INL/EXT-10-18028

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

## March 2010



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

New Project	Edit Project
Name	Name DEMO
Description	Description Demonstration Sample Family
Storage Info General Info Additional	Storage Info General Info Additional
Created By Creation Date 3/3/2010	Created By Creation Date
Default IE Frequency Units Year	Default IE Frequency Units Hour
Facility Location	Facility Location
Version Use SPAR-H Adjustment Equation (Page 27, NUREG/CR-6883)?	Version 0 . 0 Use SPAR-H Adjustment Equation (Page 27, NUREG/CR-6883)?
SPAR Model? 🔽 Site Hazard Curve 🔽	SPAR Model? 🗖 Site Hazard Curve 💌
Notes	Notes
<b>_</b>	× I
	Edit Project vr. K Cancel

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:

😪 User Settings		? _ 🗆 🗙
	General Analysis Settings	
User Settings Category	Cut Set Truncation	
General Display	None  Cut Set Size	
Rules Editor	Olahal Taut Trac Value 15.15	
Graphical Editor		
RASP CCF	Normal  Event Tree Value  1E-15	
	Analysis Settings	
	Random Number Seed	
	Number of Iterations 5000	
	Uncertainty Sampling Method Monte Carlo	•
	Intermediate Values None	•
	Path	
	Mission Time 24	
	Quantification Method Min Cut	•
	Pass Count 5	
	Visual BDE	Solve
	Number Significant Digits 2 🗾 🗆 S	now
Defaults	Undo Changes	X Cancel

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:

춗 User Settings	? _ 🗆 🗙
User Settings Category General Analysis Rules Editor SDP RASP CCF	irrephical Editor Settings         Use General Setting         Fault Tree       Event Tree         Node Style         Num Significant Digits       2
Jerauns	Undo Changes

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:

SAPHIRE Fault Tree Editor CCS (FT Edit)	<u>? 7 _ 0 ×</u>
File Edit Insert View Help	
X     X     Zoom %     X     Image: Search       Image: Search     Image: Search     Image: Search	÷

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:

SAPHIRE Fault Tree Editor CCS (FT Edit)	? 🗗 💶 🗵
File Edit Insert View Help	
Image: Control with the second sec	$\Rightarrow$

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:

SAPHIRE Fault Tree Editor CCS (FT Edit)	? 🛛 💶 🗆 🗙
File Edit Insert View Help	
Image: Com %     I	$\sim$

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:

SAPHIRE Event Tree Edito	NEW-ET (ET Edit)			?@_O×
File Edit Insert View Help				
X		:1	🔍 Search	$\sim$

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:

Solve Cut Sets for Group (FT)		
Cut Set Truncation Options	Solve For Model Types	
By Probability Global 💌 1.000E-15	ASP_CONDITION	ASP CONDITION ASSESSMENT
By Size	ASP_INIT_EVENT	ASP INITIATING EVENT ASSESS
	FIRE	FIRE
Solve using Flag Set	RANDOM	RANDOM FAILURE
1		
Quantification Method		
Default		
Solution Steps		
Solve for Cut Sets		
Market Apply Post-processing Rules		
🔽 Update / Quantify Cut Sets		
🔲 Copy Cut Sets to Base Case		
		Solve Y Cancel

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:

	#	Prob/Freq	Total %	Cut Sets	
		2.120E-2	100	Displaying 15 of 15 Cut	Sets.
	1	2.000E-2	94.33	DG-B	
	2	1.000E-3	4.72	C-MOV-1	
-	3	1.000E-4	0.47	C-MOV-B,DG-A	
1	4	6.000E-5	0.28		
		3.000E-3		C-PUMP-B	CCS Train B pump discharge check valve
		2.000E-2		DG-A	Emergency diesel generator A
	5	2.500E-5	0.12	C-MOV-A,C-MOV-B	
	6	1.500E-5	0.07	C-MOV-A,C-PUMP-B	
	7	1.500E-5	0.07	C-MOV-B,C-PUMP-A	
	8	9.000E-6	0.04	C-PUMP-A,C-PUMP-B	
	9	2.000E-6	0.01	C-CV-B,DG-A	
	10	5.000E-7	< 0.01	C-CV-A,C-MOV-B	
	11	5.000E-7	< 0.01	C-CV-B,C-MOV-A	
	12	3.000E-7	< 0.01	C-CV-A,C-PUMP-B	
	13	3.000E-7	< 0.01	C-CV-B,C-PUMP-A	
	14	1.000E-7	< 0.01	TANK	
	15	1.000E-8	< 0.01	C-CV-A,C-CV-B	

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:

<b>†</b>	Importance Measures - CC5 (FT)										? 🗗	X
Poir	nt Est. F-V	RIR	RRR	88 RII	RRI	Unc (Std. Dev	0					
Data Plot Report			rt									
Name			Count	Prob.	FV	RIR	RRR	Birnbaum	RI	RRI	Uncertainty	Descri
ΙĒ	C-CV-A		3	1.000E-04	3.820E-05	1.373E+00	1.000E+00	7.913E-03	7.912E-03	7.928E-07	5.932E-07	CCS T
ΙĒ	C-CV-B		4	1.000E-04	1.325E-04	2.289E+00	1.000E+00	2.733E-02	2.733E-02	2.750E-06	2.049E-06	CCS T
ΙĒ	C-MOV-1		1	1.000E-03	4.716E-02	4.716E+01	1.048E+00	9.798E-01	9.788E-01	9.798E-04	1.241E-03	CCS s
	C-MOV-A		3	5.000E-03	1.910E-03	1.371E+00	1.002E+00	7.913E-03	7.873E-03	3.964E-05	5.012E-05	CCS T
	C-MOV-B		4	5.000E-03	6.626E-03	2.283E+00	1.007E+00	2.733E-02	2.720E-02	1.375E-04	1.731E-04	CCS T
	C-PUMP-A		3	3.000E-03	1.146E-03	1.372E+00	1.001E+00	7.913E-03	7.889E-03	2.379E-05	3.007E-05	CCS T
	C-PUMP-B		4	3.000E-03	3.976E-03	2.285E+00	1.004E+00	2.733E-02	2.725E-02	8.252E-05	1.039E-04	CCS T
	DG-A		3	2.000E-02	7.640E-03	1.366E+00	1.008E+00	7.914E-03	7.755E-03	1.586E-04	3.907E-04	Emerg
	DG-B		1	2.000E-02	9.433E-01	4.716E+01	1.727E+01	9.988E-01	9.788E-01	1.998E-02	4.931E-02	Emerg
	TANK		1	1.000E-07	4.716E-06	4.716E+01	1.000E+00	9.788E-01	9.788E-01	9.788E-08	7.338E-08	RVVST
			_									
			_									
			_									
			_									
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1							_					
	Check All Un	Check All		<b>)rt</b>	aĽ	Sample	ΑΛ	/ <b>e</b>	ag	Publish		<u>C</u> lose

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:

¢	Import	ance N	1easure	s - CCS (FT	)						? 🗗	<u>- 🗆 ×</u>
Ρ	oint Est.	F-V	RIR	RRR B	8	RII RRI	Unc (Std. Dev)	]				
C	Pata	Plot	Repo	rt								
				mportan	ce M	easures		Den	nonstration S	ample Fam	nily	-
				2010_0	3_03							
	Data	a										
	Nan	ıe	Count	Prob		FV	RIR	RRR	Birnbaum	RII	RRI	U
	C-CV A	7-	3	1.000 04	)E-	3.820E- 05	1.373E+00	1.000E+00	7.913E- 03	7.912E- 03	7.928E- 07	5.
	C-CV B	7-	4	1.000 04	)E-	1.325E- 04	2.289E+00	1.000E+00	2.733E- 02	2.733E- 02	2.750E- 06	2.
	C- MOV 1	7-	1	1.000 03	)E-	4.716E- 02	4.716E+01	1.048E+00	9.798E- 01	9.788E- 01	9.798E- 04	1.
L	•			_								▶
		n	n		Show	Graph	nce	Me	eas	Publish		se

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:

😽 Solve Cut Sets for LOSP (ET)		?』 _ 🗆 ×
Cut Set Truncation Options	Solve For Model Types	
By Probability Normal   I.000E-15	ASP_CONDITION	ASP CONDITION
Ru Siza	ASP_INIT_EVENT	ASP INITIATING
	FIRE	FIRE
Solve using Flag Set	RANDOM	RANDOM FAILU
Quantification Method		
Default		
Solution Steps		
Solve for Cut Sets		
Apply Post-processing Rules		
Vpdate / Quantify Cut Sets		
Clear Cut Set Partitions		
Apply Partition Rules		
🔲 Copy Cut Sets to Base Case		
	1	
		Solve X Cancel

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:

$\Leftrightarrow$	ut Se	ts for LUSP (E	T CutSets)		×
Pro Pro Mo	ject ject F del Ty	DEM older: Casa pe: RANE	0 - Demonsti phire 8\Debu DOM	ration Sample Family Mission Time - 2.400E+1 Seed - 12345 Prob Cut Off - 1.000E-8 Size Cut Off - 0	
Exp	and All		1 3 4 4 2 5		-
	#	Prob/Freq	Total %	Cut Sets	
		5.012E-2	100	Displaying 28 of 28 Cut Sets.	
+	1	4.600E-2	91.77	LOSP,DG-A	
<b>+</b>	2	2.300E-3	4.59	LOSP,E-MOV-1	
+	3	9.200E-4	1.84	LOSP,DG-A,DG-B	
+	4	2.300E-4	0.46	LOSP,DG-B,E-MOV-A	
<b>+</b> }	5	2.300E-4	0.46	LOSP,C-MOV-B,DG-A	
<b>+</b>	6	1.380E-4	0.28	LOSP,C-PUMP-B,DG-A	
<b>+</b> }	7	1.380E-4	0.28	LOSP,DG-B,E-PUMP-A	
+	8	5.750E-5	0.11	LOSP,E-MOV-A,E-MOV-B	
+	9	4.600E-5	0.09	LOSP,DG-B,E-MOV-1	
÷	10	4.600E-5	0.09	LOSP,C-MOV-1,DG-A	
<b>+</b>	11	3.450E-5	0.07	LOSP,E-MOV-A,E-PUMP-B	
<b>±</b>	12	3.450E-5	0.07	LOSP,E-MOV-B,E-PUMP-A	
÷	13	2.070E-5	0.04	LOSP,E-PUMP-A,E-PUMP-B	
÷	14	4.600E-6	0.01	LOSP,C-CV-B,DG-A	
÷	15	4.600E-6	0.01	LOSP,DG-B,E-CV-A	
÷	16	2.300E-6	< 0.01	LOSP,C-MOV-1,E-MOV-1	
÷	<u>17</u>	<u>1.150E-6</u>	<u>&lt; 0.01</u>	LOSP,E-CV-A,E-MOV-B	
÷	18	1.150E-6	< 0.01	LOSP,E-CV-B,E-MOV-A	
÷.	19	6.900E-7	< 0.01	LOSP,E-CV-A,E-PUMP-B	-1
s	how En Slice	d States : 💿	No C	Partition defined C Sequence ets Publish Save End State X glose	1
-	_		-		4

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:

	Default Columns	Set	Load	۲	Current C Bas	9	
ASP_INIT_EVENT	Ge	eneral			Unc	ertainty	
🗇 FIRE	Description	🔽 # of Cut	Sets	🔽 Mea	n 🗖 5th	🔲 Std. Dev.	
RANDOM	Point Estimate	🔽 Truncati	ion Level	🔽 Med	ian 🥅 95th	Skewness	
Refresh	End State	🔽 Flag Set		C See	d ∏ #Sa	mples 🥅 Kurtosis	
Name	Point Estim	End State	Flag §	Bet	Cut Set Co	unt Mean	I
···· Total	5.016E-02				28	0.000E+00	1

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:

🔶 Ir	nportance Measures - Li	DSP (ET)							
Point	t Est. F-V RIR RRI	R   88	RII   RRI	Unc (St	d. Dev)				
Data	Plot Report				·				
	Name	Point Est	Mean	5th	50th	95th	Minimum	Maximum	Description
	C-CV-B	9.177E-05	8.233E-05	1.411E-05	5.390E-05	1.585E-04	9.251E-07	1.258E-03	CCS Train B pump disc
	C-MOV-1	9.661E-04	9.453E-04	8.449E-05	4.599E-04	2.075E-03	1.229E-05	1.726E-02	CCS suction isolation v
	C-MOV-A	1.835E-06	8.301E-06	1.447E-08	6.969E-07	1.709E-05	4.957E-10	1.571E-03	CCS Train A pump disc
	C-MOV-B	4.590E-03	3.773E-03	3.250E-04	1.929E-03	8.440E-03	1.728E-05	8.409E-02	CCS Train B pump disc
	C-PUMP-A	6.883E-07	1.779E-06	6.049E-09	2.395E-07	4.146E-06	1.172E-10	1.208E-04	CCS Train A motor-driv
	C-PUMP-B	2.754E-03	2.375E-03	1.762E-04	1.134E-03	5.165E-03	4.039E-06	4.835E-02	CCS Train B motor-driv
	DG-A	9.439E-01	8.331E-01	2.804E-01	8.683E-01	9.830E-01	1.130E-02	9.995E-01	Emergency diesel gene
	DG-B	2.670E-02	2.368E-02	2.174E-03	1.137E-02	4.919E-02	1.282E-04	5.556E-01	Emergency diesel gene
	E-CV-A	1.289E-04	2.283E-04	2.962E-05	1.088E-04	4.753E-04	5.810E-06	4.895E-03	ECS Train A pump disc
	E-CV-B	3.717E-05	1.459E-04	2.192E-06	3.702E-05	3.506E-04	2.224E-07	4.738E-03	ECS Train B pump disc
	E-MOV-1	4.685E-02	1.443E-01	2.863E-03	4.803E-02	3.882E-01	2.674E-04	9.835E-01	ECS suction isolation v
	E-MOV-A	6.449E-03	1.491E-02	5.316E-04	3.629E-03	3.235E-02	5.418E-05	6.221E-01	ECS Train A pump disc
	E-MOV-B	1.860E-03	1.115E-02	3.962E-05	1.203E-03	2.380E-02	2.556E-06	6.139E-01	ECS Train B pump disc
	E-PUMP-A	3.869E-03	8.400E-03	3.471E-04	2.252E-03	1.696E-02	1.267E-05	4.937E-01	ECS Train A motor-driv
	E-PUMP-B	1.116E-03	6.027E-03	2.766E-05	7.594E-04	1.224E-02	1.532E-06	4.825E-01	ECS Train B motor-driv
	LOSP	1.000E+00	1.000E+00	1.000E+00	1.000E+00	1.000E+00	1.000E+00	1.000E+00	Loss of OffsitePower
	TANK	4.589E-06	1.875E-05	4.897E-07	6.263E-06	4.498E-05	3.284E-08	5.097E-04	RW/ST supply to the inj
с	heck All UnCheck All	Oľ	ta	Sample	E.	M	<b>ea</b> .	Publi	sh Close

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:

😋 Importance Measures - LOSP (F	ET)		? 🗐 💶 🗙
Point Est. F-V RIR RRR E	18 RII RRI Unc (Std. De	()	
Data Plot Report			
105.0 .	Importa	nce Graph	
1.00-2			
1.6E-2			
1.4E-2			
1.2E-2			
1.0E-2			
8.0E-3			
6.0E-3			
4.0E-3			
2.0E-3	🔳		
	<u></u>		<u></u>
Ω Σ	H H W	W	ч- МР
7	D d t		□ 
¥			
Impo	Logrithmic Axis		iblish

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:

e u	ut Se	ts for LUSP (I	: I LutSets)	<u>Y</u>	
Pro	ject E	DEM	0 - Demonst	ration Sample Family Mission Time - 2.400E+1 Seed - 12345	<b>_</b>
Mo	del Tv	De: RANI		Prob Cut Off - 1.000E-8	
Eve	and All		122.20	Size cut oir - o	
니사	tt and All	Prob/Freg	Total %	Cut Sets	
,		5.012E-2	100	Displaying 28 of 28 Cut Sets.	-
+	1	4.600E-2	91.77	LOSP.DG-A	
+	2	2.300E-3	4.59	LOSP.E-MOV-1	
÷	3	9.200E-4	1.84	LOSP,DG-A,DG-B	
÷	4	2.300E-4	0.46	LOSP,DG-B,E-MOV-A	
+	5	2.300E-4	0.46	LOSP,C-MOV-B,DG-A	
±.	6	1.380E-4	0.28	LOSP,C-PUMP-B,DG-A	
÷.	7	1.380E-4	0.28	LOSP, DG-B, E-PUMP-A	
<b>.</b>	8	5.750E-5	0.11	LOSP,E-MOV-A,E-MOV-B	
+	9	4.600E-5	0.09	LOSP,DG-B,E-MOV-1	
÷.	10	4.600E-5	0.09	LOSP,C-MOV-1,DG-A	
<b>.</b>	11	3.450E-5	0.07	LOSP,E-MOV-A,E-PUMP-B	
<b>+</b>	12	3.450E-5	0.07	LOSP,E-MOV-B,E-PUMP-A	
+	13	2.070E-5	0.04	LOSP,E-PUMP-A,E-PUMP-B	
<b>+</b>	14	4.600E-6	0.01	LOSP,C-CV-B,DG-A	
+	15	4.600E-6	0.01	LOSP,DG-B,E-CV-A	
÷	16	2.300E-6	< 0.01	LOSP,C-MOV-1,E-MOV-1	
<b>.</b>	17	1.150E-6	< 0.01	LOSP,E-CV-A,E-MOV-B	
÷	<u>18</u>	<u>1.150E-6</u>	<u>&lt; 0.01</u>	LOSP,E-CV-B,E-MOV-A	
÷.	19	6.900E-7	< 0.01	LOSP,E-CV-A,E-PUMP-B	-
s	now En	d States : 💿	No C	Partition defined C Sequence	
	Slice	Invert	Original Cut S	ets Publish Save End State	X ⊆lose

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:

Cut Set Report	1.1				× ם_ &I
? Cut Set Results	?	Cut	Set Report - Lo 03/03/2010 14:5 LOSP (ET)	OSP (ET) 3:24	Demonstration Sample Family in C:\Saphire 8 \Debug\Demo\ Slice of - Cut Set Results
(eu		<u>#</u> Total	PROB/FREO 5.012E-2	<u>Total%</u> 100	CUT SET Displaving 28 of 28 Cut Sets.
slect o		1	4.600E-2	91.77	LOSP,DG-A
8		3	9.200E-4	1.84	LOSP,DG-A.DG-B
pplat		4	2.300E-4	0.46	LOSP,DG-B,E-MOV-A
Terr		5	2.300E-4	0.46	LOSP,C-MOV-B,DG-A
		6	1.380E-4	0.28	LOSP,C-PUMP-B,DG-A
• HTML	e l	7	1.380E-4	0.28	LOSP,DG-B,E-PUMP-A
CIPDE	nctr	8	5.750E-5	0.11	LOSP,E-MOV-A,E-MOV-B
C Bish Tout Format (BTF)	т Т	9	4.600E-5	0.09	LOSP,DG-B,E-MOV-1
C Rich Text Format (RTF)	jeut	10	4.600E-5	0.09	LOSP,C-MOV-1,DG-A
C Comma Delimited	Cum	11	3.450E-5	0.07	LOSP,E-MOV-A,E-PUMP-B
C Excel Format (XLS)	å	12	3.450E-5	0.07	LOSP,E-MOV-B,E-PUMP-A
Cutoff % (for detail display, where applicab	le)				

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:

٠	Cut Sets for LOSP (ET CutSets)									
Pro Pro Mo	oject oject F del Ty	DEM Folder: C:\S: /pe: RAN	O - Demons aphire 8\Deb DOM	tration Sample Family ug\Demo\	111 - L - L	Mission T Seed Prob Cut Size Cut	ime - 2.400E+1 - 12345 Off - 1.000E-8 Off - 0	▲ ▼		
Exp	band A	1	,							
	#	Prob/Freq	Total %	Cut Sets						
		4.825E-2	100	Displaying 2 of 28 Cut	Sets.					
•	1	4.600E-2	95.33	LOSP,DG-A						
÷	2	2.300E-3	4.77	LOSP,E-MOV-1						
s	how Er	nd States : 🕡	No (	C Partition defined C Set	quence					
	Slice	Invert	Cutoff top 95	5 Percent 4.825E-2	•	Publish	Save End State	<b>X</b> ⊆lose		

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:

Integrate Pro	oject						
Current Pr	oject C:\Sa	ohire 8\Debu	ug\Demo\				
and the	- the	C.F. Warden					
Compare Currer	t Project To						- 1
C:\Saphire 8\D	ebug\STEX-345\					<u> </u>	Browse
Basic Events	Event Models	Fault Trees	Event Trees				
s	Summary	1	Field attribu	tes to display	1	Changed events	s (0)
Events	not in current proj	ect (2540)	Ever	nts not in comparison projec	t (20)	Identical	events (4)
Name							
• ME-F&B-	SUC	-					
• HE-LOC	SVV.						
• HE-LOOI	>						
- HE-SI-SI	GNAL						
HE-SPAR	R-SUC						
PPR-MO	V-FC-RC001A						
PPR-MO	V-FC-RC001B						
<ul> <li>/RPS-CCF</li> </ul>	P-TM-CHA						
<ul> <li>ACC</li> </ul>		_					
<ul> <li>ACC-CKV</li> </ul>	/-CC-46A	_					
<ul> <li>ACC-CKV</li> </ul>	/-CC-46B	-					
<ul> <li>ACC-CKV</li> </ul>	/-CC-46C						
ACC-MO	V-OC-039A						
ACC-MO	V-OC-0398						j.
•							•
Update Curre	nt Project		Check All	Uncheck All		Integrate	X Clos

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:

Solve Cut Sets for LARGE-RELEASE (ES)		<u>?7 _0 ×</u>
Cut Set Truncation Options	Solve For Model Types	
By Probability Normal 💌 1.000E-15	ASP_CONDITION	ASP CONDITION ASSESSMENT
By Size None 🔻	ASP_INIT_EVENT	ASP INITIATING EVENT ASSESS
		FIRE
Quantification Method	RANDOM	RANDOM FAILURE
Default		
Gather By <ul> <li>Sequence End State</li> </ul>		
C Cut Set Partition		
Solution Steps		
Gather Cut Sets		
Update / Quantify Cut Sets		
Copy Cut Sets to Base Case		
	I	
		Solve X Cancel

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:

٠	Eut Se	ts for CD (ES	CutSets)	<u>*0 - 1 ×</u>						
Pro Pro Mo	Project     STEX_3P-SOUTH TEXAS PROJECT 1_2 SPAR MODEL     Mission Time - 2,400E+1       Project Folder:     CASAphire 8DebugISTEX-3461     Prob Cut Off - 1,000E-13       Model Type:     RANDOM     Size Cut Off - 0									
EX	H H	Brob/Frog	Total %	Cut Sate						
	*	7 776E-6	100	Displaying 244299 of 244299 Cut Sets						
<b>H</b>	1	8.029E.7	10.33	IE-ISI-BHR ISI-PSE-RP-RHR ZV-ISI-REC-RHR						
Ē.	2	4.503E-7	5 79	IE-SGTR MSS-HDV-CE-ALL						
÷.	3	3.676E.7	4.73	IE-LOOP EPS-CRB-CE-E1ABC1 /RCS-MDP-LK-BP2						
Ē.	4	3.425E-7	4.4	IE-LOOP EPS-DGN-CE-RUN EPS-XHE-XL-NR04H OEP-XHE-XL-NR04H /RCS-MDP-LK-B						
+	5	3.212E-7	4.13	IE-ISL-RHR ISL-PSF-RP-RHR ISL-XHE-XD-DIAG						
Ē.	6	1.200E-7	1.54	IE-SLBOC.CFC-XHE-XM-ERROR.OPR-XHE-XM-MSLISO						
•	7	1.000E-7	1.29	IE-XLOCA,RXVESSEL						
+	8	9.926E-8	1.28	IE-SGTR HPI-MDP-CF-START						
+	9	9.817E-8	1.26	IE-LOOP, EPS-FAN-CF-FRFNS, EPS-XHE-XL-NR04H, OEP-XHE-XL-NR04H, /RCS-MDP-LK						
+	10	9.660E-8	1.24	IE-LOHVC, AFW-TDP-FS-P14						
<b>+</b>	11	9.190E-8	1.18	IE-LOOP,EPS-CRB-CF-E1ABC1,RCS-MDP-LK-BP2						
+	12	8.563E-8	1.1	IE-LOOP,EPS-DGN-CF-RUN,EPS-XHE-XL-NR04H,OEP-XHE-XL-NR04H,RCS-MDP-LK-BP2						
+	13	6.900E-8	0.89	IE-LOHVC, AFW-TDP-TM-P14						
+	14	6.755E-8	0.87	IE-SLOCA,MSS-HDV-CF-ALL						
+	15	6.400E-8	0.82	IE-SGTR,RCS-XHE-XE-ECA312,RCS-XHE-XE-SGTR						
+	16	5.666E-8	0.73	IE-LOHVC,AFW-TDP-FR-P14						
+	17	5.520E-8	0.71	IE-LOHVC,CVC-XHE-XM-SEALS,RCS-MDP-LK-BP2						
+	18	5.100E-8	0.66	IE-LOOP,EPS-FAN-CF-FSFNS,EPS-XHE-XL-NR04H,OEP-XHE-XL-NR04H,/RCS-MDP-LK						
÷	19	4.961E-8	0.64	IE-LOOP,ECW-1B1CRUN-1ASTBY,ECW-MDP-CF-START,OEP-XHE-XL-NR04H,/RCS-M						
÷	20	4.961E-8	0.64	IE-LOOP,ECW-1A1BRUN-1CSTBY,ECW-MDP-CF-START,OEP-XHE-XL-NR04H,/RCS-M						
m i	11	A OC 4E O	0.04							
	Slice	Invert	Original Cut S	ets Publish Save End State Cose						

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:

😪 Solve Cut Sets for Group (ES)		<u>? 7 _ 0 ×</u>
Cut Set Truncation Options	Solve For Model Types	
By Probability Normal   I.000E-15	ASP_CONDITION	ASP CONDITION
By Size	ASP_INIT_EVENT	ASP INITIATING
	FIRE	FIRE
Quantification Method	RANDOM	RANDOM FAILU
Default		
Gather By . • Sequence End State	-	
C Cut Set Partition		
Solution Steps		
Gather Cut Sets		
Update / Quantify Cut Sets		
Copy Cut Sets to Base Case		
	2	
		Solve X Cancel

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:

ې	Cut Sets for Group (ES CutSets)				
Project         DEMO - Demonstration Sample Family         Mission Time - 2.400E+1           Project Folder:         C4Saphire 91Debug1Demot         -0           Model Type:         RANDOM         -1.000E-15					
EX	pand /		T 1 1 %	C + C +	
	#	5 012E 2	100al 4	Luit Sets	•
-	1	4.600E 2	91.77	LOSP DG-A	-
	2	2 300E 3	4.59	LOSP E-MOV-1	
	3	9 200E-5	1.84	LOSE DGA DGB	
ц 	4	2.300E4	0.46	LOSE DG-B E-MOV-A	
Ē.	5	2.300E-4	0.46	LOSE C-MOV-B DG-A	
÷.	6	1.380E-4	0.28	LOSP.C-PUMP-B.DG-A	
÷	7	1.380E-4	0.28	LOSP.DG-B.E-PUMP-A	
+	8	5.750E-5	0.11	LOSP,E-MOV-A,E-MOV-B	
+	9	4.600E-5	0.09	LOSP,DG-B,E-MOV-1	
+	10	4.600E-5	0.09	LOSP,C-MOV-1,DG-A	
+	11	3.450E-5	0.07	LOSP,E-MOV-A,E-PUMP-B	
÷	12	3.450E-5	0.07	LOSP,E-MOV-B,E-PUMP-A	
+	13	2.070E-5	0.04	LOSP,E-PUMP-A,E-PUMP-B	
÷	14	4.600E-6	0.01	LOSP,C-CV-B,DG-A	
•	15	4.600E-6	0.01	LOSP,DG-B,E-CV-A	
+	16	2.300E-6	< 0.01	LOSP,C-MOV-1,E-MOV-1	
+	17	1.150E-6	< 0.01	LOSP,E-CV-A,E-MOV-B	
÷	18	1.150E-6	< 0.01	LOSP,E-CV-B,E-MOV-A	
÷	19	6.900E-7	< 0.01	LOSP,E-CV-A,E-PUMP-B	
÷	20	6.900E-7	< 0.01	LOSP,E-CV-B,E-PUMP-A	<b>▼</b>
-		Show Origin	20.04		۲
	Slice	e Invert	Original Cut S	ets Publish Save End State Cose	]

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:

Publish (C5) Group (E5) Cut Set Report				22 _l×
2 Cut Set Results	? Cu	t Set Report - Gi 03/04/2010 08:5	roup (ES) i2:02	Demonstration Sample Family in C:\Saphire 8 \Debug\Demo\ Cut Set Results
		Group (ES)		
	<u>#</u>	PROB/FREO	TOTAL%	CUT SET
(e)	Total	5.012E-2	100	Displaying 120 of 120 Cut Sets.
	1	4.600E-2	91.77	LOSP,DG-A
	2	2.300E-3	4.59	LOSP,E-MOV-1
le le	3	9.200E-4	1.84	LOSP,DG-A,DG-B
[편]	4	2.300E-4	0.46	LOSP,DG-B,E-MOV-A
	5	2.300E-4	0.46	LOSP,C-MOV-B,DG-A
	6	1.380E-4	0.28	LOSP,C-PUMP-B,DG-A
• HTML	<u>ଥ</u> ୁ 7	1.380E-4	0.28	LOSP,DG-B,E-PUMP-A
C PDF	8 nct	5.750E-5	0.11	LOSP,E-MOV-A,E-MOV-B
C Dish Taxt Format (DTF)	र्फे <u>9</u>	4.600E-5	0.09	LOSP,DG-B,E-MOV-1
C Rich Text Format (RTF)	<b>1</b> 0	4.600E-5	0.09	LOSP,C-MOV-1,DG-A
C Comma Delimited	5 11	3.450E-5	0.07	LOSP,E-MOV-A,E-PUMP-B
🚊 C Excel Format (XLS)	പ്പാ	3.450E-5	0.07	LOSP,E-MOV-B,E-PUMP-A
Cutoff % (for detail display, where applicable	))			

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:

😪 Summary Results for Group (ES)						27 <u>- C ×</u>
Project DEMO - Demonstration Sample Family Project Folder: C:Saphire 8/Debug Demo						
Model Types ASP CONDITION	Default Columns	Set Lo	oad ©	Current C Base		
ASP INIT EVENT	Ge	eneral		Uncerta	inty	
	Description	🔽 # of Cut Se	ets 🔽 Mei	an 🕅 5th	Std. Dev.	
RANDOM	I Point Estimate	✓ Truncation	Level 🔽 Me	dian 🕅 95th	Skewness	
Refresh			C See	ed 🥅 # Sample	es 🥅 Kurtosis	
Name	Point Estim	Cut Set Count	Mean	Median	Prob. Trunc	Description
⊡ Total	5.016E-02	120	0.000E+00	0.000E+00	0.000E+00	
LARGE-RELEASE	1.760E-03	109	0.000E+00	0.000E+00	1.000E-15	
SMALL-RELEASE	4.840E-02	11	0.000E+00	0.000E+00	1.000E-15	
l <u>P</u> ublish						X Close

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			
N/A	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.			
Criteria	Does the User Manual provide instructions on how to install, setup, and access the			
Priority: 16	application?			
	NUREG/BR-0167 Section 2.6			
Pass	Comments			
Fail	X Installation instructions are provided in section 1.4 Installation of SAPHIRE along with			
N/A	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 " <i>This reference guide will</i> <i>introduce the SAPHIRE Version 8.0 software. A brief discussion of the purpose and</i> <i>history of the software is included along with general information such as installation</i> <i>instructions, starting and stopping the program, and some pointers on how to get</i> <i>around inside the program. Next, database concepts and structure are discussed.</i> <i>Following that discussion are nine sections, one for each of the menu options on the</i> <i>SAPHIRE main menu, wherein the purpose and general capabilities for each option are</i> <i>furnished. Next, the capabilities and limitations of the software are provided.</i> " The following information in section 1.2 Overview of SAPHIRE Users' Guide " <i>When</i> <i>starting SAPHIRE, the main screen displays will be shown as they appear on the video</i> <i>display (Error! Reference source not found.</i> )", and section 2.1 Opening a Project " <i>If</i> <i>there is not a current project available or a second session of SAPHIRE is started</i> " were found, but specific instructions for starting SAPHIRE swere not found.			
Criteria	Does the User Manual provide a complete, consistent, correct, and adequate coverage			
Priority: 17	of software functionality and is it presented in a "logical" and hierarchical order?			
Desc	NUKEG/DK-010/ Section 2.2, Section 4.5       V       Comments			
Fass	A Comments The information presented within the Volume 2 Users' Cuide provides a complete			
	inc information presented within the volume 5 Users Guide provides a complete,			
	logical and hierarchical order.			
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	Does the User Manual provide instructions on accessing on-line help features				
Priority: 19	(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."				