Independent Verification and Validation of SAPHIRE 8 Volume 3 Users' Guide

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SAPHIRE

Systems Analysis Programs for Hands-on Integrated Reliability Evaluations

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1.0   Executive Summary

The purpose of the Independent Verification and Validation (IV&V) role in the evaluation of the SAPHIRE 8 Volume 3 Users' Guide is to assess the user documentation for its completeness, correctness, and consistency with respect to requirements for user interface and for any functionality that can be invoked by the user. The IV&V team began this endeavor after the software engineering and software development of SAPHIRE had already been in production.

The requirements for IV&V review were extracted primarily from the NUREG but also included an examination of best software engineering methods provided in the IEEE Standard for Software Verification and Validation.   IV&V developed a checklist that mapped these requirements with these standards which was used in the evaluation. The evaluation criteria and the results of the assessment are identified in section 3 of this document.

Per the requirements and document outline provided in the SAPHIRE IV&V Plan, this report and all subsequent reports will be included as attachments and/or background evidence of the evaluation as well as the results of the assessment.

2.0   Background Information

NUREG/BR-0167, Software Quality Assurance Program and Guidelines, requires the development of user documentation with respect to requirements for user interface and for any functionality that can be invoked by the user and in planning an acceptance test that is representative of the operational environment. User documentation includes:

1. A description of the user's interaction with the software, and a description of any required training necessary to use the software.

2. Input and output specifications and formats, including sample cases.

3. A description of the limitations of the software.

4. A description of anticipated errors and how the user can respond.

5. For each error message, provide the message, an explanation of the message, how the message may have come about, and actions that may or should be taken.

6. Information about obtaining user and sustaining engineering support.

This report provides an evaluation of the SAPHIRE 8 Volume 3 Users' Guide. The SAPHIRE 8 Volume 3 Users' Guide is intended to provide readability and effectiveness to end users, and to meet the contractual commitments prepared by the sponsor; the Nuclear Regulatory Commission.

Independent Verification and Validation (IV&V) evaluates and assesses the processes and products developed during each phase of the Software Development Life Cycle (SDLC). The SAPHIRE 8 development team is implementing a "spiral" rapid application approach to the product development. One of the roles that IV&V performs, regardless of the development methodology, is to analyze products developed throughout the development process. The intent is to provide a level of confidence to the sponsor that the quality of the software product and supporting documentation is built into the software, not tested in. Evaluating the supporting documentation for each product is one aspect of providing this level of confidence.

IV&V supports and is complementary to the Quality Assurance, Project Management, and product development activities. To achieve this support, IV&V must also evaluate the processes identified in the documentation to ensure that the development team is implementing the processes and methodology that ensures a high-level software product.

Due to the spiral approach implemented for the software development, it is expected that the SAPHIRE 8 Volume 3 Users' Guide will evolve as the SAPHIRE 8 product matures. Therefore, IV&V will evaluate each iteration of the SAPHIRE 8 Volume 3 Users' Guide.

To provide direction in the evaluation process, IV&V has developed a checklist to support the requirements for the SDLC. The Project Plan requirements used for the analysis of the SAPHIRE 8 Volume 3 Users' Guide is contained in a checklist that is included in the SAPHIRE 8 Software Independent Verification and Validation Plan (INL/EXT-09-15649). The evaluation criteria for the SAPHIRE 8 Volume 3 Users' Guide have been extracted from the checklist contained in the "IV&V Plan" and included in section 4 of this report. A summary of the findings is provided in section 3.

3.0   Summary of Findings

An Independent Verification and Validation evaluation of the Volume 3 Users' Guide for SAPHIRE 8 was performed using the checklist contained in section 4.0. The checklist was extracted from the SAPHIRE 8 Software Independent Verification and Validation Plan Document ID: INL/EXT-09-15649. The following sections refer to the specific parts of the NUREG/BR-0167 Software Quality Assurance Program and Guidelines requirements the SAPHIRE 8 Volume 3 Users' Guide failed to satisfy. Minor corrections for the SAPHIRE 8 Volume 3 Users' Guide are also listed in section 3.2 of the Summary of Findings.

3.1   NUREG/BR-0167 Findings

The following provides the corrections needed for the failed criteria in the checklist supplied in section 4.

Criteria 15 – References to the description of required training necessary to use the software, anticipated errors and user response to errors, error messages with workarounds and information about user support were not found.

Criteria 16 – Specific instructions for starting SAPHIRE 8 were not found.

Criteria 19 – The Volume 3 Users' Guide does not provide instructions for accessing the on-line help features or User Support.

3.1.1 Section 4.7 User Documentation

Fail 4 – The SAPHIRE 8 Users' Guide does not provide descriptions of anticipated errors and how the user can respond.
Fail 5 – The SAPHIRE 8 Users' Guide does not provide the error message, an explanation of the error message, how the message may have come about and actions that may or should be taken for each error message.
Fail 6 – Information about obtaining user and sustaining engineering support was not found in the SAPHIRE 8 Users' Guide.

In user documentation, include:

1. A description of the user's interaction with the software, and a description of any required training necessary to use the software.
2. Input and output specifications and formats, including sample cases.
3. A description of the limitations of the software.
4. A description of anticipated errors and how the user can respond
5. For each error message, provide the message, an explanation of the message, how the message may have come about, and actions that may or should be taken.
6. Information about obtaining user and sustaining engineering support.

3.2   SAPHIRE 8 Volume 3 Users' Guide Document Findings

1. The acronyms "*SAPHIRE*" and "*SAPHIRE 8*" are used throughout the document when referring to SAPHIRE 8. IV&V suggests using the acronym "*SAPHIRE 8*" when specifically referring to SAPHIRE version 8.

2. When referencing sections throughout the document uppercase "*Section*" and lowercase "*section*" is used. IV&V suggests using one or the other to be consistent throughout the document.

3. Page iii, last paragraph states "*Following that discussion are nine sections, one for each of the menu options on the SAPHIRE main menu*". Is this correct, the main menu items are "File", "View", "Bookmarks", "Publish", "Project", "Tools" and "Help".

4. Page v, paragraph 3 has a typo.
   I believe "*SAPIRE*" should be "*SAPHIRE*".

5. Page 4, section 1.4 Installation of SAPHIRE, second paragraph.
   The sentence starting "*A databases (such as the DEMO database) can…*"
   IV&V suggests changing "*databases*" to "*database*".

6. Page 21, section 4.4 Basic Event Failure Model, first paragraph.
   Reference is made to "*Section 3.3*".
   IV&V believes this should be "*Section 4.3*".

7. Page 31, section 4.9 Template Events, first bullet.
   The sentence "*These are the*" is incomplete.

8. Page 38, section 4.11.3.1 Entering CCF Data into RASP, third bullet.
   Reference is made to "*section 12*".
   IV&V believes this should be "*section 10.3*".

9. Page 52, section 5.5.1.2 Stacked Basic Events.
   Reference is made to "*Section 3*".
   IV&V believes this should be "*Section 4*".

10. Page 56, sections 5.7.1 File and 5.7.2 Edit.
    IV&V believes the screen captures of the menus in these two sections need to be swapped.

11. Page 89, section 8.4 Sequence Uncertainty Analysis.
    Reference is made to "*section 7.2*".
    IV&V believes this should be "*section 7.3*".

12. Page 93, section 8.5 Viewing Sequence Importance Measures.
    Reference is made to "*section 7.3.2*".
    IV&V believes this should be "*section 7.4.2*".

13. Page 112, section 11.2 Using Model Types.
    Reference is made to "*Section 10.1*".
    IV&V believes this should be "*Section 11.1*".

14. Page 144, section 14.5 Event Tree Sequence Post-processing Rules.
    The first paragraph has two double words "*in the in the*".
    Make corrections as necessary.

15. Page 149, section 15.4.5 View Cut Sets.
    The third paragraph contains the partial sentence "*and the path **by** individually **by** clicking on the…*"
    IV&V suggests removing the second "*by*".

16. Page 149, section 15.4.5 View Cut Sets.
    The last sentence references "*Section 14*".
    IV&V believes this should be "*Section 9*".

17. Page 4, section 1.6 SAPHIRE Project Settings.
    Selecting File, New, Project and Project, Modify displays the following screens:
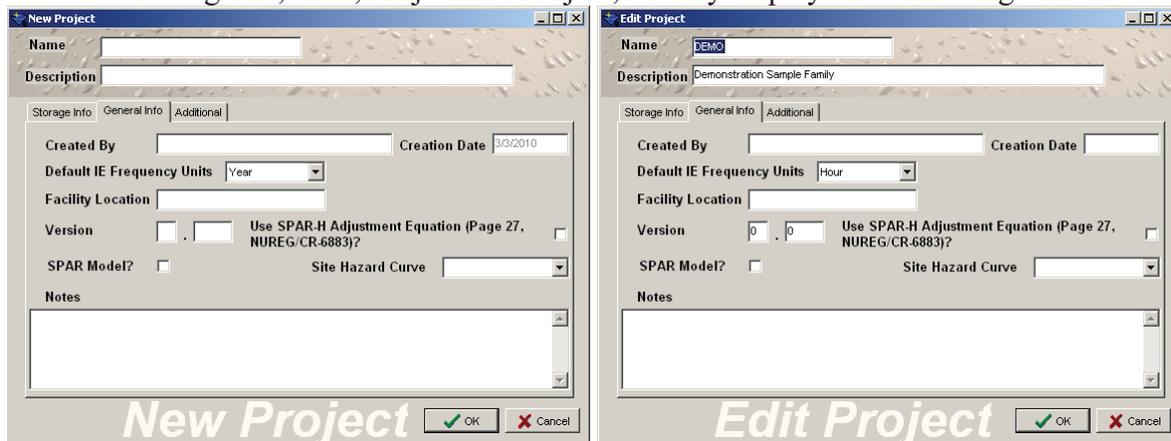
The Users Guide shows that the same selections display the Edit Project screen which is different than the ones currently displayed. Make corrections as necessary.

18. Page 7, section 1.7.2 General Analysis Settings.
    Selecting General Analysis displays the following screen:
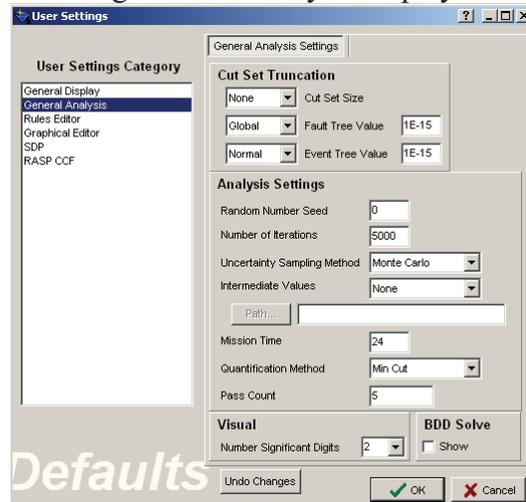
The Users Guide displays a different screen. Make corrections as necessary.

19. Page 9, section 1.7.4 Graphical Editor Constants Settings.
Selecting Graphical Editor displays the following screen:
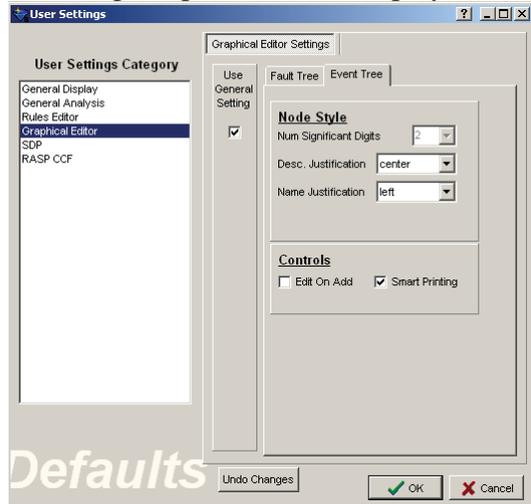
The Users Guide displays a different screen. Make corrections as necessary.

20. Page 38, section 4.11.3 RASP Common-Cause Failure Module.
Displaying the Fault Tree Editor shows the following menu bar that shows an option on the far right:
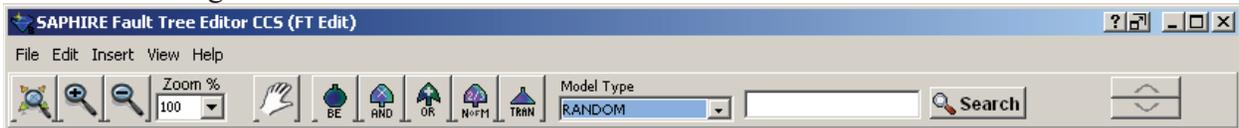
The screen in the Users Guide does not show this option. Make corrections as necessary.

21. Page 44, section 4.11.3.5 RASP Common-Cause Failure Module.
Displaying the Fault Tree Editor shows the following menu bar that shows an option on the far right:
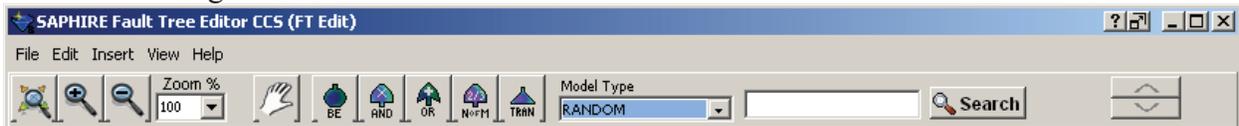
The screens in the Users Guide doe not show this option. Make corrections as necessary.

22. Page 51, section 5.4 Opening a New Fault Tree.
Displaying the Fault Tree Editor shows the following menu bar that shows an option on the far right:
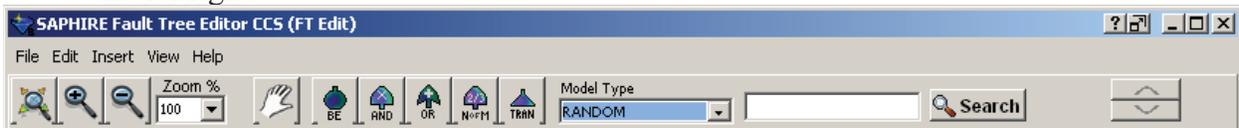
The screen in the Users Guide does not show this option. Make corrections as necessary.

23. Page 63, section 6.4.1 Adding a New Event Tree.

Displaying the Event Tree Editor shows the following menu bar that shows an option on the far right:
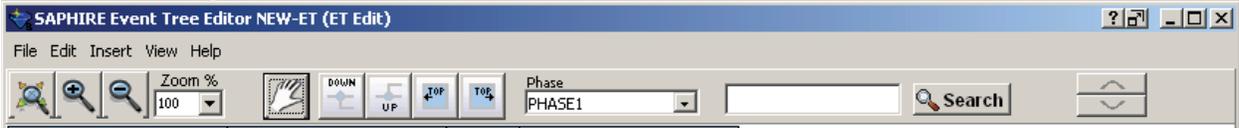
The screen in the Users Guide does not show this option. Make corrections as necessary.

24. Page 71, section 7.1.2 Menus and options for fault tree cut set generation.
Selecting the Solve option displays the following screen:
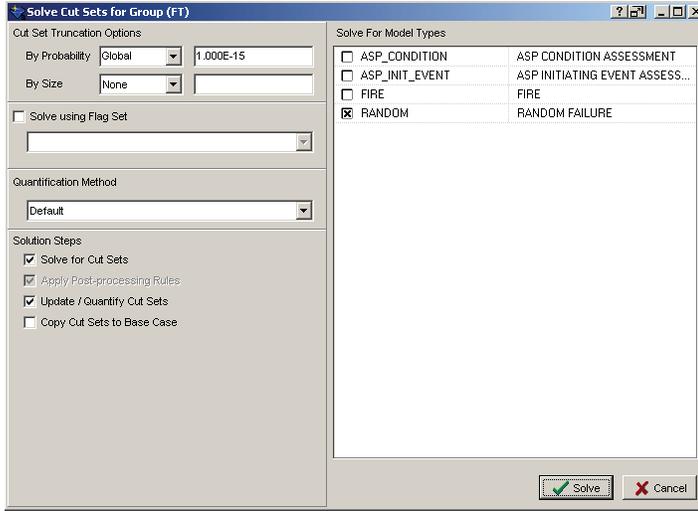
The Users Guide displays a different screen. Make corrections as necessary.

25. Page 74, 76 and 77, section 7.1.7 Selecting Fault Tree Cut Sets to View and section 7.2 Analyzing Fault Tree "Sub-trees".
Displaying the Cuts Sets for shows the Publish button at the bottom right of the screen:
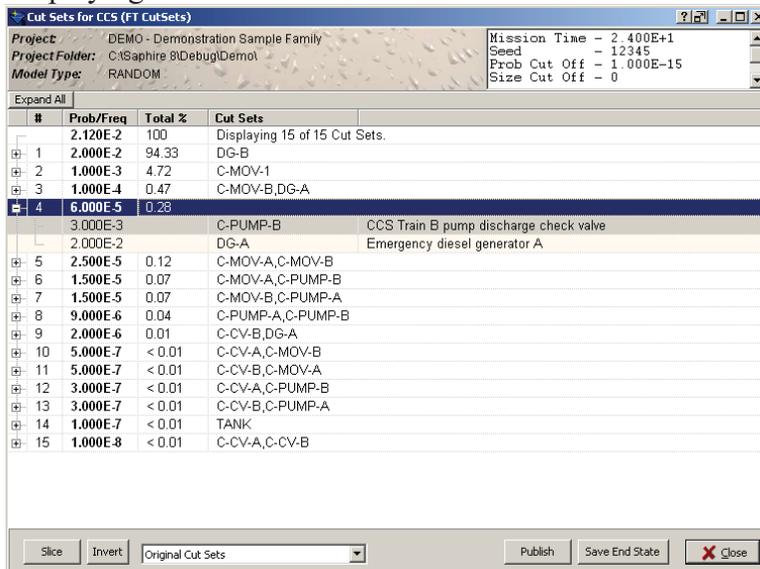
The screens in the Users Guide show a Report button. Make corrections as necessary.

26. Page 83, section 7.4.3.1 Viewing Importance Measures.

Selecting the View Importance Measures option displays the following screen showing the Publish button at the bottom right of the screen:
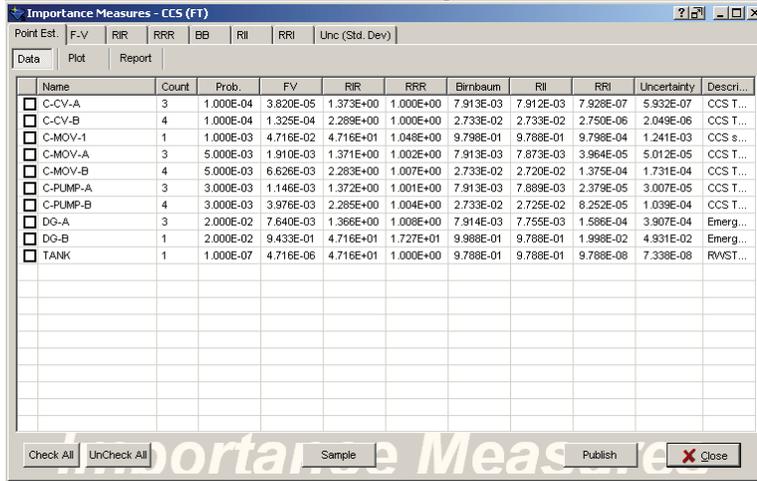
The screen in the Users Guide does not show a Publish button. Make corrections as necessary.

27. Page 84, section 7.4.3.1 Viewing Importance Measures.

Selecting the Report tab displays the following screen showing the Publish button at the bottom right of the screen:
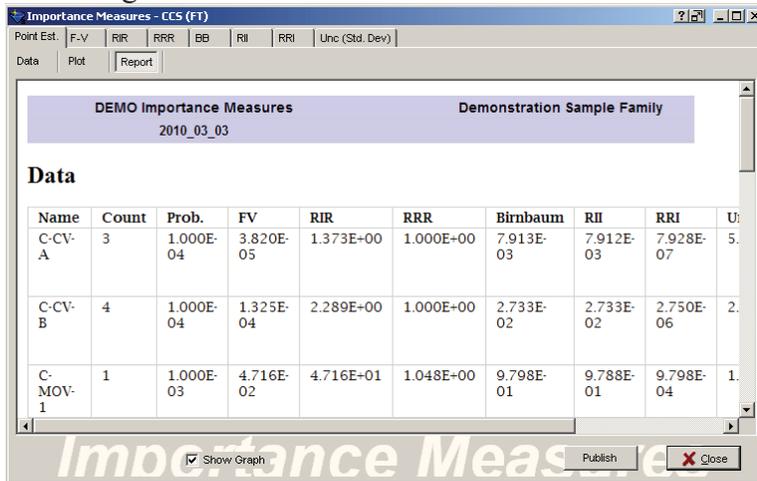
The screen in the Users Guide does not show a Publish button. Make corrections as necessary.

28. Page 86, section 8.2.3 Cut Set Generation cutoff Values.

Selecting the Solve option displays the following screen:
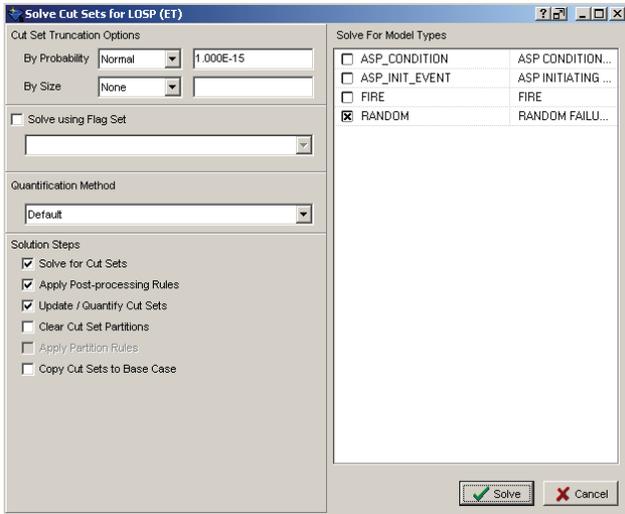
The Users Guide displays a different screen. Make corrections as necessary.

29. Page 88, section 8.2.5.1 Display Sequence Cut Sets.

Displaying the Cuts Sets for shows the Publish button at the bottom right of the screen:
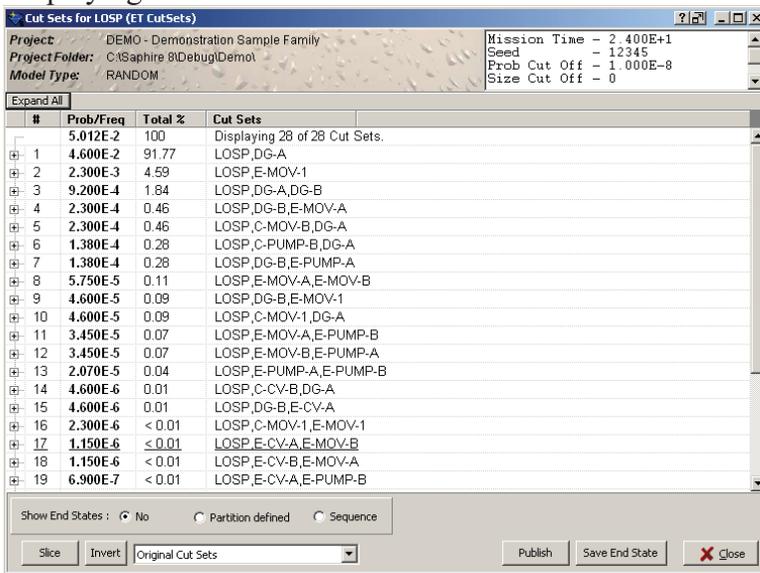
The screen in the Users Guide shows a Report button. Make corrections as necessary.

30. Page 92, section 8.4.3 Uncertainty Results.

Selecting the Results Table button displays the following screen showing the Expand All and Publish button at the bottom left of the screen:
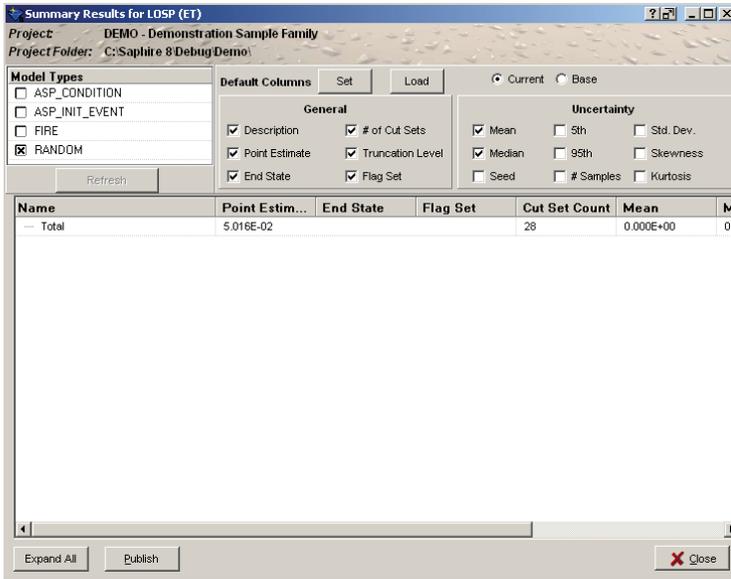
The screen in the Users Guide does not show an Expand All or Publish button. Make corrections as necessary.

31. Page 93, section 8.5 Viewing Sequence Importance Measures.
   Selecting the View Importance Measures option displays the following screen showing the Publish button at the bottom right of the screen:
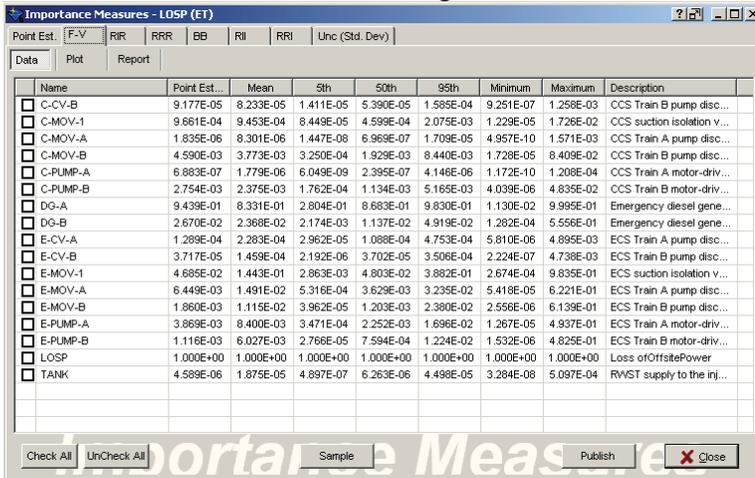
The screen in the Users Guide does not show a Publish button. Make corrections as necessary.

32. Page 94, section 8.5 Viewing Sequence Importance Measures.
    Selecting the Plot tab displays the following screen showing the Publish button at the bottom right of the screen:
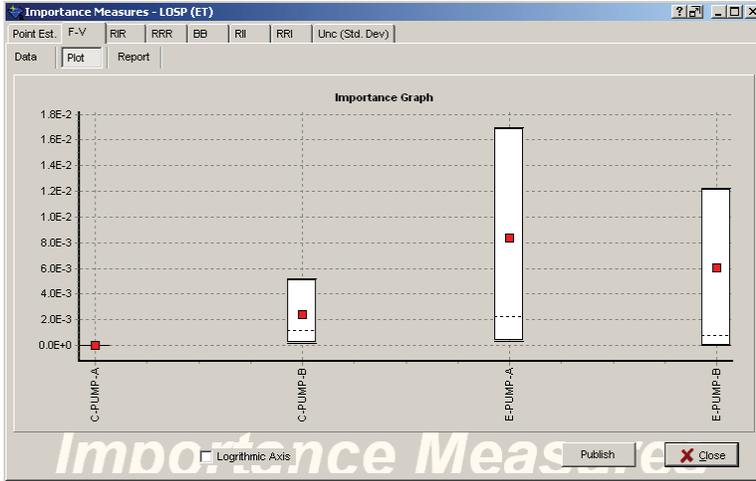
The screen in the Users Guide does not show a Publish button. Make corrections as necessary.

33. Page 95 and 97, section 9.1 The View Cut Sets Option.
Displaying the Cuts Sets for shows the Publish button at the bottom right of the screen:

The screen in the Users Guide shows a Report button. Make corrections as necessary.

34. Page 98, section 9.2 The Event Slice Option.
The first instruction at the top specifies "Click on the [Report] button to view an .html report of the cut sets." The Cuts Sets for window has a Publish button. Make corrections as necessary.

35. Page 98, section 9.2 The Event Slice Option.
Selecting the Publish button displays the following screen:
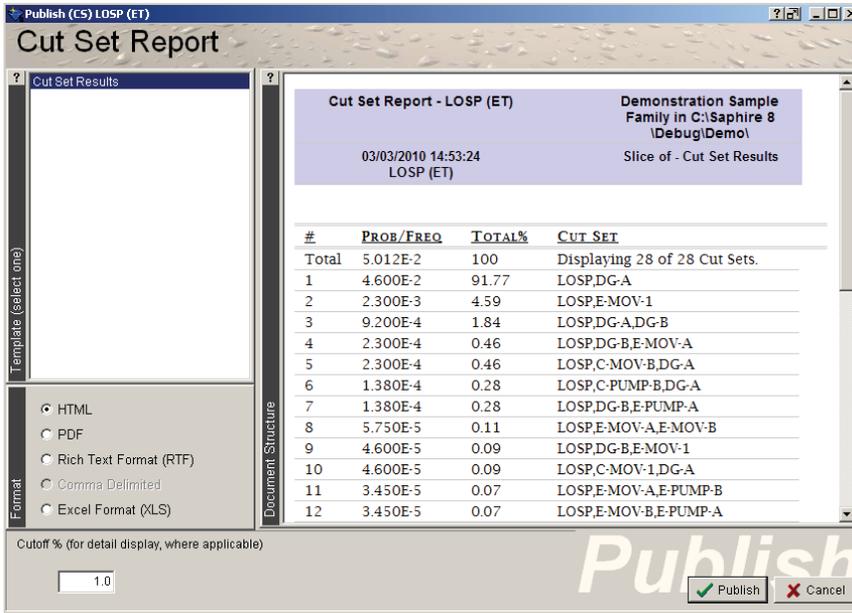
The Users Guide displays a different screen. Make corrections as necessary.

36. Page 99, section 9.3 The Cutoff Slice Option.

Selecting the OK button displays the following screen showing the Publish button at the bottom right of the screen:
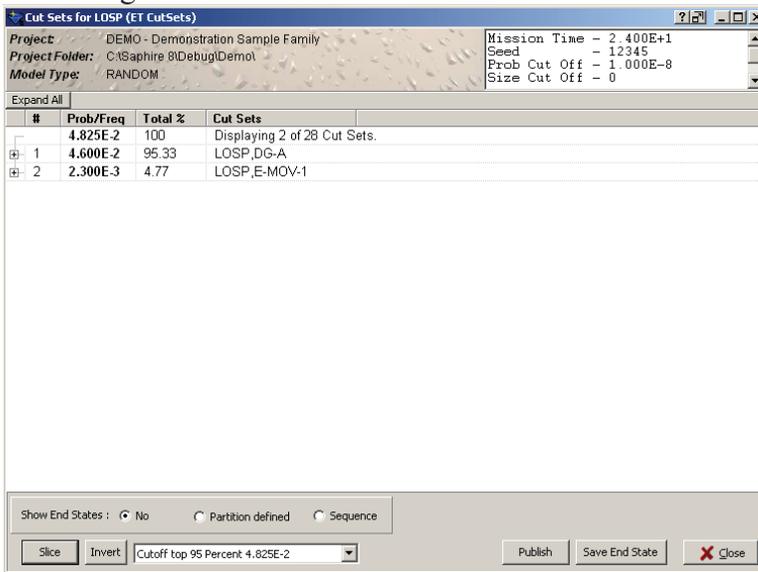
The screen in the Users Guide shows a Report button. Make corrections as necessary.

37. Page 103, section 10.2 Integrate Project Utility.

Selecting the Integrate button displays the following screen showing the Integrate button at the bottom right of the screen:
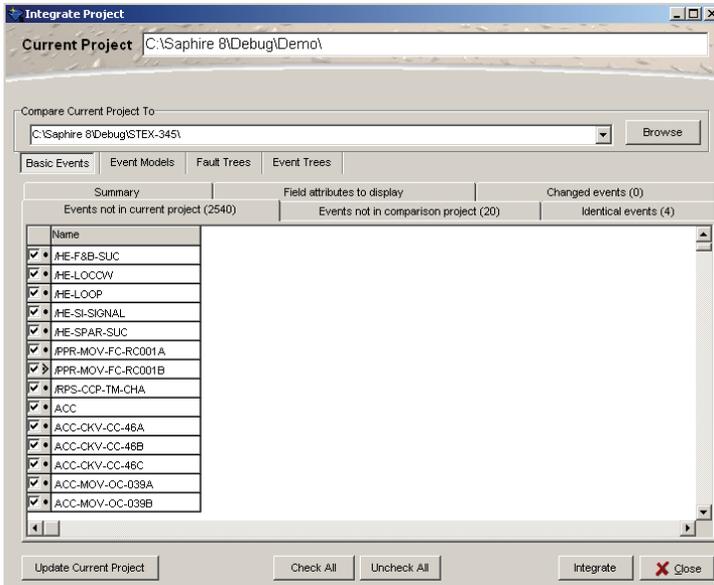
The Users Guide displays a different screen. Make corrections as necessary.

38. Page 110, section 10.3.2 MAR-D Load and Extract Menus.
    Selecting the Extract tab displays the following screen with text in the upper portion of
    the screen different then that shown in the Users Guide.
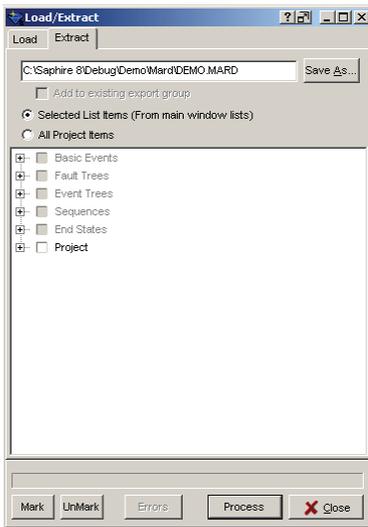
Make corrections as necessary.

39. Page 146, section 15.3.1 Options to Solve End State Cut Sets.
    After performing the gather steps the following screen is displayed:
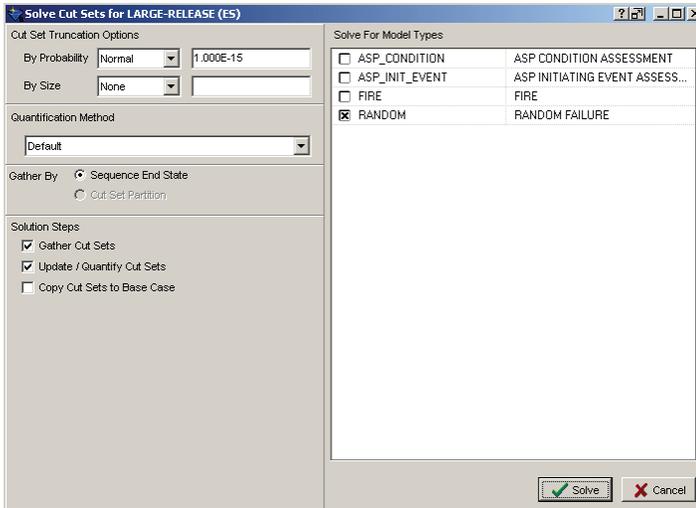
The Users Guide displays a different screen. Make corrections as necessary.

40. Page 149, section 15.4.5 View Cut Sets.

Selecting the View Cut Sets option displays the following screen showing the Publish button at the bottom right of the screen:
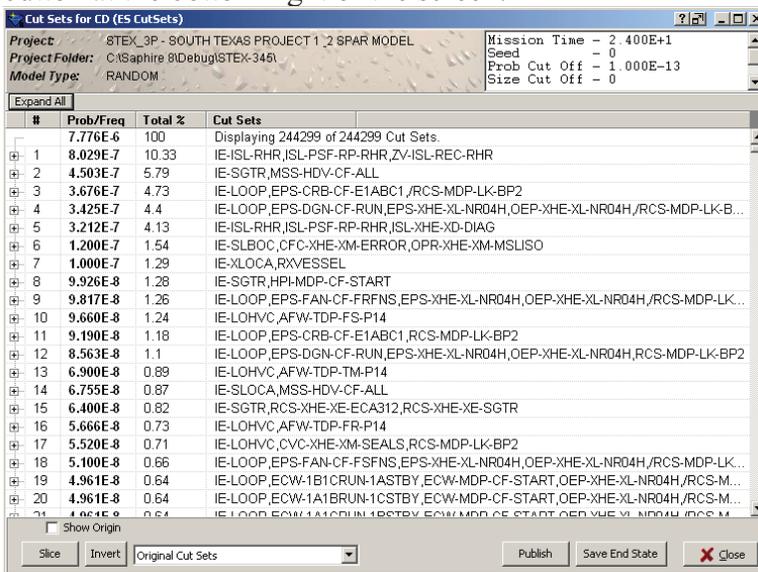
The screen in the Users Guide shows a Report button. Make corrections as necessary.

41. Page 162, section 15.8.3 Using End State Analysis to Gather the Partitioned Cut Sets.
After performing the gather steps the following screen is displayed:
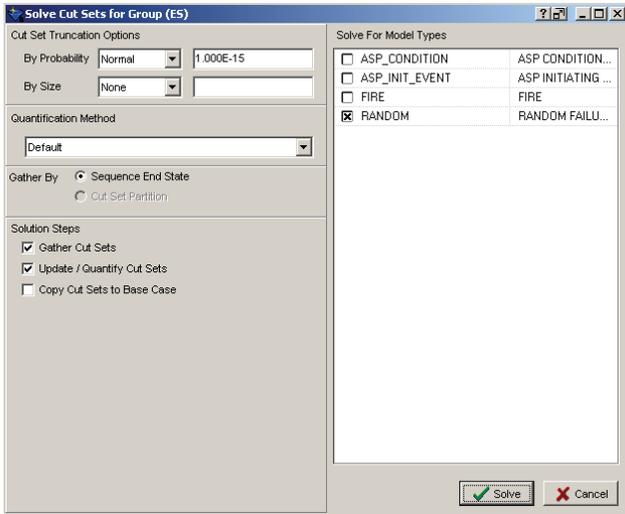
The Users Guide displays a different screen. Make corrections as necessary.

42. Page 163, section 15.8.4 Reporting End State Results.
   Selecting the Cut Sets button displays the following screen showing the Publish button at the bottom right of the screen:
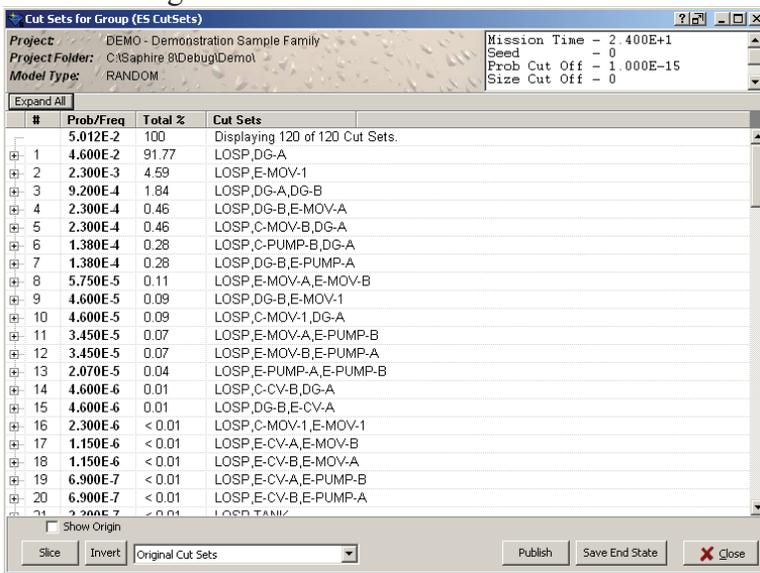
The screen in the Users Guide shows a Report button. Make corrections as necessary.

43. Page 164, section 15.8.4 Reporting End State Results.
    Selecting the Publish button displays the following screen showing the Publish button at the bottom right of the screen:
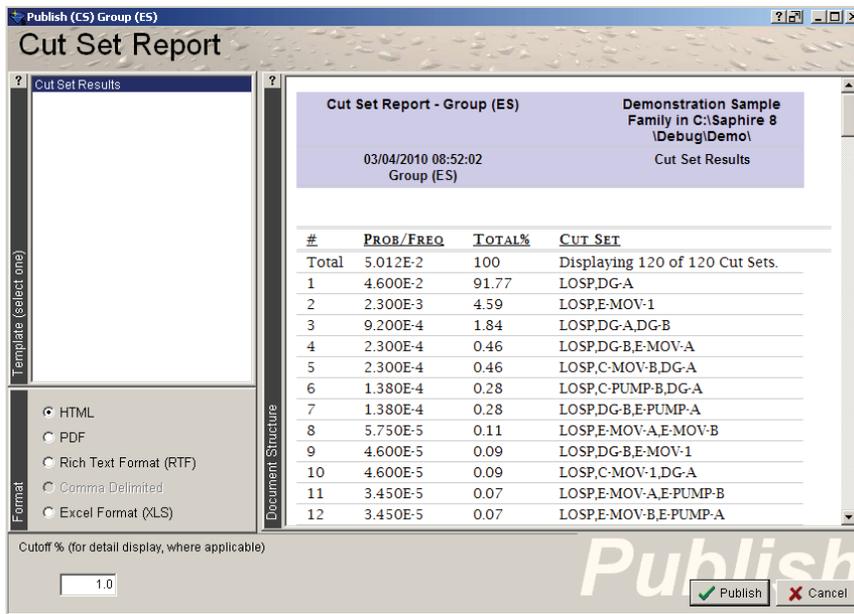
The Users Guide displays a different screen. Make corrections as necessary.

44. Page 164 and page 165, section 15.8.4 Reporting End State Results.

The View Summary Results option displays the following screen showing the Publish button at the bottom left of the screen:
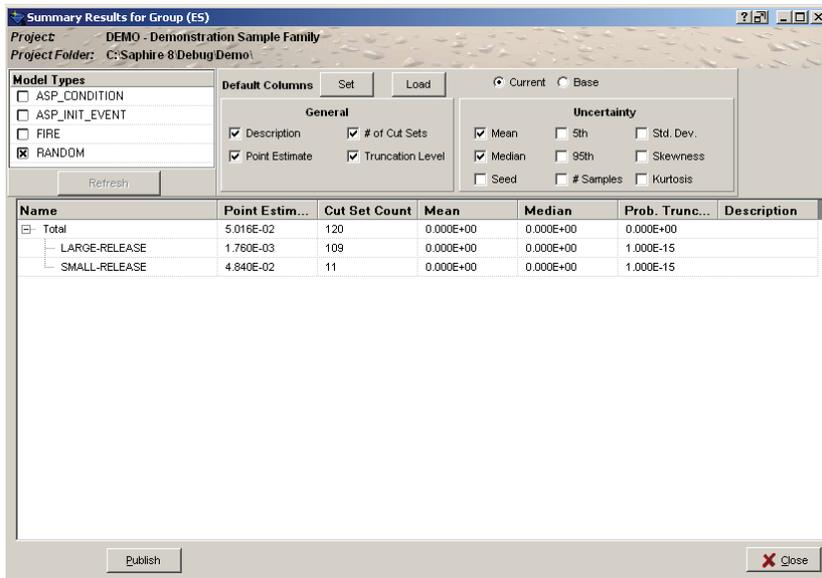
The screen in the Users Guide shows a Print button. Make corrections as necessary.

4.0   IV&V Evaluation Checklist

The evaluation criteria used in evaluating the SAPHIRE 8 Users' Guide is contained in the Implementation/User Documentation checklist that is included in the SAPHIRE 8 Software Independent Verification and Validation Plan (INL/EXT-09-15649). The criterion listed in the checklist also contains evaluation criteria for Implementation. Only the criteria specific to the User Documentation was used for the evaluation of the SAPHIRE 8 Users' Guide.

USER DOCUMENTATION		
Criteria Priority: 15	**Is the User Manual complete, including: A description of User's interaction with the software, description of required training necessary to use the software, input and output specifications and formats with sample cases, limitations of the software, anticipated errors and user response to errors, error messages with workarounds (when applicable), information about user support?** **NUREG/BR-0167 Section 4.7**	
Pass		Comments
Fail	X	The information presented within the Volume 3 Users' Guide provides a complete description of the user's interaction with the software, limitations and input and output specifications showing formats with sample cases. References to the description of required training necessary to use the software, anticipated errors and user response to errors, error messages with workarounds and information about user support were not found.
N/A		
Criteria Priority: 16	**Does the User Manual provide instructions on how to install, setup, and access the application?** **NUREG/BR-0167 Section 2.6**	
Pass		Comments
Fail	X	Installation instructions are provided in section 1.4 Installation of SAPHIRE along with un-installation instructions in section 1.5 Un-installation of SAPHIRE. Setup instructions are given in section 1.6 SAPHIRE Project Settings and the sub-sections in section 1.7 SAPHIRE User Settings. Specific instructions for accessing the SAPHIRE 8 application were not found. The ABSTRACT states "*This reference guide will introduce the SAPHIRE Version 8.0 software. A brief discussion of the purpose and history of the software is included along with general information such as installation instructions, **starting and stopping** the program, and some pointers on how to get around inside the program. Next, database concepts and structure are discussed. Following that discussion are nine sections, one for each of the menu options on the SAPHIRE main menu, wherein the purpose and general capabilities for each option are furnished. Next, the capabilities and limitations of the software are provided.*" The following information in section 1.2 Overview of SAPHIRE Users' Guide "*When starting SAPHIRE, the main screen displays will be shown as they appear on the video display (**Error! Reference source not found.**)*", and section 2.1 Opening a Project "*If there is not a current project available or a second session of SAPHIRE is started*" were found, but specific instructions for starting SAPHIRE 8 were not found.
N/A		
Criteria Priority: 17	**Does the User Manual provide a complete, consistent, correct, and adequate coverage of software functionality and is it presented in a "logical" and hierarchical order?** **NUREG/BR-0167 Section 2.2, Section 4.3**	
Pass	X	Comments
Fail		The information presented within the Volume 3 Users' Guide provides a complete, consistent, correct, and adequate coverage of software functionality and is presented in a logical and hierarchical order.
N/A		
Criteria	**Does the User Manual provide screen shots, reports, examples etc. to provide end**	

Priority: 18	users' with typical/example outputs (for reference, help, etc.)? NUREG/BR-0167 Section 4.7	
Pass	X	Comments
Fail		Multiple screen shots, reports and examples are provided within the Volume 3 Users'
N/A		Guide for reference.
Criteria Priority: 19	Does the User Manual provide instructions on accessing on-line help features (including User Support)? NUREG/BR-0167 Section 4.7	
Pass		Comments
Fail	X	The Volume 3 Users' Guide does not provide instructions for accessing the on-line help
N/A		features or User Support. Information is provided on page v within the FOREWORD section referencing the seven volumes that address the use and capabilities of SAPHIRE Version 8. "*This NUREG-series report comprises seven volumes, which address use and capabilities of SAPHIRE Version 8. Volume 1, "Overview/Summary," gives an overview of the functions available in SAPHIRE and presents general instructions for using the software. Volume 2, "Technical Reference," discusses the theoretical background behind the SAPHIRE functions. Volume 3, "SAPHIRE Users Guide," provides installation instructions and a step-by-step approach to using the program's features. Volume 4, "SAPHIRE Tutorial," provides an example of the overall process of constructing a PRA database. Volume 5, "SAPHIRE Workspace Reference Guide," discusses the use of analysis Workspaces. Volume 6, "SAPHIRE Quality Assurance," discusses QA methods and tests. Lastly, Volume 7, "SAPHIRE Data Loading," assists the user in entering PRA data into SAPHIRE using the built-in MAR-D ASCII-text file data transfer process.*"