July 14, 2003

NOTE TO: Stuart A. 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/**
Licensing Section
Probabilistic Safety Assessment Branch
Division of Systems Safety and Analysis
Office of Nuclear Reactor Regulation

SUBJECT: RESULTS OF THE NINE MILE POINT NUCLEAR PLANT UNIT 2 SDP PHASE 2 NOTEBOOK BENCHMARKING VISIT

During October, 2002, NRC staff and a contractor visited the Nine Mile Point Nuclear Plant site in Scriba, New York to compare the Nine Mile Point (NMP) Nuclear Plant Unit 2 Significance Determination Process (SDP) Phase 2 notebook and the licensee's risk model results to ensure that the SDP notebook was generally conservative. Since the licensee had completed analyses on the impact of external event initiators subsequent to the benchmarking visit, the benchmarking team performed sensitivity analyses to assess the impact of external event 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 NMP2 were also 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 good correlation between the Phase 2 SDP Notebook and the licensee's PRA model. The results indicate that the NMP Unit 2 SDP Phase 2 notebook has about 70 percent matching of the hypothetical cases, and 14 percent more conservative in comparison to the licensee's PRA model. Prior to benchmarking, the revision 0 SDP notebook has about 56 percent matching of the hypothetical cases, and 22 percent more conservative in comparison to the licensee's PRA model. A summary of the results of comparisons of hypothetical inspection findings between the SDP notebook and the licensee's PRA model are as follows:

CONTACT: S. Wong, SPSB/DSSA/NRR
301-415-1125

- 14% Notebook predicted the risk significance by one order of magnitude less than the licensee's PRA model,
- 2% Notebook predicted the risk significance by two orders of magnitude less than the licensee's PRA model,
- 70% Notebook and licensee's PRA results matched within an order of magnitude,
- 14% Notebook predicted the risk significance by one order of magnitude greater than the licensee's PRA, and
- 0% Notebook predicted the risk significance by two orders of magnitude greater than the licensee's PRA.

At NMP Unit 2, the CDF contribution from internal events was 4.8E-5/yr, including a contribution of 1.2E-6/yr from internal flooding events, and the CDF contribution from external events was 7.0E-6/yr. Examination of the impact of external event initiators showed that the importance of all systems/components and operator actions considered in the benchmarking exercise were not affected by external events, i.e., their significance would not be raised by one order of magnitude if the impact of external events were included in the risk significance determination. This effect is largely due to the relative importance of internal events contribution to the total combined CDF for NMP2. The internal events CDF constitutes 86% of the total CDF combining internal events and external events contributions.

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 NMP Unit 2 SDP Phase 2 Notebook and the licensee's PRA.

If you have any questions regarding this effort, please contact See-Meng Wong.

Attachments: As stated

14% Notebook predicted the risk significance by one order of magnitude less than the licensee's PRA model,
2% Notebook predicted the risk significance by two orders of magnitude less than the licensee's PRA model,
70% Notebook and licensee's PRA results matched within an order of magnitude,
14% Notebook predicted the risk significance by one order of magnitude greater than the licensee's PRA, and
0% Notebook predicted the risk significance by two orders of magnitude greater than the licensee's PRA.

At NMP Unit 2, the CDF contribution from internal events was 4.8E-5/yr, including a contribution of 1.2E-6/yr from internal flooding events, and the CDF contribution from external events was 7.0E-6/yr. Examination of the impact of external event initiators showed that the importance of all systems/components and operator actions considered in the benchmarking exercise were not affected by external events, i.e., their significance would not be raised by one order of magnitude if the impact of external events were included in the risk significance determination. This effect is largely due to the relative importance of internal events contribution to the total combined CDF for NMP2. The internal events CDF constitutes 86% of the total CDF combining internal events and external events contributions.

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 NMP Unit 2 SDP Phase 2 Notebook and the licensee's PRA.

If you have any questions regarding this effort, please contact See-Meng Wong.

Attachments: As stated

Distribution: SPSB: r/f, E. Cobey

Accession#ML031970581
G:\SPSB\wong\NMP2bench.wpd NRR-096

OFFICE	SPSB	SPSB:SC	SPSB:RI
NAME	SWong:nxh2	MReinhart	ECobey
DATE	07/02/03	07/16/03	07/02/03

OFFICIAL RECORD COPY

SUMMARY REPORT ON RISK-INFORMED BENCHMARKING TRIP

TO THE NINE MILE POINT NUCLEAR PLANT

UNIT 2

(October 21-24, 2002)

James C. Higgins

Energy Sciences and Technology Department
Brookhaven National Laboratory
Upton, N.Y. 11973-5000

June, 2003

Table of Contents

List of Tables

1 Introduction

This report compares the NRC Risk Informed Inspection Notebook, developed by BNL, and the licensee's risk model for the Nine Mile Point Unit 2 NPP to ensure that the Notebook is generally conservative. The benchmarking was performed after the worksheets were revised to include the appropriate licensee comments and recommendations. The comparison was made to the internal events portion of the NMP2 PRA, that is a combined Level I/Level II PRA. The Level I PRA includes both internal and external events and uses the Riskman methodology. The combined CDF is 5.6E-5 core damage events per reactor-year and the internal events portion is 4.82E-5 core damage events per reactor-year. Internal flooding contributes 1.2E-6 core damage events per reactor-year (or 2.4%) to the internal events.

2 Summary of Results from Benchmarking

The benchmarking visit verified that the NMP2 notebook generally matches the licensee's PRA, although there are a few items that were either non-conservative or conservative. Table 1 provides a detailed comparison of the significance of a large number (42 items) of hypothetical inspection findings, as determined by the licensee's PRA and by the SDP Phase 2 notebook. A summary of this comparison for the notebook is given here:

- 14% Underestimates risk significance (non-conservative by 1 color)
- 2% Underestimates risk significance (non-conservative by 2 colors)
- 70% Matches risk significance
- 14% Overestimates risk significance by 1 order of magnitude (by 1 color)
- 0% Overestimates risk significance by 2 orders of magnitude (by 2 colors).

For another 4 items, we were unable to obtain suitable RAW values during the onsite benchmarking, and hence the team was unable to compare the notebook results with the licensee's PRA for these 4 items.

The reasons for the underestimated (non-conservative) items and the overestimated (conservative) items are discussed in Section 3.1 below. The non-conservative items are mainly due to the higher EDG failure probabilities used in the licensee's PRA as compared to the probabilities assumed in the notebook. Additionally, the modeling of detailed support system dependencies in the PRA contributes to the non-conservatism of the notebook. The conservative items are due to a few reasons, including: lower ATWS frequencies in the licensee's PRA. The mis-matches are discussed below and are addressed in the footnotes of Table 2 of the Risk-Informed Inspection Notebook.

3 Modifications to SDP Worksheets

3.1 Benchmarking Details

The Nine Mile Point 2, Rev. 0, Inspection Notebook was originally prepared in 2001. The Notebook was reviewed prior to this Benchmarking visit in order to identify potential changes that may be needed. Some changes were made (see Attachment 2) and other areas were identified for clarification onsite. The updated notebook with these changes and the questions were provided to the licensee about 2 weeks prior to the benchmarking.

The onsite visit was conducted by a BNL representative, an NRC headquarters PSA representative, and the Region I SRA. During the visit, we met with Nine Mile Point 2 licensee and contractor PRA representatives at the plant site and conducted the benchmarking of the Nine Mile Point 2 notebook.

The initial activities included discussing the updates made to the Nine Mile Point 2 notebook as described in Section 1 with the licensee. The Nine Mile Point 2 licensee researched the BNL questions and provided answers to the team. The licensee also provided information to the team based on the PRA Update for the Nine Mile Point Unit 2 Nuclear Plant, dated March 2002. The PRA internal events CDF was 4.82E-5 core damage events per reactor-year. The internal flooding CDF was 1.17E-6 core damage events per reactor-year. The external events CDF was calculated by the licensee to be 7.0E-6 core damage events per reactor-year, for a total combined CDF of 5.6E-5 core damage events per reactor-year.

The licensee provided additional PRA information in response to team questions throughout the visit. Information included: definition of basic events, cutsets, RAW values, HEP values, system design information, analysis assumptions, and PRA results. This information was used to update the notebook prior to the onsite benchmarking. The licensee provided RAW values based on internal events and also RAW values based on combined internal and external events. However, as the benchmarking proceeded a number of RAW values had to be recalculated in order to obtain the correct RAW values for the selected benchmarking components. During the benchmarking visit, these updated RAW values were only obtained for internal events. Subsequent to the benchmarking visit, at the request of the NRC, the licensee provided re-calculated RAW values for combined internal and external events. These are displayed in Table1.

The team computed the break points in RAW values for the different SDP colors based upon a current PRA total internal events CDF of 4.82E-5 core damage events per reactor-year. The team had pre-selected a fairly large list of components and human actions, as listed in Table 1 below, that would be evaluated for the effect of having the component or human action fail. Prior to the site visit, the team developed the color corresponding to failure of each item. This list of items was modified slightly onsite. The team then used the latest revised version of the notebook to develop the color corresponding to failure of each item and compared that to the color that would be implied by the item's RAW value from the PRA.

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. The team 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 1E-8 events per reactor-year) were equivalent to one sequence of value 7. Likewise three sequences of value 7 (3-7s) were equivalent one 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
Sequences of value 6	White
Sequences of value 5	Yellow
Sequences of value 4 or less	Red.

Upon completion of the benchmarking performed onsite, the team identified a few items that were non-conservative and some that were conservative as compared to the color based on the internal

events RAW values. The team requested cutset and sequence information in order to determine the reasons for the differences between the notebook and PRA based results. Most, but not all of the requested information, was provided by the licensee. As a result, the team identified several additional changes that were needed to the event trees and worksheets. Since this was determined at the end of the onsite visit, the changes were made at BNL after completion of the onsite visit.

A summary of the additional changes made to the notebook as a result of the information gathered onsite is provided in Attachment 2.

Subsequent to the above changes to the notebook, the list of items in Table 1 were benchmarked again.

Discussion of Seven Non-conservative Benchmarking Results

RCIC was benchmarked as Yellow but the PRA RAW implies Red. This is non-conservative. The team noted that on LOOP sequences, the PRA uses a failure probability of 0.012 for failure of EDGs 1 and 2 (function EAC1/2 in notebook). The notebook credits EAC1/2 as a multi-train system and gives a credit of 3. Also, on LOOP sequences, the PRA uses a failure probability of 0.15 for failure of HPCS. The notebook credits HPCS as a single train system and gives a credit of 2. Thus, there are two non-conservatisms in the LOOP worksheet as a result of the standard notebook construction rules. This was evaluated subsequent to the benchmarking, by setting the EAC1/2 to a credit of 2 and on LOOP setting credit of HPCS to 1. Changing either one of these functions still gave a Yellow for RCIC. However, changing the credit for both of these functions gave a Red for RCIC, which would be a match.

For the reasons stated in the above paragraph, relating to the EDG failure probabilities, the four operator actions in the LOOP worksheet (RLOOP30M, RLOOP2H, RLOOP8H, & LOADSHED) all were one order of magnitude non-conservative.

The LPCS pump was non-conservative by one order and RHR pump C by 2 orders. The importance in the PRA of LPCS primarily comes from sequences (e.g., LOOP & LOACII) where partial power system failures (e.g., Div. II Battery) are also modeled to occur in the PRA and are the dominant cutsets. This is because of the very detailed electrical support system modeling in the Riskman methodology. The PRA importance of RHR pump C also seems to come from similar partial electrical support system failures. The notebook does not model this level of support system dependencies and hence the non-conservatism.

Discussion of Conservative Benchmarking Results

One SRV fails to open (fto) is Yellow versus White based on the PRA value of RAW. There are 7 SRVs and only 2 are needed to open, hence the benchmarking was done by just evaluating DEP, LDEP, and OVERP. Since there are so many excess SRVs, this is a conservative method of evaluation. Also, the Yellow is obtained by accumulation of many lower level sequences (there are no direct 5 sequences and only one 6 sequence).

There are three conservative items related to the ATWS worksheet: the SLC pump, and operator actions for LC and INH. This appears to be due to the higher ATWS frequency assumed by the worksheet (Row V). The conditional probability in the PRA of a mechanical ATWS given a transient is 4.3E-6. For an electrical ATWS, including the failure probability of ARI, the conditional probability is ~E-9. This implies ATWS for a TRANS event is 3E-5 and for a TPCS event is 1.8E-6.

The success criteria of the ATWS worksheet presumes the more severe ATWS following a TPCS, which, using the PRA frequency, would imply Row VI. One row difference would account for the 1 order of magnitude conservatism in these three items.

One HVAC room cooler for an RHR pump is one order of magnitude conservative. The HVAC cooler for RHR pump A is Yellow based on the counting rule and three Whites (in TPCS, LOOP, & LEAC). The PRA gives a White. There are two redundant coolers for each pump room. Therefore, this item was benchmarked by just evaluating those sequences containing RHR pump A, without reducing the credit. This type of evaluation can result in a conservative finding, because were are counting many sequences in the notebook that credit RHR. However, while we are impacting the reliability of the RHR pump with the loss of one HVAC cooler, it is not significantly reduced.

Also one 125 VDC safety related battery charger is one order of magnitude conservative (Yellow RAW and Red per the notebook). NMP2 has two redundant battery chargers per division, but they are not automatically switched (operator action is required). Thus, in the benchmarking we did not credit the second charger. This may be the reason for the conservatism.

Table 1: Summary of Benchmarking Results for NMP2

Internal [(3)] events CDF is 4.82E-5 core damage events per reactor-year
Combined [(3)] events CDF is 5.6E-5 core damage events per reactor-year
at a 1E-12 Truncation limit
RAW thresholds are: W = 1.02, Y = 1.21, R = 3.07 for internal events
RAW thresholds are: W = 1.02, Y = 1.18, R = 2.79 for combined events

Component Out of Service or Failed Operator Action	SDP Results (Before)	NMP2 Basic Event	Int. Events RAW Ratio	Color by Int. RAW	Comb. Events RAW Ratio	Color by Comb. RAW	SDP Results (After)	Comments
Component								
PCS steam	Y	MSSVAZOAOV6AXXMD	2.60	Y	2.4	Y	Y	
PCS feed	Y	CNMWJZOEJ1AXXXBD	2.36	Y	2.2	Y	Y	
HPCS	R	CHSPE1XP1XXXXXRD	3.44	R	3.1	R	R	
EDG-3	W	EGSGBZXEG2XXXXR1	2.44	Y	2.2	Y	Y	
RCIC	Y	ICSPT1XP1XXXXXS1	4.47	R	3.7	R	Y	non-conservative
1 SRV fto	W	MSSVP1XPSV127X01	1.04	W	1.07	W	Y	conservative
1 SRV ftc	Y	IORV	-	-	-	-	Y	
LPCS pump	G	CSLPE1XP1XXXXXRD	2.21	Y	2.2	Y	W	non-conservative
RHR - pump A	R	RHSPE1XP1AXXXXRD	10.3	R	9.2	R	R	
RHR - pump B	R	RHSPE1XP1BXXXXRD	5.68	R	5.0	R	R	
RHR - pump C	G	RHSPE1XP1CXXXXRD	1.44	Y	1.7	Y	G	non-conservative 2 orders

Component Out of Service or Failed Operator Action	SDP Results (Before)	NMP2 Basic Event	Int. Events RAW Ratio	Color by Int. RAW	Comb. Events RAW Ratio	Color by Comb. RAW	SDP Results (After)	Comments
RHR HX A	R	RHSHCZXE1AXXXXLQ	9.88	R	8.9	R	R	
RHR HX B	R	RHSHCZXE1BXXXXLQ	9.3	R	8.8	R	R	
1 CV valve (AOV-109)	R	CPSVA3SXAOV10901	8.67	R	7.7	R	R	
One SLC pump	Y	SLSPR4XP1AXXXXR1	1.16	W	1.14	W	Y	conservative
EDG 1	W	EGSGAZXEG1XXXXR1	3.11	R	3.3	R	R	
EDG 2	Y	EGSGAZXEG3XXXXR1	4.91	R	5.1	R	R	
4160 AC Div. I	R	ENSEBAXSWG101XLD	144.3	R	126	R	R	
4160 AC Div. II	R	ENSEBAXSWG103XLD	422.9	R	381	R	R	
IA item	R	IAFCZOC3BXXXXRD	1.03	W	1.03	W	W	
N_2 item	-	GSNVRZOPSV30AXND	1.92	Y	1.7	Y	Y	note 8
RBCLC pump	R	CCPPB10P1BXXXXRD	1.45	Y	1.4	Y	Y	note 9
TBCLC item	Y	CCSPB10P1BXXXXRD	1.49	Y	1.4	Y	Y	note 10
SW A (standby)	R	CDF calculation	1.11	W	1.14	W	W	
One DW-SP vacuum breaker	G	ISCVC3XRV33AXX01	1.01	G	1.01	G	G	
CRD pump A	Y	CDF calculation	1.002	G	1.00	G	G	
HVAC item (RHR A room cooler)	-	CDF calculation	1.04	W	1.05	W	Y	conservative note 11
DC Div I bus	R	BYSEDBXSWGOO2ALD	242	R	208	R	R	

Component Out of Service or Failed Operator Action	SDP Results (Before)	NMP2 Basic Event	Int. Events RAW Ratio	Color by Int. RAW	Comb. Events RAW Ratio	Color by Comb. RAW	SDP Results (After)	Comments
DC Div II bus	R	BYSEDBXSWG002BLD	424	R	364	R	R	
DC Battery A	-	BYSCA4SW002A1BND	33.7	R	29.1	R	R	
DC Battery B	-	BYSCA4SW002B1BND	110	R	94.7	R	R	
1 SR 125 VDC battery charger	-	DYSDAZCHTR2C1XLB	1.4	Y	1.4	Y	R	conservative
RRCS -1 train	G	ISCITZXPT2AXXXLQ	1.01	G	1.00	G	G	
RRCS - 2 trains	Y	ISCITZXPT2CXXXLQ	2.3	Y	2.1	Y	Y	
1 Fire pump	G	FPWPD10P1XXXXXR1	1.0	G	1.00	G	G	
Failed Operator Actions								
PCS	Y	-	-	-	-	-	Y	
DEP	R	MSSZODMSSOP10001	117	R	101	R	R	
SW crosstie	W	SWPZAMHSWS00001	1.015	G	1.01	G	G	
CV	R	Top Event CV	8.7	R	7.7	R	R	
RLOOP30M	G	OSPZZZOFFINP5H01	1.3	Y	1.3	Y	W	non-conservative
RLOOP2H	-	CDF calculation	1.04	W	1.03	W	G	non-conservative
RLOOP8H	W	OSPZZZOFFINO8HO3	2.0	Y	1.9	Y	W	non-conservative
LOADSHED	-	CDF calculation	1.24	Y	1.20	Y	W	non-conservative
LC	Y	CDF calculation	1.10	W	1.08	W	Y	conservative

Component Out of Service or Failed Operator Action	SDP Results (Before)	NMP2 Basic Event	Int. Events RAW Ratio	Color by Int. RAW	Comb. Events RAW Ratio	Color by Comb. RAW	SDP Results (After)	Comments
INH	Y	CDF calculation	1.10	W	1.08	W	Y	conservative
OVERFL	Y	-	-	-	-	-	Y	
OP/SW	-	SWPZSAHHSWSOOO01	-	-	119	R	Y	note 6
RHR SP cooling	R	OH SPC	306	R	253	R	R	

Notes:

1. The Nine Mile Point RAW values were derived using the average maintenance case. The licensee computed RAW values based on the internal events PRA and on the combined internal plus external events PRA.

2. The ΔCDF used in RAW value calculations represented the change in CDF due to the component being out of service for 1 year.

3. The CDF of 4.82E-5 core damage events per reactor-year is for internal events including an internal flooding contribution of 1.17E-6 core damage events per reactor-year (2.4%). The RAW values used for the benchmarking were calculated using this value of internal events base case CDF. The PRA external events CDF was notably lower at 7.0E-6 core damage events per reactor-year, for total combined CDF of 5.6E-5 core damage events per reactor-year. This was used only for comparison purposes to see the effect of external events on the RAW colors. It was not used for benchmarking since the notebook does not address external events.

4. The results of the benchmarking were based on the counting rule as described above. In some cases the counting rule will increase the color.

5. The licensee provided the RAW values requested. The team, with the licensee's assistance, identified the values from a large list of component RAWs. The team discussed the reasonableness of these RAW values with the licensee. In some cases the RAW values were determined not to be correct and separate CDF calculational runs were performed to determine the appropriate RAW values. The licensee provided the combined PRA RAW values subsequent to the benchmarking visit.

6. When a " - " is entered in the Basic Event column, this means we were not able to obtain a satisfactory RAW value for the component or operator action.

7. The benchmarking evaluation was performed per the Usage Rules in NRC MC 0609, App. A (Ref. 4).

8. For the benchmarking of N_2, we evaluated DEP, LDEP, & OVERP. We did not evaluate the inboard CV valve since that has an IA backup.

9. One RBCLC pump was initially White while the RAW implied a Yellow. This appeared to be mostly due to the fact that the IEF for LORBCLC is 6.7E-2 events per reactor-year, which places it high in Row II. Our worksheet sequences were 7, 8, 9, & 11, while the total PRA sequence frequency for LORBCLC is 2.2E-6 events per reactor-year. The top cutsets from the PRA for LORBCLC agree with our worksheet. Notebook construction rules allow the IEF to be rounded up and, therefore, we have moved LORBCLC to Row I. This gives a Yellow and a match for the RBCLC pump.

10. TBCLC pump was evaluated using Rule 1.3 and the TPCS worksheet. See comment 2 in Section 3.3 below.

11. One RHR room cooler was benchmarked by evaluating RHR pump A. There are two redundant room coolers, so that failure of one does not fail the pump.

Table 2: Comparative Summary of the Benchmarking Results

	SDP Worksheet Before Benchmarking		**SDP Worksheet Modified After Benchmarking**	
	Number of Cases	**Percentage**	**Number of Cases**	**Percentage**
SDP: Non-Conservative 1 order	8	22	6	14
SDP: Non-Conservative 2 orders	0	0	1	2
SDP Conservative - 1 order	5	14	6	14
SDP Conservative - 2 orders	3	8	0	0
SDP: Matched	20	56	31	70
Total	36	100	44	100

Notes:

1. Prior to the onsite adjustments in the notebook, there were **8** conservative items. Of these, **3** were conservative by two orders of magnitude. After the adjustments to the notebook, there are **6** conservative items. **None** of these items were two orders of magnitude conservative.

2. The **6** conservative items after the benchmarking were: 1 SRV fto; 3 related to ATWS (SLC pump, LC, & INH); one safety related 125 VDC battery charger, and one HVAC cooler for an RHR pump.

3. After benchmarking and related changes to the notebook, there were **7** non-conservative items remaining. Of the seven items, **5** were related to the LOOP worksheet (RCIC, RLOOP30M, RLOOP2H, RLOOP8H, & LOADSHED). The LPCS pump was one order non-conservative and RHR pump C was 2 orders non-conservative.

4. An additional 4 items (beyond the above 44 items), were benchmarked using the notebook, but we were unable to obtain suitable RAW values during the onsite visit for these.

3.2 Specific Changes to the Rev 0 SDP Worksheets for Nine Mile Point 2

A number of changes were made to the Nine Mile Point 2 worksheets. Changes made before the onsite visit are noted in Attachment 2. A number of additional changes, made during and after the plant onsite visit, are also summarized in Attachment 2 and are contained in the updated notebook.

3.3 Generic Changes in IMC 0609 for Guidance to NRC inspectors

1. Consider expanding Rule 1.7 on the evaluation of DC battery chargers. There should be a difference in the evaluation depending on whether or not the plant has redundant battery chargers for each DC bus.

2. For Rule 1.3, the word "special" should be deleted from the rule. This would make the rule also apply to the case of evaluating a system such as TBCLC which affects the PCS. Thus, we would increase TPCS frequency to evaluate a TBCLC component and would not need to add a LOTBCLC worksheet.

3.4 Generic Change to the SDP Notebooks

c) We should re-visit the possibility of changing the credit for EAC on LOOP when the licensee models it as ~ 0.01 for failure of both EDGs, which we credit as 3 for multi-train system.

4 Discussion on External Events

The NMP2 PRA is a combined Level I/Level II PRA. The Level I PRA includes both internal and external events and uses the Riskman methodology. As analyzed by the licensee's updated PRA models, the PRA internal events CDF was 4.82E-5 core damage events per reactor-year. The PRA external events CDF was notably lower at 7.0E-6 core damage events per reactor-year, for total combined CDF of 5.6E-5 core damage events per reactor-year.

The licensee provided RAW values based on internal events and also RAW values based on combined internal and external events. However, as the benchmarking proceeded, a number of RAW values had to be recalculated due to various reasons in order to obtain the correct RAW values for the selected benchmarking components. During the onsite benchmarking these updated RAW values were only obtained for internal events. Subsequently (on request by NRC) the licensee re-calculated the external and the combined RAW values and provided them to BNL (Ref. 5). BNL thus was able to compare the color determined from the internal RAW for each item with the color determined from the combined RAW.

As can be seen in Table 1, for all of the 44 items benchmarked, the color based upon internal events RAW and the color by the combined events RAW were the same. This can be explained by the relative importance of internal events to the total combined CDF. The internal events CDF constitutes 86% of the combined total CDF. Thus, even if the external events importance were different, the weighting makes it difficult to change the overall combined color.

In general if the internal events is a large portion of the combined (internal plus external) CDF, then the color by internal events will likely be the same as the combined color.

5 References

4. March 2002 version of the NMP2 PRA (U2PRA01).

5. *Lessons Learned From Early Benchmarking of Risk Inspection Notebooks*, M. A. Azarm, P. K. Samanta, and J. C. Higgins, June 2002, BNL Technical Report JCN-2899 06-14-02.

6. *NRC Manual,* Chapter 0609.

7. *Risk-informed Inspection Notebook for Nine Mile Point Nuclear Plant Units 1 and 2*, (Draft Revision 1), Fall 2002.

8. Email from Yan Gao to J. Higgins, dated March 14, 2003 with external and combined RAW values for NMP2.

ATTACHMENT 1

<u>List of Participants</u>

See Meng Wong	NRC/NRR
Rick Rasmussen	NRC/NRR
Gene Cobey	NRC/Region I
James Higgins	BNL
John Schroeder	INEEL
Ted Kulczycky	Constellation
Jim Orr	Constellation
Yan Gao	Constellation
Bob Kirchner	R+K Dynamics
Jim Moody	Consultant

ATTACHMENT 2
Changes to Notebook

Notebook Changes Prior to Onsite Visit

- Updated Table 2 to provide additional details on systems.
- Dropped credit for PCS in SORV worksheet and ET.

Notebook Changes During and Subsequent to Onsite Visit

- Updated Tables 1 and 2 to reflect licensee's comments.
- In Table 1, moved LOIA from Row I to II, LOOP from Row II to I.
- Updated operator action credits based on latest PRA HEPs and generic NRC values.
- Updated footnotes to all Tables.
- Added discussion of how the NMP2 ECCS pumps are designed to operate under saturated water conditions. Revised worksheets and ETs to reflect this credit. Changed the LI function to LDEP and applied it only to the RCIC success branches in the ETs. Provided LDEP credit for LPCI, LPCS, and CRD pumps.
- Dropped credit for PCS on MLOCA.
- Revised LOOP worksheet and event tree to more closely match PRA by adding BATT, LOADSHED, and RLOOP2H. Dropped credit for diesel fire pump.
- Split the treatment of inhibit and level control in the ATWS ET and worksheet. Also dropped credit for RCIC on ATWS.
- On LOIA, added credit for CV (with local operator action), and added LDEP.
- On LOAC and LODC worksheets, dropped credit for PCS from 3 to 2.
- Updated plant response for LOAC and LODC events based on NMP2 latest analysis.
- Added worksheets and event trees for LOSW, LORBCLC, & LEAC.