September 24, 2003

NOTE TO: Stuart Richards, Chief
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SUBJECT: RESULTS OF THE BROWNS FERRY NUCLEAR PLANT NUCLEAR POWER STATION UNITS 2 AND 3 SDP PHASE 2 NOTEBOOK BENCHMARKING VISIT

During August, 2003, NRC staff and contractors visited the Browns Ferry site to compare the Browns Ferry Significance Determination Process (SDP) Phase 2 notebook and licensee's risk model results to ensure that the SDP notebook was generally conservative. The Browns Ferry PSA did not include external initiating events so no 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 Browns Ferry 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 strong correlation between the Phase 2 SDP Notebook and the licensee's PSA. The results indicate that the Browns Ferry Phase 2 notebook was generally more conservative in comparison to the licensee's PSA. The revision 1 SDP notebook will capture 93 % (results matched or overestimated the licensee's PSA 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 PSA are as follows.

- 6 % Underestimates Risk Significance (non-conservative)
- 52 % Match Risk significance
- 41 % Overestimates Risk Significance by 1 Order of Magnitude (conservative)
- 2 % Overestimates Risk Significance by 2 Orders of Magnitude
- 0 % Overestimates Risk Significance by 3 Orders of Magnitude

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The Rev-1 SDP notebook has been improved as a result of the benchmarking activity. The number of cases that the Rev-1 SDP notebook would overestimate the risk associated with a hypothetical finding by two orders of magnitude decreased from 3 to 1. The number of underestimations decreased from 10 to 4. However the number of overestimations by one order of magnitude increased from 12 to 24.

The licensee's PSA 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 Browns Ferry SDP Phase 2 Notebook and the licensee's PSA.

Attachments: As stated

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Attachments: As stated

Distribution: SPSB:r/f R. Bernhard

Accession#

G:SPSB\wilson\brownsferry.wpd NRR-096

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SUMMARY REPORT ON RISK-INFORMED BENCHMARKING

TRIP TO THE BROWNS FERRY NUCLEAR PLANT

(August 12 - 14, 2003)

J. C. Higgins
Brookhaven National Laboratory

September 2003

ATTACHMENT A

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1 Introduction

On August 12-14, 2003, the NRC conducted an SDP Benchmarking visit with the Browns Ferry Nuclear Plant (BFN) PSA staff in the site engineering and administrative offices onsite at the Browns Ferry Nuclear Plant in AL (Attachment 1 provides a list of participants). The purpose of this visit was to validate the underlying assumptions of the draft Revision 1, SDP Phase 2 Notebook. The validation was conducted by soliciting comments from the licensee's PSA staff; reviewing differences between the underlying assumptions of the notebook and the licensee's PSA; and comparing the safety significance of hypothetical inspection findings using both the notebook and the PSA. The outcome of this SDP Benchmarking visit was the issuance of Revision 1 of the SDP notebook. The SDP notebook is used by inspectors to determine the safety significance of inspection findings.

The Browns Ferry Nuclear Plant SDP Notebook was originally prepared in 2001. The BFN notebook was reviewed prior to this benchmarking visit in order to identify potential changes that may be needed in order to address generic NRC changes for the Rev. 1 notebook update. A number of questions were developed while making this update. These questions and the draft Rev. 1 notebook were provided to the licensee about 5 weeks prior to the benchmarking visit. The licensee sent answers to the questions the week prior to the onsite visit. BNL incorporated the information from the answers into the notebook before arriving onsite for the benchmarking. A summary of the changes to the notebook are listed in Attachment 2.

2 Summary of Results from Benchmarking

The benchmarking visit identified that the notebook was generally conservative compared to the licensee's PSA with a few non-conservative items. The comparison of the significance between the licensee's PSA and the SDP Phase 2 notebook for hypothetical inspection findings is provided in Tables 1 & 2. A summary of the results of the risk characterization of hypothetical findings by the SDP notebook are as follows.

- 6 % Underestimates Risk Significance (non-conservative)
- 52 % Match Risk significance
- 41 % Overestimates Risk Significance by 1 Order of Magnitude (conservative)
- 2 % Overestimates Risk Significance by 2 Orders of Magnitude
- 0 % Overestimates Risk Significance by 3 Orders of Magnitude

The benchmarking team noted several reasons why the notebook was more conservative than the PSA. The principle reasons for the differences were believed to be as follows:

- BFN has added redundancy and cross tie capability in their electrical system that was not all modeled in notebook.

- BFN has 4 LPCI/RHR pumps and HXs that were not fully credited in notebook.

- The BFN PSA used lower HEPs than were credited in notebook.

- The PSA separately credited the Shutdown Cooling mode of RHR in addition to the SPC mode.

3 Modifications to SDP Worksheets

3.1 Benchmarking Details

Benchmarking Methodology

The licensee's PSA information used during this benchmarking visit was based on the updated 5/16/2002 version of the BFN PSA. The baseline PSA core damage frequency (CDF) from internal events was 1.25E-6 core damage events/reactor-year, including internal flooding which was about 5% of CDF. With the internal flooding contribution removed, the CDF was 1.19E-6 core damage events/reactor-year for U2 and 1.81E-6 per RY for U3.

At the beginning of the benchmarking visit, the team reviewed the notebook with the licensee's staff and obtained comments from the licensee. These comments were incorporated, as appropriate, into the notebook prior to the onsite benchmarking.

The team computed the break points in RAW values for the different SDP colors based upon a current PSA total internal events CDF of 1.19E-6 core damage events/reactor-year. The team pre-selected components and human actions, as listed in Table 1, that would be evaluated for the effect of having the component or human action fail. The team developed the color corresponding to failure of each item. The latest revised version of the notebook was used to develop the color corresponding to failure of each item and compared that to the color that would be implied by the items RAW value from the PSA. Table 1 tabulates the results of the benchmarking of both the Rev. 0 and the modified Rev. 1 worksheets that are contained in the risk-informed inspection notebook for Browns Ferry.

In developing the colors from the notebooks, the team evaluated all sequences in each worksheet that contained the item (component or human action). A number was obtained for each re-evaluated sequence. We then used a "counting rule" to cascade lower value sequences to higher value ones as follows. For example three sequences of value 8 (shorthand for an estimated sequence frequency of 1 E-8 events/reactor-year) were equivalent to one sequence of value 7. Likewise 3 sequences of value 7 (3-7s) were equivalent 1 sequence of value 6 (1-6). Also, 3-6s were equal to 1-5, and so on. Colors were developed as follows:

Sequences of value 7, 8, and higher	Green (G)
Sequences of value 6	White (W)
Sequences of value 5	Yellow (Y)
Sequences of value 4	Red (R)
Sequences of value 3	Double Red (RR)
Sequences of value 2	Triple Red (RRR)

Key BFN PSA Assumption

CRD was credited for early HPI for general (non-break) transients in the enhanced vessel injection (two pumps) mode. As a rule, this assumption was not credited in BWR notebooks. At BFN the PSA model credited CRD with 2/2 pumps and operator action to maximize flow by opening valve 8550 for direct injection to the RPV providing 275 gpm. The HEP for these actions was 1E-3 and they were required to be completed in 45 minutes. MAAP runs and NUREG/CR-3179, "The Effect of Small-Capacity High-Pressure Injection Systems on TQUV Sequences at BFN Unit One" provided the basis for the analysis. The licensee stated that after the BFN power uprate was approved, this credit for CRD would no longer be possible.

Non-conservative Benchmark Results

For this benchmarking there were 4 items that were non-conservative (where the licensee's PSA RAW value gave a color closer to Red than the notebook). These were: one RHR HX, CRD pump 2A, Unit 3 EDG 3C, and the operator action for RHR suppression pool cooling (SPC).

The RHR HXs all had the same RAW value of 1.92 (see note 7 of Table 1 for discussion of RAW calculation). The Green-White threshold was 1.84 so this places the HXs just barely into the White range per the PSA. The HXs all benchmark as Green with two 7s (after cascading). This placed the HXs just barely out of the White range. So they were actually very close to a match.

CRD pump 2A had a RAW value of 1.98 which was White. The notebook benchmark gave a Green with only one 8. This was primarily due to the "Key assumption" discussed above where CRD was credited for early HPI by the PSA but not in the notebook.

Unit 3 EDG 3C benchmarked as Green while the RAW was 2.71 (White). We generally evaluated the U3 EDGs for their ability to cross tie and supply U2 power on a LOOP at U2 and to supply U3 power on a LOOP at U3. However, due to the EECW power issue (see notebook footnotes for Table 2 and the LOOP worksheet), EDG 3C cannot power an EECW pump on an SBO. Therefore, in the somewhat simplified notebook LOOP model, it was not credited as supplying EAC. However, if the U2 EDGs were operating and supplying EECW (a site system), then EDG 3C could supply ECCS for U3. Our model does not address this eventuality. Thus, we non-conservatively get a Green for the EDG3C.

The operator action for RHR suppression pool cooling (SPC) benchmarked as Red but had a RAW of 1506, which was RR (one order non-conservative). For the CHR function, both the PSA and the notebook credited the U2 SPC mode of RHR and, as a backup, cross tie of either U1 or U3 RHR in the SPC mode to U2. The HEP for use of RHR in the SPC mode in Unit 2 was 7.7E-5. Because of this the notebook credits SPC as a multi-train system with a credit or 3. The HEP for crosstie of either U1 or U3 to U2 was 1.6E-2, therefore the notebook applied a credit of 2 for this operator action in the notebook. This gave a total credit of 5 for CHR in most worksheets. In the PSA, in the event of failure of the PSA operator action for U2 SPC, the PSA applied a common cause factor, which reduced the HEP for the SPC crosstie to U2 from 1.6E-2 to 0.59. This makes the U2 SPC operator action more important in the PSA. The notebook model was not so detailed and maintained the cross tie credit at 2. This causes the benchmarking of the operator action for SPC to benchmark one order non-conservative.

Conservative Benchmark Results

There were 24 items that benchmarked as one order conservative (notebook gave a color closer to Red than the PSA RAW value). These were due to variety of reasons that were not specifically examined, but that generally were due to the 4 reasons noted in paragraph 2 above.

For this benchmarking there was only one item that was more than one order conservative, Level Control (LC) on ATWS, which was 2 orders conservative. The notebook was generally one order of magnitude conservative on most all ATWS items due to a one order difference in the initiating event frequency between the notebook and the PSA. Additionally, the notebook modeled LC failure as leading to core damage (CD) on all ATWS events. The PSA differentiated between ATWS events caused by loss of PCS steam (e.g., MSIV closure or loss of condenser) and other transient-initiated ATWS events. For the first type, the PSA also went to CD on an LC failure. But for the second type (transient-initiated) the PSA did not go to CD on LC failure, whereas the notebook and other BWR PRAs typically did. So, there was no contribution to the RAW for LC from these transient-initiated sequences in the PRA. This led to a second order of magnitude, for a total mismatch of two orders.

3.2 Specific Changes to the Rev. 0 SDP Notebook for Browns Ferry

A number of changes were made to the BFN Rev. 0 notebook, in the process developing the Rev. 1 notebook. Some of these were made prior to the onsite benchmarking effort. Additionally, at the conclusion of the benchmarking, further changes were made to the notebook in order to minimize the differences between the notebook and the licensee's PSA, while maintaining consistency with the NRC notebook construction rules. Refer to Attachment 2 for a summary of the changes.

3.3 Generic Changes in IMC 0609 for Guidance to NRC Inspectors

No new generic changes identified.

3.4 Generic Changes to the SDP Notebooks

No new generic changes identified.

4 Discussion on External Events

The licensee's updated PSA does not have an quantitative external events model. As noted in the benchmarking details, the PSA model does not include internal flooding which adds about 5 % to the internal risk.

5 References

5. Tennessee Valley Authority, Browns Ferry Nuclear Plant - Multi-Unit Probabilistic Risk Assessment (PRA), submitted to NRC via letter dated April 14, 1995

6. Updated Browns Ferry Nuclear Plant (BFNP) Unit 2 and Unit 3 PSA dated 5/16/2002.

7. Licensee comment package on draft version of Inspection Notebook contained in memo from Ian Jung to Jose Ibarra dated June 16, 2000 and based on site visit to Browns Ferry on May 24, 2000.

8. Risk-informed Inspection Notebook for Browns Ferry Nuclear Plant, Revision 1, September, 2003.

9. Email from Don McCamy, BFN to J., Higgins, BNL dated 87/2003 with BFN responses to BNL questions related to notebook and PSA.

Table 1: Summary of Benchmarking Results for Browns Ferry Nuclear Plant (BFN)

Unit 2 Internal Events CDF is 1.19E-6 events/reactor-year excluding internal flooding at a 5E-12 truncation limit (note 2)
RAW thresholds based on the Unit 2 CDF are: W = 1.84, Y = 9.4, R = 85.0, RR = 841, RRR = 8404

Component Out of Service or Failed Operator Action	SDP Work-sheet Results (Before)	BFN Basic Event	U2 BFN RAW ratio	Color by BFN RAW	SDP Worksheets Results (After)	Comments
Component						
HPCI	W	HPI/HPL	2.13	W	Y	conservative
RCIC	W	RCI/RCL	2.76	W	Y	conservative
PCS steam	Y	MCD	3.56	W	Y	conservative
PCS feed	W	OF	5.66	W	W	
1 SRV fto	W	CDF calculation	1.00	G	W	conservative
1 SRV ftc	Y	100V (IE)	1.91	W	Y	conservative
CS pump A	G	PMSFR2PMPO750005	1.05	G	G	
RHR pump A	W	CDF calculation	2.92	W	W	note 7
RHR pump B	W	CDF calculation	2.92	W	W	note 7
RHR HX	W	CDF calculation	1.92	W	G	non-conservative note 7
1 RHRSW pump	W	CDF calculation	1.34	G	G	
1 W/W CV valve	R	AOVFO2FCV640221	1.64	G	W	conservative
1 RCW pump	W	PMOFR1___024001A	1.005	G	G	
1 condensate pump	G	PMOFR2_CP002002A	1.00	G	G	
SLC pump	G	PMSFR2___063002B	1.01	G	G	
RPT 1 train	G	FUSXO2FU26825418	1.00	G	G	
RPT both trains	Y	RPT	2.10	W	Y	conservative
U2 EDG DGA	G	CDF calculation	1.65	G	G	
U2 EDG DGB	G	GB	3.16	W	W	

Component Out of Service or Failed Operator Action	SDP Work-sheet Results (Before)	BFN Basic Event	U2 BFN RAW ratio	Color by BFN RAW	SDP Worksheets Results (After)	Comments
U2 EDG DGC	G	CDF calculation	3.78	W	W	
U2 EDG DGD	G	GD	3.72	W	W	
U3 EDG DG3A	G	GE	6.30 (U3)	W	Y	conservative note 8
U3 EDG DG3B	G	GF	3.09 (U3)	W	Y	conservative
U3 EDG DG3C	G	CDF calculation	2.71 (U3)	W	G	non-conservative
U3 EDG DG3D	G	GH	2.16 (U3)	W	Y	conservative
USST	-	CDF calculation	1.00	G	G	
4KV shutdown board A	W	AA	1.00	G	W	conservative
4KV shutdown board B	W	AB	5.02	W	W	
3 ECCS HVAC - components	-	See below 3 items	See Below	-	-	
RHR room cooler	W	HXRRP2HXR074002A	3.91	W	W	
CS room cooler	G	HXRPP2CLR0670920	1.32	G	G	
EDG Ventilation (one fan)	G	VAAS	1.07	G	G	
CRD pump A	G	PMSFRE1PMP085002	1.98	W	G	non-conservative
1 PCA compressor	W	CMPFR2CMP032000A	1.00	G	W	conservative
1 DWCA compressor	W	CMPFS2CMP032002A	1.05	G	G	
CAD system	-	CAD	1.0	G	G	
1 RBCCW pump	W	PMSFR2___070002A	1.00	G	G	
1 EECW pump	W	CDF calculation	4.02	W	W	
250 VDC Dist. Panel A 250 V RMOV BD 2A	-	RB/RB3	20.4	Y	R	conservative
250 VDC Dist. Panel B 250 V RMOV BD 2B	-	RC/RC3	14.7	Y	R	conservative
250 VDC Battery SB-A	-	DA	1.81	G	W	conservative
250 VDC Battery SB-B	-	DB	21.5	Y	R	conservative
250 VDC Battery SB-C	-	DC	1.66	G	W	conservative

Component Out of Service or Failed Operator Action	SDP Work-sheet Results (Before)	BFN Basic Event	U2 BFN RAW ratio	Color by BFN RAW	SDP Worksheets Results (After)	Comments
250 VDC Battery SB-D	-	DD	2.00	W	W	
250 VDC Battery 1	W	DE	5.68	W	W	
250 VDC Battery 3	R	CDF calculation	7.85	W	W	
250 VDC Battery 2	R	CDF calculation	2.71	W	W	
DC Charger SB-A	-	CDF calculation	1.79	G	G	
DC Charger SB-B	-	CHSBB2R	1.84	G [11]	W	conservative
1 SP vac. bkr	R	Not modeled in PSA	-	-	W	
2 SP vac. bkrs.	R	PRESS_SPRES_LOST	55.5	Y	R	conservative
Failed Operator Actions						
PCS	W	OF	5.66	W	W	
DEP	R	ORVD	213	R	RR	conservative
RHR SPC mode	W	OSP	1506/1171	RR	R	non-conservative
RHR SDC mode	-	OSD	1.97	W	-	note 10
LI with CRD pump	G	OCRD1/OCRD2	1.02	G	G	
RHR crosstie to other BF unit for SPC	W	CDF calculation	2.80	W	Y	conservative
INH for ATWS	Y	OAD	3.41	W	Y	conservative
LC for ATWS	-	OAL/OLA	1.10	G	Y	conservative 2 orders
SLC for ATWS	Y	OSL	4.20	W	Y	conservative
Overfill for ATWS	G	OF4	1.09	G	G	
CV	R	OLP2/OLP3	2.01	W	W	
RLOOP 30 min	-	EPR30	1.003	G	-	Not credited in notebook
RLOOP 6hours	G	EPR6	3.08	W	W	

Component Out of Service or Failed Operator Action	SDP Work-sheet Results (Before)	BFN Basic Event	U2 BFN RAW ratio	Color by BFN RAW	SDP Worksheets Results (After)	Comments
EDG crosstie to other BF unit	G	OX2	1.00	G	W	conservative

Notes:

1. BFN RAW for internal events, average maintenance case.

2. The Delta CDF used in RAW value calculations represented the change in CDF due to the component being out of service for 1 year. The Riskman model RAW routine was used to calculate RAW values initially using a truncation limit of 5E-12 for most initiators and 1E-12 for LOCAs. The licensee stated that the RAW calculation routine for Riskman was somewhat approximate for BFN and that for more accurate RAW values, a full re-quantification for each component was necessary. For RAW values that appeared incorrect or had problems during the benchmarking, the licensee did a full model re-quantification CDF run to calculate a more accurate RAW value. This is indicated by “CDF calculation” in the BFN Basic Event column.

3. The licensee originally provided RAW values for both U2 and U3. The original plan was to perform the benchmarking for U2 and then for U3 and to identify differences in colors or mismatches between the U2 and the U3 benchmark results. However, during the U2 benchmarking, many of the RAW values were not acceptable and had to be re-calculated with more detailed CDF runs. These took up to two hours per run and there was insufficient time to re-do the U3 RAW values.

4. For a component such as a pump, we examined the RAW values for the basic events both for “failure to start” and “failure to run,” and either selected the highest (more conservative) value here, or used a synthesized RAW value separated calculated by the licensee that included all failure modes. Where the basic event column indicates by CDF calculation, the licensee separately calculated a RAW by setting all the appropriate system events to true (or failed) and resolving the model to obtain the new higher CDF.

5. For those items where the basic event column is noted as “not modeled,” the PSA did not separately model the item and so a PSA RAW value was not available.

6. When comparing the modified SDP worksheet color to the color by BFN RAW, we found many that were conservative. Each color of conservatism represents approximately one order of magnitude in delta CDF. In the comments column, we indicate by how many orders of magnitude the item is conservative, if it is more than one order conservative.

7. For systems that have redundant components (such as 4 RHR pumps and 4 RHR HXs), the BFN Riskman model generally asks for the A component first and then B, C, and D. If the first or second component has failed, the failure probability of the second (and succeeding) component is increased to account for common cause failure. The PSA methodology tends to make the RAW importance of the first items (A and B) have a higher RAW value. In some cases (RHR pumps & HXs), the licensee had to re-calculate all 4 RAWs using a full re-quantification and then average them to obtain a more accurate and realistic RAW (when there was no physical reason to have different importances).

8. For all of the components in the Table, the RAWs presented were based on the U2 PSA, except for the U3 EDGs. We originally obtained U2 and U3 RAWs for the U3 EDGs and compared them. The U3 RAWs, as might be expected, were higher. Further, we

found that the LOOP worksheet had to be modified to reflect the differences between U2 and U3 for the EDGs. Thus, we have benchmarked the U3 EDGs using the U3 LOOP worksheet and we have compared them to the U3 RAW values.

9. The PSA credits operator actions for the SPC mode of CHR and operator actions to crosstie U1 and U3 RHR systems to U2 for SPC. Many PSA sequences have a CHR-CV combination. Based on a PSA certification comment, they have modified the HEP for CV to include common cause operator failures (between SPC on U2, the crosstie of SPC, and CV). This reduced the HEP for CV to 0.14. However, the benchmarking identified that the PSA also now gives CV only an HEP of 0.14 for sequences where SPC fails due to hardware faults. The licensee plans to correct this in the model.

10. The PSA separately credits the shutdown cooling mode of RHR for CHR. The licensee did not provide a clear justification for this and it is not typically credited in BWRs; hence, it was not credited in the notebook. Therefore, it was not benchmarked.

11. DC Charger SB-B falls just on the Green side of the Green/White threshold.

12. There were no items that were 3 orders of magnitude conservative.

13. There was 1 item that was 2 orders of magnitude conservative: LC on ATWS.

14. The 24 items that were 1 order of magnitude conservative were: HPCI, RCIC, PCS steam, 1 SRV fails to open or fails to close, one CV valve, both trains of RPT, PCA compressor, Unit 3 EDGs 3A, 3B, & 3D, 4KVAC shutdown board A, 250 VDC Dist. Panel A RMOV 2A, 250 VDC Dist. Panel B RMOV 2B, 250 VDC battery for Shutdown Board A, B or C, DC charger for Shutdown Board B, two suppression pool vacuum breakers, and operator actions for DEP, RHR cross-tie to other Unit for SPC, inhibit on ATWS, SLC for ATWS, and cross tie of U3 EDGs to U2 on LOOP.

15. The 4 items that were non-conservative were: an RHR HX, a CRD pump, Unit 3 EDG 3C, and operator action for the suppression pool cooling (SPC) mode of RHR.

Table 2: Comparative Summary of the Benchmarking Results

	Rev. 0 SDP Worksheets		Rev. 1 SDP Worksheets, as Modified	
	Number of Cases	Percentage	Number of Cases	Percentage
SDP: Non-Conservative	10	19.6	4	6.6
SDP: Conservative	(16)	(31.4)	(25)	(41.0)
by one order	12	23.5	24	39.4
by two orders	3	5.9	1	1.6
by three orders	1	2.0	0	0
SDP: Matched	25	49.0	32	52.4
Total	51	100	61	100

Notes:

1. Before the benchmarking there were 10 non-conservative items (1 by three orders of magnitude). After the benchmarking, there were 4 non-conservative items (all one order of magnitude).

2. Before the benchmarking there were 16 conservative items; 12 by one order, 3 by two orders, and 1 by three orders of magnitude. After the benchmarking, there were 25 conservative items; 24 by one order, 1 by two orders, and none by three orders of magnitude.

3. The conservative and non-conservative items are discussed in Section 3.1 above.

ATTACHMENT 1

List of Participants

Russell Gibbs	NRC/NRR
Brett Rini	NRC/NRR
Rudy Bernhardt	NRC/Region II
James Higgins	BNL
Bob Buell	INEEL
Don McCamy	BFN
Bill Mims	BFN
Mike Morrow	BFN
Paul Heck	BFN
Rashid Abbas	BFN

ATTACHMENT 2

Notebook Changes Prior to Onsite Visit

- Changed credit for DEP from 2 to 3 throughout except for ATWS.
- Dropped credit for PCS from the SORV worksheet.
- Added the need for LPI following successful HPCI on SORV.
- Revised credit for LI from 2 to 3 on most worksheets.
- Dropped credit for RLOOP30M.
- Editorial changes.
- Updated footnotes to Table 2.
- Added base case credits to the worksheet sequences.
- Developed draft worksheets for Loss of Plant Control.
- Developed draft worksheets for Loss of DC Bus A, Loss of DC Bus B, and Loss of 4160 VAC Div. A Bus (not used in Rev. 1 of notebook).

Notebook Changes Made During & After Benchmarking Visit

- Updated Tables 1 and 2.
- Updated footnotes to all Tables.
- Clarified CHR wording in all worksheets. Dropped credit for Shutdown cooling (SDC) mode of CHR. Added credit for crosstie of RHR for suppression pool cooling (SPC) from Units 1 and 3. This increased CHR to 5 in most worksheets.
- Dropped credit for CRD for HPI.
- Added RCIC to the SORV worksheet.
- Changed EC on MLOCA & LLOCA to 11/12 vacuum breakers.
- Dropped CV & LI from MLOCA, LLOCA, ATWS, & LRCW worksheets.
- Re-did the LOOP event tree. Changed credit for EDGs in EAC to reflect the need to power 2 EECW pumps to cool the EDGs. Modeled Unit 3 in the LOOP worksheet due to significant difference in the crosstie capability of the EDGs between Unit 2 and Unit 3.
- Revised LI credit throughout all worksheets.
- Added Event Trees for LRCW & LOPCA.
- Updated ISLOCA to reflect licensee's comments.