September 24, 2003

NOTE TO: Stuart Richards, Chief
Inspection Program Branch
Division of Inspection Program Management
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Patrick D. O'Reilly
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FROM: Mark F. Reinhart, Chief **/RA/** M. Caruso for
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SUBJECT: RESULTS OF THE BEAVER VALLEY POWER STATION UNIT 1 SDP PHASE 2 NOTEBOOK BENCHMARKING VISIT

During July, 2003, NRC staff and contractors visited the Beaver Valley Power Station to compare the Beaver Valley Unit 1 Significance Determination Process (SDP) Phase 2 notebook and licensee's risk model results to ensure that the SDP notebook was generally conservative. The Beaver Valley Unit 1 PRA did include most external initiating events, so sensitivity studies were performed to assess the impact of these initiators on SDP color determinations. In addition, the results from analyses using the NRC's draft Revision 3i Standard Plant Analysis Risk (SPAR) model for Beaver Valley Unit 1 were compared with the licensee's risk model. The results of the SPAR model benchmarking effort will be documented in the next revision of the SPAR (revision 3) model documentation.

The benchmarking visit identified that there was a strong correlation between the Phase 2 SDP Notebook and the licensee's PRA. The results indicate that the Beaver Valley Unit 1 Phase 2 notebook was generally more conservative in comparison to the licensee's PRA. The revision 1 SDP notebook will capture 90 percent (results matched or overestimated the licensee's PRA by one order of magnitude) of the risk significance of inspection findings. A summary of the results of comparisons of hypothetical inspection findings between SDP notebook and the licensee's PRA are as follows.

CONTACT: Peter Wilson, SPSB/DSSA/NRR
301-415-1114

4% (2 of 47 cases)	Non-conservative; underestimation of risk significance (by one order of magnitude)
6% (3 of 47 cases)	Conservative; overestimation of risk significance (by two orders of magnitude)
28% (13 of 47 cases)	Conservative; overestimation of risk significance (by one order of magnitude)
62% (29 of 47 cases)	Consistent risk significance.

The Rev-1 SDP notebook has been significantly improved as a result of the benchmarking activity. The number of overestimations by two orders of magnitude decreased from 4 to 3. the number of overestimations by one order of magnitude decreased from 14 to 13. In addition, the number of underestimations decreased from 5 to 2. The number of cases that the Rev-1 SDP would match that of the updated licensee's PRA increased 20 to 29.

The licensee's PRA staff was very knowledgeable of the plant model and provided very helpful comments during the benchmark visit.

Attachment A describes the process and results of the comparison of the Beaver Valley Unit 1 SDP Phase 2 Notebook and the licensee's PRA.

Attachments: As stated

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The licensee's PRA staff was very knowledgeable of the plant model and provided very helpful comments during the benchmark visit.

Attachment A describes the process and results of the comparison of the Beaver Valley Unit 2 SDP Phase 2 Notebook and the licensee's PRA.

Attachments: As stated

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SUMMARY REPORT ON BENCHMARKING TRIP

TO THE BEAVER VALLEY POWER STATION

UNIT 1

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September 2003

ATTACHMENT A

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List of Tables

1. INTRODUCTION

A Benchmarking of the Risk-Informed Inspection Notebook for the Beaver Valley Power Station, Unit 1, to be referred to as BV-1, was conducted during a plant site visit on July 28-August 2, 2003. NRC staff (P. Wilson and W. Schmidt) and BNL staff (P. Samanta) participated in this Benchmarking exercise.

In preparation for the meeting, BNL staff reviewed the SDP notebook for the Beaver Valley Power Station and evaluated a set of hypothetical inspection findings using the Rev. 0 SDP worksheets. In addition, NRC staff provided the licensee with a copy of the meeting protocol.

The major milestones achieved during this meeting were as follows:

1. Recent modifications made to the BV-1 PRA were discussed for consideration in the Rev. 1 model to be prepared following benchmarking.

2. Importance measures, including the Risk Achievement Worths (RAWs) for the basic events in the internal events model for average maintenance, were obtained from the licensee.

3. Benchmarking was conducted using the Rev. 0 SDP model and the revised SDP model considering the licensee's input and other modifications that were judged necessary based on comparison of the SDP model and the licensee's detailed model.

4. For cases where the color evaluated by the SDP notebook differed from that determined based on the RAW values generated by the updated licensee's PRA, results of the licensee's base case model including the dominant minimal cutsets were reviewed to understand the reason for the differences.

The Rev. 1 version of the SDP notebook was developed considering the changes identified based on the licensee's input and the evaluation of the benchmarking results.

2. SUMMARY RESULTS FROM BENCHMARKING

Summary of Benchmarking Results

Benchmarking of the SDP Notebook for the Beaver Valley Power Station, Unit 1 was conducted comparing the risk significance of the inspection findings obtained using the notebook with that obtained using the plant PRA. The benchmarking identified the hypothetical inspection findings for which the results of the evaluation using the notebook were under or overestimated compared to the plant PRA. Two cases of non-conservative results or underestimations by the notebook (i.e., the significance obtained using the notebook is one color lower than that to be obtained by the plant PRA) were noted. Also, three cases of conservative results by two orders of magnitude (i.e., the significance obtained using the notebook is two colors higher than that to be obtained using the plant PRA) were noted. A summary of the results of the risk characterization of hypothetical inspection findings is as follows:

4% (2 of 47 cases)	Non-conservative; underestimation of risk significance (by one order of magnitude)
6% (3 of 47 cases)	Conservative; overestimation of risk significance (by two orders of magnitude)
28% (13 of 47 cases)	Conservative; overestimation of risk significance (by one order of magnitude)
62% (29 of 47 cases)	Consistent risk significance.

Detailed results of Benchmarking are summarized in Table 1. Table 1 consists of eight columns. The first two columns identify the components or the case runs. The assigned colors from the SDP Rev. 0 worksheets without incorporating any modification from the Benchmarking exercise are shown in the third column. The fourth column gives the basic event name in the plant PRA used to obtain the risk achievement worth (RAW) for the component out of service or the failed operator action. The fifth and sixth columns respectively show the licensee's internal RAW value and the color to be defined based on the RAW values from the latest PRA model. The seventh column presents the colors for the inspection findings based on the Rev. 1 version of the notebook. The Rev. 1 version of the notebook is prepared considering the revisions to the Rev. 0 version of the SDP notebook judged applicable during Benchmarking. The last column provides comments identifying the difference in results between the SDP Rev. 1 notebook and the plant PRA, and the applicable rules in obtaining the color of the inspection finding using the SDP notebook.

Table 2 presents a summary of the comparison between the results obtained using the Beaver Valley Power Station, Unit 1 notebook and the plant PRA. It also shows a comparison of the results using the Rev. 0 and Rev. 1 versions of the notebook. The results showed that both underestimations and overestimations by the notebook were reduced and, consequently, matches were increased through revisions to the notebook implemented as a result of Benchmarking. The overestimations were reduced from 41% to 34%, the underestimations were reduced from 12% to 4%, and the matches increased from 47% to 62%. Following benchmarking, the notebook matched or overestimated by one order of magnitude in 90% of the cases evaluated.

Discussion of Non-conservative Results by the Notebook

During benchmarking, non-conservative results or underestimation by the notebook compared to the plant PRA were noted for 2 out of the 48 cases analyzed. The reasons for the differences, as identified, are discussed below.

1. Operator failure to provide makeup to RWST was underestimated by one order. The dominant risk contributor for RWST makeup involved steam generator tube rupture sequences. SGTR frequency in the plant PRA was a factor of 5 higher than that assumed in the SDP notebook. SGTR was placed in Row III in the notebook which was equivalent to 1E-3. Also, the HEP for operator failure to isolate the faulted SG in the plant PRA was approximately 3E-2 which was a factor of 3 higher that the operator action credit of 2 in the notebook.

2. Operator failure to conduct emergency boration was underestimated by one order of magnitude. In an ATWS, failure to conduct emergency boration leads to a core damage. In the plant PRA, the ATWS was modeled as part of different initiators and the approximate ATWS frequency was 1.14 E-5. In the SDP notebook, ATWS was placed in Row VI implying a frequency of 1E-6 in the evaluation. This difference in ATWS frequency between the plant PRA and the notebook contributed to the underestimation.

<u>Discussion of Conservative Results by the Notebook</u>

Sixteen cases of overestimations or conservative results were noted during the benchmarking. Of the sixteen cases, three cases were overestimated by two orders of magnitude and the remaining twelve cases were overestimated by one order of magnitude. Since the notebooks are designed to be screening tools and include assumptions that can result in conservative assessment, overestimation by an order of magnitude, i.e., by one color, was not unexpected. We discuss the overestimation by two orders of magnitude below.

1. An inside RS pump was overestimated by two orders of magnitude compared to the plant PRA. In the plant, Recirculation Spray (RS) function can be provided by 1 of the 4 RS (2 inside RS and 2 outside RS) pumps. Since they have a common electrical dependency, the notebook assigned a credit of 1 multi-train system which is equivalent to an unavailability of 1E-3. In the PRA, the unavailability of the four pumps was approximately two orders of magnitude lower. This difference contributed to the two orders of magnitude overestimation.

2. Outside RS pump was overestimated by two orders of magnitude. The reason for this difference was the same as that discussed for the inside RS pump in item 1 above.

3. 1 RS heat exchanger was overestimated by two orders of magnitude. The reason for this difference was also the same as that discussed for the RS pumps in items 1 and 2 above.

Changes Incorporated Following Benchmarking Resulting in Updating of Benchmarking Results

No change was made following benchmarking that resulted in changes to the benchmarking results. However, revised results were obtained from the licensee following benchmarking changing the colors obtained from the plant RAW values. The results are updated using the revised RAWs.

Table 1. Summary of Benchmarking Results for Beaver Valley Power Station, Unit 1 (Internal Initiators)

Internal Events CDF = 6.82E-6, excluding internal flooding, at Truncation Level of 1E-12
RAW Thresholds are: W =1.15, Y = 2.47, R = 15.66, and RR=147.6

No.	Component Out of Service or Failed Operator Action	SDP Before	Basic Event Name	RAW	Plant CDF Color	SDP After	Comments
	Component						
1.	1 MDAFW pump	Y	FW-P-3B	2.15	W	Y	over by 1 order of magnitude
2.	1 TDAFW pump	Y	FW-P-2	1.14	G	W	over by 1 order of magnitude
3.	DFW pump P4	G	FW-P-4	2.40	W	Y	over by 1 order of magnitude
4.	1 Cond. pump	G	Not modeled; assumed same as MFW pump	1.0	G	G	
5.	1 MFW pump	G	FW-P-1A	1.0	G	G	
6.	PORV 455C FTO	W	PCV-RC-455C; case run	1.25	W	W	
7.	PORV 455D or 456	W	PCV-RC-455D PCV-RC-456	1.03	G	W	over by 1 order of magnitude
8.	1 PORV FTC	Y	PCV-RC-455C	4.33	Y	Y	
9	1 RHR pump	G	RH-P-1A	1.0	G	G	
10.	HHSI pump P-1A	W	CH-P-1A	1.65	W	W	
11.	HHSI pump P-1B	W	CH-P-1B	2.47	W	W	
12.	Spare HHSI pump	W	CH-P-1C (spare)	1.04	G	W	over by 1 order of magnitude
13.	1 BAT pump	G	CH-P-2A	1.0	G	G	

No.	Component Out of Service or Failed Operator Action	SDP Before	Basic Event Name	RAW	Plant CDF Color	SDP After	Comments
14.	LHSI purple pump	Y	SI-P-1B	1.65	W	W	
15.	1 QS pump	G	QS-P-1B	1.83	W	W	
16.	1 Inside RS pump	W	RS-P-1A	1.04	G	Y	over; two orders of magnitude
17.	1 Outside RS pump	W	RS-P-2A	1.03	G	Y	over; two orders of magnitude
18.	1 RS HX	W	RS-E-1A	1.04	G	Y	over; two orders of magnitude
19.	1 RPCCW pump	Y	CC-P-1C	1.01	G	G	
20.	1 TPCCW pump	G	CC-P-3A	1.0	G	G	Always Green
21.	AC Orange Bus	RR	4KVS-1AE	795.16	RR	RR	
22.	1 EDG	Y	EE-EG-1	1.79	W	Y	over by 1 order of magnitude
23.	ERF DG (Black)	G	RG-EG-1	1.08	G	G	
24.	1 DC Bus Orang	RR	DC-SWBD-1	218.41	RR	RR	
25.	DC Bus Purple	RR	DC-SWBD-2	309.11	RR	RR	
26.	1 Battery purple	W	BAT-1	11.12	Y	Y	
27.	1 battery Charger orange	RR	BAT-CHG1-1-A	217.27	RR	RR	
28.	1 River water pump	G	WR-P-1B	5.57	Y	Y	
29.	1 Alt RW pump	NA	WR-P-9B	1.44	W	W	
30.	1 EDG Exhaust fan	Y	VS-F-22A	1.80	W	W	
31.	1 Station Air Compressor	G	SA-C-1A	1.00	G	W	over by 1 order of magnitude

No.	Component Out of Service or Failed Operator Action	SDP Before	Basic Event Name	RAW	Plant CDF Color	SDP After	Comments
32.	Diesel air compressor	G	SA-C-2	1.07	G	W	over by 1 order of magnitude
33.	1 MSIV	Y	TV-MS-101A	2.76	Y	Y	Strictly, RAW is not comparable. Licensee model does not address pressurized thermal shock issues.
34.	1 ACC	R	SI-TK-1A	7.62	Y	R	over by 1 order of magnitude
35.	1 SG ASDV	W	PCV-MS-101A	1.01	G	W	over by 1 order of magnitude
36.	1 HRV	NA	HCV-MS-104	1.26	W	W	
	Operator Actions						
37.	Op fails to recover MFW	W	OPROF4	1.02	G	G	
38.	Fails to use DFW pump	G	OPROF6	1.89	W	Y	over by 1 order of magnitude
39.	Fails to FB	Y	OPROB1	1.56	W	W	
40.	Fails to DEP in SLOCA	W	OPRCD1	1.01	G	G	
41.	Fails to RAPDEP	W	OPRCD6	2.38	W	W	
42.	Fails to close the Block valve	W	OPRPI1	1.00	G	G	
43.	EQ and isolation in a SGTR	Y	OPRSL1	6.26	Y	Y	
44.	RWST makeup	Y	OPRWM1	20.75	R	Y	under by 1 order of magnitude

No.	Component Out of Service or Failed Operator Action	SDP Before	Basic Event Name	RAW	Plant CDF Color	SDP After	Comments
45.	Emergency Boration	W	OPROA1	2.68	Y	W	under by 1 order of magnitude
46.	Failure to initiate RHR	Y	OPRRR1	1.00	G	W	over by 1 order of magnitude
47.	Operator fails to align Alt RW	NA	OPRWA1	3.12	Y	R	over by 1 order of magnitude
48.	Operator fails to align fire water during LOOP	NA	OPRWA5	1.0	G	G	

Table 2: Comparative Summary of Benchmarking Results

Comparisons		**Rev. 0 SDP Notebook (Before benchmarking)**		**Rev. 1 Notebook (Following Benchmarking)**	
		Total Number of Cases Compared = 48			
		Number of Cases	**Percentage**	**Number of Cases**	**Percentage**
SDP: Less Conservative		5 [1]	12	2	4
SDP: More Conservative	by one order	14	32	13	28
	by two	4	9	3	6
SDP: Matched		20	47	29	62
Comparable RAW not available or not modeled in the Notebook		5		1	

Note:

1. 2 cases by 2 orders of magnitude; remaining 3 cases by one order of magnitude.

3. PROPOSED MODIFICATIONS TO THE REV. 0 SDP NOTEBOOK

3.1 Specific Changes to the Rev. 0 SDP Notebook for the Beaver Valley Power Station, Unit 1

The following changes were made based on the licensee's inputs and evaluations conducted as part of Benchmarking:

1. Changes to Table 1

    1.1 Loss of 125V DC Bus initiator was replaced by two initiators: Loss of 125V DC Bus (orange) (LDCO) and Loss of 125V DC Bus (Purple) (LDCP). They were both placed in Row II.

    1.2 Loss of 4.2 kV AC Bus initiator was replaced by two initiators: Loss of 4.2 kV AC Bus (orange) (LACO) and Loss of 4.2 kV Bus (purple) (LACP). They were both placed in Row II.

    1.3 Loss of Reactor Plant Component Cooling Water (LCCR) was added to Row III.

    1.4 Loss of River Water Headers (LRW) was added to Row IV.

2. Changes to Table 2

    2.1 RCP seals dependency on charging for seal integrity was included.

    2.2 Availability of backup nitrogen for PORVs was moved to a footnote.

    2.3 A separate row was defined for the dedicated feed pump. ERF (black) diesel generator providing power in case of a LOOP was noted in footnote.

    2.4 125V DC dependency for the TDAFW train was deleted. Dependency of the flow control valves on 480V EAC was included.

    2.5 480V EAC dependency for the RHR MOVs was included as part of the RHR support systems.

    2.6 480V EAC dependency for HHSI MOVs were included as part of the support systems.

    2.7 Quench spray pumps dependency was corrected to 480V EAC. Dependency on 4.16 kV was deleted.

2.8 Separate row were defined for inside RS and outside RS systems.

2.9 Dependency of CCR pumps on Vital Bus Channels was deleted.

2.10 A separate row was defined for raw water system.

2.11 Emergency AC (EAC) dependency on offsite power and 125V DC were noted. Need for ventilation was clarified to SWGR ventilation.

2.12 SSPS and Vital Bus Channels were removed from the EDG support system.

2.13 It was noted that ERF (black) diesel has its own batteries, fuel oil transfer system, and ventilation.

2.14 Battery chargers were added for 125V DC. A footnote was added about the battery chargers.

2.15 Ventilation requirement for River Water pumps were clarified. A footnote was added.

2.16 Major components of SWGR Ventilation system were redefined to exhaust fans. Chilled water cooling coils are not needed for supporting safety functions. Support systems column was redefined to 480V EAC.

2.17 DC dependency of Station Instrument air was deleted.

2.18 Chilled water system row was deleted.

2.19 Main Steam components were redefined to Heat release valve (HRV). A separate row was defined for MSIVs.

3. Changes to Worksheets and Event Trees

3.1 Credit for dedicated feed pump (DFP) was removed from the PCS function and was included as part of the auxiliary feedwater (AFW). The DFP was assigned a credit of 1 train. Credit for recovering the MFW trains was changed to operator action=2 (from 3). A footnote was added to note that the operation of the DFP does not require a condensate train.

3.2 HPR mitigation capability was revised to include the need for 1/2 QS trains to assure adequate inventory in the sump for the RS pumps.

3.3 RWST makeup capability was modeled as applicable for different transients, SLOCA, and MLOCA scenarios.

3.4 LPR capability was revised to include the need for QS trains similar to HPR, except for LLOCA & MLOCA.

3.5 For the steam relief path, the heat release valve was included.

3.6 In the SLOCA worksheet, use of HRV was included for RCS depressurizations. Operator action credit for rapid depressurization was changed from 2 to 1, based on plant-specific HEP.

3.7 SORV worksheet was modified similar to SLOCA worksheet.

3.8 Credit for aligning RS pumps for injection in case of failure of LHSI trains was deleted in MLOCA and LLOCA worksheets. High radiation levels pevents such actions.

3.9 The need for QS for the RS systems was deleted from LLOCA worksheet and event tree.

3.10 The LOOP event tree and worksheet were modified to include the use of the diesel compressor to maintain integrity following success of the EDGs, but failure of the charging pumps. LOOP results in loss of station air and consequently, loss of CCR cooling to the RCP seals. The diesel compressor can be started to maintain CCR cooling to the seals. Also, crosstie of other unit’s EDG was credited.

3.11 SGTR event tree and worksheet were modified for the scenario involving feed and bleed, and RWST makeup needs. Dedicated feed pump was credited for secondary heat removal.

3.12 A footnote was added for the MSLB worksheets stating that a MSLB is assumed cause a loss of the dedicated feed pump.

3.13 Two separate worksheets were added for LACO and LACP. Credit for PCS was deleted, but the credit for dedicated feed pump (DFP) was retained within AFW function.

3.14 Two separate worksheets were added for LDCO and LDCP. Credit for DFP was added as part of AFW function.

3.15 LOIA worksheet and event tree were modified to include the need to trip the RCPs and that a failure to trip the RCPs will result in a SLOCA.

3.16 LEAC worksheet was modified to retain the sequences that are not captured in the LOOP worksheet. Operator action credit for RCSDEP was changed from 3 to 2.

3.17 Worksheet and event tree for Loss of Reactor Plant Component Cooling Water (LCCR) were added.

3.18 Worksheet and event tree for Loss of River Water Headers (LRW) were added.

3.2 Generic Change in 0609 for Inspectors

None identified.

3.3 Generic Change to the SDP Notebook

None identified.

4. DISCUSSION ON EXTERNAL EVENTS

The Beaver Valley Power Station, Unit 1 integrated PRA model includes internal floods, internal fire, and seismic initiators. The CDF in the integrated model including these external initiators was 2.35E-5/reactor-yr. The integrated model was used to assess whether the inclusion of the external initiators will result in increased risk significance for components or operator actions. The assessment was carried out by evaluating the RAWs for a set of components and operator actions for the model that included the fire and flood initiators and then, comparing them with the RAWs calculated previously for internal initiators.

Table 3 presents the comparisons for the same set of components and operator actions that were used for benchmarking. To obtain the color for the component being out of service or the failed operator action, new thresholds were obtained. A comparison of the RAWs for the internal initiators with those obtained including the external initiators showed that in four cases the color or the risk significance would have increased by an order of magnitude if the risk contributions of external initiators were included. These items are noted in the table.

Although the BVPS Unit 1 SDP notebook does not include external initiators, the team compared the Rev. 1 results of Table 1 against the licensee's PRA model including external initiators. In two of the four cases noted above, the notebook would underestimate. These cases are: HHSI pump B and operator failure to rapidly depressurize following failure of HHSI in a SLOCA.

Table 3. Summary of Benchmarking Results for Beaver Valley Power Station, Unit 1 (Including External Initiators)

Integrated CDF including external initiators = 2.35E-5, at Truncation Level of 1E-12
RAW Thresholds are: W =1.04, Y = 1.43, R = 5.25, and RR = 43.55

No.	Component Out of Service or Failed Operator Action	Basic Event Name	Internal Initiator RAW	Plant CDF Color (Internal Initiator)	RAW Including External Initiators	Plant CDF Color (Including External Initiator)	Rev. 1 SDP Color	Comments
	Component							
1.	1 MDAFW pump	FW-P-3B	2.15	W	1.32	W	Y	
2.	1 TDAFW pump	FW-P-2	1.14	G	1.04	W	W	risk significance increases by one order
3.	DFW pump P4	FW-P-4	2.40	W	1.39	Y	Y	risk significance increases by one order
4.	1 Cond. pump		1.0	G	1.0	G	G	
5.	1 MFW pump	FW-P-1A	1.0	G	1.0	G	G	
6.	PORV 455C FTO	PCV-RC-455C; case run	1.25	W	1.14	W	W	
7.	PORV 455D or 456	PCV-RC-455D PCV-RC-456	1.03	G	1.01	G	W	
8.	1 PORV FTC	PCV-RC-455C	4.33	Y	1.97	Y	Y	
9	1 RHR pump	RH-P-1A	1.0	G	1.0	G	G	
10.	HHSI pump P-1A	CH-P-1A	1.65	W	1.19	W	W	
11.	HHSI pump P-1B	CH-P-1B	2.47	W	1.47	Y	W	risk significance increases by one order

No.	Component Out of Service or Failed Operator Action	Basic Event Name	Internal Initiator RAW	Plant CDF Color (Internal Initiator)	RAW Including External Initiators	Plant CDF Color (Including External Initiator)	Rev. 1 SDP Color	Comments
12.	Spare HHSI pump	CH-P-1C (spare)	1.04	G	1.01	G	W	
13.	1 BAT pump	CH-P-2A	1.0	G	1.0	G	G	
14.	LHSI purple pump	SI-P-1B	1.65	W	1.25	W	W	
15.	1 QS pump	QS-P-1B	1.83	W	1.31	W	W	
16.	1 Inside RS pump	RS-P-1A	1.04	G	1.01	G	Y	
17.	1 Outside RS pump	RS-P-2A	1.03	G	1.00	G	Y	
18.	1 RS HX	RS-E-1A	1.04	G	1.01	G	Y	
19.	1 RPCCW pump	CC-P-1C	1.01	G	1.0	G	G	
20.	1 TPCCW pump	CC-P-3A	1.0	G	1.0	G	G	
21.	AC Orange Bus	4KVS-1AE	661.98	RR	194.55	RR	RR	
22.	1 EDG	EE-EG-1	1.79	W	1.26	W	Y	
23.	ERF DG (Black)	RG-EG-1	1.08	G	1.02	G	G	
24.	1 DC Bus Orange	DC-SWBD-1	218.41	RR	63.65	RR	RR	
25.	DC Bus Purple	DC-SWBD-2	309.11	RR	63.65	RR	RR	
26.	1 Battery purple	BAT-1	11.12	Y	3.65	Y	Y	
25.	1 battery Charger orange	BAT-CHG1-1-A	217.27	RR	63.4	RR	RR	
28.	1 River water pump	WR-P-1B	5.57	Y	2.41	Y	Y	

No.	Component Out of Service or Failed Operator Action	Basic Event Name	Internal Initiator RAW	Plant CDF Color (Internal Initiator)	RAW Including External Initiators	Plant CDF Color (Including External Initiator)	Rev. 1 SDP Color	Comments
29.	1 Alt RW pump	WR-P-9B	1.44	W	1.13	W	W	
30.	1 EDG Exhaust fan	VS-F-22A	1.80	W	1.26	W	W	
31.	1 Station Air Compressor	SA-C-1A	1.00	G	1.0	G	W	
32.	Diesel air compressor	SA-C-2	1.07	G	1.01	G	W	
33.	1 MSIV	TV-MS-101A	2.76	Y	1.51	Y	Y	Strictly, RAW is not comparable. Plant PRA does not address PTS issues.
34.	1 ACC	SI-TK-1A	7.62	Y	2.92	Y	R	
35.	1 SG ARV	PCV-MS-101A	1.01	G	1.0	G	W	
36.	1 HRV	HCV-MS-104	1.26	W	1.07	W	W	
	Operator Actions							
37.	Op fails to recover MFW	OPRO4	1.02	G	1.0	G	G	
38.	Fails to use DFW pump	OPROF6	1.49	W	1.15	W	Y	
39.	Fails to FB	OPROB1	1.56	W	1.17	W	W	
40.	Fails to DEP in SLOCA	OPRCD1	1.01	G	1.0	G	G	
41.	Fails to RAPDEP	OPRCD6	2.38	W	1.96	Y	W	risk significance increases by one order
42.	Fails to close the Block valve	OPRPI1	1.00	G	1.0	G	G	

No.	Component Out of Service or Failed Operator Action	Basic Event Name	Internal Initiator RAW	Plant CDF Color (Internal Initiator)	RAW Including External Initiators	Plant CDF Color (Including External Initiator)	Rev. 1 SDP Color	Comments
43.	EQ and isolation in a SGTR	OPRSL1	6.28	Y	2.54	Y	Y	
44.	RWST makeup	OPRWM1	20.75	R	6.75	R	Y	
45.	Emergency Boration	OPROA1	2.68	Y	1.48	Y	W	
46.	Failure to initiate RHR	OPRRR1	1.00	G	1.0	G	W	
47.	Operator fails to align Alt RW	OPRWA1	3.12	Y	1.66	Y	R	
48.	Operator fails to align fire water during LOOP	OPRWA4 OPRWA5	1.0	G	1.0	G	G	

5. LIST OF PARTICIPANTS

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