September 24, 2003

NOTE TO: Stuart Richards, Chief
Inspection Program Branch
Division of Inspection Program Management
Office of Nuclear Reactor Regulation

Patrick D. O'Reilly
Operating Experience Risk Applications Branch
Division of Risk Analysis and Applications
Office of Nuclear Regulatory Research

FROM: Mark F. Reinhart, Chief /**RA/** M. Caruso for
Licensing Section
Probabilistic Safety Assessment Branch
Division of Systems Safety and Analysis
Office of Nuclear Reactor Regulation

SUBJECT: RESULTS OF THE BEAVER VALLEY POWER STATION UNIT 2 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 2 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 2 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 2 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 2 Phase 2 notebook was generally more conservative in comparison to the licensee's PRA. The revision 1 SDP notebook will capture 96% (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

2% (1 of 47 cases)	Non-conservative; underestimation of risk significance (by one order of magnitude)
2% (1 of 47 cases)	Conservative; overestimation of risk significance (by two orders of magnitude)
26% (12 of 47 cases)	Conservative; overestimation of risk significance (by one order of magnitude)
70% (33 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 cases that the Rev-1 SDP would match that of the updated licensee's PRA has increased from 23 to 33. The number of overestimations by two orders of magnitude decreased from 5 to 1. In addition, the number of underestimations decreased from 8 to 1. However, the number of overestimations by one order of magnitude increased slightly from 11 to 12.

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

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

2% (1 of 47 cases)	Non-conservative; underestimation of risk significance (by one order of magnitude)
2% (1 of 47 cases)	Conservative; overestimation of risk significance (by two orders of magnitude)
26% (12 of 47 cases)	Conservative; overestimation of risk significance (by one order of magnitude)
70% (33 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 cases that the Rev-1 SDP would match that of the updated licensee's PRA has increased from 23 to 33. The number of overestimations by two orders of magnitude decreased from 5 to 1. In addition, the number of underestimations decreased from 8 to 1. However, the number of overestimations by one order of magnitude increased slightly from 11 to 12.

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

DISTRIBUTION: SPSB:r/f W. Schmidt

Accession#ML032681044
G:\wilson\Pilgrimbench.wpd NRR-096

OFFICE	SPSB	SPSB:SC	SPSB:RII
NAME	PWilson:nxh2	MReinhart **/RA/** M. Caruso for	WSchmidt
DATE	09/24/03	09/24/03	09/24/03

OFFICIAL RECORD COPY

SUMMARY REPORT ON BENCHMARKING TRIP

TO THE BEAVER VALLEY POWER STATION

UNIT 2

Pranab K. Samanta

Energy Sciences and Technology Department
Brookhaven National Laboratory
Upton, NY 11973-5000

September 2003

ATTACHMENT A

Table of Contents

List of Tables

1. INTRODUCTION

A benchmarking of the Risk-Informed Inspection Notebook for the Beaver Valley Power Station, Unit 2, to be referred to as BV-2, 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-2 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 2 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 overestimations compared to the plant PRA. One case of a non-conservative result or underestimation by the notebook (i.e., the significance obtained using the notebook was one color lower than that obtained by the plant PRA) was noted. Also, one case of a conservative result by two orders of magnitude (i.e., the significance obtained using the notebook was two colors higher than that to be obtained using the plant PRA) was noted. A summary of the results of the risk characterization of hypothetical inspection findings is as follows:

2% (1 of 47 cases)	Non-conservative; underestimation of risk significance (by one order of magnitude)
2% (1 of 47 cases)	Conservative; overestimation of risk significance (by two orders of magnitude)
26% (12 of 47 cases)	Conservative; overestimation of risk significance (by one order of magnitude)
70% (33 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 was 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 2 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 show 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 34% to 28%, the underestimations were reduced from 17% to 2%, and the matches increased from 49% to 70%.

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 1 out of the 48 cases analyzed. The reason for the difference, as identified, is discussed below.

1. Operator failure to recover MFW following transient or SLOCA was underestimated by one order by the notebook. The reason for the underestimation was the difference in failure probability for the AFW system in the PRA versus the mitigation credit for AFW in the notebook. In the plant PRA, failure of AFW system was modeled due to common cause failure of the check valves resulting in back flow with a probability of approximately 1E-3. In the notebook, the credit for the AFW system was 4 (3 for the motor-driven pumps and 1 for the turbine-driven pump). This difference was the reason for the underestimation. The notebook did not model the common cause failure of the check valves leading to failure of the AFW pumps. Failure of AFW pumps due to failure of the check valves could be recovered through closure of the hydraulic control valves in the line. This action was not modeled in the plant PRA.

Discussion of Conservative Results by the Notebook

Eight cases of overestimations or conservative results were noted during the benchmarking. Of the eight cases, one case was overestimated by two orders of magnitude and the remaining seven 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, is not unexpected. We discuss the overestimation by two orders of magnitude

1. Failure of 1 SG ASDV was overestimated by two orders of magnitude, i.e., by two colors. SG ASDVs provide steam relief for the secondary and are used for RCS depressurization. In all cases when SG ASDVs were used, multiple redundancies were available. In the PRA calculation, the loss of 1 SG ASDV has a minimal impact. However, in the notebook evaluation, many sequences were counted considering the base case impact leading to the overestimation by two orders of magnitude.

Changes Incorporated Following Benchmarking Resulting in Updating of Benchmarking Results

No change was made following benchmarking that resulted in changes to the benchmarking results.

Table 1. Summary of Benchmarking Results for Beaver Valley Power Station, Unit 2

Internal Events CDF = 1.85E-5, excluding internal flooding, at Truncation Level of 1E-10
RAW Thresholds are: W = 1.054, Y = 1.54, R = 6.4, RR = 55. , RRR = 541.5

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 A	R	2FWE-P23A	7.71	R	R	
2.	MDAFW pump B	R	2FWE-P23B	1.47	W	Y	over by 1
3.	1 TDAFW pump	Y	2FWE-P22	2.7	Y	Y	
4.	1 Accumulator	R	2SIS-TK21A	3.45	Y	R	over by 1
5.	1 Cond. pump	G	Not modeled	1.0	G	G	RAW is assumed to be same as the MFW pump.
6.	1 MFW pump	G	2FWS-P21A	1.0	G	G	
7.	1 PORV FTO	W	Case run	1.21	W	W	
8.	1 PORV FTC	Y	2RCS-PCV455D	1.3	W	W	
9.	1 RHR pump	G	2RHS-P21A	1.0	G	G	
10.	HHSI pump A	Y	2CHS-P21A	1.25	W	Y	over by 1
11.	Spare HHSI pump	W	2CHS-P21C	1.34	W	W	
12.	1 BAT pump	G	Not Modeled			G	Comparable RAW not available
13.	1 LHSI pump	W	2SIS-P21B	1.07	W	W	
14.	QS pump A	G	2QSS-P21A	1.96	Y	Y	
15.	QS Pump B	G	2QSS-P21B	1.17	W	W	
16.	RS pump C	R	2RSS-P21C	1.95	Y	Y	
17.	RS pump D	R	2RRS-P21D	1.32	W	W	
18.	RS HX C	R	2RSS-E21C	1.9	Y	Y	
19.	RS HX D	R	2RSS-E21D	1.28	W	W	
20.	1 CCP pump	Y	2CCP-P21B	1.04	G	G	

No.	Component Out of Service or Failed Operator Action	SDP Before	Basic Event Name	RAW	Plant CDF Color	SDP After	Comments
21.	SW Pump A	R	2SWS-P21B	1.62	Y	Y	
22.	SW pump B	R	2SWS-P21B	1.87	Y	Y	
23.	AC Orange Bus	RRR	4KVS-2AE	1013.8	RRR	RRR	
24.	AC Purple Bus	RRR	4KVS-2DF	1021.1	RRR	RRR	
25.	1 EDG	Y	2EGS-EG2-1	3.37	Y	Y	
26.	ERF DG (Black)	G	1RG-EG-1	1.0	G	G	Always Green
27.	DC Orange Bus	RRR	DC-SWBD2-1	277	RR	RRR	over by 1
28.	DC Purple Bus	RRR	DC-SWBD2-2	161.	RR	RRR	over by 1
29.	Battery 2-1	Y	BAT-2-1	4.07	Y	Y	
30.	Battery 2-2	Y	BAT-2-2	1.15	W	Y	over by 1
31.	Battery Charger 1	R	BAT-CHG2-1	277.73	RR	RRR	over by 1
32.	Battery Charger 2	R	BAT-CHG2-2	161.	RR	RRR	over by 1
33.	1 EDG Exhaust fan	Y	2HVD-FN270A	1.0	G	W	over by 1
34.	1 Containment IA compressor	G	2IAC-C21A	1.0	G	G	Always Green
35.	1 Station Air Compressor	G	2SAS-C21A	1.0	G	G	Always Green
36.	1 MSIV	Y	2MSS-AOV101A	1.62	Y	Y	
37.	1 SCCW Pump	G	2CCS-P21A	1.0	G	G	Always Green
38.	1 SG HRV	W	2SVS-HCV104	1.12	W	Y	over by 1
39.	1 SG ASDV	W	2SVS-PCV101A	1.04	G	Y	over by 2
	Operator Actions						
40.	Op fails to recover MFW	G	OPROF2	5.11	Y	W	under
41.	Fails to FB	R	OPROB1	28.69	R	R	
42.	Fails to DEP in SLOCA	W	case run	1.001	G	G	

No.	Component Out of Service or Failed Operator Action	SDP Before	Basic Event Name	RAW	Plant CDF Color	SDP After	Comments
43.	RAPDEP in SLOCA	W	OPRCD1	1.06	W	W	
44.	Fails to close the Block valve	W	OPRPI1	1.0	G	G	
45.	EQ and isolation in a SGTR	R	OPRSL1	2.86	Y	Y	
46.	RWST makeup	W	Case run	1.27	W	Y	over by 1
47.	Fails to initiate RHR	W	OPRRR1	1.02	G	W	over by 1
48.	Emergency Boration	W	OPROA1	1.36	W	W	

Table 2: Comparative Summary of Benchmarking Results

Comparisons		Rev. 0 SDP Notebook		Following Benchmarking, Rev. 1 Notebook	
		Total Number of Cases = 48			
		Number of Cases	Percentage	Number of Cases	Percentage
SDP: Less Conservative		8 (1)	17	1 (2)	2
SDP: More Conservative	one order	11	23	12	26
	two orders	5	11	1	2
SDP: Matched		23	49	33	70
Comparable RAW not available or not modeled in the Notebook		1		1	

Notes:

1. 2 cases by two orders of magnitude and the remaining 6 cases by one order of magnitude.

2. By one order of magnitude.

3. PROPOSED MODIFICATIONS TO THE REV. 0 SDP NOTEBOOK

A set of modifications were proposed for the Rev. 0 SDP notebook as a result of the site visit. These proposed modifications are driven by the licensee's revisions to the plant's PRA, better understanding of the current plant design features, revised Human Error Probabilities (HEPs), modified initiator frequencies, and the results of benchmarking.

3.1 Specific Changes to the Rev. 0 SDP Notebook for the Beaver Valley Power Station, Unit 2

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 a 4 kV EAC Bus (LAC) was replaced by two separate initiators, Loss of a 4 kV Orange Bus (LACO) and Loss of 4 kV Purple Bus (LACP). Both initiators were placed in Row II.

    1.2 Loss of a DC Bus (LDC) was replaced by two separate initiators, Loss of a DC Orange Bus (LDCO) and Loss of a DC Purple Bus (LDCP). Both initiators were placed in Row II.

    1.3 Loss of Service Water Header A or B (LOSWH) was replaced by two separate initiators, Loss of Service Water Header A (LOSWHA) and Loss of Service Water Header B (LOSWHB). Both initiators were placed in Row III.

    1.4 Loss of Primary Component Cooling Water (LCCP) was added in Row II.

2. Changes to Table 2

    2.1 DC dependency of MFW and condensate pumps was clarified. Startup feed pump was added as a major component. ERF DG was removed as a support system, but a footnote was added stating that the ERF diesel serves as the backup power source for the startup feed pump.

    2.2 CIA and SSPS dependency for MSIV were removed. MSIV was included as part of Main Steam.

    2.3 SW Header B as the backup water supply for the AFW system was noted in the footnote and removed from the Support System column.

2.4 125V DC dependency for TD AFW pump was removed. A footnote was added to note that the SOVs on the steam admission line fail open on loss of power.

2.5 125V DC dependency for EAC Buses was added.

2.6 A footnote for the ERF diesel was added to note the separate battery for start and control power.

2.7 480V EAC dependency for the 125V DC system was noted.

2.8 SSPS dependency on Vital Bus Channels was clarified. Channels I and II are needed, not channels III and IV.

2.9 Major components for Ventilation System was corrected to include only fans. Dependency on Vital Bus Channels I and II was deleted.

2.10 For the SW system, it was noted in the footnote that ventilation is needed only for starting the standby pumps.

2.11 For the IA/CIA system, a footnote was added to note that ERF diesel provides a backup power supply in case of loss of power.

2.12 The Chilled Water system was deleted.

3. Changes to Worksheets and Event Trees

3.1 RWST makeup in case of failure of HPR and LPR was added, as applicable, for different initiators.

3.2 For the HPR and LPR functions in different transient and SLOCA scenarios, success of 1/2 QS pumps is needed and is included as part of the mitigation capability. For MLOCA and LLOCA, success for a QS pump is not required.

3.3 In SLOCA worksheet, use of the Heat Release valve was credited in the RAPDEP function and the operator action credit was reduced to 1 (from 2).

3.4 SLOCA worksheet and event tree were modified to credit FW consistently following loss of AFW.

3.5 SORV worksheet and event tree were modified similar to SLOCA worksheet and event tree.

3.6 LLOCA worksheet and event tree were modified to remove the need for QS for LPR.

3.7 LOOP worksheet and event tree were modified to address the capability to crosstie other unit's EDG to power a charging pump. For this, Crosstieing other unit's EDG is separated from the EAC function. RWST makeup is only credited when offsite power is recovered.

3.8 SGTR worksheet and event tree were modified to remove the need for EQ following FB and to address RWST makeup.

3.9 In the ATWS worksheet, steam relief requirement for AFW was added. Also, RWST suction, in case of failure of the BAT pumps, was included.

3.10 Separate worksheets and event trees were included for Loss of Service Water Headers A and B. For loss of Service Water Header B, RWST makeup is not possible.

3.11 LEAC worksheet was modified to include manual operation of ASDVs and to modify the credit for RAPDEP to operator action = 1.

3.12 Separate worksheets and event trees were developed for Loss of Orange and Purple EAC Buses. In the Loss of the Orange Bus (LACO), credit for using feedwater was changed to operator action = 2 based on the plant-specific HEP. Loss of the Purple Bus (LACP) results in loss of the feed pumps and the ability to use RWST makeup.

3.13 Similar to loss of AC Buses, separate worksheets and event trees were developed for loss of orange and purple DC Buses.

3.14 The worksheet and event tree were developed for Loss of Primary Component Cooling water (LCCP).

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 2 integrated PRA model includes internal floods, internal fire, and seismic initiators. The CDF in the integrated model including these external initiators was 3.33E-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. Obtaining RAWs for some items required separate computer runs which were not conducted for the integrated model. RAWs for these items were not available and are noted as "NA."

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 two 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 2 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 the two cases noted above, the notebook would underestimate one case: operator failure to recover MFW.

Table 3. Summary of Benchmarking Results for Beaver Valley Power Station, Unit 2

Integrated CDF = 3.33E-5, including external initiators, at Truncation Level of 1E-10
RAW Thresholds are: W = 1.03, Y = 1.3, R = 4.0, RR = 31.0, RRR = 301.3

No.	Component Out of Service or Failed Operator Action	Basic Event Name	Internal Initiator RAW	Plant CDF Color (Internal Initiator)	RAW Including External Initiator	Plant CDF Color (Including External Initiator)	Rev. 1 SDP Color	Comments
	Component							
1.	MDAFW pump A	2FWE-P23A	7.71	R	5.07	R	R	
2.	MDAFW pump B	2FWE-P23B	1.47	W	1.33	Y	Y	risk significance increased by one order
3.	1 TDAFW pump	2FWE-P22	2.7	Y	1.96	Y	Y	
4.	1 Accumulator	2SIS-TK21A	3.45	Y	2.3	Y	R	
5.	1 Cond. pump	Not modeled	1.0	G	G	G	G	RAW is assumed to be same as the MFW pump.
6.	1 MFW pump	2FWS-P21A	1.0	G	G	G	G	
7.	1 PORV FTO	Case run	1.21	W	NA		W	
8.	1 PORV FTC	2RCS-PCV455D	1.3	W	1.12	W	W	
9.	1 RHR pump	2RHS-P21A	1.0	G	1.0	G	G	
10.	HHSI pump A	2CHS-P21A	1.25	W	1.27	W	Y	
11.	Spare HHSI pump	2CHS-P21C	1.34	W	1.22	W	W	
12.	1 BAT pump	Not Modeled					G	
13.	1 LHSI pump	2SIS-P21B	1.07	W	1.04	W	W	
14.	QS pump A	2QSS-P21A	1.96	Y	1.73	Y	Y	
15.	QS Pump B	2QSS-P21B	1.17	W	1.09	W	W	
16.	RS pump C	2RSS-P21C	1.95	Y	1.72	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 Initiator	Plant CDF Color (Including External Initiator)	Rev. 1 SDP Color	Comments
17.	RS pump D	2RRS-P21D	1.32	W	1.21	W	W	
18.	RS HX C	2RSS-E21C	1.9	Y	1.7	Y	Y	
19.	RS HX D	2RSS-E21D	1.28	W	1.18	W	W	
20.	1 PCCW pump	2CCP-P21B	1.04	G	1.02	G	G	
21.	SW Pump A	2SWS-P21B	1.62	Y	1.4	Y	Y	
22.	SW pump B	2SWS-P21B	1.87	Y	1.53	Y	Y	
23.	AC Bus Orange	4KVS-2AE	1013.8	RRR	595.	RRR	RRR	
24.	AC Bus Purple	4KVS-2DF	1021.1	RRR	601.	RRR	RRR	
25.	1 EDG	2EGS-EG2-1	3.37	Y	2.94	Y	Y	
26.	ERF DG (Black)	1RG-EG-1	1.0	1.0	1.0	G	G	
27.	DC Bus Orange	DC-SWBD2-1	277	RR	160.65	RR	RRR	
28.	DC Bus Purple	DC-SWBD2-2	161.	RRR	NA		RRR	
29.	Battery 2-1	BAT-2-1	4.07	Y	3.18	Y	Y	
30.	Battery 2-2	BAT-2-2	1.15	W	1.09	W	Y	
31.	Battery Charger 1	BAT-CHG2-1	277.73	RR	160.32	RR	RRR	
32.	Battery Charger 2	BAT-CHG2-2	161.	RR	NA		RRR	
33.	1 EDG Exhaust fan	2HVD-FN270A	1.0	G	1.0	G	W	
34.	1 Containment IA compressor	2IAC-C21A	1.0	G	1.0	G	G	
35.	1 Station Air Compressor	2SAS-C21A	1.0	G	1.0	G	G	
36.	1 MSIV	2MSS-AOV101A	1.62	Y	1.35	Y	Y	
37.	1 SCCW Pump	2CCS-P21A	1.0	G	1.02	G	G	
38.	1 SG HRV	2SVS-HCV104	1.12	W	1.07	W	Y	
39.	1 SG ASDV	2SVS-PCV101A	1.04	G	1.02	G	Y	

No.	Component Out of Service or Failed Operator Action	Basic Event Name	Internal Initiator RAW	Plant CDF Color (Internal Initiator)	RAW Including External Initiator	Plant CDF Color (Including External Initiator)	Rev. 1 SDP Color	Comments
	Operator Actions							
40.	Op fails to recover MFW	OPROF2	5.11	Y	4.81	R	W	risk significance increased by one order of magnitude
41.	Fails to FB	OPROB1	28.69	R	16.93	R	R	
42.	Fails to DEP in SLOCA	case run	1.001	G	NA		G	
43.	RAPDEP in SLOCA	OPRCD1	1.06	W	1.03	W	W	
44.	Fails to close the Block valve	OPRPI1	1.0	G	1.0	G	G	
45.	EQ and isolation in a SGTR	OPRSL1	2.86	Y	2.04	Y	Y	
46.	RWST makeup	Case run	1.27	W	NA		Y	
47.	Fails to initiate RHR	OPRRR1	1.02	G	1.01	G	W	
48.	Emergency Boration	OPROA1	1.36	W	1.20	W	W	

5. LIST OF PARTICIPANTS

Wayne Schmidt	USNRC - Region I
Peter Wilson	USNRC - NRR
Pranab Samanta	BNL
Robert Buell	INEEL
William Etzelf	First Energy/Beaver Valley Power Station