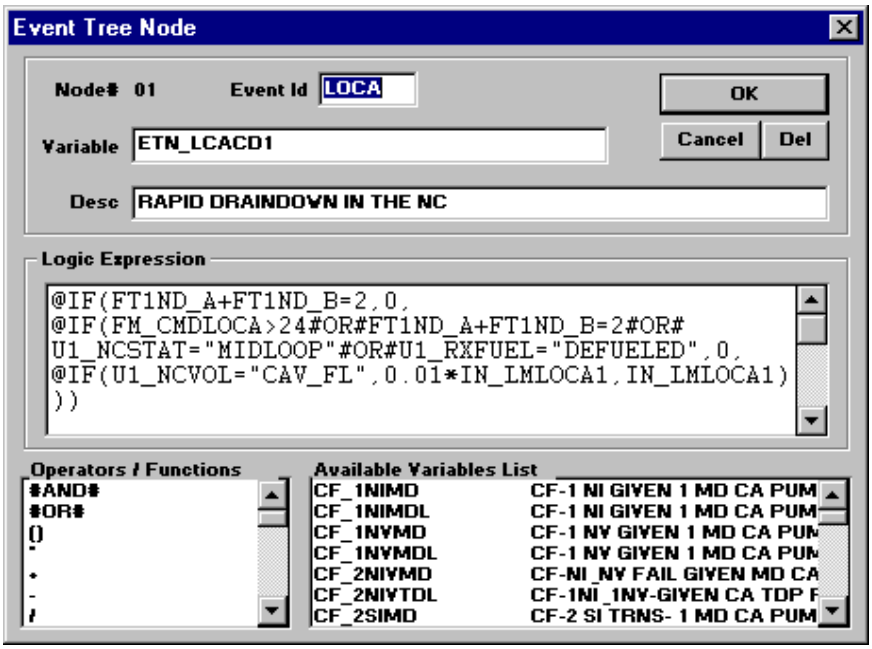


Figure 4-27
Event Tree Node

A typical outage PSSA model might contain two or more end-states, each containing ten to twelve initiating events, each with an average of seven or eight event nodes and two or three failure sequences defined. Once all of the desired event nodes have been defined, the next step is to establish one or more failure sequences, comprised of expression formula involving the values (to be calculated during PSSA evaluations) of the event nodes. To select a failure sequence, move the mouse pointer to the desired failure sequence line, and click. The failure sequence line is the line immediately below the line of event nodes. The code then displays an Event Tree Sequence dialog box. Figure 4-28 shows an example of a completed Event Tree Sequence. The model builder must complete the required failure sequence data. In the sequence path boxes, input “I” for initiator, “F” for failure, “P” for pass, or “S” for success. These inputs do not affect the calculations or results and are for descriptive purposes only.

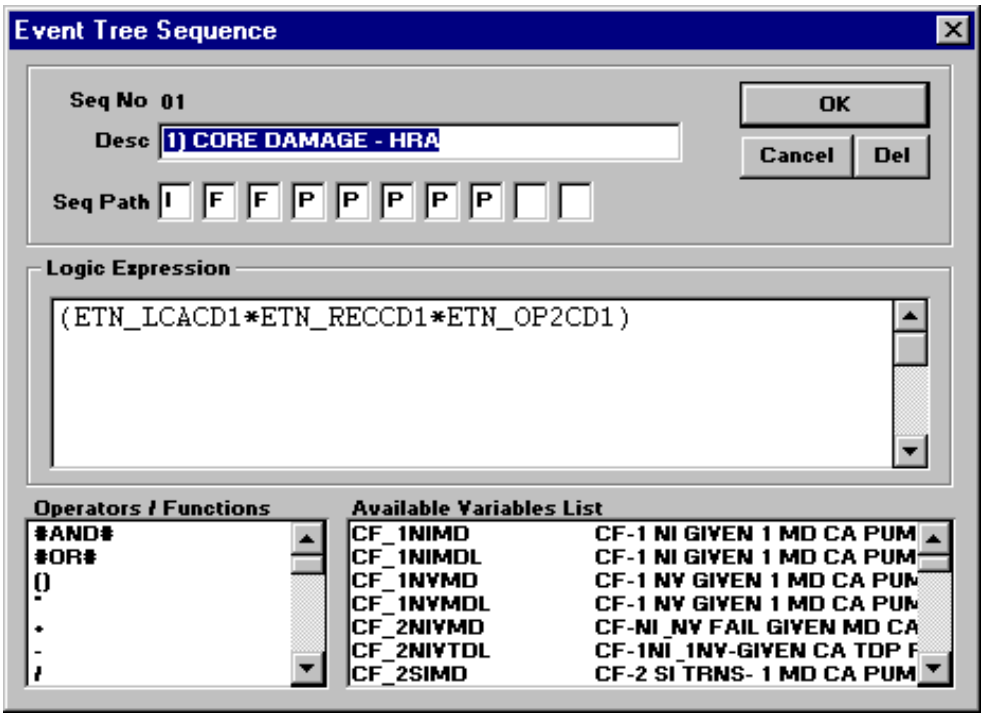


Figure 4-28
Event Tree Sequence

When the entry is complete, click on OK to close the Event Tree Sequence dialog box. To save the event tree and quit the Event Tree Database Editor, close the screen and then answer YES to the user prompt.

Editing Event Trees

The procedures for editing an existing event tree are similar to those already discussed when creating a new event tree record. The only difference is that the model builder will select the event tree to edit using the SELECT FROM RECORD LIST button. The model builder may need to edit the event tree header information. Accessing an event node or failure sequence for editing purposes is identical to the procedures already described. Any of the event nodes or failure sequences may be edited by single clicking on the appropriate section of the Event Tree Sequences Database Editor.

Deleting Event Nodes Or Failure Sequences

To delete an existing event node, select the node for deletion. ORAM-Sentinel will display it in the Event Tree Node dialog box, now click on DEL. The program will ask for confirmation, click on YES to delete the node or NO to retain it.

To delete a failure sequence from an initiating event tree, the model builder must first access the sequence editor by clicking on the desired sequence. ORAM-Sentinel will display the Event

Tree Sequence dialog box, now click on DEL. If the user wishes to delete, confirm deletion by selecting YES otherwise cancel by selecting NO.

Copying Event Trees

The procedure for copying an existing event tree into a new record under a different event tree name is relatively easy and straightforward. Choose the event tree record to be copied and click on the COPY THIS RECORD button. ORAM-Sentinel will display the Copy to New Event Tree dialog box. Figure 4-29 displays an example of this dialog box. The Copy To box requires a unique Event Tree type and Initiator. Upon completion of the new information, click on OK. ORAM-Sentinel will create the new event tree record and return to the Event Tree Sequences Database Editor with this new record selected for editing. Note: At the completion of the event tree copy process, the original and copy event trees will have duplicate event tree node Variable field names for each event tree node. Therefore, the Variable field name in the Event Tree Node editor should be changed to an unique value for each event tree node in either the original or copy event tree. It is important that the Variable field name is changed only once for each event tree node following the copy process.

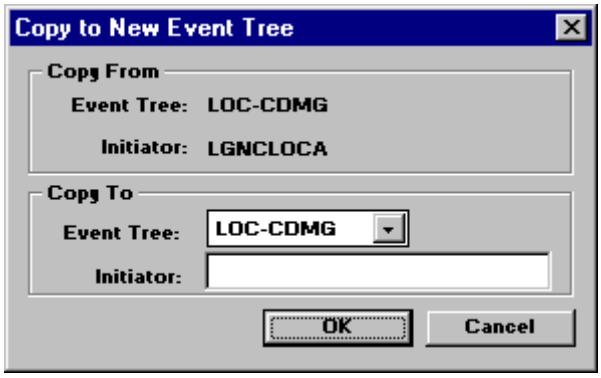


Figure 4-29
Copy to New Event Tree

Fault Trees Database

The fault tree (FT) database maintains the graphics-based logic diagrams used in determining system and train unavailability, support system unavailability, and other configuration related tests. The fault trees provide much of the underlying logic to both the assessment tree evaluations and the PSSA analysis. Fault trees generate output values of one or zero. The primary input to fault trees is status from the PCDB. As a secondary input, fault trees can receive data from user variables and expressions including other fault trees. The fault tree screen is accessed from the main menu by selecting DATABASE then FAULT TREE LOGIC DIAGRAMS.

Fault Tree Logic

Fault Trees contain one or more gates connected with one or more events. Figure 4-30 displays an example fault tree that uses each type of gate and event. These items are described below.

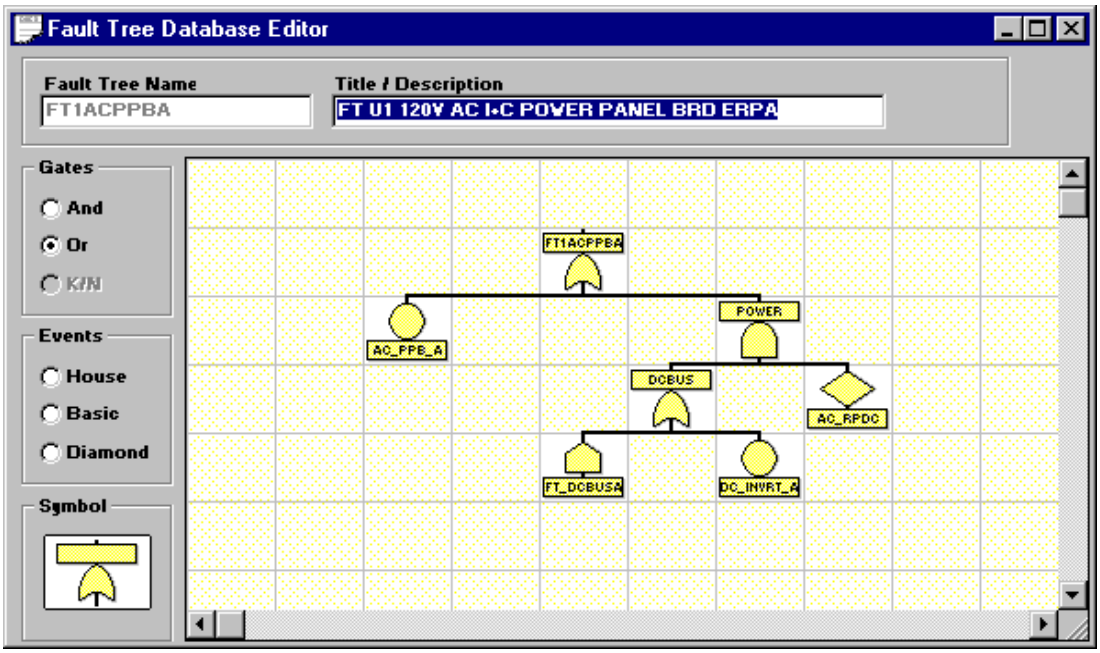


Figure 4-30
Fault Tree Database Editor

Gates

The principle logic symbols and buttons available are AND gates and OR gates. Typically, if the system or train is available, the fault tree will result in a value of zero (0). If the system or train is unavailable, the fault tree will result in a value of one (1). Each gate will return a one or a zero, representing the logical response to the conditions and events that connect into the gate from below.

An OR gate will pass a value of one upward through the gate upon the first occurrence of a one being fed into it from below. If all input lines feeding into the OR gate are zero, the gate will be set to zero. The AND gate, on the other hand, will require that all its input lines have a value of one before it will pass a one upward through the logic. Upon the first occurrence of a zero being fed into an AND gate, the gate will immediately pass a value of zero upward.

Events

The three types of Events and buttons are BASIC, HOUSE and DIAMOND. Events differ from the Gates in the fault tree. Events do not have inputs feeding into them from within the fault tree, but rather exist as the lowest points along a branch. To evaluate an Event, the program first calculates the result of the formula in the Event's Logic Expression or retrieves the value from

the PCDB and then passes the result. Any non-zero result will have a value of one (1). A zero (0) will be passed only if a zero results from the event Logic Expression.

Gates may have AND gates, OR gates or Events feeding into them. Events are terminal, and no logic can be connected below them.

Basic Events typically receive input from the plant configuration database. House Events typically use formula based logic entered by the model builder (e.g. another fault tree, or a custom made formula). Diamond Events typically are used for events other than input from the PCDB and other than formula based logic. This format is suggested but not required. Diamond, Basic and House Events perform mathematical functions in the same manner. The only difference is their appearance on the screen. These appearance differences supply the model builder with visual cues relating to the type of information contained within the Event. The Symbol box in the Fault Tree Database Editor displays the symbol for each Event and Gate as the associated button is selected.

Adding Fault Trees

To build a new fault tree, the model builder must select the CREATE NEW RECORD button from the main tool bar with the Fault Tree Database Editor open. The model builder should then enter the Fault Tree Name (up to 10 characters) and Title and Description (up to 39 characters). The Fault Tree Name must be unique.

The model builder should then enter the top gate. Typically the top event is an OR GATE, however it may be an AND gate if that logic is required. To enter the top gate the model builder first clicks on the radio button corresponding to the gate type required. Next double click on a grid location in the editor (usually top, center). Next, the model builder should enter the top event gate information. This is accomplished by double clicking on the top event that was just created. To close this editor click on the OK button.

Editing Fault Trees

The model builder can add Gates or Events into a fault tree. When viewing the desired fault tree, select a type of Gate or Event to be added from the list on the left side of the editor. Then point the mouse to the desired grid location on the work area and double click. This process will draw the new symbol onto the grid. This new Gate or Event is not currently connected to any Gate. The model builder should then double click on the Gate to which the new addition should be connected. At this time, ORAM-Sentinel will connect the addition to the selected gate and display the Fault Tree Gate Editor for the new addition. When the new gate information is completed, the model builder should click on OK.

The Fault Tree Gate Editor is different for Events, Figure 4-31, and Gates, Figure 4-32. The editor includes a Logic Expression box for Events but does not include one for Gates. This provides for entering formula-based logic for Events, representing the decision making process of that event. Gates do not require and do not accept logic expressions.

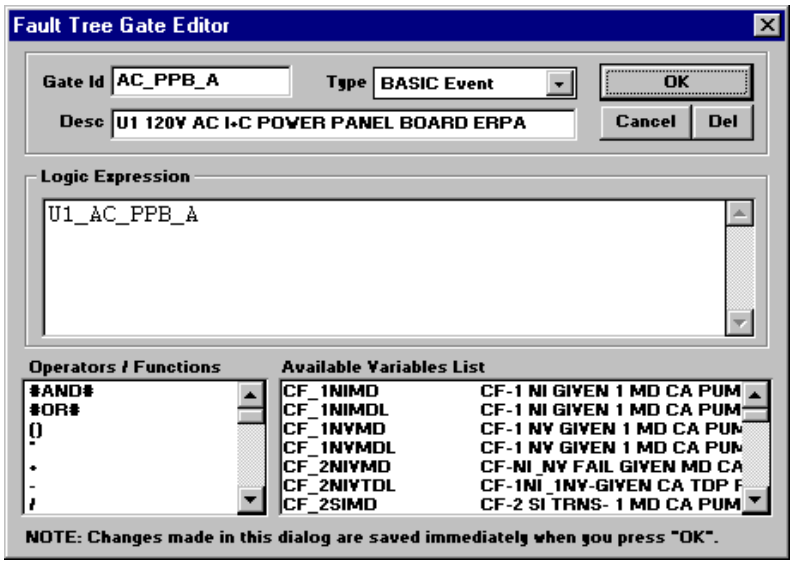


Figure 4-31
Fault Tree Gate Editor for Events

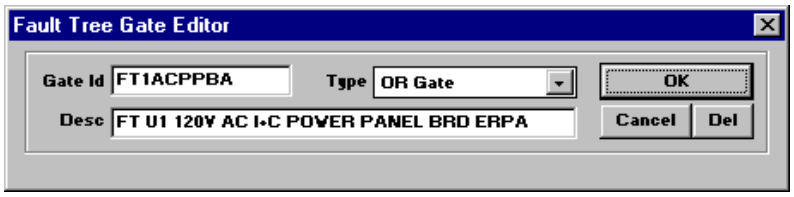


Figure 4-32
Fault Tree Gate Editor for Gates

To edit any particular symbol (gate or event), move the mouse pointer to the target symbol in the grid and double click. ORAM-Sentinel displays the target symbol for editing. From there, editing the symbol is identical to the steps taken during creation. The model builder may edit the GATE ID and DESC fields. If the symbol type is an event, the Logic Expression may also be edited. Note: Do NOT modify the gate/event type once a gate/event has been created. If you desire to change the gate/event type (e.g., OR gate to an AND gate), you must delete the gate/event and then create the desired gate/event type.

To delete a symbol from the fault tree drawing, double click on the target symbol to be deleted. Then left click on the DEL button on the Fault Tree Gate Editor. This will prompt the user for confirmation before deleting the target symbol.

Deleting Fault Trees

To delete an entire fault tree, the model builder first selects the fault tree and can then use the DELETE THIS RECORD button on the tool bar. Once selected, the deletion confirmation prompt will be displayed. Select YES to delete the fault tree, or NO to avoid the deletion.

Copying Fault Trees

To make a copy of an existing fault tree, the model builder first selects the fault tree. Next, click on the COPY THIS RECORD button on the main tool bar. Once selected, ORAM-Sentinel displays the Copy to New Fault Tree dialog box as the example shows in Figure 4-33. The model builder should now enter the new Fault Tree Name and Title/Description, being certain that the Fault Tree Name has not already been used.

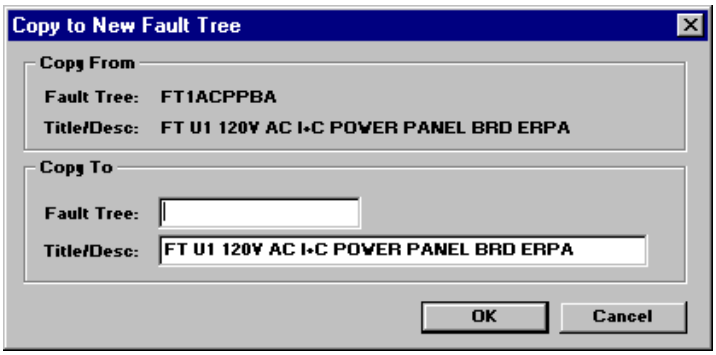


Figure 4-33
Copy to New Fault Tree

Once performed, the copy function generates an identical fault tree (excluding the Fault Tree Name) including all symbols, logic, and formulas. The model builder may continue with any desired changes, as necessary.

User Variables and Expressions Database

The user variables and expressions database contains formulas that manipulate data to provide answers for required questions. Input to the user variables and expressions may include numerical values PCDB variables or other user variables and expressions. The user defined variables can be used in event trees, fault trees, assessment trees, and other user variables and expressions. User variables and expressions are often necessary to provide the time to boiling equations, decay heat formulas, event tree node failure probabilities and initiating event frequencies. They are also helpful in eliminating unnecessary editing when a formula is repeated in many fault trees, event tree nodes, or assessment tree decision blocks.

Adding Variables and Expressions

To add a new user variable and expression, the model builder must first open the Variables/Expressions Database Editor by clicking on DATABASE from the main menu, then USER Variables/Expressions. Figure 4-34 shows this editor with data completed. Next select the CREATE NEW RECORD option from the tool bar. This step will clear the variables editor and create an empty record. The model builder should now enter the required fields including the Variable Name, Description, Return Value (either numeric or alphanumeric), and the specific Expression and Value. The Return Value of NUMERIC or ALPHA STRING must be selected based upon the type of result from the user variable and expression.

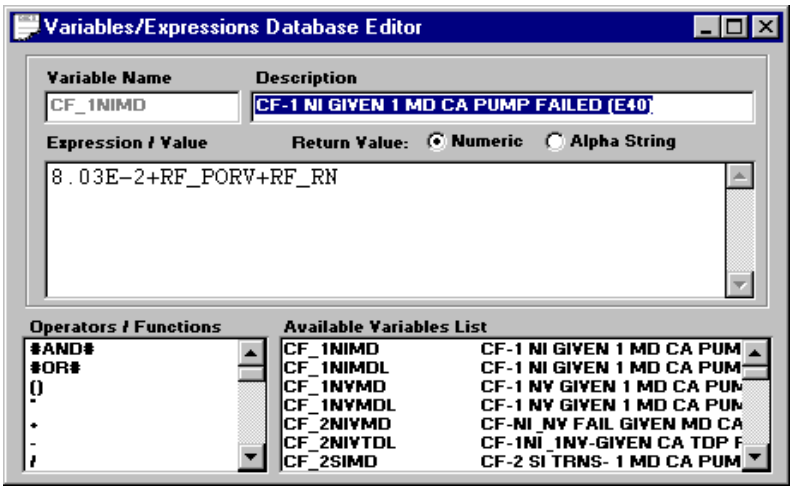


Figure 4-34
Variables/Expressions Database Editor

Expression formulas follow a standard spreadsheet format and syntax. The formula entries are typically based upon @IF statements, which work just as they do in spreadsheets. The model builder is able to use the Operators and Functions drop down menu within the editor.

Editing Variables

Editing, copying, and deleting user variables and expressions is performed using the edit buttons on the tool bar. The model builder must have the User Variables/Expressions Editor open when using these buttons.

System and Internal Variables

There are some pre-established variables that are "hard-wired" in the ORAM-Sentinel code. These variables are used throughout the code but do not appear in the Variables/Expression Database Editor. This section describes which variables are hard-wired and their purpose.

The variable PLANT_OPMODE identifies the plant operating mode. A result of 1 tells the code to use the outage assessment process. A value of 0 tells the code to use the on-line assessment process. The inputs to this variable are the mode variable created by the model builder in the PCDB. The model builder is responsible for creating this variable in the Variables/Expression Database Editor.

The variable SD_DAYS identifies the number of days since reactor shutdown. This result can be used by the model builder to determine decay heat levels. The user would need to create user defined variables for decay heat based upon time after shutdown.

The variables ISAR_???? (where ???? is the end-state code defined in the end-state editor and the Time Tracking option in Application Preferences) track the quantified output of the PSA Results module. The end-states normally used for on-line are CDF and LERF or ISAR_CDF and

ISAR_LERF variables. These outputs are then used to develop the PSA profiles. The outputs can also be used to display a color in Safety Function Status View or the Plant Transient Status View (Note: The model builder can use the sample models provided and trace the PSA Results safety function from the Safety Function Status View. This will provide insight into how the ISAR_???? variable can be used.)

The variables ET#### (where # is a number) tracks the quantified output of the outage PSA module. #### is the sequential order of the event trees. For example, ET0001 would return the result of the first event tree (sum of all sequences).

The variables SFAT_????, PTAT_???? and ISAT_???? (where ???? are the names identified in the Safety Functions Database Editor, the Plant Assessments Database Editor and the Integrated Safety Assessment Database Editor) track the output of the assessment trees. These outputs can then be used by the code to populate the variable OVERALL_STATUS. The OVERALL_STATUS variable is used in various displays. (Note: The model builder can use the sample models provided and lookup the OVERALL_STATUS variable in the Variables/Expressions Database Editor to provide insights into how this variable is made.)

The variables SFATWF_???? and PTATWF_???? are the Weighting Factors assigned to each safety function and plant transient category, respectively. ???? is the function code assigned to each SFAT or PTAT. The Weighting Factors are entered in the Safety Functions Database Editor and Plant Assessments Database Editor if the option to implement Weighting Factors is chosen in Preferences. These variables are intended to be used in the ORAM-Sentinel variables SFAT_SCORE and PTAT_SCORE, but can be used in any ORAM-Sentinel expression.

SFAT_SCORE, PTAT_SCORE and PSA_SCORE are internally generated by ORAM-Sentinel. Although the variable is internally generated, it can be edited in the Variables/Expressions Database Editor. The default value for these variables is 0 (zero). The results of the variable expressions are displayed in the Overall Plant Status View for SFATs and PTATs and the Configuration Guidance View for PSA (Schedule Planning Mode) and the SFAT, PTAT and PSA blocks in the Operations Plant Status View (Work Release Mode). If the result of the variable expression is 0 (zero), no value will appear in these blocks.

SFAT_STATUS, PTAT_STATUS and PSA_STATUS are internally generated by ORAM-Sentinel when function Weighting Factors are implemented in Preferences. Although the variable is internally generated, it can be edited in the Variables/Expressions Database Editor. The default value for these variables is 0 (zero). The results of the variable expressions are displayed as a color in the Overall Plant Status View for SFATs and PTATs, and the Configuration Guidance View for PSA (Schedule Planning Mode), and the SFAT, PTAT and PSA blocks in the Operations Plant Status View (Work Release Mode). Therefore, the expression must return a numeric value of 0 through 4 (corresponding to White, Green, Yellow, Orange and Red).

The variable TIME_CONFIG is generated by ORAM-Sentinel when the Time Tracking option in Application Preferences is selected. TIME_CONFIG is used to calculate and store the time (in hours) for each unique front-line configuration. A front-line configuration is defined by the status of the PCDB variables which are marked as front-line. Each time the status of a front-line variable changes, the front-line configuration changes, so a front-line configuration can span

many normal ORAM-Sentinel configurations. For the first and last configurations within the results date frame, TIME_CONFIG is only calculated from the beginning of the date frame and to the end of the date frame, respectively. TIME_CONFIG can be used in any expression within an ORAM-Sentinel model and is compared to and displayed with the ISAR AOT variable in the Operations Plant Status View.

There are 12 internal variables which are used for display in the Work Release Mode only. The variables can be initialized in the View Options Preferences tab and edited in the User Variable Editor. The variables are of the form WROLVAR_STATx, WROLVAR_VALUEx, WROTGVAR_STATx and WROTGVAR_VALUEx. These variables are discussed in detail in Section 6.

PSA Results

The PSA Results Database can be accessed from DATABASE on the main menu, clicking on PSA RESULTS and displaying the PSA Results Database Editor as shown in Figure 4-35. This database permits storage of information from the station Probabilistic Safety Assessment (PSA).

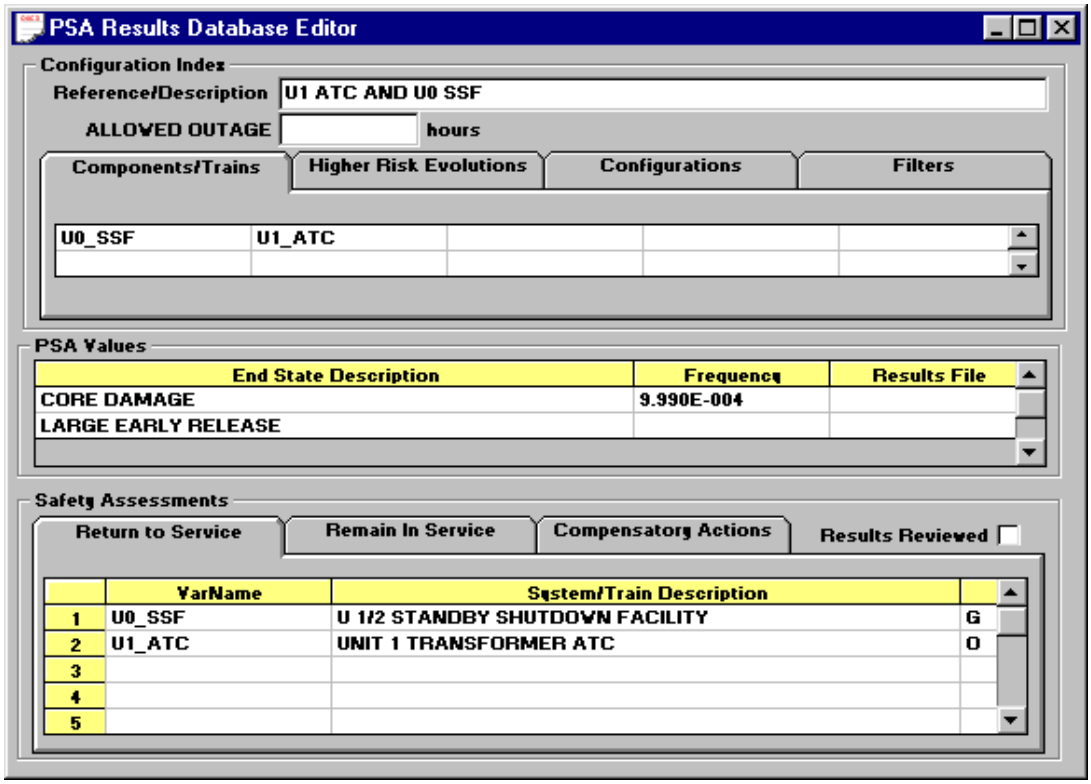


Figure 4-35
PSA Results Database Editor

The predetermined results from the PSA can be stored for combinations of Components and Trains, Higher Risk Evolutions, Configurations and Filters. The user must verify the Filter values are valid, since the code will not check for inconsistencies. These predetermined results can be accessed by ORAM-Sentinel when that PCDB variable or combination of PCDB

variables is encountered. The information stored for each configuration includes the Frequency, Results File, Return-to-Service, Remain-in-Service and Compensatory Actions. The edit buttons on the main tool bar are functional for this database. The Compensatory Actions is capable of holding descriptions up to 255 characters. To view the entire 255 characters, it is necessary to click on reference number on the left side of each compensatory action in the Integrated Safety Assessments Database Editor.

If Time Tracking is enabled in Preferences, an edit window is available in the PSA Results Database Editor to enter the ISAR_AOT variable data for each configuration. The units for this variable is hours. The ISAR_AOT variable can be used in any expression within an ORAM-Sentinel model and is compared to and displayed with TIME_CONFIG in the Operations Plant Status View.

Associated with this database there is likely to be a user variable to equate the frequency identified in the editor to a color for display on the status view. The results of the lookup will be displayed in the Work Release mode and can be made to show on the results of the assessment tree analysis. (Note: The model builder can use the sample models provided to gain insights into how PSA results can be displayed in the assessment views.)

PSA Filters Database

The PSA Filter Definitions Editor, Figure 4-36, can be accessed from DATABASE on the main menu and by selecting PSA FILTERS from the drop-down menu. This database allows the user to choose variables that can be used in the PSA Results Database Editor, under Filters. The filters provide an additional level of detail for defining a configuration in the PSA Results Database

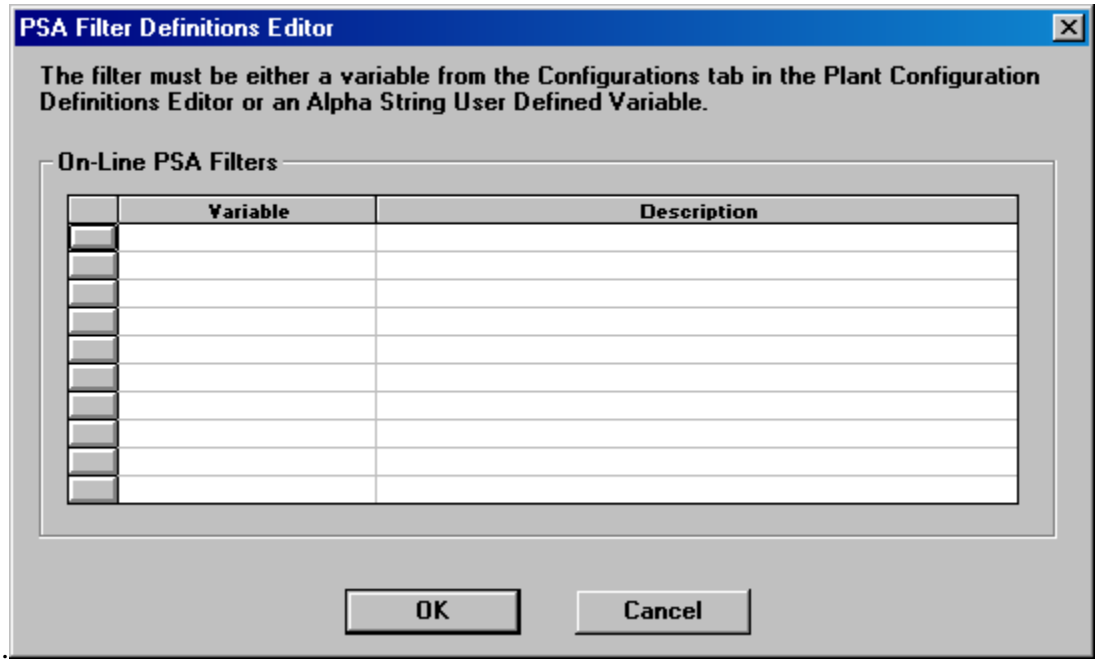


Figure 4-36
PSA Filter Definitions Editor

To create a new entry, select the next empty row and type the variable name under the Variable field. Once the cursor is moved out of the cell, the description of the variable will appear. The variables can only be from the Configurations tab in the PCDB, or an alpha-string variable from the User-Defined Variable database. To delete an entry, click the button on the left of the variable and hit the <Delete> key. Ten User Variable Filters are permitted for each of the modes, online and outage.

Safety Assessment Worksheet

The safety assessment worksheet (SAW) allows the model builder to display information associated with a plant configuration. This related information is based upon specific formulas of the model builder's choice. Suppose for example that the model builder is interested in displaying the plant operating mode and whether or not a higher risk evolution exists. Formulas for these two conditions can be developed and entered into the SAW database. The results for these two formulas will be calculated for each plant configuration. The results (operating mode and HRE status) can then be viewed as necessary.

The results can be viewed from two locations, the Operations Plant Status View using the WORKSHEET button or if in the schedule planning mode by selecting TOOLS on the main menu and SAFETY ASSESSMENT WORKSHEET on the drop-down menu.

If in the Operations Plant Status View, the SAW results shown in Figure 4-37 can be viewed by clicking on the WORKSHEET button at the bottom right corner of the screen. When viewing from this location, no changes can be made to the formulas. To make changes to the formulas,

access must be through TOOLS on the main menu and SAFETY ASSESSMENT WORKSHEET on the drop-down menu (in the schedule planning mode).

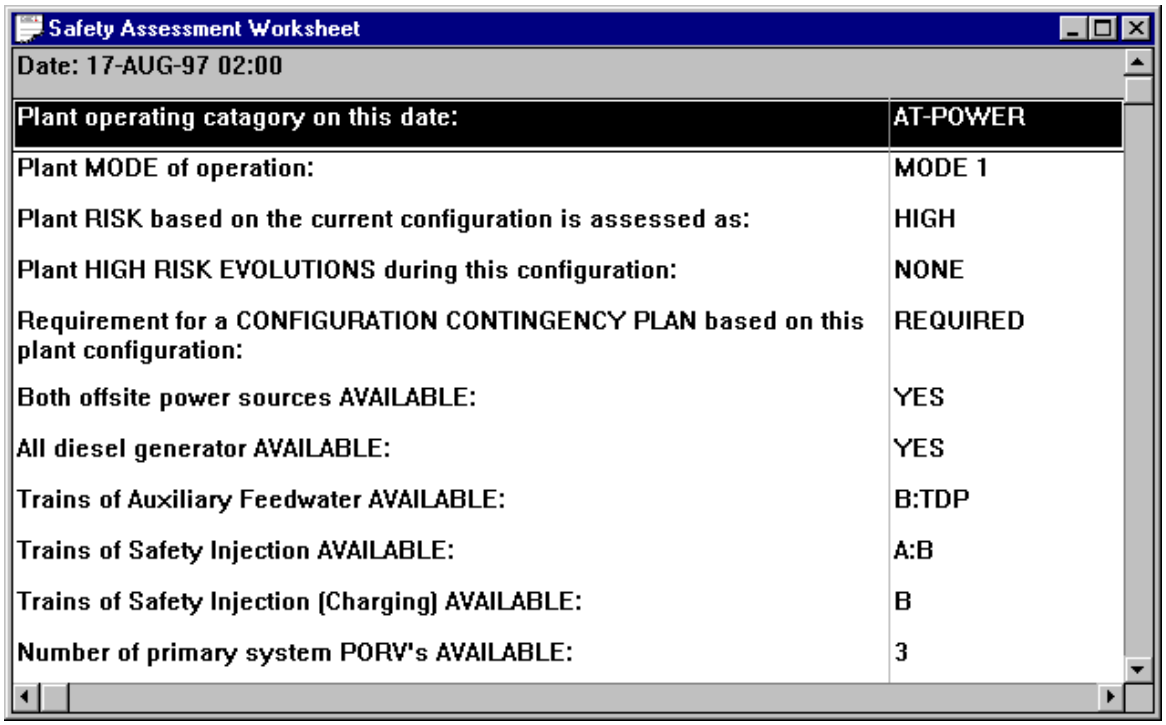


Figure 4-37
Safety Assessment Worksheet

When in the SAW database new items may be added using the CREATE NEW RECORD button on the tool bar. The Worksheet Text and Expression Editor, as shown in Figure 4-38, will be displayed. The Safety Assessment Description, Expression (two parts), and the Return Value must be entered. The description will be displayed in the SAW table. The expression has two parts including the sequential expression number which can be changed by the user and the expression itself. The Return Value of numeric or alpha string must be selected based upon the expected results. The Result Mask (optional) is used for formatting the numerical output.

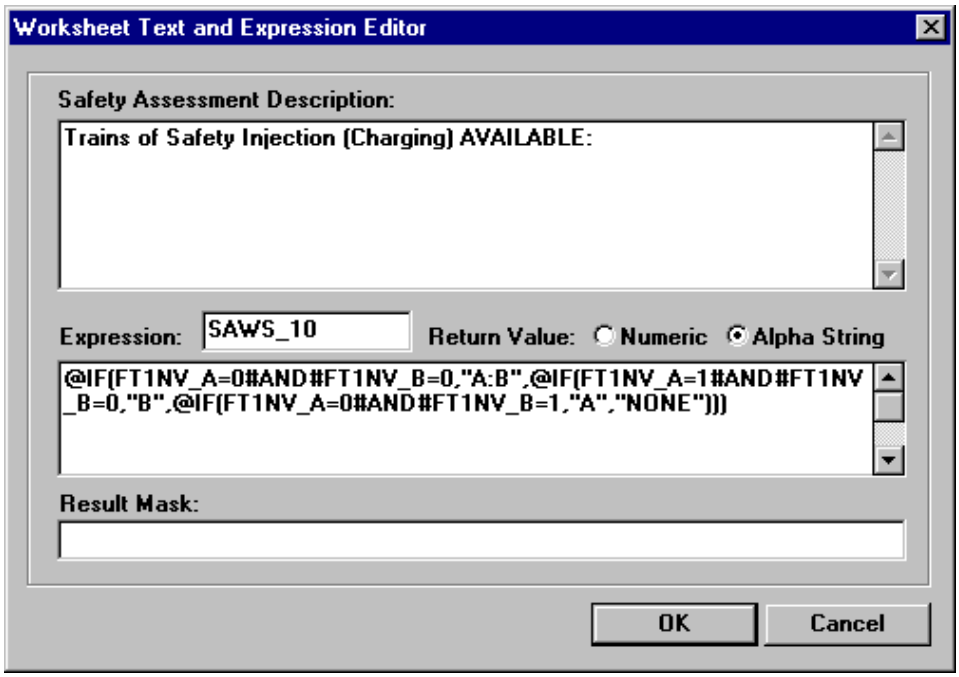


Figure 4-38
Worksheet Text and Expression Editor

For additional examples on using this feature, load the guided tour model and review the SAW database.

5
RESULTS EVALUATION AND DISPLAY

Overview

This section presents topics on the inputs to, procedural usage of and outputs from ORAM-Sentinel. Previous sections of the manual have explained general usage, conceptual approach and model building. This section details how to perform safety assessments, view and trace the results.

ORAM to ORAM-Sentinel Conversion

The ORAM to ORAM-Sentinel Conversion (OConvert) program is no longer provided with ORAM-Sentinel. If it is necessary to convert an ORAM model to ORAM-Sentinel, the version 3.3 release must be obtained from EPRI.

Date Frame Selection

The date frame selection is the time period over which safety assessments will be calculated and the results displayed. The DATE FRAME SELECTION button is located under RESULTS on the main menu. Figure 5-1displays the Date Frame Selection dialog box. Date Frame Selection fields can also be accessed on the ORAM-Sentinel Application Mode dialog. The dates in the Date Frame Selection dialog box can be changed by the user as needed. The times in the Date Frame Selection dialog box can not be changed by the user. This period can be shorter than, equal to, or greater than the Date-Frame To Import used during the import process in the Maintenance Schedule Importing dialog box. The dates entered in the Date Frame Selection dialog box are displayed in the status bar at the bottom of the screen. Reference the subsequent topic of Calculation Time for information about the impact of the Date Frame Selection.

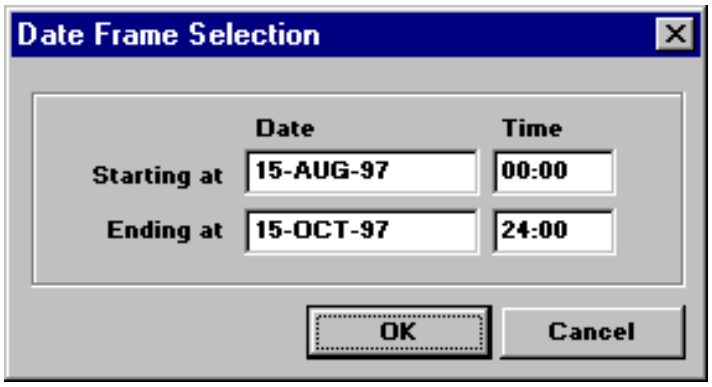


Figure 5-1
Date Frame Selection

Recalculating

Recalculating should be performed after the appropriate databases have been created and after the schedule data is imported into the model. Reference Section 4 for instructions on building databases. Selecting the RECALCS button from the viewbar displays the Recalculations dialog box, Figure 5-2. The Recalculations dialog box can also be displayed using RESULTS from the main menu and RECALCULATE MODEL from the drop-down menu.

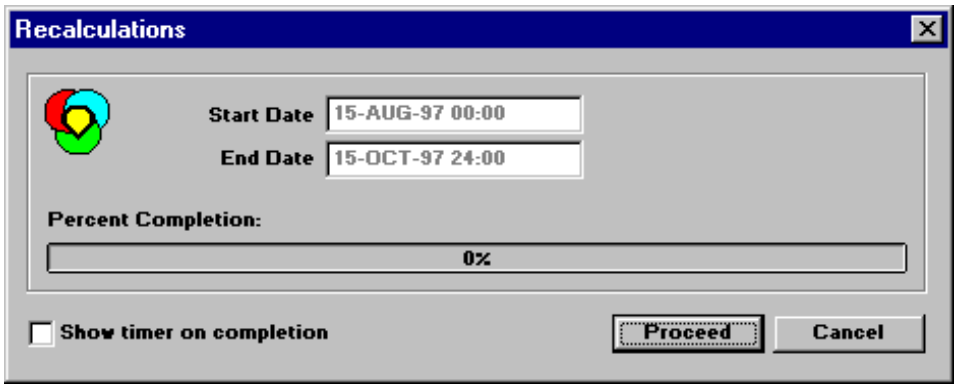


Figure 5-2
On-Line Recalculations

The dates shown in the Recalculations dialog box are copied from the Date Frame Selection dialog box. If different dates are required for recalculations, the change must be made in the Date Frame Selection dialog box.

The Show Timer On Completion box can be selected in the Recalculations dialog box to display the ending calculation time. The PROCEED button starts the calculation. The CANCEL button is active to close the dialog box only before the calculation is started. The CANCEL button will not stop the calculation after it has started.

When a recalculation is performed, all completed modules (safety function assessment, plant transient assessment, PSA, PSSA, performance criteria) within ORAM-Sentinel are calculated for the schedule data in the Dataset being evaluated. It is not necessary to calculate ORAM-Sentinel data separately for each module. Note: When in outage mode, an option exists where the PSSA evaluation may be omitted from the recalculation. Additional information pertaining to recalculation steps for assessment trees and PSSA is presented later in this section.

On the status bar at the bottom of the screen, is a box that displays the indicator CALC. If CALC is displayed, ORAM-Sentinel is indicating that the evaluation needs to be run. It is displayed after any changes occur to the supporting databases (schedule, fault trees, assessment trees etc.). The CALC indicator is also displayed each time that the Date Frame Selection is changed. If the indicator is not displayed, then the currently stored results are consistent with the current databases. The CALC indicator will only be extinguished for the condition that was last calculated - the last mode, unit, and dataset. If the user then moves to a different mode, different dataset, or different unit, the CALC indicator will be displayed. Therefore, the user must recalculate any time the user wants to evaluate a different mode (online or outage), dataset, or unit. The CALC indicator will display each time a model (*.um7/*.um8) is opened, even if the model was recalculated before being saved.

Error Messaging

Table 5-1, ORAM-Sentinel Btrieve Error Messages, identifies the errors that may occur when interfacing with Btrieve files. The error message will reference Btrieve and the error number. Other error messages, not related to Btrieve, provide descriptive information regarding the nature of the error and are therefore not included in this table. Users who are experiencing errors which they can not resolve or explain should contact technical support at the numbers or address listed at the beginning of Section 2.

Table 5-1
ORAM-Sentinel Btrieve Error Messages

No.	Description	Error
2	The application encountered an I/O error.	Btrieve encountered an error while reading from or writing to the disk. One of the following has occurred: • The file is damaged and must be recreated • There is a large pre-image file inside a transaction, and there is not enough space for a write to the pre-image file.
3	The file is not open.	The operation cannot be executed because the file is not open. The application must perform a successful open operation before Btrieve can process any other operations.
4	The application cannot find the key value.	Btrieve cannot find the specified key value index path.

No.	Description	Error
8	The current positioning is invalid.	The current position must be established to update or delete a record. Perform a Get or Step operation to establish the current position.
9	The operation encountered an end-of-file mark.	The operation encountered an end-of-file boundary or tried to read past a file boundary (end-of-file or start-of-file)
10	The key field is not modifiable.	During an update operation, an attempt was made to modify a key field that is defined as non-modifiable.
11	The specified filename is Invalid.	This status code indicates that the filename specified does not conform to file naming conventions. Make sure the filename is valid for the environment. Status Code 11 can also have the following meanings in server-based versions of Btrieve: • An attempt was made to open a file that has.^^^ as its extension. This extension is reserved for Btrieve to use during a continuous operation. (continuous operations are used only in the server based Btrieve environment) • The data buffer for a Begin or End continuous operation is not set up correctly.
12	Btrieve cannot find the specified file.	The file was not found for Btrieve open operation.
14	Btrieve cannot create or open the pre-image file.	There are two possible causes for this status code: • Btrieve cannot create a new pre-image file because the disk directory is full. Btrieve must be able to create a pre-image file. • Btrieve cannot open the pre-image file to restore file integrity. If the pre-image file is erased or damaged, Btrieve cannot restore the files integrity
16	The application encountered an expansion error.	Pre-v6.0 versions of Btrieve return this status code when they encounter an error while writing the directory structure to disk prior to creating the expanded file partition.

No.	Description	Error
18	The disk is full.	Either of the two following conditions exists: • The disk is full, and the file cannot be expanded to accommodate additional records. Erase any unnecessary files. If using a version Btrieve prior to v6.0, you can possibly extend the file to gain additional disk space. • There is not enough space to append a new page to the data file.
20	The Record manager or Requester is inactive.	Btrieve, or if applicable, the Btrieve Requester is not loaded.
21	The key buffer parameter is too short.	The key buffer parameter is not long enough to accommodate the key field for the index path requested.
22	The data buffer parameter is too short.	The data buffer parameter is not large enough to accommodate the length of the data record defined when the file was created.
46	Access to the requested file is denied.	Either of the two following conditions exists: • The application opened a file in read-only mode and tried to perform an Insert, Update, or Delete on that file. • An attempt was made to perform an Insert, Update, or Delete on a file that is flagged read-only to NetWare or DOS.
51	The owner name is invalid.	If this status code occurred during an Open operation, the application attempted to open a file that has an owner name assigned to it.

No.	Description	Error
94	The application encountered a permission error.	Any of the following conditions exists: • The application tried to open or create a file in a directory without the proper privileges. Btrieve does not override the network privileges assigned to users. • The designated server is in the server routing table, but your particular workstation is not logged into that server. • Server-based BREQUEST and client based Btrieve (versions earlier that Btrieve for Windows v6.15) are trying to access that same file at the same time. • The application tried to access a Btrieve file using NetWare Runtime support using the given user name. Specifically, one of the following situations exists regarding the supplied user-name: - The user is not a valid user on the runtime server. - The user does not have the appropriate rights to access the file.
101	Insufficient operating system memory is available.	This status code, returned by server-based Btrieve v6.0 and later indicates that there is not enough operating system memory available to perform the requested operation.

Command Line Arguments

ORAM-Sentinel includes the ability to input instructions for automatically performing multiple steps during program startup. These command line arguments are input on the command line during the launch of the program. This feature allows the user to automatically open screens, select a mode, perform recalculations, open views, etc. with a single instruction set. Table 5-2, Command Line Arguments, provides a list of switches recognized by the code. This capability will allow ORAM-Sentinel to be started and run from another application such as EPRI's EOOS software.

Table 5-2
Command Line Arguments

Format
c:\oramsent\oramsent.exe *arguments*
Arguments
/D:mm/dd/yyyy,hh:mm,mm/dd/yyyy,hh:mm This is used to establish the date frame.
/F:mm/dd/yyyy,hh:mm This is used to establish the application focus date. This should be included for displaying specific date in the Overall Plant Status View.
/I:mm/dd/yyyy,hh:mm,mm/dd/yyyy,hh:mm This is used to import the specified date-frame. The name of the file to be imported is stored in ORAMSENT.INI, but this can be modified by the user. The default filename is autoimpt.dat. If the /R switch is combined with the /I switch then the import will occur first regardless of its position in the command-line.
/L:userid:password This is used to automatically complete the log-on screen. UserID and password must be defined and valid. A blank password may be valid for some UserIDs.
/M:start-up mode This is used to start the specified mode of code operation. Options are **1** (on-line schedule planning), **2** (outage schedule planning), **3** (on-line work-release), and **4** (outage work-release).
/Q This is used upon finishing command-line tasks to quit ORAM-Sentinel.
/R This is used to recalculate the current model.

/V:start-up view

This is used to display the specified view. Options are **SFSTAT** for safety function status, **PTSTAT** for plant transient status, and **OVSTAT** for overall status. You can include as many /V switches as needed.

/P

This is used to perform the IPDS import. The command line argument for the IPDS import is described in more detail in Section 6

Examples of Command Line Arguments

Examples of detailed command line arguments are presented for clarification. The "∧" represents a required space before each switch.

Example: Log-on with a valid UserID (work) and Password (control), go to the on-line planning mode (1), set the date frame from Sept. 1, 1997 to Sept. 15, 1997, and recalculate the model. This command line argument would be written as follows:

C:\ORAMSENT\ORAMSENT.EXE∧/L:WORK:CONTROL∧/M:1∧/D:09/01/1997,00:0
0,09/15/1997,24:00∧/R

Example: Log-on with a UserID of supervisor but with no password, go to the outage planning mode, import scheduled data from June 15, 1997 to July 15, 1997, set the date frame from July 1, 1997 to July 15, 1997, recalculate the model. This command line argument would be written as follows:

C:\ORAMSENT\ORAMSENT.EXE∧/L:SUPERVISOR:∧/M:2∧/I:06/15/1997,00:00,07/
15/1997,00:00∧/D:07/01/1997,00:00,07/15/1997,24:00∧/R

NOTE: If a command line argument is used for schedule importing (/I), ORAM-Sentinel will import the schedule data that is stored in AUTOIMPT.DAT file in the Import Sub-directory. The file path to the import sub-directory is specified in the Directories editor within ORAM-Sentinel (located under FILES on the main menu).

Example: Log-on with a UserID of supervisor but with no password, go to the outage planning mode, and display the Safety Function Status View (Note: the data must have been recalculated for the Safety Function Status View to display results). This command line argument would be written as follows:

C:\ORAMSENT\ORAMSENT.EXE∧/L:SUPERVISOR:∧/M:2∧/V:SFSTAT

Modes of ORAM-Sentinel Operation

There are four modes of Evaluations in ORAM-Sentinel. Buttons for ON-LINE WORK RELEASE, OUTAGE WORK RELEASE, ON-LINE SCHEDULE PLANNING and OUTAGE SCHEDULE PLANNING can be accessed from the ORAM-Sentinel Application Mode dialog box shown in Figure 5-3. This dialog box is shown when entering ORAM-Sentinel after the Logon Screen. Additionally, the model Unit must be selected in this screen as it can no longer be changed from either the Schedule Planning or Work Release Modes.

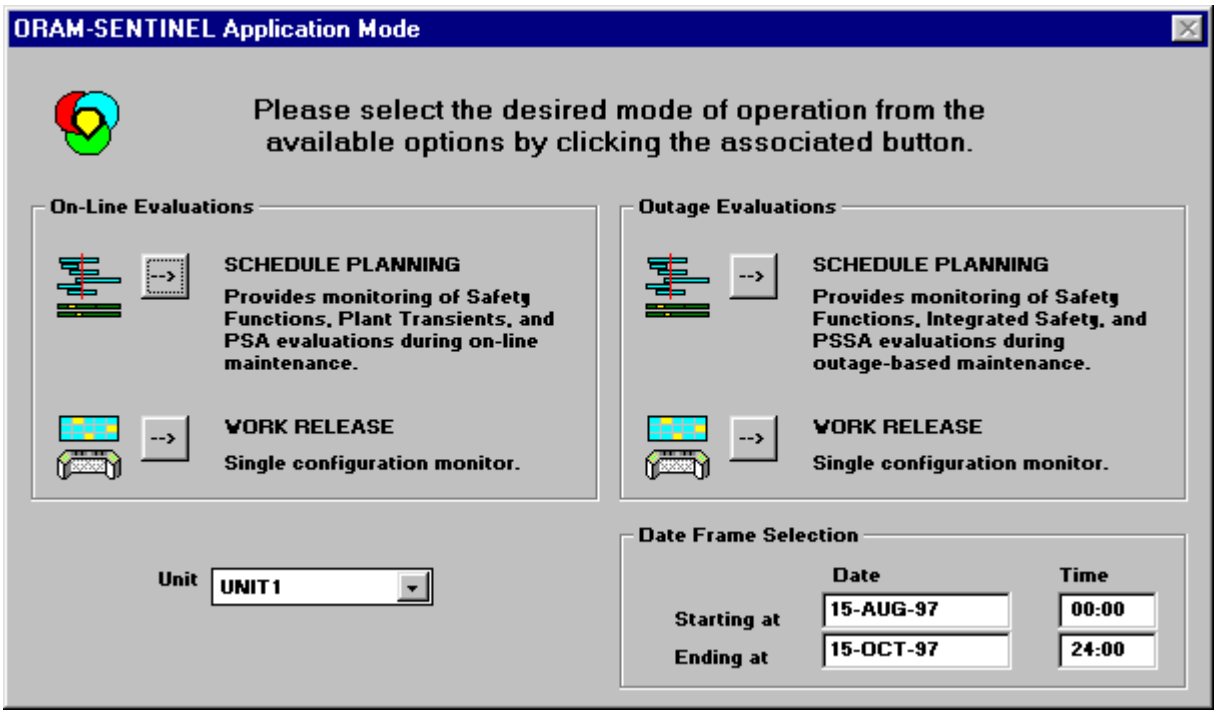


Figure 5-3
ORAM-Sentinel Application Mode

The main difference between the two work release modes and the two schedule planning modes is the style and quantity of information presented. The results displayed for a given configuration will be the same. The Work Release Mode permits viewing of multiple results (plant transient, safety function, PSA) for one configuration at a time. The schedule planning mode permits viewing multiple configurations but typically for only one result at a time. (It is acceptable to have multiple results open at once in the schedule planning mode.)

In order to switch modes or units, the ORAM-Sentinel application must be closed and restarted. After the software is restarted and the UserID and Password are entered, the user will be able to select which mode and unit to open. Command Line Arguments (as described above) could be used as shortcuts to start ORAM-Sentinel in a specific mode, thus bypassing the login and mode selection process.

Activity Datasets

The activity data in ORAM-Sentinel is divided into two datasets, Actual and Planned. Evaluations can be done based on information from either dataset. The Dataset Selection box is located in the upper left corner of the Schedule Planning and Work Release screen, to the right of the Unit box . The user can select which Schedule Dataset to examine, Planned or Actual, by selecting the appropriate dataset. ORAM-Sentinel will then display the results for the dataset selected.

The Planned Dataset contains schedule information imported through the Schedule Planning mode "Maintenance Schedule Importing" feature. The Actual Dataset contains schedule information that was populated from one of the following methods: 1) Schedule Planning Import feature, 2) Manual edits from the Work Release Screen, or 3) Integrated Plant Datasource (IPDS) Import. Note: Methods 2) and 3) are explained in detail in Section 6.

Note that Multi What-if Scenarios in the Schedule Planning Mode can only be performed in the Planned Dataset as described in Section 3. Also, some Actual activities may not be edited in the Schedule View, depending on how they were input to the schedule. See Section 4, Schedule View, for a more detailed discussion.

Work Release Mode

The Work Release Mode is described in detail in Section 6.

Schedule Planning Mode

Overview

The Schedule Planning Modes (on-line or outage), are accessed from the ORAM-Sentinel Application Mode dialog box shown in Figure 5-3.

These modes allow for the display of results for the time period specified in the Date Frame Selection. These modes also allow for recalculation over the same time period. This time period is displayed in the status bar at the bottom of the screen. Selecting the ON-LINE SCHEDULE PLANNING button displays the ORAM-Sentinel - Plant Status Monitor screen. Selecting the OUTAGE SCHEDULE PLANNING button displays the ORAM-Sentinel - Outage Safety Assessments screen. The look and function of these two screens is similar. The status bar at the bottom indicates the mode selected.

Modules

There are several modules within the on-line and outage schedule planning modes including safety function assessment, plant transient assessment (on-line only), integrated safety assessment (outage only), probabilistic safety assessment (on-line only), and probabilistic

shutdown safety assessment (outage only). Any of these modules may be developed independently.

The safety function assessment, plant transient assessment, and integrated safety assessment are presented together since these three modules perform identically. These are presented under the heading Assessment Tree Results and Tracing. The section refers mostly to SFATs and the safety function process for ease of presentation but the topics are directly transferable to PTATs and the plant transient assessment process as well as ISATs and the integrated safety assessment process.

The functions of the PSA and PSSA modules are presented in the same section. The function of the graphical output for these two modules is the same. The topic on PSA details how to display the results on the assessment views. The topic on probabilistic shutdown safety assessments provides details on running the PSSA calculations and analysis, risk profile timelines, and PSSA reporting procedures.

Before presenting details on reviewing results, an import and recalculation must be performed. These two topics are presented earlier in this section.

Unless specifically addressed, the descriptions in these sections apply to both the Actual and Planned datasets.

Recalculating Assessment Trees

The following discussion on assessment trees is equally applicable to SFATs, PTATs, and ISATs.

The assessment tree evaluations are dependent upon the completion of the PCDB and the appropriate assessment (safety function, plant transient or integrated safety) database; and depending on the model's complexity, the fault trees database, and user defined variables. Therefore, this process cannot generate any realistic information until the model builder has completed these databases. Evaluations can be run at intermediate development stages, providing there exists the supporting plant configuration data, assessment tree logic, fault trees, and/or user defined variables needed. This means that the model builder can build one assessment tree for a function and recalculate without having to build all of the assessment trees for that function before testing starts.

The assessment trees evaluation cycle (recalculation) consists of the following steps for each assessment function and for each plant configuration database record:

1. Load and interpret the plant configuration data record.
2. For each safety function, plant transient, or integrated safety function defined:
    a. Determine appropriate tree to use for the analysis
    b. Evaluate the selected assessment tree condition blocks
    c. Store the resulting decision

3. Proceed to the next plant configuration data record.
4. Return to step 1 above.

One calculation is performed to provide all results. If the PSA or PSSA databases are developed, then these results will also be calculated at the same time. After the import and recalculation are successfully completed, the results are available for review.

Assessment Tree Results and Tracing

The SFATs take input from the plant configuration database, fault trees, and user defined variables, and evaluate this data. The process is to compare the actual equipment availability against the required equipment for the actual plant condition. The result of the SFAT analysis is a set of colors and Guidance Reference numbers which are specific to each end-state encountered within each safety function. ORAM-Sentinel displays the resulting colors in a Safety Functions Status View. This view shows the results for each safety function (or plant transient and integrated safety assessment) as a function of time. The color codes, in decreasing defense-in-depth, are green, yellow, orange, and red. Typically green is used for full defense-in-depth and red is reserved for a very degraded, highly vulnerable condition with low defense-in-depth. Yellow and orange are intermediate conditions. Plant personnel are given complete latitude in the linkage of colors to measures of defense-in-depth.

The Safety Functions Status View will not only give changes in the color levels for each safety function, but the display will also indicate changes in the SFAT path or the processing of a different SFAT even though there is no change in the color code. A solid vertical line within the status view for the overall status denotes that the assessment tree or path has changed regardless of whether the actual color changes. Reference Figure 5-4, safety function status view. The purpose of this indication is to inform the user that conditions have changed and that a different set of guidelines may apply.

The guidelines portion of ORAM-Sentinel provides features to assist in evaluating outage safety. This section explains how these databases are accessed by the model builder or user to view safety related results.

Central to the program is the decision making process involving analysis of each plant configuration using logic stored in assessment trees. These trees are the analytical engine that determines the relative level of defense-in-depth (a color) and the associated guidelines for each plant configuration. Central to this decision making process is the evaluation of the assessment trees.

From the Safety Function Status View, the user has the ability to access the assessment tree used to provide the resulting color and view the path taken within the SFAT, which resulted in the particular color. Additional information about the configuration can also be viewed if the associated databases are complete. This can be performed for any safety function for any period within the status view. The Safety Function Status View is shown in Figure 5-4.

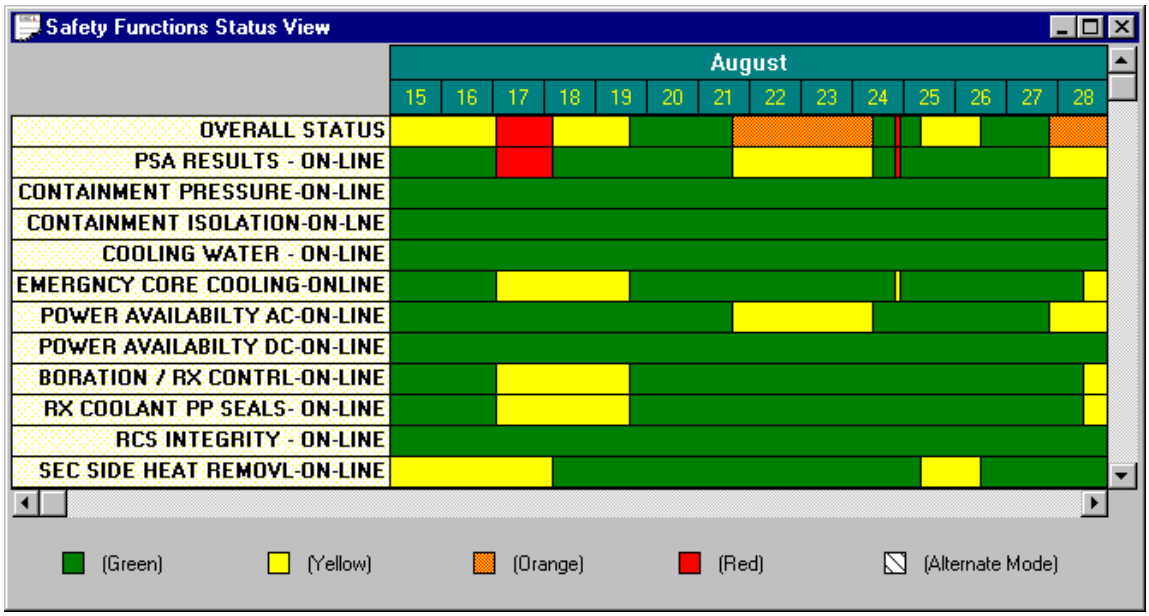


Figure 5-4
Safety Function Status View

The Safety Function Status View displays the color status of each of the modeled safety functions, over the period input in Date Frame Selection. Each safety function is represented by a horizontal band of colored rectangular blocks. Each vertical line separating any two blocks within a safety function represents a change in plant configuration or system availability that affects the selection of the specific SFAT used for evaluation.

Zoom

While viewing the Safety Function Status View, some configurations may be of too short in duration to be easily seen. The user has the ability to change the scale of the view to see segments of shorter or longer duration. The user accomplishes this by clicking on the ZOOM-IN and ZOOM-OUT buttons on the tool bar. These functions can also be accessed from VIEW on the main menu and the ZOOM-IN and ZOOM-OUT options on the drop-down menu. These functions can also be accessed by right clicking the mouse over the status view.

The process of obtaining additional information about the results is performed by opening the Safety Function Status View (or Plant Transients and Integrated Safety Status View), and double clicking in the body of the view at the time of interest. ORAM-Sentinel will display the Overall Plant Status View as shown in Figure 5-5. This view provides a detail of the status for the single configuration that exists during the time that was selected. The detail includes the Overall Status, Safety Functions status, and Plant Transients status and the start and end dates for the configuration chosen.

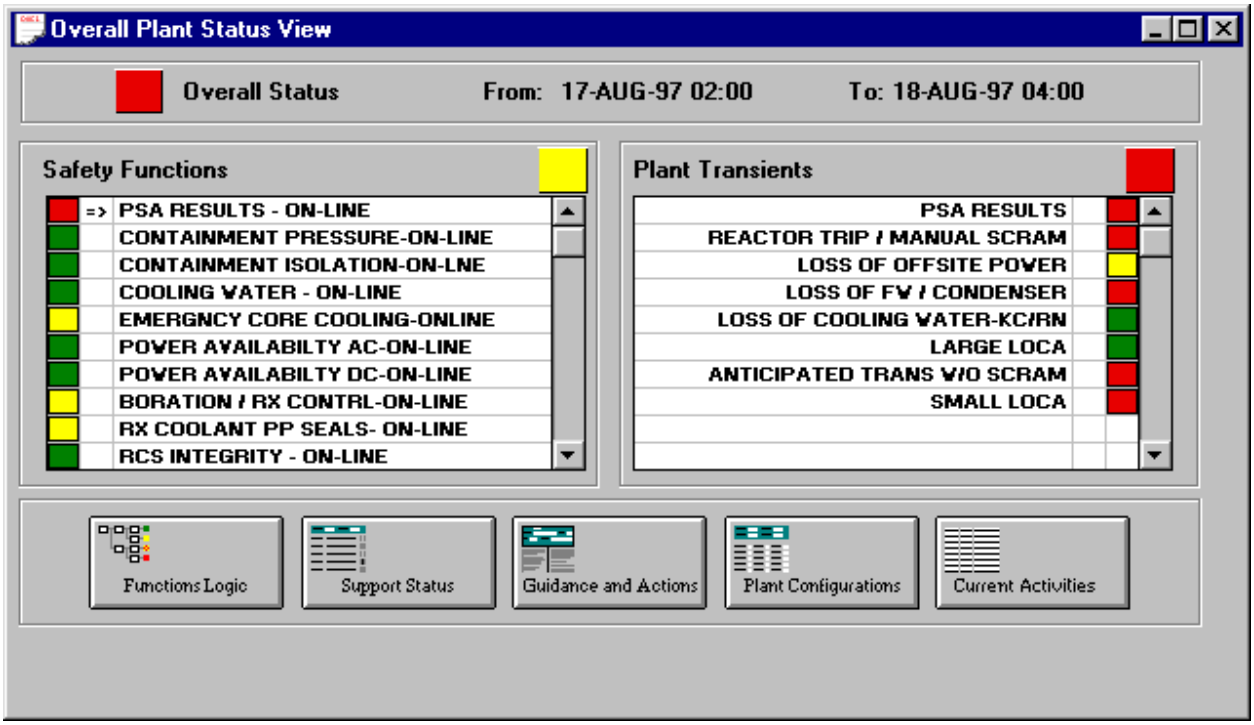


Figure 5-5
Overall Plant Status View

If the five buttons at the bottom of the Overall Plant Status View for FUNCTIONS LOGIC, SUPPORT STATUS, GUIDANCE ACTIONS, PLANT CONFIGURATIONS, and CURRENT ACTIVITIES are not visible, maximize the screen to display them. The user should identify the assessment of interest by clicking on the assessment. After the assessment is identified, any of these five buttons can provide additional details specific to the assessment that was chosen. The capabilities of these five buttons are described below.

Functions Logic

Click on the FUNCTIONS LOGIC button on the Overall Plant Status View to see the assessment tree used during calculation for that specific function during the chosen configuration. ORAM-Sentinel will display the appropriate assessment tree and highlight the decision path through the tree by using a bold colored line.

SFAT Tracing

From the Safety Function Assessment Decision Path display, the user may trace the decision logic back to the schedule activities occurring at the time. The user can view (but not modify in this view) the underlying formula of any condition block, by double clicking on the desired condition block. This will display the Calculation Tracing Window as shown in Figure 5-6.

The Calculation Tracing Window provides the user with the ability to trace back to the PCDB record entry and view comments imported with those schedule activities. To implement this

feature, the user highlights the variable of interest and then clicks on the TRACE button. This process can be repeated until the status of the desired PCDB variable is displayed. This feature also has the ability to trace back through fault trees if they are part of the logic of interest. If a fault tree is part of the decision logic, then the failed components will be highlighted in the tree.

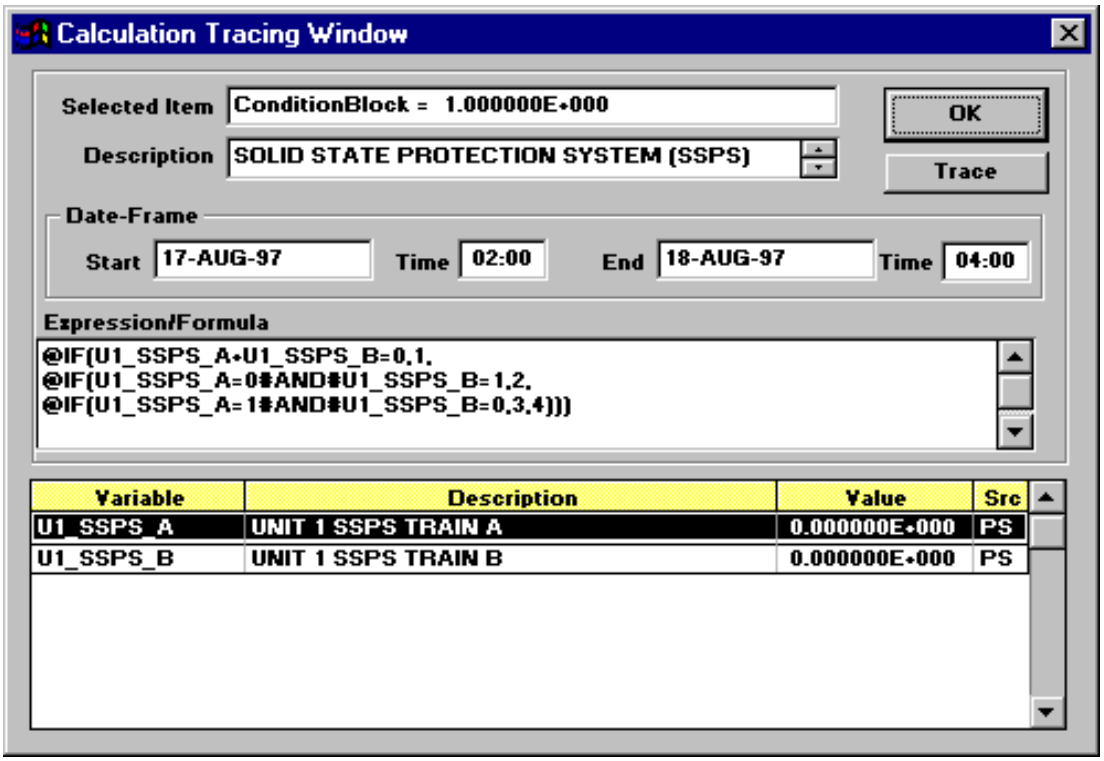


Figure 5-6
Calculation Tracing Window

Support Status

Click on the SUPPORT STATUS button on the Overall Plant Status View to see the status of selected systems, trains and components. This will display the Support System Status dialog box as shown in Figure 5-7. The status of each selected item will be displayed. The status is only for systems associated with the safety function being viewed. The linking of selected systems, trains and components to a safety function must be completed before this feature is functional. Setting up this link is detailed in Section 4 under Safety Function Definitions.

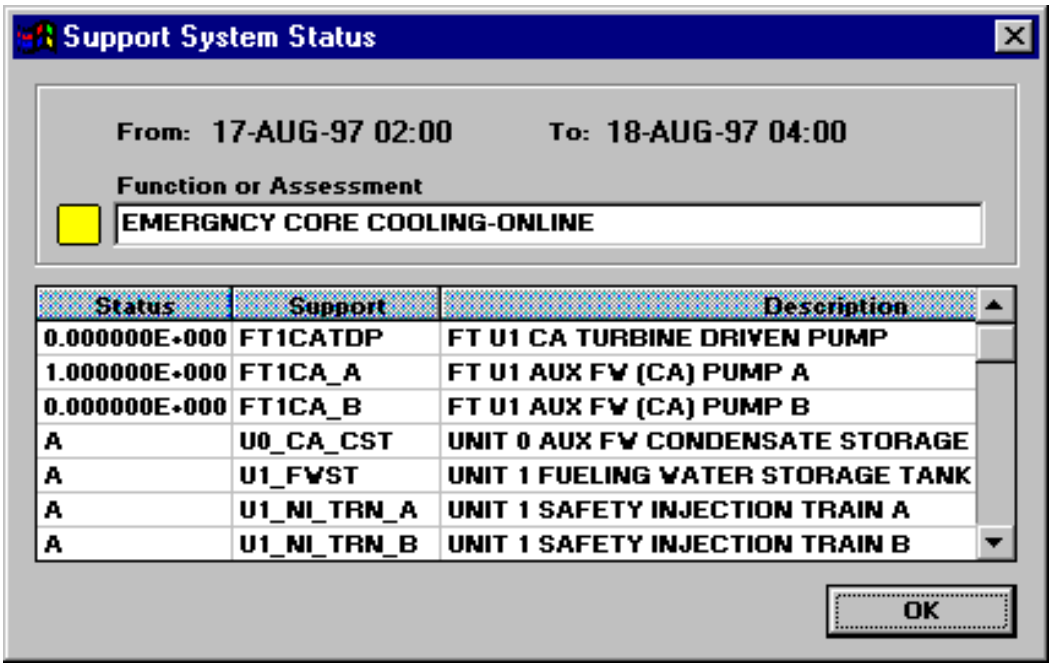


Figure 5-7
Support System Status

Guidance and Actions

Click on the GUIDANCE AND ACTIONS button on the Overall Plant Status View to reference guidance specific to the results for the assessment function selected. This will display the Guidance and Actions View dialog box as shown in Figure 5-8.

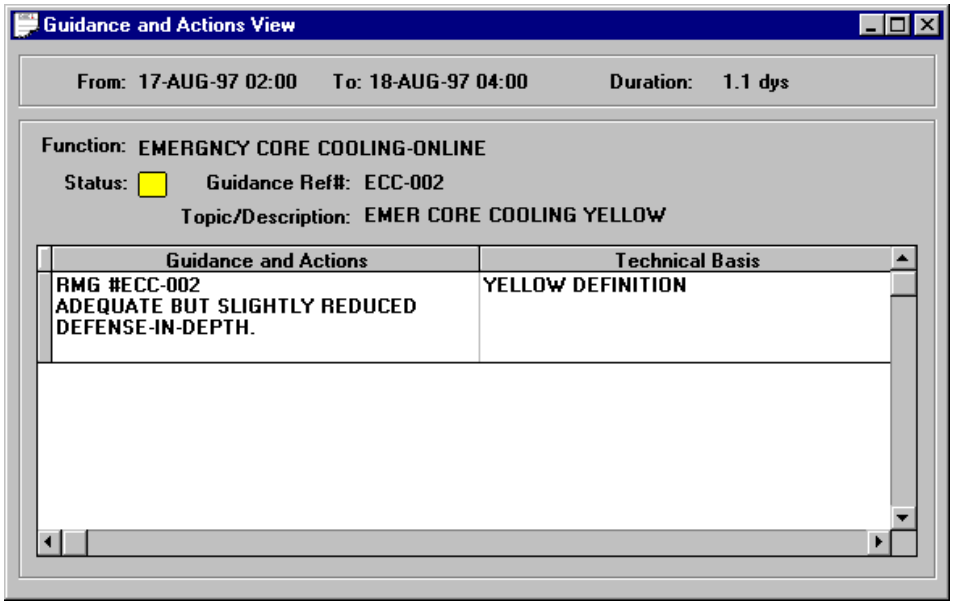


Figure 5-8
Guidance Actions View

The guidance and technical basis for the assessment function specific to the configuration will be displayed. The development of the guidance database must be completed before this feature is functional. Setting up this database is detailed in Section 4.

Since there may be more guidelines than one screen can display, the scroll bar along the right side of the view may be used to access the additional guidelines. This feature is used by clicking the mouse on the up or down arrows of the scroll bar, or by sliding the position control. Note: if there are more than 350 characters in any one paragraph of guidance, this information may not be visible. If this is the case, reference Section 4 information on editing this database.

Response and Justification

The Response and Justifications is not functional in version 3.4.

Plant Configurations

Click on the Plant Configurations button on the Overall Plant Status View to display the Plant Configurations View as shown in Figure 5-9. This will allow the user to reference the PCDB record associated with the date and time currently being reviewed. The user can then check the Configurations, Higher Risk Evolutions and Component and Trains portions of the PCDB. The equipment that is not in the default status will be highlighted in yellow. The highlighted variables will standout during searches of the database. There is no additional database setup required before this feature is functional. All items in the PCDB will be displayed.

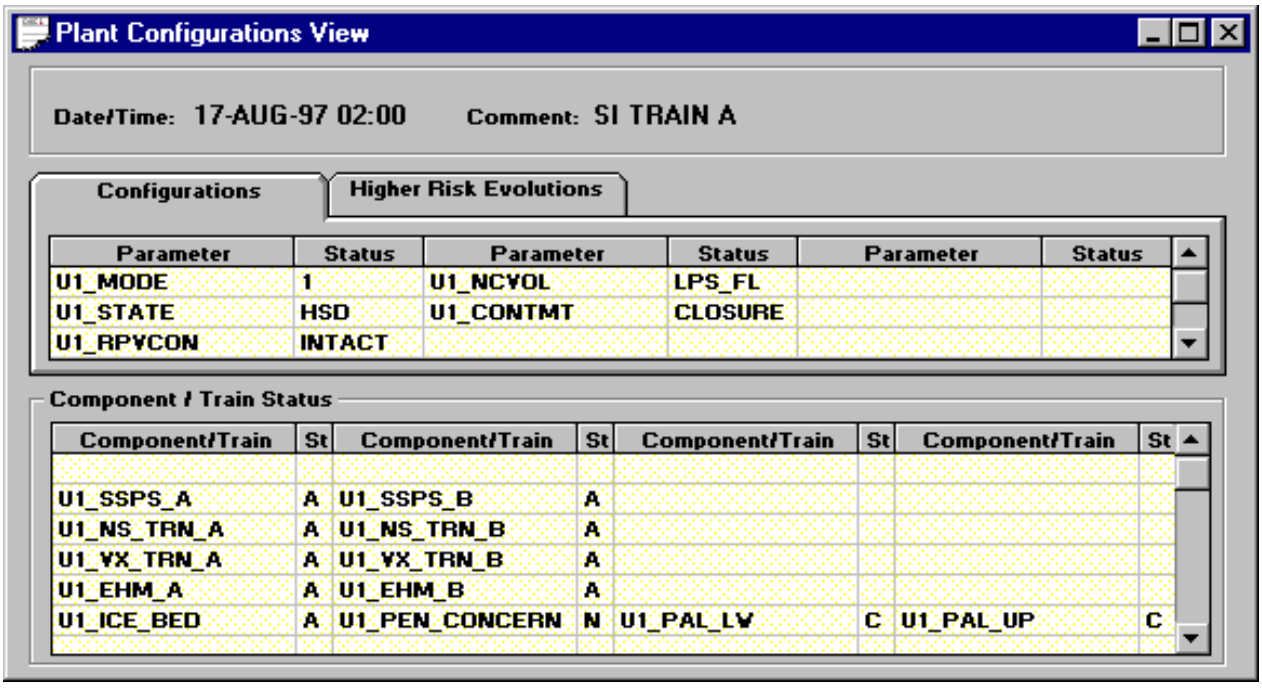


Figure 5-9
Plant Configuration View

Current Activities

Click on the CURRENT ACTIVITIES button on the Overall Plant Status View to display the Current Activities dialog box as shown in Figure 5-10. This dialog box includes the Item, Activity and Description information from the import schedule for all schedule activities associated with the date, time, and dataset currently being reviewed.

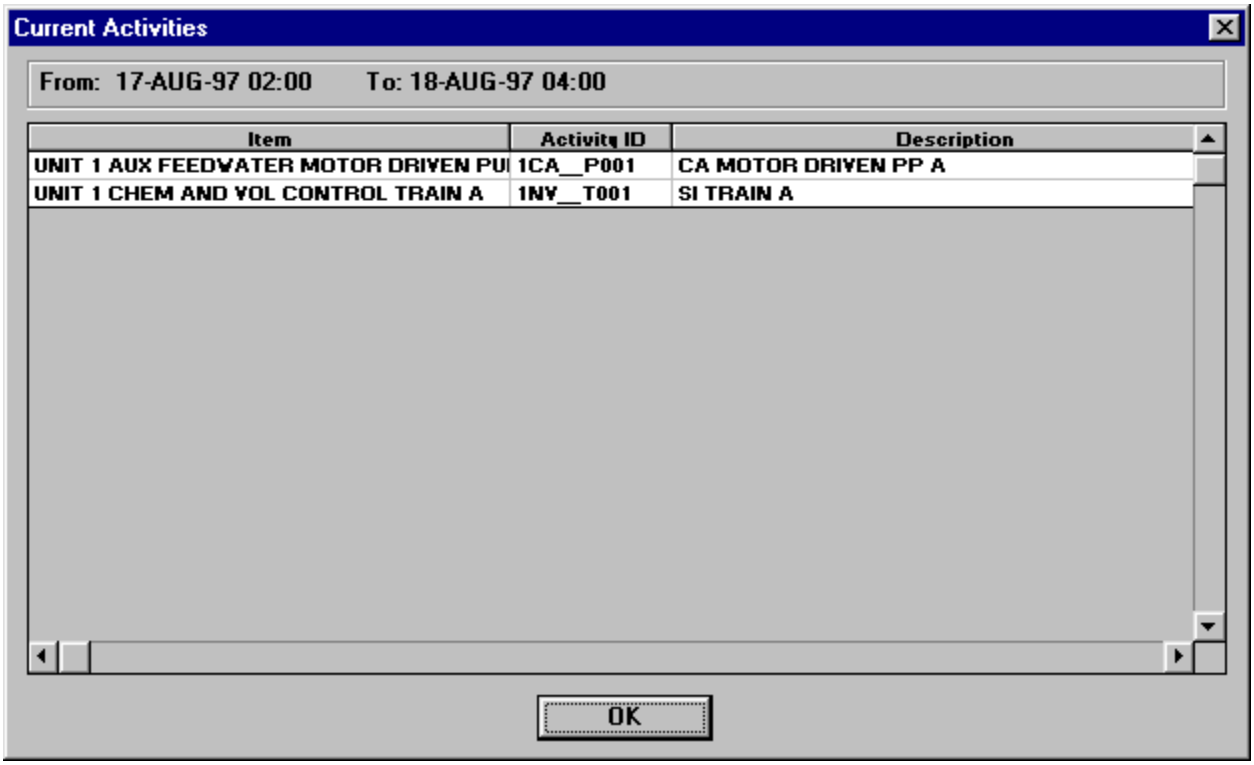


Figure 5-10
Current Activities

Weighting Factors Option

If the function Weighting Factors are implemented, the Overall Plant Status View contains additional information as shown in Figure 5-11. An additional column is provided in the Safety Functions and Plant Transients to display the Weighting Factor assigned to each function. Each box shows a color (based on variables SFAT_STATUS and PTAT_STATUS) and a number (based on SFAT_SCORE and PTAT_SCORE). If the score variable is 0 (zero), no number is displayed. Double clicking on these boxes allows the user to trace on the expressions for the status and score variables.

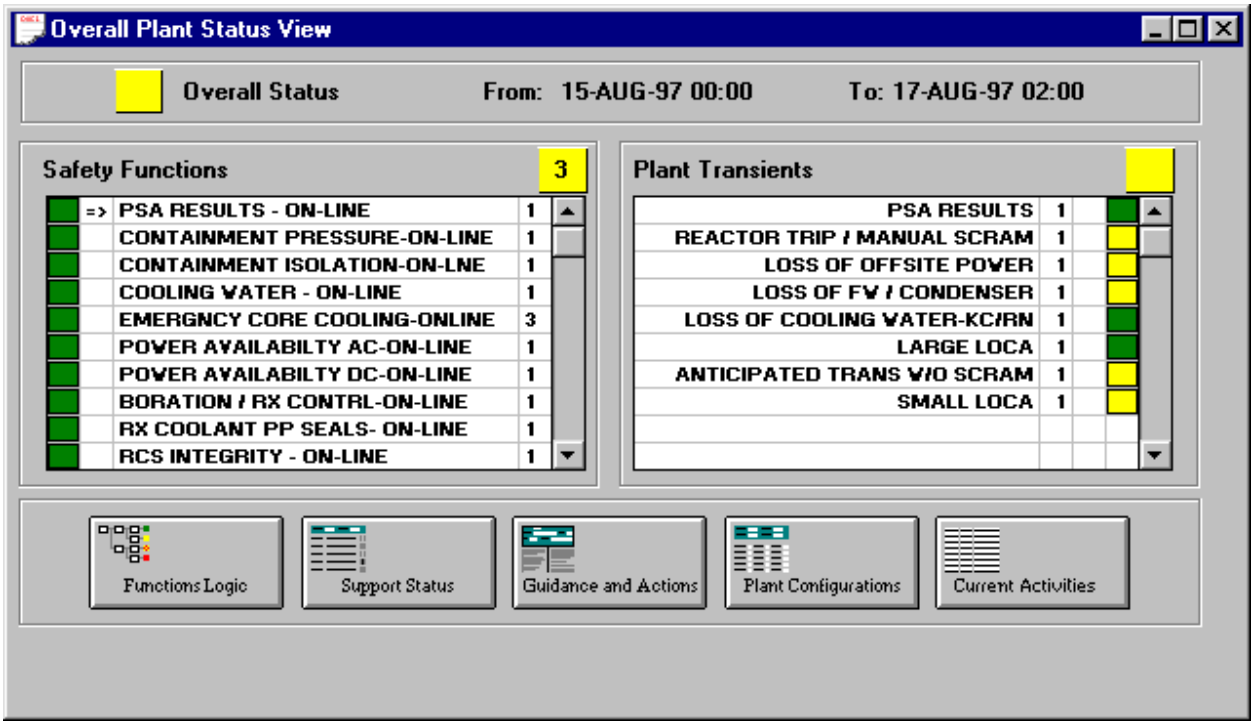


Figure 5-11
Overall Plant Status View with Weighting Factors enabled

Configuration Guidance

The Integrated Safety information for a configuration can be viewed by selecting the CFGGUIDN button on the view bar. This will display the Configuration Guidance View dialog box as shown in Figure 5-12. This dialog box indicates the Overall Status and configuration date range and includes the Return To Service Priorities, Remain In Service Priorities and Compensatory Guidance And Actions (255 characters). To access the complete (>88 characters) Compensatory Guidance And Actions statement from the configuration guidance view, double-click on the single row(s) view of the Compensatory Guidance and Actions. This will display the complete description (up to 255 characters). A colored box labeled PSA provides a color and number (if desired) from the system variables PSA_STATUS and PSA_SCORE. These variables can be edited to incorporate plant specific logic. Double clicking on this box allows the user to trace the status and score.

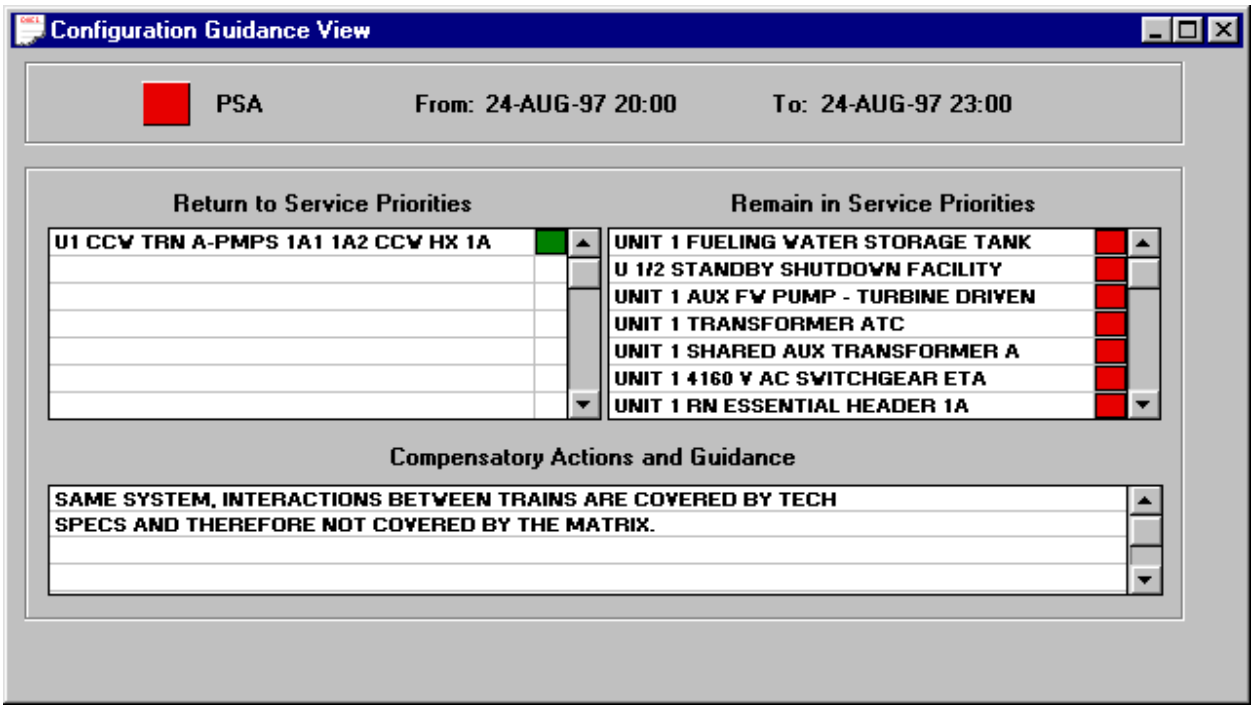


Figure 5-12
Configuration Guidance View

PSSA and PSA

The probabilistic shutdown safety assessment (PSSA) module provides a probabilistic risk assessment (PRA) approach to analyzing outage related risk profiles. This section will explain the important relationship of the PCDB, event trees database, and fault trees database to the PSSA module. Included with this section is information about graphing the PSA results. The function of the PSSA and the PSA graphs is the same. The Timeline graphs - time to boiling were part of the PSSA module in previous versions of ORAM. These "time-to" graphs are now generated using the XvsT GRPH button on the viewbar.

The main difference between the PSSA and the PSA modules is the applicable mode and the sources of the results. The PSSA is for outage mode only and the results are from calculations performed by the ORAM-Sentinel event trees, which may use data from the PSA Results database. The PSA Results database is for both on-line and outage modes and the results are from a look-up table, which may be populated manually or through direct interaction with an external risk model. The risk numbers are calculated using the station Probabilistic Safety Assessment tool. The results are then stored in the ORAM-Sentinel PSA Results Database for look-up and display when matching configurations are encountered.

This section on probabilistic shutdown safety assessments is presented to discuss the traditional ORAM PSSA methodology with the calculations performed within ORAM-Sentinel, and will cover the following topics:

- PSSA evaluations and analysis
- Timeline graphs - risk profiles
- Contributor graphs
- PSSA reports and displays

The PSSA is the primary process that generates the risk-related information used in viewing the outage. This PSSA information is applicable to outage conditions only. It produces risk profiles over time. For the PSSA module, the analytical engine performs numerous calculations and evaluations utilizing the formulas stored in the event trees, fault trees, and user defined variables databases.

The PSSA analysis cycle is composed of the following for each plant configuration database record:

1. Load and interpret the plant configuration data record
2. For each initiating event tree:
    a. Evaluate all initiating event sequences
    b. Store all intermediate calculation results
3. Retrieve the next plant state data record
4. Return to step 1 above

PSSA Evaluations and Analysis

The PSSA depends upon a complete PCDB, event tree database, and depending on the model's complexity, the fault trees database, and user defined variables database. Therefore, this process cannot generate any realistic information until the model builder has input this design information. Calculations can be run at intermediate stages, providing there exists the appropriate plant configuration data, an initiating event tree, and any required supporting fault trees and user defined variables.

Once this portion of the outage model has been built, and the PSSA analysis has been performed, the user will need to re-run the analysis whenever the CALC indicator is displayed. On the status bar at the bottom of the main menu screen there is a box to indicate whether the currently available results are consistent with the current input data and model. If the databases and any results are not consistent, the status bar will display the CALC indicator. If they are consistent, the status bar will be blank.

PSSA Calculations

To run the PSSA analysis, the user must select RESULTS from the main menu, then click on RECALCULATE MODEL or select RECALCS from the viewbar. This is the same function that gets performed for any other ORAM-Sentinel recalculation.

During the PSSA analysis the intermediate results data are stored in an internal array, and upon completion the internal array is stored in a disk file. This function maintains these results until the analysis is run again, at which time the old data is overwritten. In this manner the user does not need to run the analysis (recalculate), unless the import file, associated databases, mode, or date frame have changed.

Once the analysis has finished, the various PSSA results features may be used to view the recalculated data. The PSSA module of ORAM-Sentinel provides risk profiles graphing features for this purpose.

Timeline Graphs - Risk Profiles

To access the risk profile graphs of the PSSA application, click on the PSAPROF button on the viewbar. This will display the PSA Graph View and the last risk profile that was viewed. An example of the PSA Graph View is the Core Damage graph shown Figure 5-13.

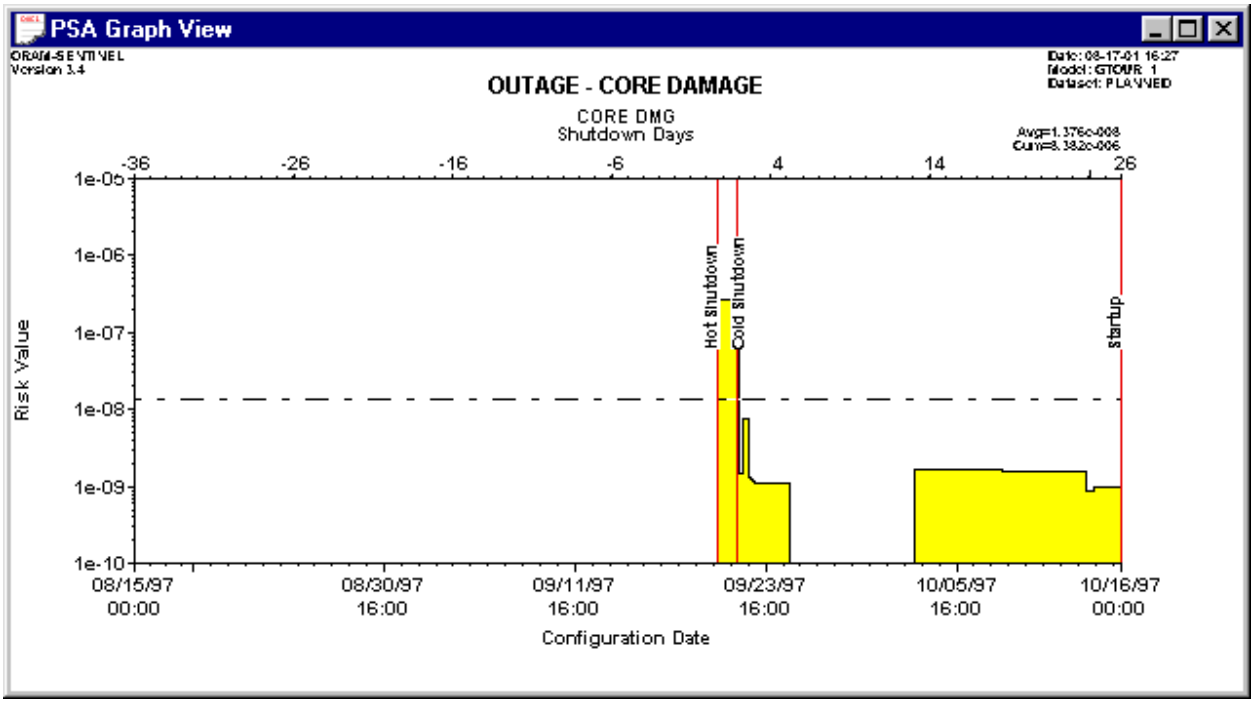


Figure 5-13
Outage - Core Damage

In the outage mode, the PSA Graph View will only plot risk profiles calculated by the PSSA Event Trees. Outage PSA Results data (e.g., ISAR_????? values) can be plotted using the X vs. T Graphs.

ORAM-Sentinel displays the risk profiles as linear histograms over the duration identified in the Date Frame Selection. The X-axis scale is both calendar days (across the bottom), and shutdown days (across the top). The Y-axis is the risk value. The Y-axis units are logarithmic, and typically measured in events per hour. The dashed line shown in figure 5-13 represents the average core damage frequency for the given duration. Any zeros in the timeline graphs represent a numerical zero (as in figure 5-13), an unknown value, or another mode depending on the graph type. Note: Generally, PSSA results are in events per hour and PSA results are in events per year. These rates are user definable.

If the user requires a different profile, click the right mouse button over the view. This will display the PSA Graph View dialog box. From this dialog box, the user can select the desired risk profile.

The PSA Graph View dialog box allows the user to also select the Graph Title, End-state, Graph Type, and Y-axis Options. This dialog box can also be used to develop a new graph by clicking on the NEW GRAPH button.

Graphing Limitations

The display of the first plant configuration in the cumulative PSA graph will not display a value of zero. The first point in the cumulative graph should be zero, however, the graph is a log scale graph and cannot show a zero value. Therefore, the first point of the graph will be shown at the x-axis (non-zero) and will "point" towards zero. The slope of the first line from "zero" to the 2nd point can potentially be off. For this reason, users are cautioned about the functionality of the graphing mechanism while attempting to graph a zero value on a log scale.

Contributor Graphs

One of the major underlying features of the risk profile graph, is the ability to view individual or grouped initiating events. Each end-state is comprised of one or more event trees that model the individual initiating events. When first entered, the risk profile defaults to the selection of all initiators. However, the USE SELECTED INITIATORS radio button on the PSA Graph View, Figure 5-14, allows the user to individually select one or more of these initiating events and graph only that portion of the risk data. After displaying the PSA Graph View dialog box, click on EDIT button to make the USE SELECTED INITIATORS radio button active. After selecting the desired initiators and after selecting the Initiator Graph Mode, click on SAVE. To graph the new data, next click on OK.

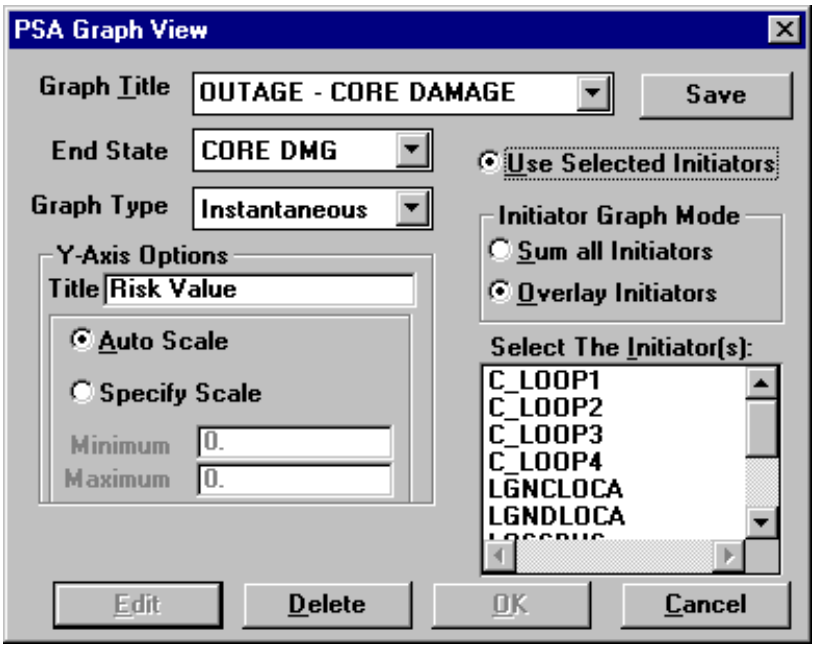


Figure 5-14
PSA Graph View

The Initiator Graph Mode in the PSA Graph View dialog box allows the user to select between SUM ALL INITIATORS or OVERLAY INITIATORS. If the SUM ALL INITIATORS button is selected, the program will accumulate the underlying initiators, and display their combined risk data as a single risk profile graph. If the OVERLAY INITIATORS button is selected, the program will display each of the selected initiators as its own profile. This overlay feature allows the user to more easily compare the relative contributions of each initiator and how those contributions change during the progression of the outage.

Tracing to View Contributors

The PSA Graph View includes the ability to show the initiators and their percentage of contribution at any point along the timeline. To view this data, the user must move the pointer (mouse)to the graph area of interest, and double click. The Calculation Tracing Window will be displayed as shown in Figure 5-15. The user is able to select the appropriate data and trace the initiators with their calculated percentage of risk contribution at that time.

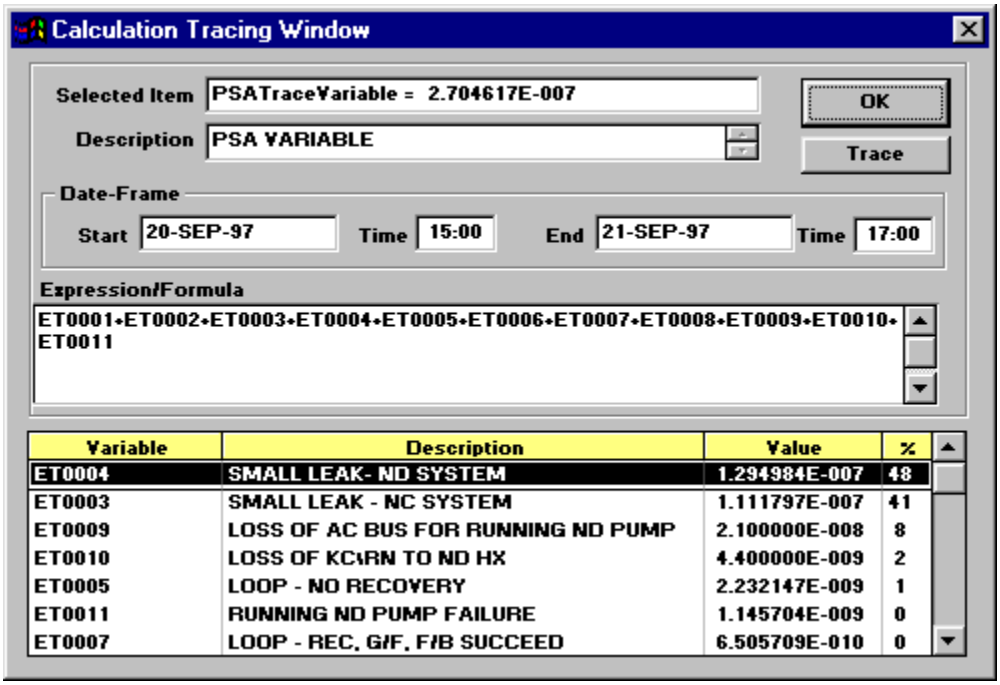


Figure 5-15
Calculations Tracing Window

PSSA Tracing

ORAM-Sentinel provides for tracing of PSSA results. By clicking on a specific outage time on the PSA Graph View, the user can find the contributing causes to the risk at that time as well as the contributing percentage. This is accomplished by selecting the desired initiating event and sequence, and then clicking on TRACE. ORAM-Sentinel will display the equation that models that sequence and the values for each of the variables in the equation. The user can trace back through each variable in the equation and to the PCDB input from the outage schedule.

PSSA and PSA Displays

The PSA Graph View dialog box, shown previously in Figure 5-14, can be displayed by right clicking on the graph. This dialog box allows for changing the Graph Title, End-state, Graph Type, Y-axis Options, and Selected Initiators. Clicking on the EDIT button will activate the screen for editing. After changes are made, the SAVE button will record and maintain the changes. After the save, the OK button will display the new graph.

The PSA Graph View will display white (no data) if the opposite mode occurs during the graph or if no data is available in the current mode. If the AUTO SCALE button is selected from the PSA Graph View dialog box, all available data will be displayed.

The dotted line in the middle of the graph is the average (reference Figure 5-13). The average and cumulative risk numbers are displayed in the upper right corner of the graph. These

numbers are for the displayed data only. Therefore, these numbers do not include any data for the opposite mode and do not include any data for time periods outside the displayed date range.

The graphs can be viewed in 640 x 480 screen resolution but are optimized for 800 x 600 screen resolution. The user may wish to change the setting of the desktop display area to view these graphs in finer detail.

The tracing feature of these graphs allows users to view the details of the input to the graph. Tracing can be performed by clicking in the body of the graph at the point of interest. Further tracing will eventually lead to the import schedule. This tracing can be accomplished by highlighting the variable in question and selecting the TRACE button.

If the Graph Type of cumulative is chosen on the PSA Graph View dialog box, a cumulative point is drawn at the beginning of each plant configuration. A straight line is then drawn between each point. For this reason the graphs are an approximation of the actual risk for times that are between points. If tracing is performed on a cumulative graph, the instantaneous results for that time period are displayed.

To view the initiators for a graph, click on EDIT, then USE SELECTED INITIATORS, then click on the initiators of interest. Next decide on which Initiator Graph Mode to use and click on the SAVE button. To display the new graph select OK. No tracing is permitted on graphs of initiators.

Zoom

The zoom feature for PSSA and PSA graphs is the same as for X versus T graphs. Reference the subsequent discussion on how to zoom.

PSSA and PSA Reports

The reporting feature provides the user with the ability to print out the graphical output of the timelines. The user must click on the PRINT VIEW button on the tool bar.

External Link and Call To Risk Engine

Included with ORAM-Sentinel version 3.4 is the capability to connect to an external risk engine. In the External Interfaces Tab under Preferences from File on the Main Menu, the user has the option to “Use PSA Engine.” When this option is toggled, a text file (OS??????.txt) gets created and placed in the root directory every time the model gets recalculated. This text file can get written to a location specified by the user by defining a path in the Application Path box in the PSA Engine Definition dialog. If an unsolved PSA case exists, a line is added to this file to represents that unsolved case. This text file can then be used as a mechanism for running the station specific PSA to calculate risk results for those plant configurations where the risk results do not already exist in the ORAM-Sentinel PSA Results database. ORAM-Sentinel can start the PSA calculation, receive the resulting information and permanently store the results in the database. Separate executables are available which interface with ORAM-Sentinel. Model

builders who desire instructions on using this feature should contact EPRI at the numbers and address listed at the beginning of Section 2.

X Versus T Graphs

The X versus T graphs is a feature that allows the user to display the results of selected variables. The Variable Versus Time Plot shown in Figure 5-16 is displayed by clicking on the XvsT Graph button on the view bar.

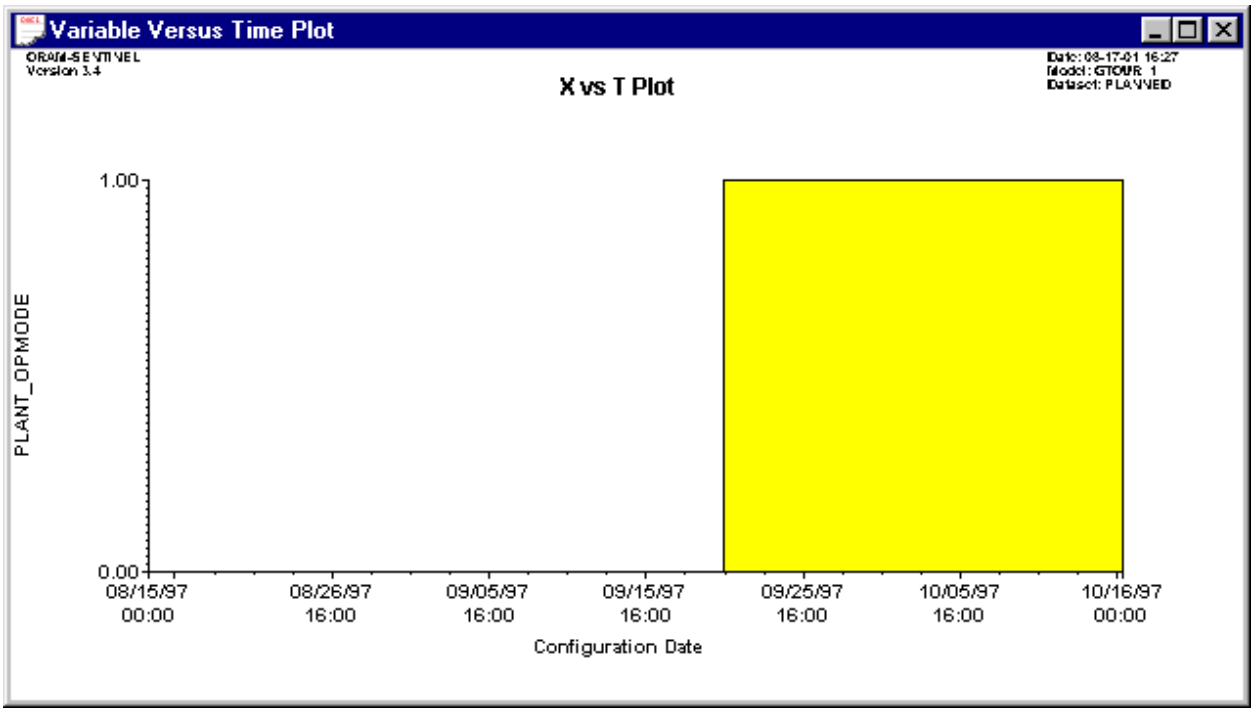


Figure 5-16
Variable Versus Time Plot

XvsT Graph Error Message

When selecting a graph an error message may appear indicating that no data is available in the time period. This message appears during any of the following three conditions: there is valid data and in some cases it is equal to zero, the opposite mode exists in the selected time frame (opposite mode data will not be displayed), or there is no data available at one or more points in the time frame.

Modify, Reset and Print

When in the Variable Versus Time Plot dialog box, a right mouse click is required to display the drop-down menu. This menu allows the user to modify, reset or print the graph. After selecting MODIFY from this drop-down menu, the Define Variable Over Time Graph dialog box is displayed. From this dialog box, the user can select any variable for graphing including PCDB,

fault tree or user defined variables. The user can also define the Graph Title and Vertical Axis Title.

The Graph Title and Vertical Axis Title remain the same until changed by the user. It may be appropriate to use generic titles. The recalculation of the required results is performed each time that the parameters of the graph change.

Selecting the RESET button on this drop-down menu will return the graph parameters to their original setting. Selecting the PRINT button on this drop-down menu will print the graph to the previously defined printers.

Graphing Limitations

In the X vs. T graphs, data will not be shown during the opposite ORAM-Sentinel operating mode (as defined by the PLANT_OPMODE variable). If the graph is being viewed in the outage mode, any variable will display as zero during the on-line periods (even if the variable has an on-line value). If the graph is being viewed in the on-line mode, any variable will display as zero during the outage periods (even if the variable has an outage value).

Zoom

The scale on the X vs T graphs can be changed. To zoom in on a period, the Variable Versus Time Plot must be open. The following steps must be performed:

1. Move the mouse to the left side of the portion to be expanded.
2. Click and hold down the left mouse button.
3. Move the cursor to the right side of the portion to be expanded.
4. Click the right mouse button.
5. While still holding the left mouse button, the cursor can be moved to the exact location on the right side of the portion to be expanded.
6. Release the left mouse button when the cursor is on the desired date.
7. A dialog box appears asking for confirmation of the zoom.

Timeline Graphs - Time to Graphs

A timeline-based graphing feature includes the ability to plot "time-to" graphs. In earlier versions of the software, this was performed as part of the PSSA application. This function is now performed as an X versus T graph. The built-in graphs for time to RCS boiling and time to core damage require that the user have created the necessary plant specific formulas (user defined variables). These graphs take time to generate on screen because ORAM-Sentinel recalculates the current expression and formula every time a graph is drawn.

Performing What-If Scenarios

The what-if scenario feature in the Schedule Planning Mode allows users to temporarily change the schedule and analyze the impact of the change on safety functions, plant transient and integrated safety functions and PSA and PSSA safety profiles. This what-if feature can only be performed on the Planned Dataset. In the Actual Dataset, the Work Release Mode is used to perform what-ifs.

Selecting the WHAT-IF button on the viewbar displays two dialog boxes (reference Figure 3-24). These can also be accessed from RESULTS on the main menu and WHAT-IF SCENARIO CONTROLS on the drop-down menu. The Schedule-based What-If Scenarios dialog box is displayed. The Schedule View is also displayed. Both of these dialog boxes must be kept open for the entire duration of the what-if analysis. As soon as the Schedule-based What-If Scenarios dialog box is closed, any changes made in the Schedule View are overwritten with the original schedule information. Saving the what-if scenarios is not permitted.

The Schedule View is used to temporarily modify the status of equipment. There are two methods available to modify equipment status. The Planning Schedule Task Editor can be displayed by double clicking on any individual activity either in the description or on the Gantt bar. This editor will allow the user to input the new Start Date and Time and End Date and Time. The other alternative is to drag and drop the Gantt bars. The whole bar can be moved to a new location without changing the duration. This is performed by clicking and holding the left mouse button in the middle of the bar. When a new location is found, release the left mouse button to drop the whole bar. Similar activities can be performed on the ends of the bar. This will only move the end of the selected bar. The duration of the activity will change when one end is adjusted. A schedule activity can be deleted by entering a zero duration. To add a schedule activity, right click anywhere in the schedule view and select ADD MAINT TASK.

After the schedule is manipulated, click on the EVALUATE CONFIGURATION button on the Schedule-based What-If Scenarios dialog box. When the calculation is complete, the results can be accessed from RESULTS on the main menu. There are drop-down menu items for COMPARATIVE SAFETY FUNCTION STATUS, COMPARATIVE PLANT TRANSIENTS STATUS and COMPARATIVE PSA SAFETY PROFILE. All of these results will be calculated if the databases have been built. Tracing is permitted on these comparative displays. However, the trace logic for the original configuration is displayed, not the what-if configuration.

Dial-CAFTA and EOOS Fault Tree Interface

Included with ORAM-Sentinel version 3.4 is the capability to synchronize with schedule evaluation through a large fault tree model including EOOS and CAFTA. For this feature, a schedule is processed through an external fault tree in a binary fashion (results of TRUE and FALSE only for each gate) as in the case of Dial-CAFTA and certain features of EOOS. The resulting TRUE and FALSE values of GATES corresponding to ORAM-Sentinel PCDB parameters are then imported in the same manner that an ASCII schedule file is imported. ORAM-Sentinel uses these gate results in the deterministic and probabilistic logic evaluations. With this feature, there is little or no need for ORAM-Sentinel logic back into the CAFTA Fault Trees using a DDE with the CAFTA Browser. Model builders who desire instructions on using

this feature should contact EPRI at the numbers and address listed at the beginning of Section 2. The ORAM 2.0 Users Manual (Reference 20) contains a description of Dial-CAFTA.

System Performance Criteria

The system performance criteria function has been removed from ORAM-Sentinel.

Reports

Refer to Section 7, Menu Items, for printing reports. Instructions for printing X Versus T Graphs and for printing PSA and PSSA graphs are included in this section.

6
WORK RELEASE MODE

Description of Work Release Mode

The Operations Plant Status View (or Work Release Mode) provides one screen showing the Overall Status, Safety Function Status, Plant Transients Status, PSA Results (including Return and Service, Remain and Service, and Comp Actions), Plant Configuration status, and Components and Trains status. This information is displayed for one plant configuration at a time. The information presented on this screen includes these results only for the applicable time period (shown at the top left as From: and To:). The user has the ability to perform what-if scenarios by adding, editing, or deleting activities. The user can store activity data by saving the what-if scenario.

Additional features of the new Work Release Mode include the ability to electronically import the status of plant equipment as defined by an external program, to export the configuration results data to a text file, and launch a user-defined external program.

When reading this section, refer to Figure 6-1 that displays the main Work Release screen.

Results Date Frame

This permits the user to specify the time frame for which the current assessment is being made and for which graphical output will be displayed. The Results Date Frame is displayed in the Status Bar at the bottom of the Work Release screen. For making assessments in the "current" date/time, ensure the Date Frame selected encompasses the computer clock date/time.

Changing Date Frames

The date frame may be changed by choosing DATE FRAME SELECTION under the RESULTS pull down menu or directly on the Application Mode screen when starting the program. Select the DATE FRAME SELECTION option from the RESULTS pull down menu, the Date Frame Selection dialog box will appear. A sample date frame is 15-AUG-01 00:00 to 15-OCT-01 24:00. Note: The Date Frame times are locked to 00:00 for the start time and 24:00 for the end time. Select OK to close the Date Frame Selection dialog box.

Work Release Mode

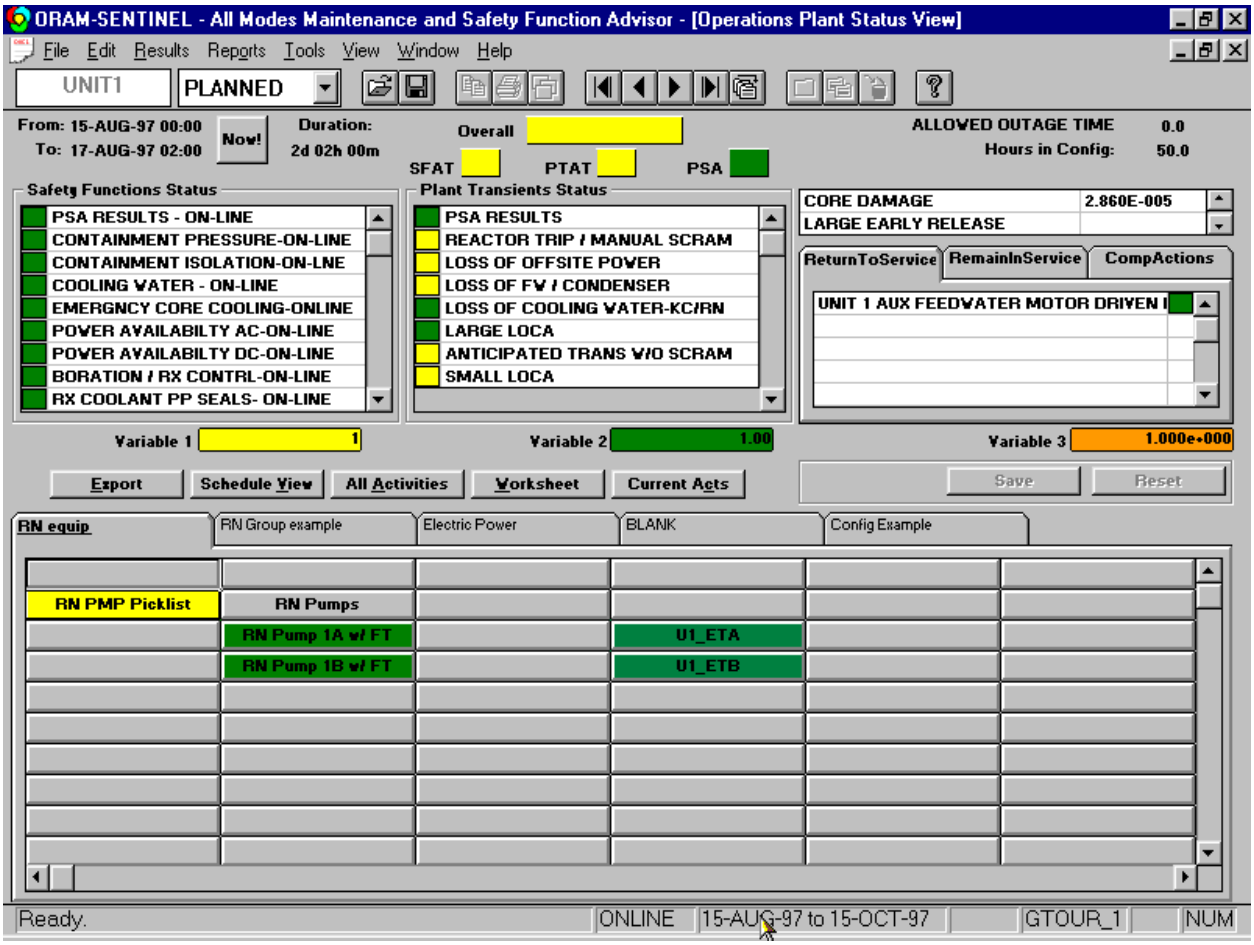


Figure 6-1
Operations Plant Status View (Work Release) Screen

Unit Selection

The Unit display box is located in the upper left corner of the Work Release screen. This box displays the applicable Unit. The Application Mode screen (used when starting the program) is where the unit can be switched.

Dataset Selection

The Dataset Selection toggle box is located in the upper left corner of the Work Release screen, to the right of the Unit Selection display. The user can select which Schedule Dataset to examine, Planned or Actual, using this dataset toggle on the toolbar and selecting the appropriate dataset. ORAM-Sentinel will then display the results and allow manipulation of this dataset.

Planned

The Planned Dataset contains schedule information imported through the Schedule Planning Mode Maintenance Schedule Importing feature. When in the Work Release Mode, the user can examine results of the Planned Schedule by selecting PLANNED from the Dataset Selection toggle box. Note that in the Work Release Mode PLANNED dataset, the SAVE feature is not an option (the PLANNED dataset file cannot be written to from Work Release mode).

Actual

The Actual Dataset contains schedule information that was populated from one of the following methods: 1) Maintenance Schedule Importing feature, 2) Manual edits from the Work Release Screen, or 3) Integrated Plant Datasource (IPDS) Import. When in the Work Release mode, the user can examine results of the Actual schedule by selecting ACTUAL from the Dataset Selection toggle box.

Shadow Database Feature

The Shadow Database feature allows for users other than the user controlling the actual activities to view the most updated Actual schedule information from their own workstations. The Shadow Actual Database feature is enabled in the Preferences|Process Options screen. Note that this preference is an application-specific (not model-specific) preference. The Shadow Actual Database feature provides the ability to automatically create a "Shadow" (duplicate) copy of the Actual Dataset after each time the Actual Dataset is saved. The computer of the user who is controlling the Actual Dataset, selects the path where the Shadow copy shall reside; it can be on the network as long as the location contains a mapped drive letter.

The following example describes a shadow arrangement: A Control Room User adds activities to the Actual Dataset on the local C:\ drive, a Shadow copy of the Actual Dataset is automatically written to the network drive where other users have access. Other User obtains a copy of the Shadow Actual Dataset, places it on their C:\ drive, and views the dataset with their local copy of ORAM-Sentinel.

The Shadow copy of the Actual Dataset information (database files SCHDMST2.BTR and SCHEDUL2.BTR), will be updated after any of the following:

- When a new model is opened with YES selected in the Overwrite Actual option on the Select and Load from Archive screen. Schedule files in the model being opened will be copied to the shadow location after the model is open.
- When a schedule file is imported to the Actual Dataset from the Schedule Planning mode
- When adding an activity to the Actual Dataset from the Schedule View
- When any manual Work Release activity edits are saved
- After each IPDS import to Work Release

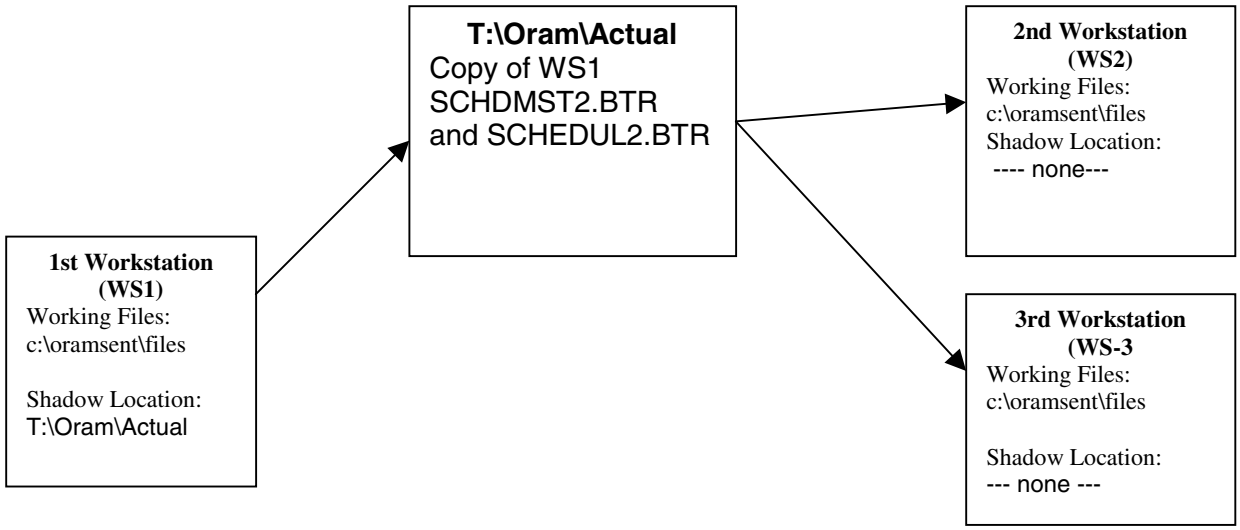
Example Setup of ORAM-Sentinel v3.4 Shadow Database Usage.

Refer to the diagram below for a diagram of an example setup.

The first workstation, WS1 is updating the Actual Database (SCHDMST2.BTR and SCHEDUL2.BTR) on WS1 ORAMSENT\FILES directory (the Working Files directory, as defined in the Directories Editor). A copy of SCHDMST2.BTR and SCHEDUL2.BTR from WS1 is placed in the Shadow Location (e.g., T:\ORAM\ACTUAL) every time changes are made.

Workstations WS2, WS3, etc., can examine this information by copying the files SCHDMST2.BTR and SCHEDUL2.BTR from the Shadow Location to their Working Files directory.

NOTE: The Shadow Location feature only provides the ability to copy the files SCHDMST2.BTR and SCHEDUL2.BTR from the workstation Working Files directory (typically C:\ORAMSENT\FILES) to the user-defined location. ORAM-Sentinel always reads its data from the working files directory established in the Directories editor.



Note that the only way the second workstation can read the Shadow Database that exists on the specified network location is to copy those files (SCHDMST2.BTR and SCHEDUL2.BTR) from that location to the Working Files directory of the second workstation. The Shadow Database location should not be used as the Working Files directory, as this will prevent the Actual Dataset files from being written to or read from while they are being used by the workstation that is mapped to them. It is not recommended to have more than one workstation simultaneously updating the shadow copy.

The session of ORAM-Sentinel on the computer that is producing the Shadow Database files does not have to be closed for others to copy from the Shadow location. However, while the Shadow Database is being updated, the files will be temporarily locked from other users.

For the workstation where the files are to be copied, ORAM-Sentinel must not be running when the user copies these files down to the hard drive.

Configuration Information (From, To, and Duration)

The current configuration (or current "time slice") being analyzed in Work Release is displayed in the upper left-hand corner of the Work Release screen. The Duration of the configuration is calculated from the From and To fields. When the user selects the NOW! Button, the current configuration which encompasses the computer clock time will be selected. Note the current configurations is a subset of the Results Date Frame, and will only be equal to the Results Date Frame when there are no unique configurations created by activities within the chosen date frame.

Overall Status

In addition to the SFAT, PTAT and PSA assessments, ORAM-Sentinel includes an Overall Plant Status Assessment. The Overall Plant Status allows a single color to represent the overall assessed configuration safety. For at-power evaluations, the Overall Status may be derived from the at-power Safety Function Assessment, Plant Transient Assessment, PSA results, or combinations thereof. For outage evaluations, the Overall Status may be derived from the Outage Safety Function Assessment, Integrated Safety Assessment, PSSA results, or combinations thereof. The user can define the logic formula for this display by editing the variable OVERALL_STATUS in the User-Variable Database. Double clicking on this box allows the user to trace on the expressions for the status.

Safety Functions Status

The Safety Function Status section lists each of the Safety Functions and their respective color results in the adjacent box . The colors GREEN, YELLOW, ORANGE and RED represent the best to worst condition, respectively, in terms of the Safety Function status. These assessments are traceable to the respective assessment tree diagrams.

The SFAT Status Box is displayed below the Overall Status box. Similar to the Overall Status box, the SFAT Status box shows a color (based on variable SFAT_STATUS) and an integer number (based on SFAT_SCORE). If the score variable is 0 (zero), no number is displayed. Double clicking on this box allows the user to trace on the expressions for the status and score variables.

The entire Safety Function Status display can be hidden by changing the View Options in the Preferences screen; this setting is model-specific and may be different for each mode (Outage and Online).

Plant Transients Status

The Plant Transients Status section lists each of the Plant Transient Assessements and their respective color results in the adjacent box. The colors GREEN, YELLOW, ORANGE and RED represent the best to worst condition, respectively, in terms of the Plant Transient status. These assessments are traceable to the respective assessment tree diagrams.

The PTAT Status Box is displayed below the Overall Status box. Similar to the SFAT Status box, the PTAT Status box shows a color (based on variable PTAT_STATUS) and an integer number (based on PTAT_SCORE). If the score variable is 0 (zero), no number is displayed. Double clicking on this box allows the user to trace on the expressions for the status and score variables.

The entire Plant Transients Status display can be hidden by changing the View Options in the Preferences screen; this setting is model-specific and may be different for each mode (Outage and Online).

PSA Results Status

The PSA Results section displays the modeled PSA endstates and their values for the configuration. Additionally, the Remain-in-Service, Return-to-Service, and Compensatory Actions for the configuration are shown.

If the Time-Tracking Feature is implemented, the values of the Allowed Outage Time (typically ISAR_AOT) and Hours in Configuration (TIME_CONFIG) variables are shown above the PSA Endstates. Refer to Section 5 for a further description of the Time Tracking feature.

The PSA Status Box is displayed below the Overall Status box. Similar to the SFAT and PTAT Status boxes, the PSA Status box shows a color (based on variable PSA_STATUS) and an integer number (based on PSA_SCORE). If the score variable is 0 (zero), no number is displayed. Double clicking on this box allows the user to trace on the expressions for the status and score variables.

The entire PSA Results Status display can be hidden by changing the View Options in the Preferences screen; this setting is model-specific and may be different for each mode (Outage and Online).

3 User-definable Display Fields;

The modeler has the option to display up to three “User-definable Display Fields” below the Results views. The outage model and the online model can each have their own display and logic definitions. For each field, the user can select the title of the field that appears on the screen and the numeric format (integer, decimal, or scientific). The display definitions and the logic are saved with the model. The expressions for variables that represent the color and numerical result are defined in the User Variable database. The appropriate variables are listed

later in this section of the manual. The fields can only display numerical answers as shown in the following examples:

Days since S/D (dys)	12.50
Time to boil (hrs)	24
RCS Boil Freq	3.620 E-005

External Utility Launching

The user has the ability to define and launch external executables from within ORAM-Sentinel. The RUN EXTERNAL PROGRAM feature is accessed from under the TOOLS menu in both Schedule Planning and Work Release. Four unique command lines can be defined on the External Application Launcher window (Figure 6-2), and each can be RUN. The command lines defined are stored in the ORAMSENT.INI file. To enter, edit, or delete a command line, enter the desired field, perform edits, then select CLOSE to save changes.

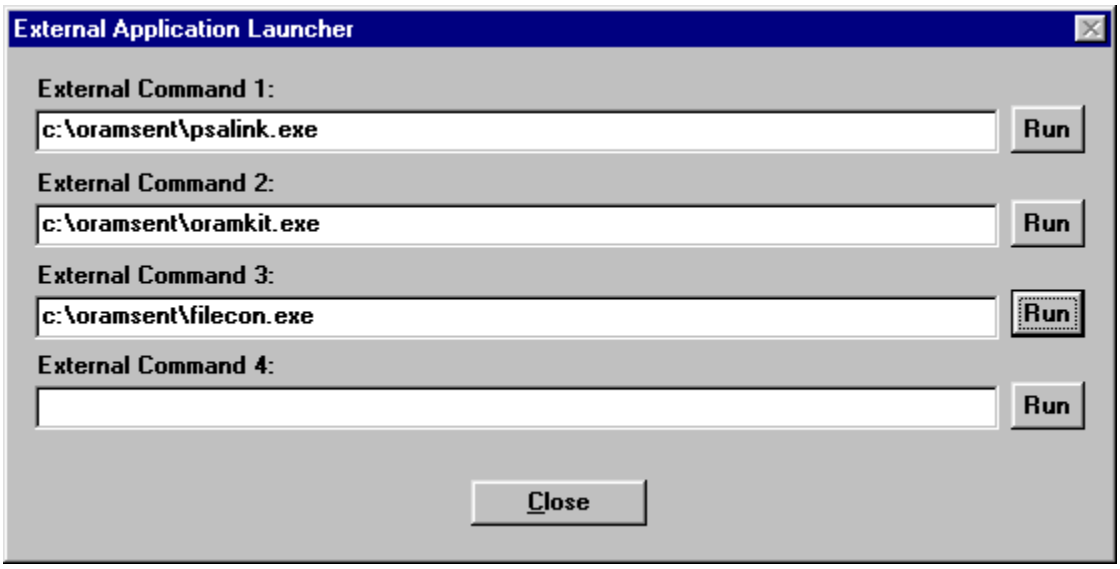


Figure 6-2
External Application Launcher

WR Results Data Export Button

The Export button allows the user to export the results data for the configuration being analyzed to a text file WREXPORT.TXT. The file will be created in the Export File Path directory as defined in the Directories editor under the FILE menu. The Work Release export text file contents will be based on the current data on the SCREEN. Therefore, if the user is performing a what-if analysis, the export will include data for that analysis. The Work Release export includes the following information, if applicable:

- The UserID, date and time of the export
- The Model Name and Description
- Configuration Information (e.g., mode, start date/time, duration)
- Overall Results color
- SFAT Results color, including Overall SFAT Color and Score
- PTAT Results color, including Overall PTAT Color and Score
- PSA Results values, including Overall PSA Color and Scor, and the ISAR configuration index
- Remain-In-Service, Return-To-Service, and Compensatory Actions from the PSA Results database record
- Allowed Outage Time and Hours in Config (if the Time Tracking Feature is enabled)
- All PCDB variables in non-default state and Front Line PCDB Variables with failed Dependency Fault Trees

Note: All color information is provided in a textual representation (e.g., G, Y, O, R, or W)

Only the information that is visible on the Work Release screen will be included. Therefore, if any results are hidden, based on the model preferences, those results are not included in the export.

Schedule View Button

The SCHEDULE VIEW button allows the user to access the Gantt chart view of the maintenance schedule for the active dataset. The Work Release Schedule View will display all activities for the Dataset within the Date Frame, including what-if activities. In the Work Release Schedule View, the activity information can not be displayed by clicking on the activity (the user should select the All Activities button), and the Overall Status bar is not displayed at the top of the Schedule View. Therefore activity data cannot be edited from this view. While the Schedule View is open, the PRINT button on the tool bar can be used to provide a Schedule View report.

All Activities Button

The ALL ACTIVITIES button on the Work Release screen displays the Activities For All PCDB Variables editor (Figure 6-3). This editor displays all activities for all PCDB variables within the Results Date Frame, from both Datasets. Activities will be marked with "P" or "A" for the Planned and Actual Dataset, respectively. An item marked with an asterisk (*) indicates that this activity has been added or edited, and saved to the Actual Dataset from the Work Release Grid Panel. An activity with a colored A or P (RED when not selected, Blue when selected), indicates that the activity is a what-if activity and is not stored in the Dataset. Within the Activities For All PCDB Variables view, the user will be able to CONVERT (from Planned only) ADDNEW, EDIT and DELETE activities.

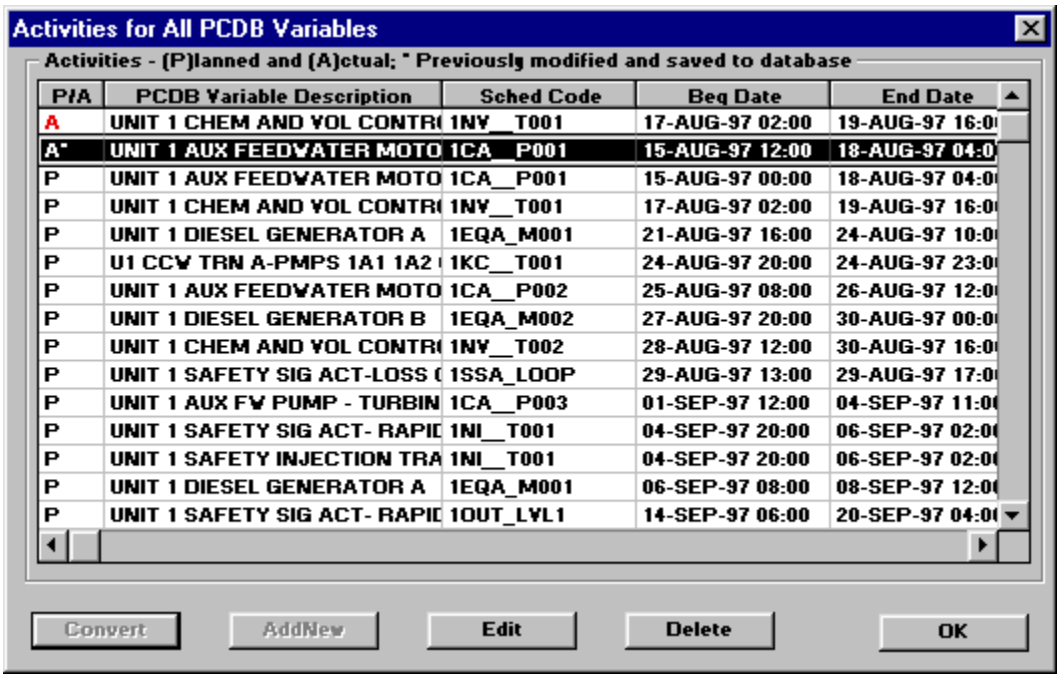


Figure 6-3
Activities For All PCDB Variables Screen

Current Acts Button

Selecting the "Current Acts" button on the Work Release Screen will display all activities within the dataset associated with the date and time currently being reviewed. The dialog box includes the Variable Description, Activity ID, Dates/Times, Description, and the seven additional activity information fields for those activities. This view is consistent with the Current Activities view in the Schedule Planning Mode.

WorkSheet Button

The WORKSHEET button in the Operations Plant Status View is used to display the Safety Assessment Worksheet (SAWs) associated with the configuration. For details on constructing the Safety Assessment Worksheet database, reference Section 4

What-if Save and Reset

The What-if Save and Reset section is located to the right of the Current Activities button. When any activities or activity edits that are not stored in the Database are being analyzed, the text "WHAT-IF" will appear in bold red letters. Additionally, if the user is in the Actual dataset, the SAVE and RESET buttons will be active. If the user is in the Planned Dataset, only the RESET

button will be active since no changes can be saved to the Planned Dataset from the Work Release mode.

In the Actual Dataset, the SAVE button will write all changes (including new, edited, or deleted activity information) to the Actual Dataset files. If the user has activated the Shadow Actual Database feature, the shadow copies of the Actual Dataset files will updated. In either the Planned or Actual Datasets, the RESET button allows rollback of the modifications made and returns all results on the Work Release screen to their original status.

While in a what-if condition, the user will not be allowed to switch Datasets, Open or Save models, change the Date Frame, perform a manual IPDS import, or import a PCDB Grid file. The user must Save or Reset before selecting these functions. During a what-if condition, if an auto IPDS import notification is made, and the user selects YES to perform the import, the what-if condition will be reset and the IPDS import will occur.

If the user attempts to exit the software to switch modes or units while pending dataset changes exist, the user will be notified that the action will "…Abort all unsaved edits…" and asked if they wish to continue. Selecting YES will abort unsaved edits and continue with the desired action. Selecting NO returns the user to the previous what-if state.

The Save and Reset buttons are disabled when the no data has been modified in the Dataset.

Grid Panel (Wall of Buttons)

The Work Release Grid Panel is the primary interface for viewing and changing the status of PCDB variables. Multiple panels, or Tabs, of user-defined button types and button colors allow the users to tailor the Work Release screens to their preference. From these Tabs, users can Add, Convert (from Planned to Actual), Delete, and Edit activities by interfacing with the user-defined buttons and the associated activities editor.

When the user enters Work Release for the first time after opening an ORAM-Sentinel v3.3 (*.um7) model, an automatic conversion of the PCDB occurs, creating three unique group buttons (Configs, HREs, and Comp/Trains). All features associated with Group buttons, as described below, will be functional. The next subsection "Interfacing with Your Work Release Mode" will describe how to customize the grid panel. Note that the grid panels within a model are different between outage and online

Tabs

Six unique Tab panels can be defined by the user. The title for each tab is user definable and can display 16 characters. On each Tab, a grid panel of 10 columns by 100 rows of buttons exists. A fixed region of 6 columns by 10 rows (60 grid buttons) will be visible without scrolling. The upper left portion of the panel is the default display area; the user can scroll down and right to navigate the remainder of the grid panel. The Tab is highlighted YELLOW when any variable on the tab (represented by a single or group button) is not in its default state.

Buttons

Three types of buttons can be defined and displayed on a Tab: Title buttons, Single PCDB buttons, and Group buttons. Title buttons are static and only display text. The Single PCDB and Group buttons are active buttons that connect the user to the PCDB variables in the model. Single buttons are connected to a Single PCDB variable. Group buttons connect the user to a list of PCDB variables defined for that button. The labels that appear on the buttons are also user-definable.

The button colors are defined by selecting a color from the color palette for each setting. The static color for the Title buttons and the Group buttons are defined on the WR Color Assignments tab of the PCDB editor as shown in Figure 6-4.

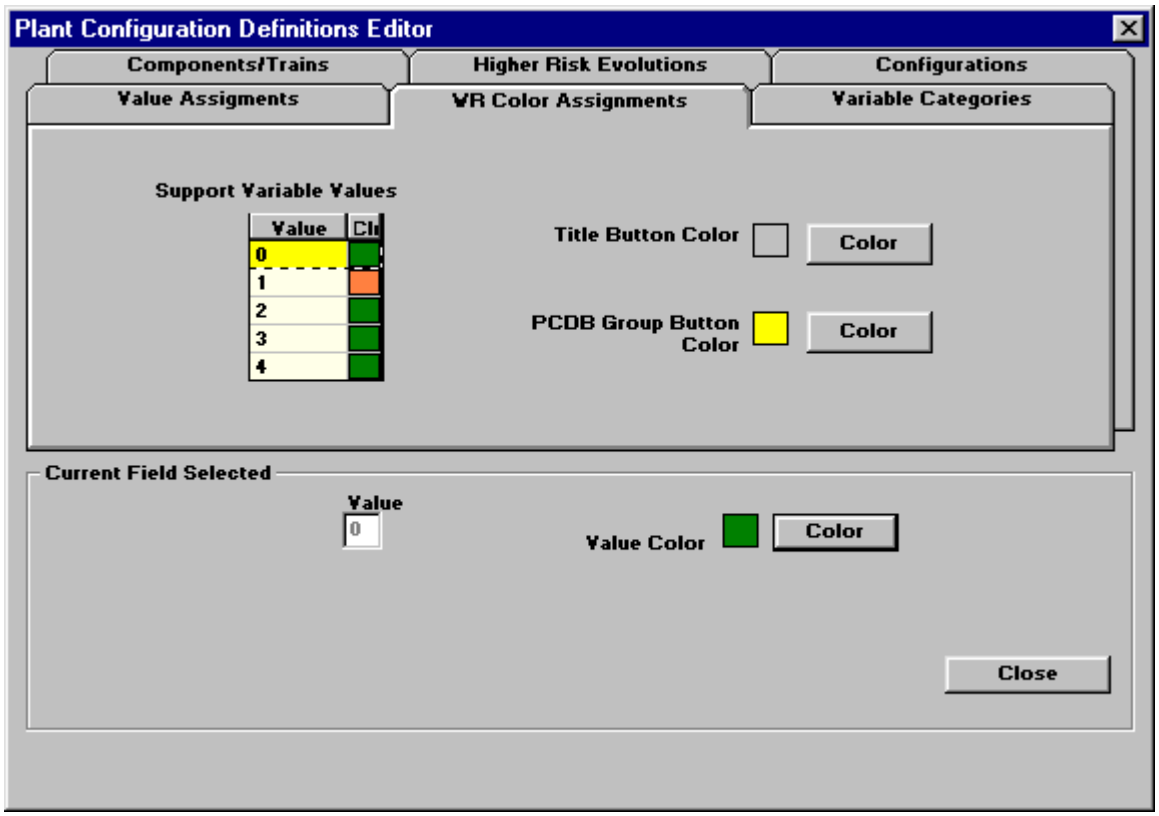


Figure 6-4
PCDB - WR Color Assignments Screen

Single button colors for the Configuration PCDB variables are defined on the Configurations tab of the PCDB. There are only 2 color assignments for the Configuration variables: one color for the variable in the default state, and a separate color for a variable not in the default state.

Single button dynamic colors for Components/Trains and HRE variables are based on either

- The color assigned to the Value in the Allowable Values tab of the PCDB editor, or

- The value assigned to the WR Support Variable result that is defined on the WR Color Assignments tab of the PCDB editor (Figure 6-4).

WR Support Variable values have colors assigned to the numeric representations of 0,1,2,3,4. Therefore, the WR Support Variables assigned must return one of those values for the button to display a color.

The default values for the button color assignments are as follows:

- Title buttons: Grey
- Single PCDB buttons: White (implies all value assignments WHITE)
- Group Buttons: YELLOW
- Configuration Default: GREEN
- Configuration Non-default: GREEN
- WR Support Variable: GREEN (implies values 0-4 are assigned GREEN)

Default Grid

The Default Grid for all models converted from ORAM-Sentinel v3.3 (*.UM7) will be three Group buttons: CONFIGURATIONS, HREs and COMPONENTS. This is true for both outage and online modes.

Transaction Log File

The Transaction Log File is a text file that maintains an active log of all Actual Dataset modifications as they are saved. It records all manual activity saves, manual IPDS imports, auto-IPDS imports, and Schedule Planning schedule imports to the Actual Dataset. The user can specify the output file-path for the log file on the General Tab of the Preferences editor; this setting is model specific.

The log file records the following information for each log entry:

- Log Entry Date and Time (time the Actual Dataset was saved)
- The ORAM-Sentinel UserID All activity information of the modified state (not for Schedule or IPDS imports)
- Manual Edits will labeled either: NEW, DEL, or EDIT as appropriate
- Schedule Imports and IPDS imports will be marked by the filepath along with the import date frame

Interfacing With Your Work Release Mode

The following subsections describe the use of the new Work Release Mode, as well as any new features added in v3.4 to support the new databases and functions of the improved Work Release Mode.

Dataset Results and Saving/Opening Models

Since the user may want to protect the existing Actual schedule information on both the local machine and in the Shadow Copy location, the user must select whether to overwrite the Actual Schedule information when opening a model. This is done by selecting a YES/NO option on the Open Model dialog.

- If NO is selected, the Actual Schedule files (SCHEDUL2.BTR and SCHDMST2.BTR) will be protected in the Working Files directory (typically C:\ORAMSENT\FILES), and in the chosen Shadow Location, if implemented.
- If YES is selected, the Actual schedule files in both locations will be replaced with the Actual Schedule files in the archived model.
- If neither YES or NO is chosen, the model cannot be opened and a message will request that a selection is made.

A default setting for this option can be defined in the General Tab of the Preferences Editor. Note that Planned schedule data will always be overwritten when opening a model. The warning message that appears after selecting OK will be consistent with which databases are being overwritten.

The ability to select whether to save Actual and/or Planned Dataset information and results when archiving models is also provided. When a dataset is not selected to be saved with the model, the schedule information and the results information for that dataset will not be archived with the model. These settings can be chosen from the Select and Save to Archive dialog.

Note that ORAM-Sentinel v3.4 allows for any file type (other than *.trn) to be archived with the model. These files must be placed in either the Files or Unit# directory before the model is saved. When the model is opened, all files previously archived with the model will be placed in the appropriate directory from which they were saved.

Setting Preferences for Work Release Mode

The Work Release results display options are chosen from the Preferences editor located under the FILE menu. Refer to the figures provided for example settings for the Work Release Screen. Note that only preferences important to the Work Release Mode operation are discussed in this section. Refer to Section 4 for preference settings for other ORAM-Sentinel features.

General Tab

On the General tab of the Preferences Editor (Figure 6-5), the following Work Release settings are defined:

Duration - The Default Activity Duration setting defines the default duration of all new activities added from the Activity Editor in the Work Release mode. The default start date/time for new activities in the Work Release is the computer clock date/time when the AddNew button is selected from the Activity Editor. The end date/time for the activity is calculated by adding the default duration to the start date/time. The format for the setting is HHHHH:MM; for a maximum duration of 10,000 hours and zero minutes. The minimum duration is 00:01 (1 minute).

Overwrite Actual Default - This setting allows the user to pre-select the "Overwrite Actual" option on the Select and Load from Archive (open model) dialog. When NONE is selected in this preference, the user will be required to select YES or NO to the Overwrite Actual option each time before a model can be opened.

Path to Log File - this setting defines the path to the Transaction Log File that records all Actual database transactions.

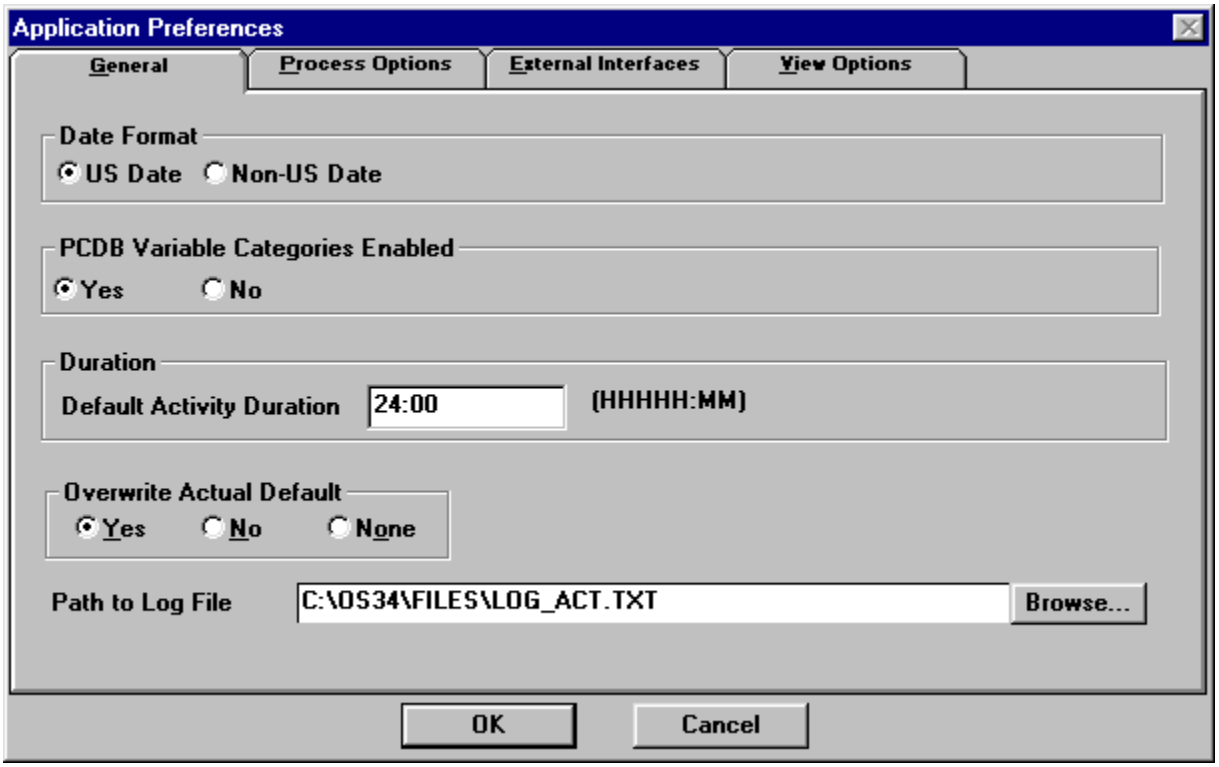


Figure 6-5
Application Preferences – General

Process Options Tab

On the Process Options tab of the Preferences Editor (Figure 6-6), the following Work Release settings are defined:

Time Tracking - When this feature is enabled along with the PSA Results Status display, the values for the Allowed Outage Time variable and Hours in Configuration variable are displayed with the PSA Results Status section of the Work Release Screen. If the PSA Results Status display is not enabled, these variables will not be displayed on the Work Release screen.

Shadow Actual Database - When this feature is enabled, the Actual database files will be copied to the Shadow Directory chosen by the user after Actual database modifications. A drive letter must be used as part of the location setting; network locations must be a mapped drive.

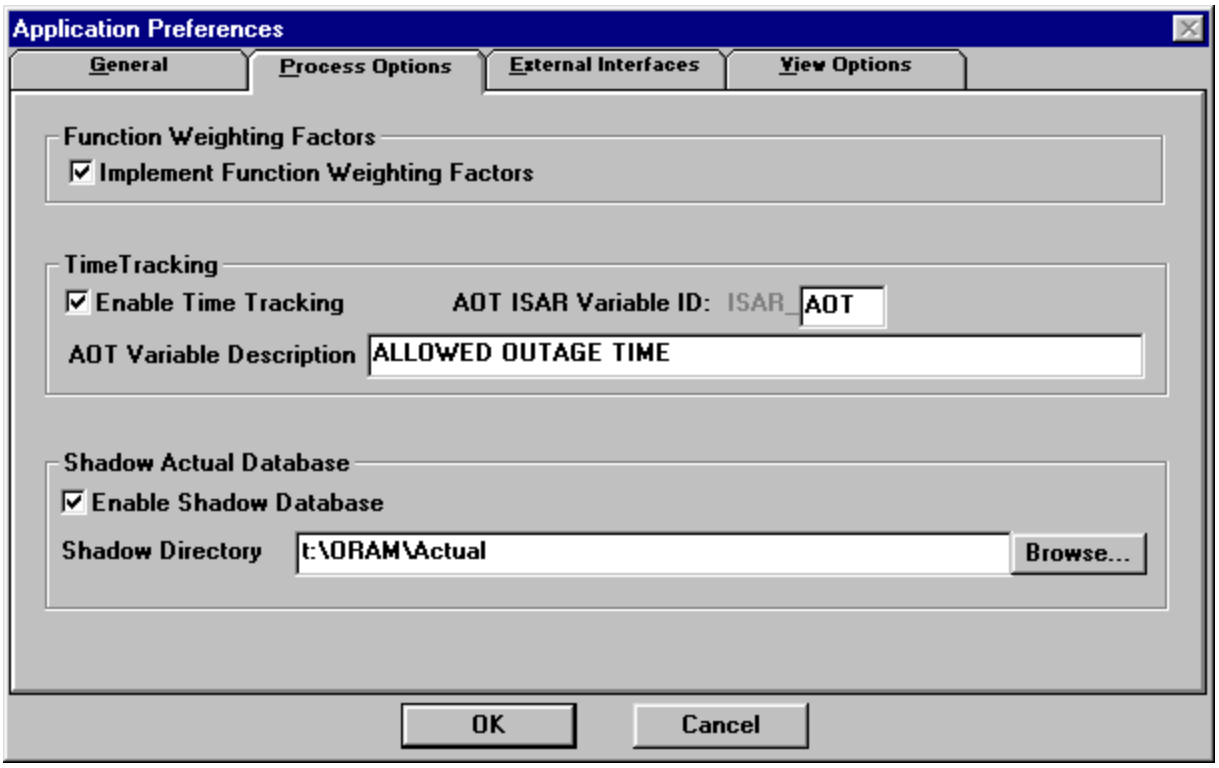


Figure 6-6
Application Preferences – Process Options

External Interfaces Tab

On the External Interfaces tab of the Preferences Editor (Figure 6-7), the following Work Release settings are defined:

PSA Results - In this portion, the user can define whether to be notified if a PSA Result does not exist, "Alert if No PSA Result," and/or whether to be notified if the PSA Result record has not been reviewed, "Alert if Result Not Reviewed." When appropriate, bold red words will be

displayed above the PSA endstates on the Work Release screen to alert the user to the appropriate condition.

If linking to an external PSA Engine, the Use PSA Engine box should be checked and the appropriate settings made in the Define PSA Engine preference.

IPDS - This preference performs two functions. The Path to IPDS field defines the location of the IPDS import file. When performing a manual IPDS import from the Work Release mode, this file location will populate the IPDS import file name. If this portion of the preference is not competed, the user can browse from the IPDS import screen to locate the correct file.

When the IPDS Auto Polling feature is enabled, and a polling frequency is selected, the Work Release mode will automatically compare the last IPDS import time stamp (the last time the IPDS was imported to ORAM-Sentinel) with the modified date of the defined IPDS import file. If the file time stamp is newer than the last IPDS import, the Work Release mode will display a window notifying the user that the IPDS import file has changed..

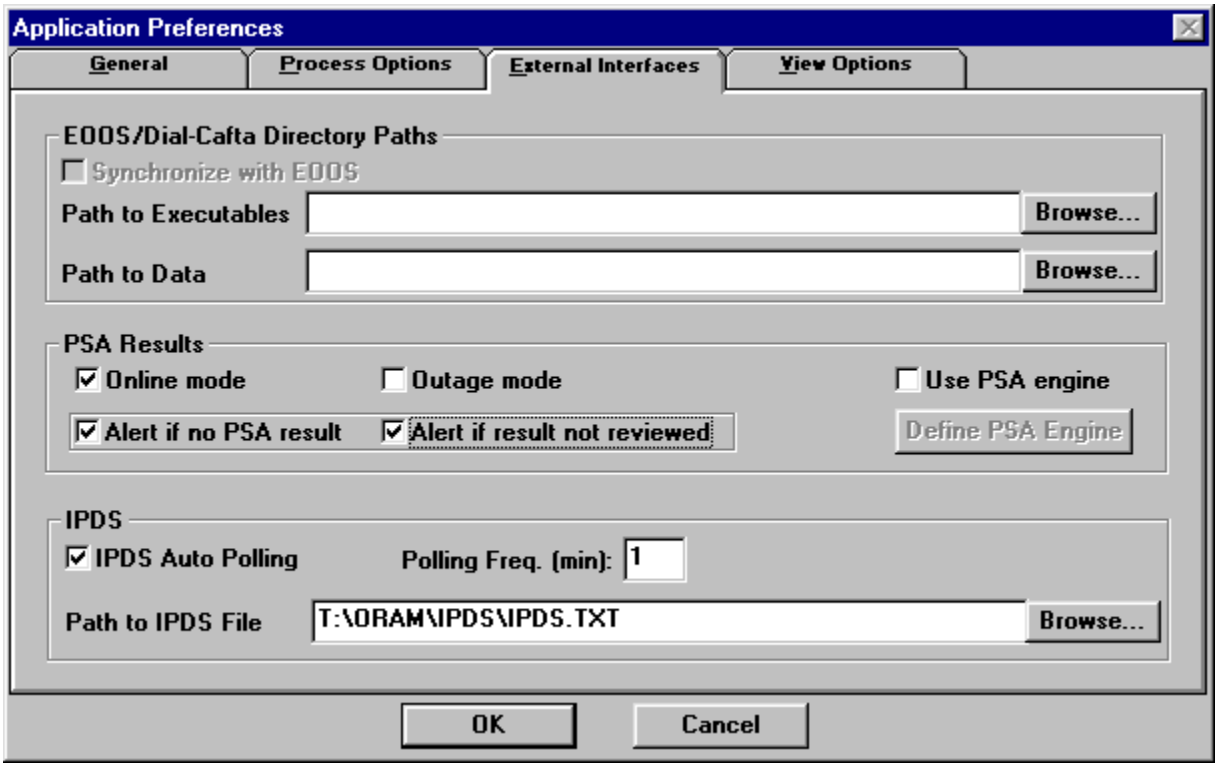


Figure 6-7
Application Preferences – External Interfaces

View Options Tab

On the View Options tab of the Preferences Editor (Figure 6-8), the Work Release settings are described below. The display options described here are available for both the Online Mode and the Outage Mode. Select the Outage tab on the right edge of this window to define the Outage Work Release Mode display settings and the Online tab for Online Work Release Mode settings. The display settings are:

Display SFAT Results - When enabled, the Safety Functions Status section and its associated status box are displayed.

Display PTAT Results - When enabled, the Plant Transients Status section and its associated status box are displayed.

Display PSA Results - When enabled, the PSA Results section and its associated status box are displayed.

Variable 1 (2, 3) WRUSERVAR1 (2, 3) - When enabled, these settings activate the User-Defined Variable displays on the Work Release Screen. The user can select the title and the display format (integer, decimal, or scientific) for each variable. To assign logic for numeric and color results, access the following variables in the UserVariable Database from Schedule Planning mode (where X is 1,2 or 3).

WROLVAR_STATX	Work Release Online Variable Status #X
WROLVAR_VALUEX	Work Release Online Variable Value #X
WROTGVAR_STATX	Work Release Outage Variable Status #X
WROTGVAR_VALUEX	Work Release Outage Variable Value #X

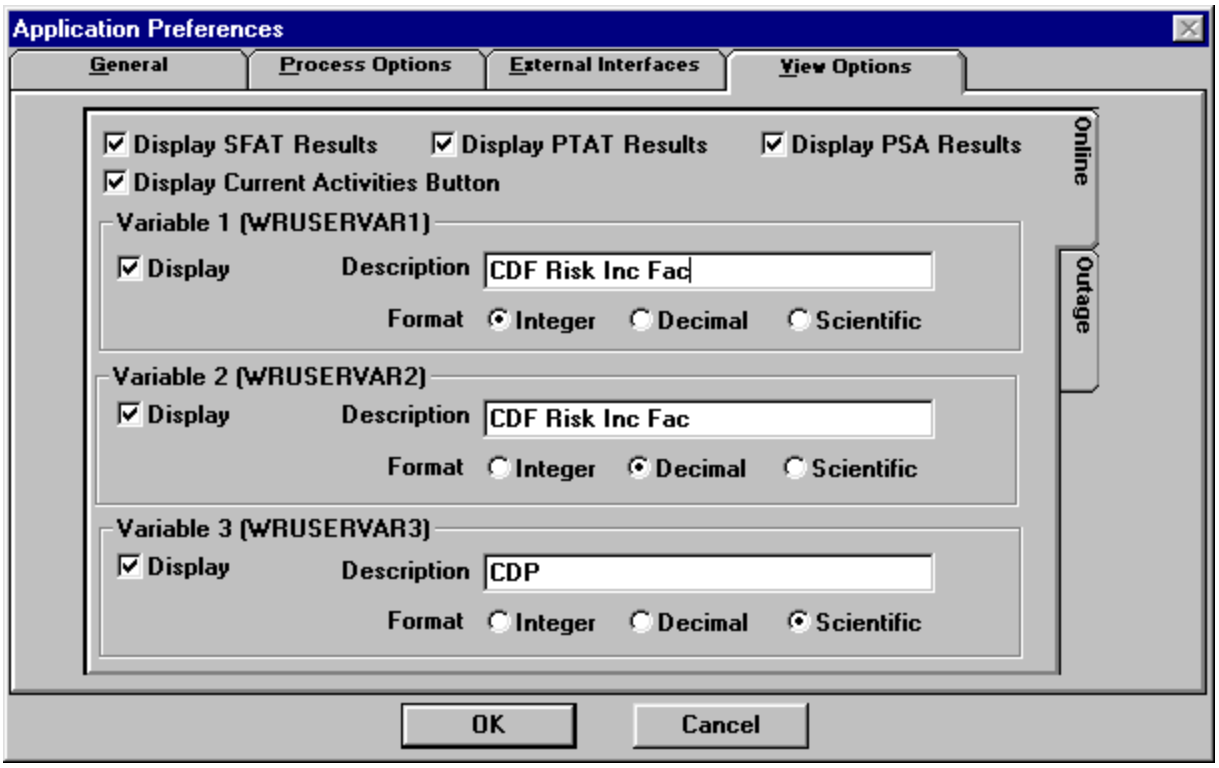


Figure 6-8
Application Preferences – View Options

The Work Release Grid Definition File

Customized Grid Panels in the Work Release view can be created by developing a grid definition file and importing it into the model. Once imported, the grid settings are stored with the model in a Btrieve database file (PCDBGRID.BTR). It is recommended that the Work Release Grid Definition File (a text file) is placed in the model UNIT# directory, so that it is archived with the model for future reference or re-import (ORAM-Sentinel v3.4 archives all files, except *.trn, in the FILES and UNIT# directories when saving a model).

The following section describes the requirement for the Work Release Grid Definition File. The requirements are the same whether importing Outage or Online Work Release Grid Definitions. Only one grid can be defined for each mode (outage/online) of a unit model.

Changes made to the PCDB database are NOT reflected in the WR Grid Panel, except for changes to the PCDB variable descriptions. If PCDB variables, which are on one or more buttons, are added, edited or deleted, the Work Release Grid Definition File must be updated and re-imported to create a new grid panel.

Comment Lines

Comment Lines will be ignored by the import process and can be used on any line in the Definition File. A comment line must begin with *, as shown in the following example:

```
** Unit 1 Online WR Grid Import File 02/02/01
```

Tab Definition

The user can define up to 6 tabs in a Grid Definition File. No Button Definitions will be allowed unless a Tab Definition precedes it. A Tab Definition will have the following format (Note: The spaces after the semicolon delimiter are optional):

```
TAB; Tab#; TabTitle
```

Where,

TAB (in all caps):is the indicator that the remaining information on the line is a tab definition.

Tab# is the tab number and must be a value from 1 to 6.

TabTitle is the title to be displayed on the tab header (upper and lower case allowed).

Button Definition

All lines that do not begin with ** or TAB will be considered Button Definitions. Button Definitions will be assigned to the TAB definition that immediately precedes it. The Button Definition has the following format (Note: The spaces after the semicolon delimiter are optional):

```
Column; Row; ButtonTitle;ButtonType; ButtonData
```

Where,

Column is the column in the grid for the button (x position)

Row is the row in the grid for the button (y position)

ButtonTitle is the text to appear on the button (allows for upper and lower case, and spaces).

ButtonType must be:

1 = Title Button
2 = Single PCDB Button
3 = PCDB Group Button

ButtonData is the variable(s) to be associated with the button and will contain the following:

Title Button - No button data will be imported.

Single PCDB Button - The button data will contain the PCDB variable name and an optional support variable name. The support variable name will be separated from the PCDB variable name by a semicolon.

PCDB Group button - The button data will be a comma-delimited list of the PCDB variables associated with the group.

Import File Restrictions

The restrictions below apply when importing grid files.

Note: All lines in the import file are checked for errors prior to grid overwrite. No data in the existing grid will be overwritten until the import contains no errors.

Tab Restrictions

- The first three characters of a tab definition line must contain the letters TAB.
- *Tab#* must have a value of 1, 2, 3, 4, 5, or 6.
- *TabTitle* can be longer than 16 characters. If it is longer it will not cause the import to be aborted, but it will be truncated to 16 characters.

Button Restrictions

NOTE: The user must ensure that no duplicate Button Locations are defined in the grid import file.

- *Column* must be an integer between 1 and 10, inclusive.
- *Row* must be an integer between 1 and 100, inclusive.
- *ButtonTitle* can use any characters, including spaces, with a maximum of 16 characters.
- *ButtonType* must be 1, 2, or 3

  If *ButtonType* is 1 (Title Button) then no further fields on that line will be read

  If *ButtonType* is 2 (Single PCDB), then no more than two additional fields will be checked in the button data. The first field in the button data must be a valid PCDB variable. If there is a second field in the button data for a Single PCDB button, then it must be a valid variable from the Available Variables List (includes PCDB Variables, User Variable, and Fault Tree Names).

  If *ButtonType* is 3 (Group PCDB), all fields in the data area for a Group Button must be valid PCDB variables.

Example Grid Import File

The example below shows an example grid import file.

```
** Guided Tour Model example Grid File
TAB; 1 ; RN equip
1; 2 ; RN PMP Picklist ; 3 ;U1_RN_PMP_1A,U1_RN_PMP_1B
2; 2 ; RN Pumps ; 1
2; 3 ; RN Pump 1A w/ FT ; 2 ; U1_RN_PMP_1A ; FT1RN_1A
2; 4 ; RN Pump 1B w/ FT ; 2 ; U1_RN_PMP_1B ; FT1RN_1B
4; 3 ; U1_ETA ; 2 ; U1_ETA
4; 4 ; U1_ETB ; 2 ; U1_ETB

TAB; 2 ; RN Group example
1; 1 ; RN Pumps group ; 1
1; 2 ; RN Pumps ; 3 ;U1_RN_PMP_1A,U1_RN_PMP_1B

TAB; 3 ; Electric Power
1; 3 ; EDG A ; 2 ;U1_DIESEL_GEN_A
1; 4 ; EDG B ; 2 ;U1_DIESEL_GEN_B
2; 3 ; U1_ETA ; 2 ; U1_ETA
2; 4 ; U1_ETB ; 2 ; U1_ETB

TAB; 4 ; BLANK

TAB; 5 ; Config Example
4; 1 ; SSA Rx Trip ; 2 ; U1_SSA_RT
```

Grid Importing

Separate grids can be defined for the Outage and Online Modes. Only two grids, one for each mode (Outage and Online), can be contained in the ORAM-Sentinel model. However, users can create and maintain multiple Grid Definition Files if they choose.

Prior to importing a grid, a valid Work Release Grid Definition File must be created in accordance with the specifications provided in previous sections.

To perform the Work Release Grid Import, select IMPORT PCDB BUTTONS from the TOOLS menu in the Work Release Mode. This opens the PCDB Button Definitions Import dialog, as shown in Figure 6-9.

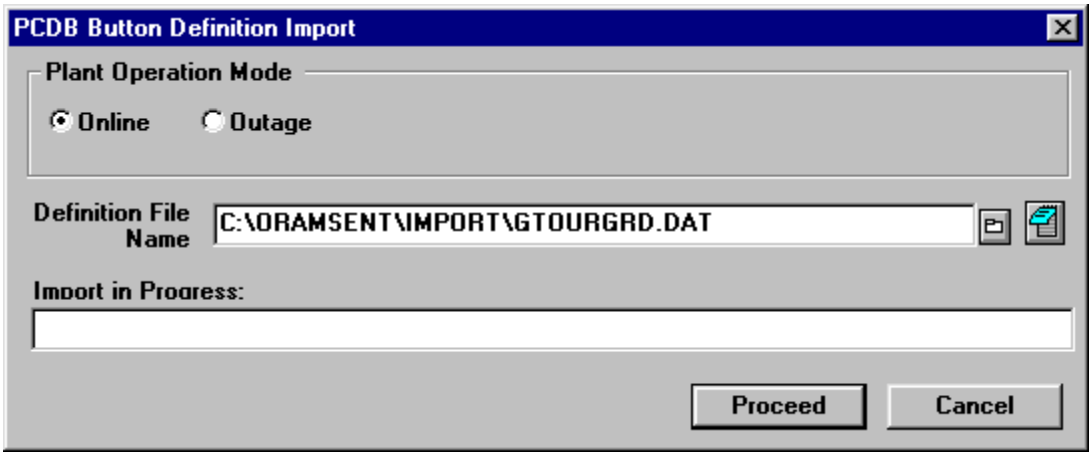


Figure 6-9
PCDB Button Definition Import

Use the browse button to select the Grid Definition File, and choose the Plant Operation Mode (Online or Outage) for that definition File. Select PROCEED to perform the import. If any errors exist in the definition file, the import will abort and provide a list of errors. Once the definition file is error-free, it will be imported and the Work Release Grid Panel will be updated.

Grid Buttons Operation

This section describes the functionality and operation of the various types of buttons in the Work Release Grid Panel: Title Buttons, Single PCDB Buttons and Group Buttons. Button color definitions and links to PCDB variables are described in previous sections.

Title Buttons

Title Buttons are static and provide no active function.

Single PCDB Buttons

Single PCDB buttons are assigned to one PCDB variable each, with the option of assigning a Work Release Support Variable.

When the user primary clicks (typically a left mouse click) on a Single PCDB button, the Activity List Editor for the applicable PCDB variable will appear as in Figure 6-10. Editing activities from this dialog is described in the next section, "Manual Activity Editing with Grid Panels."

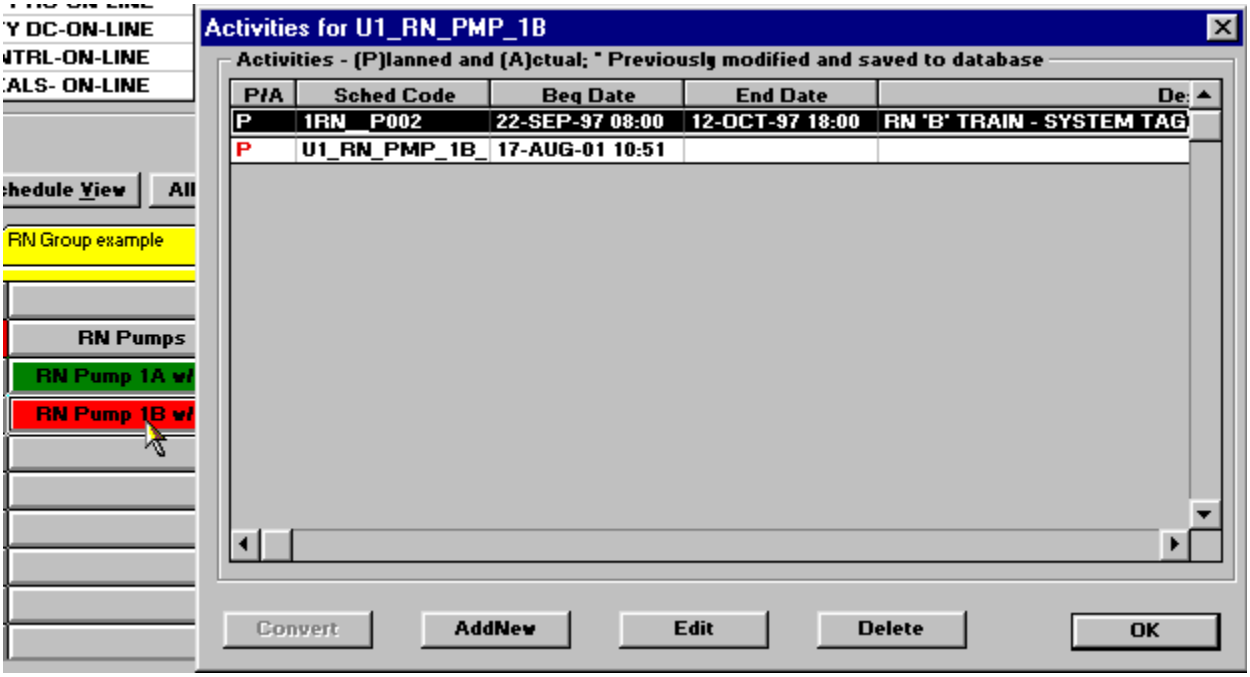


Figure 6-10
Work Release Activity List Editor

When the user secondary clicks on a button (typically a right mouse click), a shortcut menu is displayed that shows the allowable values for the PCDB variable, with the default value listed first (see Figure 6-11). A check-mark is provided on the shortcut menu to indicate the current value of the PCDB variable. If a Work Release Support Variable is assigned to the button, the support variable name with its current value will appear below the separator bar on the shortcut menu. When the PCDB variable is changed using a secondary click, a milestone activity is added.

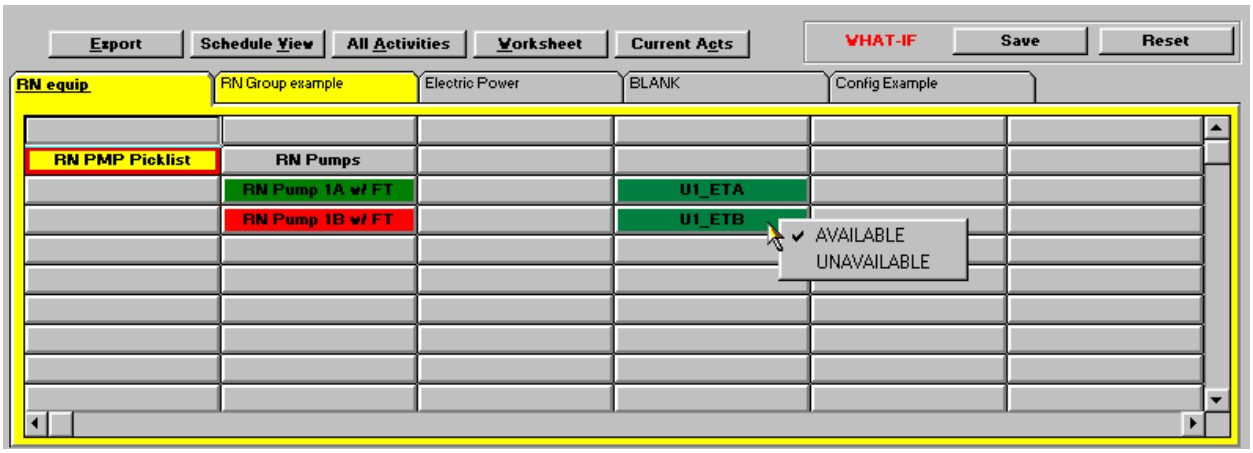


Figure 6-11
Secondary Click on Single Button (Shortcut Menu)

The display color for a Single PCDB Button is based on the following rules:

- If the PCDB variable IS NOT in its default state, use the color assigned to the PCDB variable's value stored in the Value Assignments tab of the PCDB editor.
- If the PCDB variable IS in its default state, use the color assigned to the value of the Work Release Support Variable, if applicable. If no Work Release Support Variable is assigned to the button, use the color assigned to the PCDB Variable's default state stored in the Value Assignments tab of the PCDB editor.

Group PCDB Buttons

Group Buttons are used to assign multiple PCDB variables to a single button. The Group Buttons are assigned a static color in the Work Release Color Assignments tab of the PCDB editor. If any variable in a picklist is NOT in its default state, the Group Button will be have a red border. Therefore, the user can easily locate the Group Button(s) that contain variables not in their default state.

When the user primary clicks on a Group Button, a picklist dialog is displayed which lists the PCDB variables assigned to that Group button, as seen in Figure 6-12. The list includes the variable description and the current allowable value. Variables are sorted alpha-numerically by the PCDB variable description. A dropdown box is provided to allow the user to change the current value. This method for changing PCDB variable values is comparable to the secondary click method for Single Buttons. A milestone activity is added when the variable state is changed in this manner.

Between the Value and Description column on the picklist, there is a narrow column for Frontline Fault Tree (FT) Dependencies. If a Frontline FT Dependency is assigned to the PCDB variable, and that fault tree has failed, a "D" will be placed in this column to signify the failed FT dependency. Fault tree dependencies assigned to PCDB variables only affect the state of the variable from a PSA frontline status.

Any PCDB variable that is not in its default state, or has a failed dependency fault tree, is displayed at the top of the picklist and highlighted either yellow or blue, based on the rules described below:

- If a PCDB variable is in its default state (e.g., AVAILABLE), and the assigned Dependency FT is failed (i.e., equals 1), the PCDB variable is moved to the appropriate place at the top of the picklist, highlighted in BLUE, and the current value of the PCDB variable (e.g., AVAILABLE) is shown. Additionally, the "D" should appear the column described above. Note that if the PCDB variable is AVAILABLE, but the Dependency FT is failed, the value of the variable does not change, since the Dependency FT only affects the PSA Results Front Line configuration.

- If a PCDB variable is NOT in its default state (e.g., UNAVAILABLE), the PCDB variable is moved to the appropriate place at the top of the picklist, highlighted in YELLOW, and the current value of the PCDB variable (e.g. UNAVAILABLE) is shown. The "D" should appear if the Dependency FT has failed. Note that if PCDB variable is not in its default state, the highlighted color is always Yellow, regardless of the status of the FT Dependency (if assigned).

Therefore, there are four possible displays for a variable in a picklist:

- Highlighted in Blue with D showing
- Highlighted in Yellow with D showing
- Highlighted in Yellow
- No highlight

Users can find variables in the picklist by using the standard Match Entry feature on the Description column. To use the Match Entry feature, Place the cursor in the description field of any variable, and begin typing. The cursor will move to the first record that matches the characters being typed.

Picklist windows can remain open while performing evaluations in the Work Release Mode. Multiple picklist windows can be open simultaneously, if desired. All open picklist windows will update following a PCDB value change. Note that a variable can be assigned to multiple Group and Single Buttons.

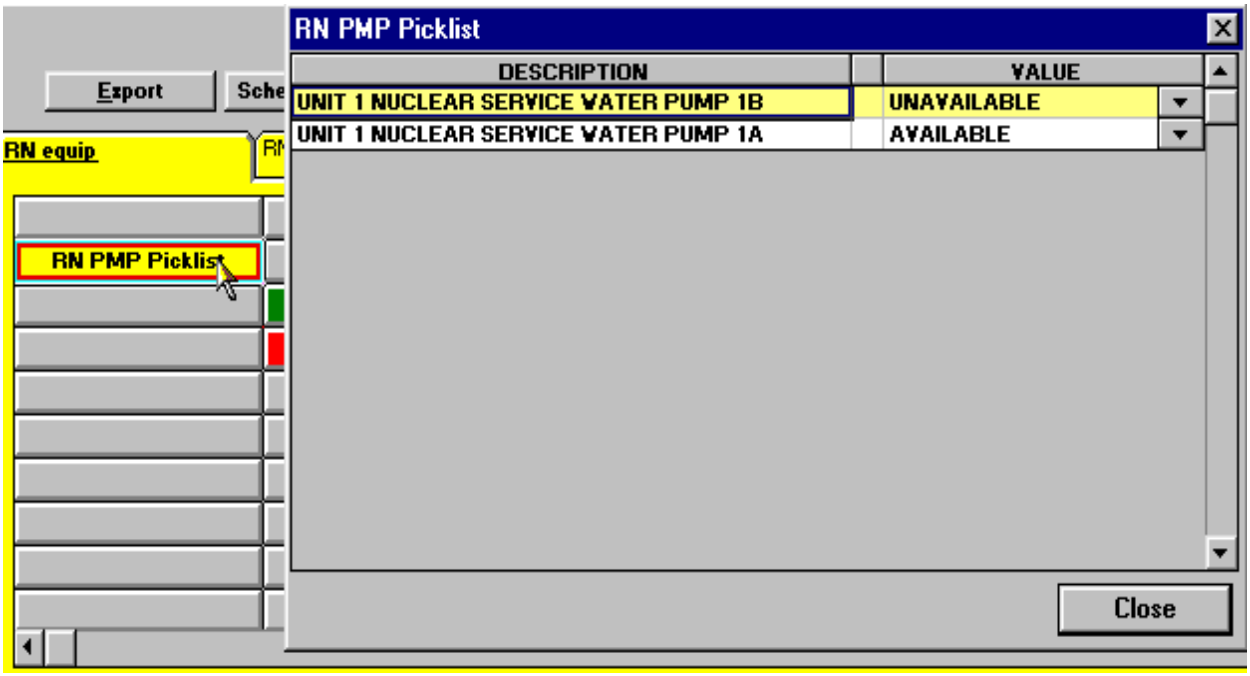


Figure 6-12
Group Button Picklist

Manual Activity Editing with the Work Release Grid Panels

Manual editing of activities from the Work Release screen is accomplished by interfacing with the PCDB variables in the Work Release Grid Panels. Activity editing includes: Add, Delete, Convert (Planned Dataset only) and Editing.

Single Button and Picklist Variable Activity Editor

The Activity List Editor (Figure 6-10) is the primary method for adding hammock (window) activities in the Work Release mode. The Activity List Editor can be accessed by primary clicking (typically a left mouse click) on the Single Button, or by double-clicking on a variable listed in a Group Button picklist. The Activity List Editor will show all activities from both datasets that affect the variable selected for the Results Date Frame. Activities will be marked with "P" for Planned Dataset or "A" for Actual Dataset. Items marked with an "A*" are Actual Dataset activities that were added or edited using the Grid Panel and saved to the Actual Dataset. Activities in the Actual Dataset that are input via the IPDS Import or Maintenance Schedule Import features will be marked with only an "A."

Converting Planned to Actual

If the user desires to convert a Planned Activity (denoted by the "P" in the list of activities), the user selects that row in the list, and then selects the "Convert" button to display the to Activity Data editor as shown in Figure 6-13.

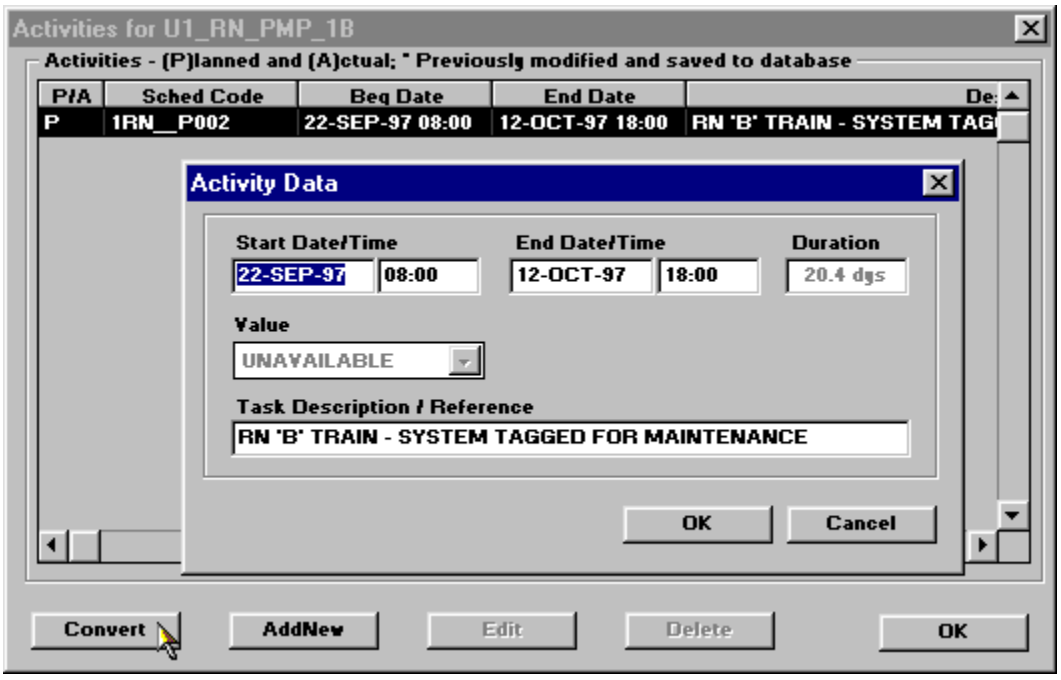


Figure 6-13
Activity Data Editor

This process will populate the Date/Time, and Task Description / Reference fields automatically; but the user can then change any of these fields. The Value field will also be populated, but the user cannot change this field. Additional comment fields associated with the activity, if present, can be edited also. After changes (if any) have been made, OK is selected, and the activity is stored as a what-if activity in the Actual Dataset. The activity will be shown in the Activity List Editor a colored "A" (red when not selected, blue when selected). No changes are made to the planned activity as stored in the Planned Dataset. If the what-if condition is saved, the activity indicator will become a black "AORAM-Sentinel

While in the Actual Dataset, the Convert button will be enabled only when a “P” activity is selected. The Convert button will never be enabled when the user is in the Planned Dataset of the Work Release Mode. The Edit and Delete buttons will be disabled when a “P” activity is selected in the Actual Dataset.

Add New

A new activity can be added by selecting the ADDNEW button, which displays the Activity List Editor.

The default Start Date/Time will be the current Date/Time from the computer clock. The default End Date/Time will be based on the Default Duration setting in Preferences. The user can edit all Date/Time fields when adding a new activity. Deleting the End Date/Time will make the new activity a milestone. The duration field will automatically update with the text "MILE,” representing a milestone.

The Value field is populated with the default state of the variable (i.e., AVAILABLE). The user should use the Value dropdown box to select the appropriate value for the activity being added. A description for the activity can also be added, but the user will not be able to add descriptions to the additional seven Comment Fields from this editor.

When the user is finished, OK is selected, and the activity is stored as a what-if activity for the Actual Dataset and is marked with an “A*” in the Activity List Editor. The ActivityID will be the PCDB variable name concatenated with an underscore and the selected allowable value (e.g., X). For example, the PCDB variable RHRA being set to X will create the ActivityID RHRA_X. Thus, the user is not required to enter an ActivityID or have knowledge of the Import Translation Matrix. In fact, the PCDB variable does not need to be in the translation matrix to add an activity from the Work Release Mode. Note that any activities added from the Grid Panel buttons can not be edited in the Schedule Planning Schedule View screen, unless the ActivityID is in the Import Translation Matrix.

After OK has been selected for either a converted or new activity, the activity will be marked with a colored (red or blue) “A” in the Activity List Editor. The “A” will be replaced with an "A*" when the what-if scenario is saved.

Edit

The EDIT button will only be enabled when the user selects an activity stored in the currently selected dataset. While in the Actual Dataset, if the data for any activity marked with an “A” or "A*" needs to be changed, the user can select that activity and click EDIT to open the Activity Data editor. Changes made will be stored as a what-if in the appropriate dataset until the SAVE button is selected. Planned Dataset editing is similar, although the changes cannot be saved, only viewed as a what-if. Data in any of the seven additional comment fields can be edited? by selecting the VIEW COMMENTS button. The VIEW COMMENTS button is hidden when there is no data in any of the additional comment fields.

Delete

Similar to the EDIT button, the DELETE button will only be enabled when the user selects an activity stored in the currently selected dataset. In the Actual Dataset, any “A” or "A*" activity can be deleted by selecting the activity and clicking DELETE. These changes will be stored as a what-if until the SAVE button is selected. In the Planned Dataset, "P" activities can be deleted for what-if scenarios only.

Single Button Right Click and Picklist Dropdown Box Shortcut

A quick method for adding milestone activities (no end date/time) to the datasets is to use the "shortcut" methods, as described in a previous section. These “shortcut” methods are right-clicking on a Single Button or using the drop-down box in a Group Button picklist.

The result of adding activities in using these shortcuts is to add a milestone activity starting at the computer time. Thus the activity will affect all configurations in the future, but have no impact on past configurations. If the Work Release user is viewing the current configuration (the one that encompasses the computer clock time) and adds a milestone activity, a new configuration will be created at the Start Date/Time of the new milestone, which will be the computer clcok time. The view will change so that the new configuration is shown. If the user adds a milestone activity from a future configuration (a configuration later than the one encompassing the computer clock time), the user will remain in that configuration and will see the impact of the milestone activity. If the user is in a past configuration (before the computer clock), the shortcut methods that add milestones will not impact those configurations.

Milestone activities have no end dates, and thus continue in the future indefinitely, until the activity is terminated or another milestone activity is added which changes the value of the PCDB value from the previous milestone. For actual activity record keeping, it is recommended that the milestone is terminated by editing the activity and adding an End Date/Time.

IPDS Import Feature

The Integrated Plant Datasource (IPDS) import feature allows Work Release Mode users that have an external means of updating the status of plant equipment (such as an electronic log) to either manually or automatically update the ORAM-Sentinel Work Release Actual Dataset with

that information. After the IPDS import is finished, the Work Release Mode will display the results of the new information.

The IPDS import feature is accomplished by importing a formatted text file, similar to the current Maintenance Schedule Import process. The file format requirements for the IPDS import file are identical to the schedule import file that is used in the Schedule Planning mode. The same logic checking and interface is used. However, the IPDS and Maintenance Schedule import files and their paths are designated sepately.

The IPDS import can be accomplished in 3 ways: Manually from the Work Release RESULTS menu, Automatically from the Work Release Mode at a user-defined polling interval, or by Command Line Argument when starting ORAM-Sentinel. The manual and automatic IPDS imports can only be performed while ORAM-Sentinel is in the Work Release Mode with the Actual Dataset selected.

When an IPDS import is performed using any method, ALL activities in the Actual Dataset that were NOT manually edited or added from the Work Release Grid Panels will be removed from the Actual Dataset and replaced with the activities in the IPDS import file. The IPDS import does not follow any rules regarding date frames, thus ALL activities marked “A” in the Actual Dataset will be deleted. Activities that were manually edited or added through the Grid Panels (those activities marked with an “A*”) will be retained in the Actual Dataset. These activities must be manually deleted in order to remove them.

IPDS imports bypass the what-if feature in the Work Release Mode and are saved directly to the Actual Dataset. The date and time of the IPDS import will be written to the ORAMSENT.INI file, and a Transaction Log entry will be recorded.

The following example of IPDS and Actual Dataset interaction is provided:

User enters Work Release Mode in the Actual Dataset which contains no activity information. User initiates a manual IPDS import and imports one activity into the Actual Dataset (the Work Release results update). User selects the All Activities button and sees the activity that was imported, and it is labeled with "AORAM-Sentinel When the activity ends, the user edits this activity from the Work Release Grid Panel and inputs the correct End Date/Time; and selects SAVE to store the information in the Actual Dataset. User selects the All Activities button and notes that the activity is now labeled with "A*" indicating that this activity has been manually modified. When the IPDS import text file is updated by the external program (e.g., electronic log), the user peforms another IPDS import. The IPDS import brings the activity in with the corrected hammock times; however it does not delete the manual edited activity denoted by the “A*.” The user can select the All Activities button and delete the activity with the “A*.”

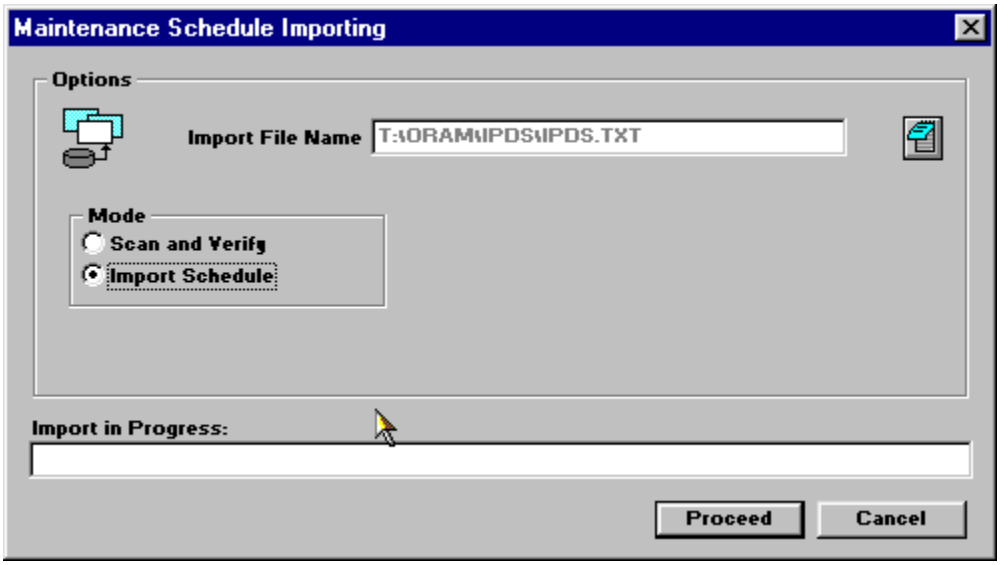


Figure 6-14
IPDS Importing

Manual IPDS Import

The manual IPDS import is accomplished by selecting IMPORT IPDS from the Work Release screen RESULTS menu (see Figure 6-14). The import file location is defined in the External Interfaces tab of the Preferences editor. Note that the IPDS Import dialog (labeled Maintenance Schedule Importing) defaults the import Mode to Import Schedule, rather than Scan and Verify. However, the user can Scan and Verify prior to a manual import, if desired.

Automatic Polling for IPDS Imports

When the IPDS Auto Polling feature is enabled (via the External Interfaces tab of the Preferences editor), the user will be notified when the IPDS import should be performed. The user can click YES on the message box and an IPDS import will be performed immediately, bypassing the dialog shown in Figure 6-14. If the user decides not to perform an IPDS import at the time of notification, click NO. ORAM-Sentinel will then provide another notification at the polling frequency.

The notification that an IPDS Import should be performed will occur when the IPDS Import File's date/time stamp is later than the last IPDS import. ORAM-Sentinel compares these two dates and times at a polling frequency, which is also set in Preferences. The minimum polling frequency is 1 minute.

Command Line Argument

As with the other Command Line Arguments described in Section 5, the IPDS import feature can be implemented when the appropriate switch, "/P" is placed in the command line. ORAM-Sentinel cannot be running when the command line is initiated. The same rules apply for

retaining manually added or edited activities that are indicated with "A*" when the command line is used.

An example of the Command Line Argument for the scenario to open ORAM-Sentinel in Online Work Release mode and peform an IPDS import is provided. Note that the unit and dataset cannot be changed with a Command Line Argument. Therefore, the program must have last been exited from the correct unit and the Actual Dataset.

```
C:\ORAMSENT\ORAMSENT /L:SUPERVISOR: /M:3 /P
```

7
MENU ITEMS

This section describes the items available from the main menu, drop-down menus, viewbar and tool bar.

File

New Model

This procedure deletes the current model in use and generates a new, empty plant model. If the current model is not saved, all data in that model is lost. The user will be prompted with a warning to prevent inadvertent data deletion. An overview of the required tasks for the development of the new model is provided. This option can also be accessed by clicking on the NEW MODEL/RESULTS button on the toolbar. NOTE: Do not attempt to open a model (with the FILE/OPEN command) while the Plant and Unit Description Dialog Box of the new model process is open.

Open

This option permits the user to open a saved model. This option can also be accessed by clicking on the OPEN MODEL/RESULTS button on the toolbar**.**

Save

This option permits the user to save the Unit Model or Results or both. This option can also be accessed by clicking on the SAVE MODEL/RESULTS button on the toolbar.

Directories

This option permits the user to specify the file paths for Applications (Configuration, Working Files, Models, User and Private) and Import and Export (Import File Path, Export File Path). ORAM-Sentinel will use these paths (directories and sub-directories) to locate the associated files. It is essential that the files be located in the specified paths.

Preferences

This option specifies various user options such as the use of external databases including EOOS (Equipment Out Of Service - an EPRI risk analysis tool) and PSA Results (an engine for performing Probabilistic Safety Assessment calculations - specific to each plant).

In the Process Options tab, three features can be actuated. Implement Function Weighting Factors allows the user to assign Weighting Factors to each Safety Function and Plant Transient category. Additionally, ORAM-Sentinel will display the results of an SFAT/PTAT color and score evaluation. Time Tracking allows the user to enter a time-based variable into the PSA Results database which is intended to be used for risk-based allowed outage times, as well as an internal variable which tracks the time that each configuration of front-line components exists. The Shadow Actual Database option allows the user to automatically create a "Shadow" (duplicate) copy of the Actual Dataset after each time the Actual Dataset is saved. The user that is controlling the Actual Database selects the path where the Shadow copy shall reside; it can be on the network as long as the location contains a mapped drive letter.

Configuration

This option permits the user to develop and edit the import translation matrix and the plant configuration definitions databases.

Import Translation Matrix

The import translation matrix allows ORAM-Sentinel to communicate with the maintenance scheduling software by establishing a cross-reference between the maintenance schedule activity codes and the corresponding ORAM-Sentinel variables.

Plant Configuration Definitions

The Plant Configuration Definitions database consists of all Component and Train, Higher Risk Evolution, Configuration and Value Assignment variables and their associated valid values, as well as the Variable Categories.

Security Profiles

This option permits the program administrator to assign, delete or change User IDs and Passwords. The program administrator can assign rights for access to specific features within the program for each ID.

Exit

This option permits the user to exit the program. If model changes have been made, the user should save prior to exiting. If model changes have been made and the program is exited without

saving, the user can restart ORAM-Sentinel where the changes will still exist. If a new model is opened without saving, any changes in the unsaved old model will be overwritten.

Edit

The individual edit buttons on the tool bar duplicate the functions under EDIT on the main menu. These buttons can be viewed in Figure 4-1, Editing Options and are also listed at the end of this section. The undo, copy, cut, and paste function are for text purposes only.

Undo

This option permits the user to undo the previous text changes and restore the text in the current open file to its prior state.

Copy

This option permits the user to copy a block of text to the clipboard. The text to be copied must first be highlighted. The original text remains unchanged. This option can also be accessed by clicking on the COPY TO CLIPBOARD button on the tool bar.

Cut

This option permits the user to cut a block of text to the clipboard. The text to be cut must first be highlighted. The text will be deleted from the file as it is installed on the clipboard. This option can also be accessed by clicking on the CUT (DELETE) button on the tool bar.

Paste

This option permits the user to paste a block of text from the clipboard to the open file. The text will be copied to the file as it appears on the clipboard. This function can be used after the cut or copy function is performed. This option can also be accessed by clicking on the PASTE FROM CLIPBOARD button on the tool bar.

Select a Record

This permits the user to select a specific record from the file that is currently open. This option can also be accessed by clicking on the SELECT RECORD FROM LIST button on the tool bar.

Beginning of File

This permits the user to go to the first record of the file that is currently open. This option can also be accessed by clicking on the MOVE TO BEGINNING OF FILE button on the tool bar.

Previous Record

This permits the user to go to the previous record in the file that is currently open. This option can also be accessed by clicking on the MOVE TO PREVIOUS RECORD button on the tool bar.

Next Record

This permits the user to go to the next record in the file that is currently open. This option can also be accessed by clicking on the MOVE TO NEXT RECORD button on the tool bar.

End of File

This permits the user to go to the last record of the file that is currently open. This option can also be accessed by clicking on the MOVE TO END OF FILE button on the tool bar.

New Record

This permits the user to create a new record in the file that is currently open. This option can also be accessed by clicking on the CREATE NEW RECORD button on the tool bar.

Copy to New Record

This permits the user to copy the current record to a new record in the same file that is currently open. This option can also be accessed by clicking on the COPY THIS RECORD button on the main tool bar.

Delete Current Record

This permits the user to delete the current record from the file that is currently open. This option can also be accessed by clicking on the DELETE THIS RECORD button on the tool bar.

Results

Date Frame Selection

This permits the user to specify the time frame for which the current assessment is being made and for which graphical output will be displayed. It is not necessary for this time frame to match the Date-Frame To Import specified in the Maintenance Schedule Importing dialog box. The Date Frame Selection should be less than or equal to the Date-Frame To Import specified in the Maintenance Schedule Importing dialog box.

Import Planning Schedule

This option displays the Maintenance Schedule Importing dialog box. This permits the user to specify the Import File Name from which the station schedule is to be imported, the Date Frame To Import and the file that contains the translation matrix (table). (Note: The Translation Table defaults to the correct file path and name.) A notepad button to the right of Import File Name allows for viewing the import file.

An option to add additional plant activities that are not part of the import schedule is available under the SIGNIFICANT ACTIVITIES EDITOR button on the Maintenance Schedule Importing dialog box. A mode selection allows the user to Scan and Verify or Import Schedule. The Scan and Verify compares the schedule codes in the import file to the schedule codes in the translation matrix without importing. The Import Schedule moves data into ORAM-Sentinel. This option can also be accessed using the IMPORTING button on the main viewbar.

Maintenance Schedule View

This permits the user to view the planning schedule in a Gantt chart. Double clicking on the task identifier or task duration bar will bring up the Planning Schedule Task Editor which contains specific information including the Schedule and Task Identifier, Start Date and Time, End Date and Time, Task Description and Reference and the Systems and Trains Affected. This option can also be accessed using the SCHEDULE button on the viewbar.

Plant Configurations View

This permits the user to view a snapshot (one plant condition) of the status of items from the plant configuration database. These items include variables for Configurations, Higher Risk Evolutions and Component and Train Status. The time chosen can be changed by using the appropriate edit button(s) on the tool bar.

Recalculate Model

This permits the user to refresh or recalculate the model results after modifications to the model are made or a new station schedule is imported. The user will have an option to display the calculation time for recalculation if desired. This option can also be accessed using the RECALCS button on the viewbar.

Overall Plant Status

This permits the user to display the Overall Plant Status View for a given plant condition. This view includes the resulting safety colors for Overall Status, Safety Functions and Plant Transients. Double clicking on any of the listed safety functions or plant transients will display the assessment tree used and permit tracing back through the fault tree(s) and eventually to the schedule activity. This option can also be accessed using the STATUS button on the viewbar.

While in the Safety Function Status View or Plant Transient Status View, double clicking the mouse button over the date and time of interest will also display the Overall Plant Status View for that date and time.

The five buttons located at the bottom of the Overall Plant Status View are FUNCTIONS LOGIC, SUPPORT STATUS, GUIDANCE AND ACTIONS, PLANT CONFIGURATIONS, and CURRENT ACTIVITIES. Each of these buttons can access additional information about the Safety Function Plant Transient, or Integrated Safety Assessment that is selected.

Safety Functions Status

This permits the user to display the Safety Function Status View over the Date Frame Selection. The date frame being viewed can be changed as desired after calculation without the need for recalculation. This option can also be accessed using the SFUNCTS button on the viewbar.

Plant Transients Status

This permits the user to display the Plant Transient Status View over the Date Frame Selection. The Plant Transient Status is relevant to the on-line mode and will not be displayed while in the outage mode. The Plant Transient Status View will be substituted with Integrated Safety Status when in the outage mode. This option can also be accessed using the TRNSIENTS button on the viewbar (on-line mode only).

Integrated Safety Status

This permits the user to display the Integrated Safety Status View over the Date Frame Selection. The Integrated Safety Status is relevant to the outage mode and will not be displayed while in the on-line mode. The Integrated Safety Status View will be substituted with Plant Transient Status when in the on-line mode. This option can also be accessed using the INTASSMS button on the viewbar (outage mode only).

Configuration Guidance

This permits the user to display the Configuration Guidance at a given time (for one plant condition). The Configuration Guidance View includes information for Return-to-Service, Remain-in-Service, and Compensatory Actions and Guidance. This option can also be accessed using the CFGGUIDN button on the viewbar.

PSA Safety Profiles

This permits the user to display a graph of the Core Damage Frequency (CDF) or reactor coolant system (RCS) boiling frequently over the specified date frame. The user has the option to alter the scale of the graphs. This option can also be accessed using the PSAPROF button on the viewbar.

X versus T Graphs

This permits the user to view a graph of planned and historical trends in system safety performance for variables chosen by the user or model builder. This option can also be accessed using the XvsT GRPH button on the viewbar.

What-If Scenario Controls

This permits the user to temporarily alter the schedule in ORAM-Sentinel and analyze the impact of those changes. The changes are made by moving or changing the duration of a scheduled task(s) or adding a new scheduled task. It is not necessary to import the schedule during this process. Once changes are made a safety evaluation can be made by clicking on the EVALUATE CONFIGURATION button. This will calculate a new set of results based on the new configuration that has been manually input. The results can be viewed under RESULTS on the main menu by selecting the drop-down menu items for COMPARATIVE SAFETY FUNCTION STATUS or COMPARATIVE PLANT TRANSIENT STATUS or COMPARATIVE PSA SAFETY PROFILE.

Clicking on the RESET button or closing the Schedule-based What-if Scenario screen will restore the PCDB back to the original configuration. No changes made during this calculation can be saved. This option can also be accessed using the WHAT-IF button on the viewbar.

Comparative Safety Functions Status

This permits the user to view the Comparative Safety Function Status View after a What-If scenario is performed. There are two rows of status for each safety function with the top row representing the status of the original configuration (Base Case) and the bottom row representing the status of the postulated configuration (What-If).

Comparative Plant Transients Status

This permits the user to view the Comparative Plant Transient Status View after a What-If scenario is performed. There are two rows of status for each transient function with the top row representing the status of the original configuration (Base Case) and the bottom row representing the status of the postulated configuration (What-If) (Online mode only).

Comparative PSA Safety Profile

This permits the user to view the PSA Graph View after a What-If scenario is performed. There are two sets of data with the dark color representing the status of the original configuration (Base Case) and the yellow color representing the status of the postulated configuration (What-If).

Reports

Clicking on any item from the drop-down menu will select it for printing. Clicking on the TOGGLE ALL button for any report will select all of the items on the list. The user may then deselect those checked items that should not be printed. Clicking on OK will send the report to the printer.

Selecting the PRINTER… button allows the user to change the printer to a non-default printer. The changes made in this dialog only apply to the current print session. For multiple reports or print jobs, it is recommended that the user change the default printer or printer settings in the Windows Control Panel.

Some problems have been reported when printing to printers other than an HP LaserJet III. These problems can generally be solved by:

1. Configure the printer (in the Windows Control Panel) to emulate a LaserJet III.
2. Lower the resolution setting (in the Windows Control Panel).
3. Close other applications on the workstation.
4. Ensure the latest driver is installed for the printer being used.

Overall Plant Status

This permits the user to print the Overall Plant Status report. This report will provide a printout of the Overall Plant Status View for each selected configuration.

Plant Configurations

This permits the user to print the Plant Configurations report. This report includes a printout of the status of every PCDB item for each selected actual plant configuration. It does not print the PCDB. See Plant Configurations Definitions below for printing the PCDB.

Safety Functions Status

This permits the user to print the Safety Function Status report. This report includes a printout of the Safety Function Status View over the entire Date Frame Selection. The report includes a legend to reference a safety color to a pattern - important for black and white printing. If the user wishes to print the report with a different time frame, this time frame must be changed under RESULTS on the main menu using DATE FRAME SELECTION from the drop-down menu.

Plant Transients Status

This permits the user to print the Plant Transient Status report. This report includes the Plant Transient Status View over the entire Date Frame Selection. The report includes a legend to reference a safety color to a pattern - important for black and white printing. If the user wishes to print the report with a different time frame, this time frame must be changed under RESULTS on the main menu using DATE FRAME SELECTION from the drop-down menu. This report option is applicable only during the online mode.

Integrated Safety Assessment Status

This permits the user to print the Integrated Safety Assessment report. This report includes the Integrated Safety Assessment Status View over the entire Date Frame Selection. The report includes a legend to reference a safety color to a pattern - important for black and white printing. If the user wishes to print the report with a different time frame, this time frame must be changed under RESULTS on the main menu using DATE FRAME SELECTION from the drop-down menu. This report option is applicable only during the outage mode.

Configuration Guidance

This permits the user to print the Configuration Guidance report. This report includes the Overall Status, Return-to-Service priorities, Remain-in-Service priorities, and Compensatory Actions and Guidance for each configuration that is selected.

Plant Configuration Definitions

This permits the user to print the Plant Configuration Definitions report. This report includes a complete accounting of the items in the Plant Configuration Database (PCDB) including all the variables, descriptions, valid values, dependencies, and flags for the Components and Trains, Higher Risk Evolutions, System and Train Alignments and Value Assignments. It does not print the status of the PCDB variables. See Plant Configurations above for the status of the PCDB during a specific configuration.

Fault Tree Logic Diagrams

This permits the user to print the Fault Tree Logic Diagrams report. This report includes a picture of the fault tree and the logic that is contained in all of the events and gates within the tree.

Some printers do not properly print the graphics used in the fault tree reports. If problems occur, it is recommended that the user change the printer settings (in the Windows Control Panel) to emulate a LaserJet III printer and/or reduce the resolution (e.g., change 600 dpi to 300 dpi).

SFAT Logic Diagrams

This permits the user to print the Safety Function Assessment Logic Database Report. This report includes a picture of the assessment tree and the logic that is contained in all of the decision logic blocks within the tree.

PTAT/ISAT Logic Diagrams

This permits the user to print the Plant Transient Assessment Logic Database Report. This report includes a picture of the assessment tree and the logic that is contained in all of the decision logic blocks within the tree.

Event Tree Sequences

This permits the user to print the Event Tree Database Report. This report includes a picture of the event tree and the logic that is contained in all of the decision logic blocks within the tree (Node, Event, Description, Variable Name, Expression and Formula).

User Variables/Expressions

This permits the user to print the User Variables Database Report. This report contains all of the formulas created by the user. The report includes the variable name, description and expression and formula for each selected User Variable.

PSA Results Database

This permits the user to print the ISAR Database Report. This report includes the ISA Configuration Index (Reference and Description, Components and Trains, Higher Risk Evolutions, Configurations, User Variable Filters for which the data apply), the PSA Values (End-state Description) and the Safety Assessments (Return-to-Service, Remain-in-Service, Compensatory Actions).

Maintenance Schedule

This permits the user to print the Maintenance Schedule Report and the Schedule View notes. If the user wishes to print the report with a different time frame, this time frame must be changed under RESULTS on the main menu using DATE FRAME SELECTION from the drop-down menu.

The Maintenance Schedule report prints the selected Left Column View and Right Column View options. This report will always be printed with the activities displayed in chronological order.

If a color printer is selected, the report will be printed using the colors and patterns selected for Display in the Plant Configuration Database, Variable Categories tab. Depending on the type of

printer, some colors may look different on the report than on the screen. Likewise, if a black and white printer is used, the report will be printed using the shading and patterns selected for Black/White in the Plant Configurations Database, Variable Categories tab. Depending on the printer selected, the pattern and shade selected may look different on the report when compared to the screen. The user should modify the shade and pattern until an acceptable report is produced.

A different Maintenance Schedule Report can be printed by using the PRINT button on the tool bar when the Schedule View is open. The report will display a replica of the Schedule View screen, excluding the Overall Status bar.

Guidance, Actions, and Advice

This permits the user to print the Guidance and Actions report. This report includes the Function and Reference, Reference Description, Guideline number and Guideline Description.

Database Notes

This permits the user to print the User Database Notes report. This report includes the notes that have been entered associated with specific records (fault trees, assessment trees, or user variables and expressions, etc.). Schedule View notes are printed from the Maintenance Schedule menu item.

Database

Plant and Unit Descriptions

This displays the Plant and Unit Descriptions Editor. This editor permits the user to record specific information about the Plant and Site (Utility, Plant and Location) and Units (UnitId, Type and Manufacturer). The information entered in the Unit Identification (UnitId) field will be used in the first box on the viewbar. This is drop down menu in the upper left corner of the main screen (below the MODE button). With this drop down menu, the user can select which unit model is displayed.

Establishing event tree end-states can be done through the Plant and Unit Description Editor (reference End-states Editor in Section 4).

Outage Records

This displays the Outage Database Editor. This editor is used to calculate the shutdown days (SD_DAYS) by entering the Hot Shutdown Date/Time, Cold Shutdown Date/Time, and Startup Date/Time (Outage mode only).

Safety Functions Definitions

This displays the Safety Functions Database Editor. This editor is used to add safety functions, assign their usage (on-line, outage, both), identify safety function Filter Variables and assign Weighting Factors. The assignment of the specific valid values associated with the Filter Variables is performed in the individual assessment trees - not in the Safety Functions Database Editor.

Plant Transients Definitions

This displays the Plant Assessments Database Editor. This editor is used to add plant transient or integrated safety functions, assign their usage (on-line, outage, both), identify safety function Filter Variables and assign Weighting Factors. The assignment of the specific valid values associated with the Filter Variables is performed in the individual assessment trees - not in the Plant Assessments Database Editor. This editor is called Integrated Assmnts Definitions in the outage mode.

PSA Filters

This displays the PSA Filter Definitions Editor. This editor supports adding and deleting of User Variable Filters that are utilized in the PSA Results Databases. Ten entries are permitted for each of the two modes, online and outage.

Fault Tree Logic Diagrams

This displays the Fault Tree Database Editor. This editor supports adding, deleting, copying, or modifying fault trees.

SFAT Logic Diagrams

This displays the SFAT Logic Diagrams Database Editor. This editor supports, adding, deleting, copying, or modifying assessment trees. Double clicking on a Condition Block within the diagram will enable the model builder to modify the expressions and logic statements within the trees. The valid values associated with the Filter Variables may be modified in this editor. Altering the Filter Variables associated with a function is performed under the drop-down menu item labeled SAFETY FUNCTIONS DEFINITIONS.

PTAT/ISAT Logic Diagrams

This displays the PTAT Logic Diagrams Database Editor. This editor supports, adding, deleting, copying, or modifying assessment trees. Double clicking on a Condition Block within the diagram will enable the model builder to modify the expressions and logic statements within the trees. The valid values associated with the Filter Variables may be modified in this editor.

Altering the Filter Variables associated with a function is performed under the drop-down menu item labeled PLANT TRANSIENTS DEFINITIONS.

Event Tree Sequences

This displays the Event Tree Sequences Database Editor. This editor supports, adding, deleting, copying, or modifying event tree names, initiators, nodes, and failure sequences. The event tree database is available for outage use only and therefore cannot be accessed when in the on-line mode.

PSA Results

This displays the Integrated Safety Assessment Database Editor. This editor supports adding, deleting, copying, or modifying, records in the Probabilistic Safety Assessment (PSA) database. This database contains information from pre-solved PSA runs including the configuration (Components and Trains, Higher Risk Evolutions, Configurations, User Variables Filters for which the data apply, PSA Values (Frequency, Results File, Risk-based Allowed Outage Time) and Safety Assessments (Return-to-Service, Remain-in-Service, Compensatory Actions).

User Variables and Expressions

This displays the Variables Expressions Database Editor. This editor supports adding, deleting, copying, or modifying, formulas created by the model builder. The model builder is required to supply a Variable Name, Description, Expression and Value and decide what type of return value (Numeric or Alpha String) is expected.

Guidelines Text and Basis

This displays the Guidance Text Database Editor. This editor supports adding, deleting, copying, or modifying, Guidance and Actions and Technical Basis used in the Guidance Reference Groups. These guidance paragraphs (Guidance and Actions and Technical Basis) are linked to the associated assessment tree using reference groups from the Guidance Reference Groups Editor. Each guidance number (Guidance No.) must be unique and associated with one function (Function Reference). Each guidance paragraph contains Guidance and Actions and a Technical Basis.

Guidance Reference Groups

This displays the Guidance Reference Groups Editor. This editor supports adding, deleting, copying, or modifying, reference numbers used in the assessment trees. The reference number is used to link Guidance Text paragraphs together and to then link those groups of text to end-states in the assessment trees. Each reference number (Reference No.) must be unique and associated with one function (Function Reference). The Selected Guidance is established by clicking on the

AVAILABLE GUIDANCE button, then selecting the appropriate Guidance and Actions, and then clicking on the SELECTED GUIDANCE button.

Tools

Run External Program

This allows the user to define and run up to four user-defined command lines.

Search and Replace

This permits the user to replace existing variable names with different variable names. The search and replace function is performed in Condition Expressions, Logic Expressions, and Expression and Value areas only. The search and replace function is not performed in Assessment Conditions, Gate IDs, Descriptions, and Title/Description areas. Additionally, search and replace is not performed in the following database editors and safety functions, plant assessments, system codes, maintenance rule performance criteria, and integrated safety assessments. These areas must be updated manually.

Safety Assessment Worksheet

This permits the user to establish text and formula expressions associated with a given configuration. After the database is populated, the Safety Assessment Worksheet (SAW) information can be viewed by using this drop-down menu item or by clicking on the WORKSHEET button at the bottom of the Operation Plant Status View screen.

Select Graph

This allows the user to select the graph options for the PSA Profile or X vs T graph.

PSA Profile

The PSA Graph View dialog box appears if the PSA Profile sub-menu item is selected.

X vs T

The Define Variable Over Time Graph dialog box appears if the X vs T sub-menu item is selected.

View

Viewbar

This option displays or hides the twelve buttons below the main menu referred to as the viewbar. These buttons extend from the MODE button on the left to the WHAT-IF button on the right. A check mark next to this option means this bar will be visible.

Toolbar

This option displays or hides the buttons below the viewbar referred to as the toolbar. These buttons extend from the Unit drop-down menu on the left to the HELP button on the right. A check mark next to this option means this bar will be visible.

Status Bar

This option displays or hides the status bar at the bottom of the screen. From the left, this bar indicates if the program is ready or processing information in the first box, the mode of operation (on-line or outage) in the second box, the date frame chosen for analysis and display in the third box, whether or not a calculation is required in the fourth box, the model name in the fifth box, whether or not the caps lock is selected in the sixth box, and the status of the num lock key (to permit use of the right keypad) in the last box on the right. A check mark next to this option means this bar will be visible.

Button Prompts

This permits the user to activate or disable the button prompts. The button prompts are the descriptions that appear when the cursor is positioned over a button. A check mark next to this option means the prompts will be visible.

Options

This will permit the user to edit the options for the current view (e.g. to resort the schedule view). This can also be accessed using the OPTIONS button on the toolbar or right click in the current view.

Zoom-In

This permits the user to enlarge the scale of a chart or graph to view less information but with more detail. This option can also be accessed using the ZOOM-IN button on the toolbar.

Zoom-Out

This permits the user to decrease the scale of a chart or graph to view more information but with less detail. This option can also be accessed using the ZOOM-OUT button on the toolbar.

Print

This permits the user to print the report for the current view (where applicable). This option can also be accessed using the PRINT VIEW button on the toolbar.

Window

Cascade

This option permits the user to arrange the open views such that the views are cascaded or stacked on top of each other. The title bars are visible for each view when CASCADE is selected.

Tile

This option permits the user to arrange the open views such that all open views are scaled to fit the screen with no overlap. The title bars and scroll bars are visible for each view when TILE is selected.

Help

Contents

This option provides information about ORAM-Sentinel including an overview of major functions, how to navigate, a list of “How Do I” options, and contact numbers for technical support. This option can also be accessed using the HELP button on the main toolbar.

Index

The index includes a find feature to search for specific words and phrases in help topics instead of searching for information by category.

Using Help

This provides general information about the functions available within Help.

About ORAM-Sentinel

This provides general information about the code version, copyrights and developer.

Viewbar Buttons

IMPORTING

SCHEDULE

RECALCS

STATUS

SFUNCTS

TRNSIENTS

CFGGUIDN

PSAPROF

XVSTGRPH

WHAT-IF

Toolbar Buttons

UNIT

DATASET

NEW MODEL/RESULTS

OPEN MODEL/RESULTS

SAVE MODEL/RESULTS

CUT (DELETE)

COPY TO CLIPBOARD

PASTE FROM CLIPBOARD

OPTIONS BUTTON

ZOOM-IN

Menu Items

ZOOM-OUT

PRINT VIEW

MOVE TO BEGINNING OF FILE

MOVE TO PREVIOUS RECORD

MOVE TO NEXT RECORD

MOVE TO END OF FILE

SELECT RECORD FROM LIST

CREATE NEW RECORD

COPY THIS RECORD

DELETE THIS RECORD

DATABASE NOTES FOR THIS RECORD

HELP

A
DEFINITIONS

And Gate

A symbol, designated by  , used in the development of a Fault Tree. The value of the And Gate is the product of the values of the gates and events attached to it.

Allowable Outage Time (AOT)
The maximum acceptable continuous duration for a given plant configuration as specified in the PSA Results database. This duration is intended to be derived from the plant's PSA model and not the Technical Specifications.

Anticipated Transient Without SCRAM (ATWS)
An initiating event where reactor power is normally expected to be reduced, but continues to operate at super-critical conditions.

Availability
The Availability of a component or system is the probability that it will be able to operate successfully at a random point in time when required. It is a dimensionless quantity.

Basic Event

A Basic Event, designated by  , represents a failure mode of a component. For example fail to open and fail to close are basic events for a valve.

Boolean Algebra
A mathematical system devised for the analysis of symbolic logic such as a Fault Tree.

Core Damage Frequency (CDF)
The frequency of uncovery and heatup of the reactor core to the point where prolonged oxidation and severe fuel damage is anticipated.

Defense In Depth
The levels of safety associated with a plant's design and operation to ensure plant safety.

Diamond Event

A Diamond Event, designated by  , represents a failure mode of a discrete function. Within a Fault Tree, a diamond event operates the same as a Basic Event.

End State
An End State is the set of conditions at the end of an event sequence that characterizes the impact of the sequence on the plant or the environment.

Event Tree (ET)
A tabular diagram which quantifies the risk of reaching an end state (e.g., core damage) given a specific initiator.

Fault Tree (FT)
A Fault Tree is a diagram that is used to determine the logical combination of failure or condition causes that will produce an undesired event.

Higher Risk Evolutions (HRE)
Higher Risk Evolutions are user-defined plant configurations that are a subset of the PCDB.

House Event

A House Event, designated by  , is a True and False flag used in the development of a Fault Tree. House Events are used to include or exclude portions of the fault tree under certain conditions. For example, when an Or Gate and a House Event are placed under an And Gate and the House Event is set to True, the cutsets from the Or Gate will be passed through the And Gate. If the House Event is set to False, all cutsets are multiplied by zero and no cutsets are passed.

Individual Plant Examination (IPE)
An IPE is an integrated analysis of plant and system response to a wide spectrum of internal, randomly initiated events such as reactor trips, loss of off-site power, and loss of coolant accidents with an emphasis on quantification of plant core damage frequency and evaluation of containment performance.

Integrated Safety Assessment Results (ISAR)
These results represent the records in the PSA Results database.

Integrated Safety Assessment Tree (ISAT)
A Logic Diagram used to assess the effects of several safety functions or any other plant function on plant safety.

Independent Safety Evaluation Group (ISEG)

Large, Early Release Frequency (LERF)
The frequency of radioactive release from the containment which is both large and early. Large is defined as involving the rapid, unscrubbed release of airborne aerosol fission products to the environment. Early is defined as occurring before the effective implementation of the off-site emergency response and protective actions.

Logic Diagram
A Logic Diagram is a network that begins with an initiating event or condition and progresses through a series of branches (up to five) that represent expected system or operator performance.

The result is a measure of plant safety indicated by a color coded scheme. The colors used are Red, Orange, Yellow and Green, where Red represents a condition with degraded plant safety and Green represents a condition with maximum plant safety.

Maintenance Rule (MR)
The NRC rule published in July 1991 that requires commercial utilities to develop and implement a documented, ongoing maintenance program to ensure key structures, systems and components are capable of performing their intended function.

Maintenance Rule Performance Criteria (MRPC)
Criteria established by a utility that outlines the acceptable performance of key plant structures, systems and components. The MRPC module has been removed in ORAM-Sentinel Version 3.4.

OConvert
The ORAM to ORAM-Sentinel Conversion program. It provides the capability to convert ORAM v2.1 models into a format that is useable by ORAM-Sentinel Version 3.3. This program is not available on the ORAM-Sentinel Version 3.4 installation disk.

Or Gate

A symbol, designated by  , used in the development of a Fault Tree. The value of the Or Gate is the sum of the values of the gates and events attached to it.

Plant Configuration Database (PCDB)
The database which stores all the variables which receives input from the import schedule.

Plant Transient
Plant transients such as reactor trip and loss of offsite power that have a direct impact on plant safety.

Probabilistic Risk Analysis (PRA)
See also PSA.

Probabilistic Safety Assessment (PSA)
A quantitative assessment of the risk associated with plant operation and maintenance. The risk is measured in terms of the frequency of occurrence of different events, including severe core damage.

Probabilistic Shutdown Safety Assessments (PSSA)
A quantitative assessment of the risk associated with plant maintenance during shutdown conditions. The risk is measured in terms of the frequency of occurrence of different events, including severe core damage.

Plant Transient Assessment Tree (PTAT)
A Logic Diagram used to assess the effects of a Plant Transient on plant safety.

Remain in Service (RIS)
A prioritized list of systems, trains, or components that are currently available for a given configuration. This list is prioritized based on the reduction in plant safety with the unavailability of the system, train, or component.

Return to Service (RTS)
A prioritized list of systems, trains, or components that are unavailable for a given configuration. This list is prioritized based on the improvement in plant safety with the restoration of the system, train, or component.

Safety Function
Plant functions such as reactivity control and reactor heat removal that have a direct impact on plant safety. Safety functions must be satisfied for safe plant operation and shutdown.

Safety Assessment Worksheet (SAW)
Is a user definable text-oriented form that highlights information of importance for configuration safety management.

SD_DAYS
An internal ORAM-Sentinel variable used to count the number of days from the start of an outage to the current time. It is used, for example, to calculate decay heat levels.

Safety Function Assessment Tree (SFAT)
A Logic Diagram used to assess the effects of a Safety Function on plant safety.

Safety Significant Activities (SSA)
Activities that are performed as part of the plant maintenance schedule that could but do not necessarily have an impact on plant safety.

Weighting Factor (WF)
A numeric value (between 1 and 99) assigned to a safety function, plant transient, or integrated safety definition to represent its relative importance to other safety function, plant transient, or integrated safety definitions, respectively.

What-If Evaluations
What-If Evaluations are evaluations of the effects on plant safety based on postulated changes in the maintenance schedule.

B
REFERENCES

1. *Guidelines for Industry Actions to Assess Shutdown Management*, Nuclear Engineering Institute, NUMARC 91-06, December 1991.

2. *Guidelines for the Management of Planned Outages at Nuclear Power Stations,* Institute of Nuclear Operations, INPO 92-005, June 1992.

3. *Requirements for Monitoring the Effectiveness of Maintenance at Nuclear Power Plants,* United States Nuclear Regulatory Commission, 10CFR50.65 [the Maintenance Rule], July 10, 1993.

4. *Survey of BWR Plant Personnel on Shutdown Safety Practices and Risk Management Needs,* EPRI, Palo Alto, CA: 1992, NSAC-173.

5. *Survey of PWR Plant Personnel on Shutdown Safety Practices and Risk Management Needs,* EPRI, Palo Alto, CA: 1991, NSAC-174.

6. *Safety Assessment of BWR Risk During Shutdown Operations*, EPRI, Palo Alto, CA: 1992, NSAC-175L.

7. *Safety Assessment of PWR Risk During Shutdown Operations,* EPRI, Palo Alto, CA: 1992, NSAC-176L.

8. *Risk of PWR Inadvertent Criticality During Shutdown and Refueling,* EPRI, Palo Alto, CA: 1992, NSAC-183L.

9. *Safety Assessment of Diablo Canyon Risk During Shutdown Operations,* EPRI, Palo Alto, CA: 1993, NSAC-195L.

10. *Use of an Individual Plant Examination (IPE) to Enhance Outage Management*, EPRI, Palo Alto, CA: 1992, TR-101172.

11. *Contingency Strategies for Diablo Canyon During Potential Shutdown Operations Events*, EPRI, Palo Alto, CA: 1993, TR-102969.

12. *Outage Risk Management Guidelines for PWRs,* EPRI, Palo Alto, CA: 1993, TR-102970.

13. *Outage Risk Management Guidelines for BWRs,* EPRI, Palo Alto, CA: 1993, TR-102971.

14. *Reflux Cooling: Application To Decay Heat Removal During Shutdown Operations*, EPRI, Palo Alto, CA: 1994, TR-102972.

15. *Generic Contingency Strategies for BWRs During Potential Shutdown Operations Events*, EPRI, Palo Alto, CA: 1993, TR-102973.

16. *Risk Management & Safety Assessments of Peach Bottom and Limerick During Shutdown Operations*, EPRI, Palo Alto, CA: 1994, TR-102974, Draft.

17. *Summary of Shutdown Safety Assessment and Utility Survey Results*, EPRI, Palo Alto, CA: 1998, TR-102975, Draft.

18. *Outage Risk Management Guidelines for Diablo Canyon During Shutdown Operations*, Electric Power Research Institute, TR-102981, Draft.

19. *ORAM™ User's Manual Version 1.5 (DOS)*, EPRI, Palo Alto, CA: 1993, TR-102919.

20. *ORAM™ Dial-CAFTA User's Manual Version 2.0 for Windows*, EPRI, Palo Alto, CA: 1993, TR-104277.

21. *SENTINEL™ User's Manual Version 1.01 For Windows*, EPRI, Palo Alto, CA: 1996, TR-106520.

22. *Probabilistic Safety Assessment Applications Guide*, EPRI, Palo Alto, CA: 1995, TR-105396.

23. *Industry Guidelines for Monitoring the Effectiveness of Maintenance at Nuclear Power Plants*, NUMARC, NUMARC 93-01, May 1993.

24. *SENTINEL™ Technical Basis Report for Limerick*, EPRI, Palo Alto, CA: 1997, TR-108953.

25. *ORAM-Sentinel User's Manual™*, Version 3.0, EPRI, Palo Alto, CA: 1997, TR-107018.

26. *ORAM-Sentinel™ Development and ORAM™* Integration at Catawba and McGuire, EPRI, Palo Alto, CA: 1998, Report TR-106802.

27. *Outage Risk Assessment and Management Implementation at Fermi 2*, EPRI, Palo Alto, CA: 1997, TR-109013.

28. *SENTINEL™ Technical Basis Report for Peach Bottom*, EPRI, Palo Alto, CA: 1998, TR-110504.

29. *ORAM-Sentinel™ Development at Calvert Cliffs*, EPRI, Palo Alto, CA: 1998, TR-110473.

30. *ORAM-Sentinel™ Development at Fitzpatrick*, EPRI, Palo Alto, CA: 1998, TR-110505.

31. *ORAM-Sentinel™ Demonstration at Sequoyah*, EPRI, Palo Alto, CA: 1998, TR-110771.

32. *ORAM-Sentinel™ Demonstration at Watts Bar*, EPRI, Palo Alto, CA: 1998, TR-110772.

33. *ORAM-Sentinel™ Development and ORAM™ Integration at Catawba and McGuire*, EPRI, Palo Alto, CA: 1998, TR-106802.

34. *An Analysis of Loss of Decay Heat Removal Trends (1989-1996)*, EPRI, Palo, Alto, CA: 1997, TR-109014.

35. *Shutdown Risk Impact Assessment for Extended Containment Leakage Testing Intervals Utilizing ORAM™*, EPRI , Palo Alto, CA: 1995, TR-105189.

36. *ORAM-Sentinel™ User's Manual Version 3.1: All Modes Maintenance and Safety Function Advisor*, EPRI, Palo Alto, CA: 1998, TR-10964D-CD.

37. *ORAM-Sentinel Development and ORAM Integration at Oconee*, EPRI, Palo Alto, CA: 1998, TR-111207.

38. *ORAM-Sentinel Demonstration at Diablo Canyon*, EPRI, Palo Alto, CA: 1998, TR-110739.

39. *ORAM-Sentinel Demonstration at Indian Point 3*, EPRI, Palo Alto, CA: 1999, TR-110716.

40. *ORAM-Sentinel™ User's Manual Version 3.3: All Modes Maintenance and Safety Function Advisor*, EPRI, Palo Alto, CA: 1999. AP-112894-CD.