August 28, 2002

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SUBJECT: RESULTS OF THE MILLSTONE PLANT UNIT 2 SDP PHASE 2 NOTEBOOK BENCHMARKING VISIT

During May, 2002, NRC staff and a contractor visited the Millstone site to compare the Millstone Plant Unit 2 (MP2) Significance Determination Process (SDP) Phase 2 notebook and licensee's risk model results to ensure that the SDP notebook was generally conservative. MP2's 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 MP2 were also compared with the licensee's risk model. The results of the SPAR model benchmarking effort will be documented in a separate trip report to be prepared by the Office of Research.

In the review of the MP2 SDP notebook, it was found that some changes to the SDP worksheets were needed to reflect how the plant is currently designed and operated. Twenty nine hypothetical inspection findings were processed through the SDP notebook. Results from this effort indicated that the total risk impacts modeled in the SDP notebook were underestimated by 14 percent, overestimated by 34 percent, and adequately estimated by 52 percent. The reviewers found that if fourteen fixes were made to the SDP notebook, the results would be 3 percent underestimation and 27 percent overestimation of risk impacts.

Attachment A describes the process and results of the comparison of the MP2 SDP Phase 2 Notebook and the licensee's PSA.

Attachments: As stated

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SUMMARY REPORT ON BENCHMARKING TRIP

to the Milestone Plant Unit 2 (MP2)
(May 15 and 16, 2002)

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1. Introduction

A benchmarking of the Milestone plant Unit 2 (MP2) SDP risk-informed inspection notebook was conducted during a plant site visit on May 15-16, 2002. NRC staff (J. Trapp and P. Wilson) supported by BNL staff (M. A. Azarm) participated in this benchmarking exercise.

In preparation of the plant site visit, BNL staff reviewed the MP2 SDP notebook and evaluated a set of hypothetical inspection findings using the Rev 0 SDP worksheets, plant system diagrams and information in the licensees updated PSA. A copy of the site visit agenda was sent to the licensee by NRC staff (P. Wilson) prior to the meeting.

The major activities performed during this plant site visit were:

1. Discussed licensee's comments on the Rev 0 SDP notebook.

2. Obtained listings of the Risk Achievement Worth (RAW) values for basic events of the internal event PRA for average maintenance model.

3. Identified a target set of basic events for the benchmarking exercise.

4. Performed benchmarking of the Rev 0 SDP worksheets with considerations of the licensee's proposed modifications to the SDP notebook.

5. Identified areas of discrepancies and reviewed the licensee's PSA model to determine the underlying reasons. Proposed additional changes to the SDP notebook when appropriate.

6. Performed a benchmarking exercise using the Revision 3i SPAR model for the MP2 (by Mr. J. Schroeder from INEEL)

The benchmarking exercise provided insights for significant improvement to the SDP notebook. The revised SDP notebook should provide either similar or slightly more conservative significance characterization (i.e., maximum by one color) than the licensee's PRA model in about 100% (i.e., no underestimation) of the cases analyzed.

The importance of this benchmarking trip was well demonstrated by significant reduction in both the number of over and under estimations. The number of overestimations were reduced from 10 to 7 and the number of underestimations were reduced from 4 to 0. These reductions in number of overestimations and underestimations were primarily attributed to more realistic modeling of the success criteria for feed and bleed and improved modeling of two initiators; Loss of one DC bus and Loss of IA.

2. Summary Results from Benchmarking

This Section provides the results of the benchmarking exercise. The results of benchmarking analyses are summarized in Table 1. Table 1 consists of six column headings. In the first column, the out-of-service components (human and recovery actions) are identified for the case analyses. The second column shows the associated colors based on the Rev 0 SDP notebook. The third column shows the RAW values based on the licensee's latest PSA model. The site color estimated based on the RAW values are shown in the fourth column. The colors assigned for significance characterization from using the modified Rev 0 SDP worksheets after incorporation of the licensee's comments are shown in the fifth column. The comparative results from the colors assigned by the licensee's latest PSA and the modified notebooks are shown in the sixth column. These comparative results are categorized as "Over", "Match", and "Under" standing for cases that were overestimated, matched, and underestimated. Finally, some clarifying notes and the reasons for any differences in second and the fifth column which resulted from incorporating the licensee's comments into Rev 0 SDP notebook are noted in the sixth column. The summary statistics of the benchmarking results is provided in Table-2. This table shows the summary results obtained through benchmarking for both the Rev 0 SDP and the revised notebooks. Examination of both Tables 1 and 2 show that the revised SDP notebook should provide either similar or slightly more conservative significance characterization (i.e.,maximum by one color) than the licensee's PRA model in about 97% (i.e., one case of underestimation) of the cases analyzed. There was a total of eight cases out of 29 cases analyzed that the revised SDP resulted in more conservative colors.

No specific reasons were found for seven cases of overestimations by one color. These differences were expected to be caused by slightly different reliability and human error probabilities used in the licensee's PSA model compare to the generic values in the SDP notebook, and the extensive use of counting rules used in SDP evaluation.

Failure of a LPSI train was characterized by "W" in the licensee's PSA, corresponding to a RAW value of 1.03 (border line of white and green). The SDP notebook estimated a green color for this event (two greens next to white). No specific reason was found for this slight underestimation.

The importance of this benchmarking trip was well demonstrated by the significant reduction in both the number of over and under estimations. The number of overestimations was reduced from 10 to 8 and the number of underestimations were reduced from 4 to 1. These reductions in number of overestimations and underestimations were primarily attributed to more realistic modeling of the success criteria for feed and bleed and improved modeling of two initiators; Loss of one DC bus and Loss of IA.

Table 1: Summary of Benchmarking Results for Milestone Unit 2

Internal Events' CDF is 5.83E-5, therefore, the RAW thresholds are: W = 1.02, Y = 1.2, and R = 2.72

Component Out of Service	SDP Worksheet Results (before)	Internal RAW[1]	Site Color	SDP Worksheet Results (after)	Comments
TDAFW Pump P4	R	1.5	Y	R	OVER **due to SDP counting rule**
MDAFW Pump P9A/P9B	R	6.02	R	R	MATCH
HPSI Pump P41A, or C	Y	14.1	R	R	MATCH **due to improved Feed and Bleed success criteria**
HPSI Pump Swing P41B	Y	1.134	W	Y	OVER **due to SDP Counting rule**
LPSI Train P42A or B	Y	1.03	W	G	Under **Slight Underestimatio, Removed the credit for rapid depressurization**

EDG 15G-12U	R	1.4	Y	Y	MATCH
EDG 15G-13U	R	1.4	Y	Y	MATCH
1/2 MSIVs FTC	W	1.5	Y	Y	MATCH **use of Rev-1 generic credit for MSIVs**
Both MSIVs FTC	R	4.08	R	R	MATCH
PZR PORV FTO FB Function 2-RC-402/404	Y	1.7	Y	Y	MATCH
PORV FTC	Y	3.2	R	R	MATCH
Block Valve FTC 2-RC-403,405	W	1.102	W	Y	OVER
Safety Valve FTO	W	1.0	G	W	OVER
One train of CAR (2 fans)	Y	1.0	G	W	OVER **Change in credit for CONT from 6 to 3**
1 ADV MS-190A, 190B	Y	1.307	Y	Y	MATCH
1SGFP (mitigation)	G	1.001	G	G	MATCH

Loss of 125VDC bus 201-A/B	R	116	R	R	MATCH
Loss of 1 Battery Charger Train (A or B)	R	1.042	W	W	MATCH **redundancy in battery chargers**
Loss of 1 480 VAC Bus 22E or F	R	31	R	R	MATCH
Loss of one Battery (A or B)	R	51	R	R	MATCH
Loss of one RBCCW pump (P-11 A, B, or C)	Y	1.3	Y	Y	MATCH
One SW Pump (P5A,B, or C)	R	1.369	Y	R	OVER
One Train of ESF Room Cooling (F15A or B)	R	2.8	R	R	MATCH
1 Train of CS (P43A or B)	G	1.01	G	W	OVER **change of credit for CONT from 6 to 3**
1 SIT (T39A–D)	G	1.0	G	G	MATCH
One train of IA Compressor	Y	1.08	W	W	MATCH **modifying the LIA model**

Loss of IA	R		R	R	MATCH
Loss of one PDP charging P18A,B, or C	W	3.2	R	R	MATCH **modifying the event tree for loss of one DC bus**
Prevent Boron Precipitation	**R**	**2.166**	**Y**	**R**	OVER

Table 2: Comparative Summary of the Benchmarking Results

Total Number of Cases Compared	SDP Notebook Before (Rev 0)		SDP Notebook After (Rev 1)	
	Number of Cases (29)	Percentage	Number of Cases (29)	Percentage
SDP: Less Conservative	4	14%	1	3%
SDP: More Conservative	10	34%	8	27%
SDP: Matched	15	52%	20	70%

3. Proposed Revisions to Rev 0 SDP Notebook

Based on insights gained from the plant site visit, a set of revisions is proposed for the Rev 0 SDP notebook. The proposed revisions are based on licensee comments on the Rev 0 SDP notebook, better understanding of the current plant design features, consideration of additional recovery actions, use of revised Human Error Probabilities (HEPs) and initiator frequencies, and the results of benchmarking.

3.1 Specific Changes to the Rev 0 SDP Notebook for MP2

The licensee provided several comments for minor revisions to the SDP Notebook. The suggested changes mainly dealt with the dependency matrix, updated footnotes associated with the worksheets, and revised HEP values. All of these changes will be incorporated in the SDP worksheets. In addition, several major revisions that directly impacted the color assignments by the SDP evaluation were discussed with the licensee and their resolutions were identified in the meeting. The proposed revisions are discussed below:

1. Modify the success criteria for Feed and Bleed per Engineering Record NGP 5.31, Rev 005 provided by the licensee. As an example for Transient, SGTR, and TPCS , use 2/2 HPSI pumps and 1/3 charging pumps.

2) Remove LIA from the initiating event column in Table-2 for main Steam.

3) Remove SGTR from the initiating event column in Table-2 for SDC.

4) Add “except LSW” to the initiating event column in Table-2 for RBCCW.

5) Remove note 5 in Table 2.

6) Globally change the credit for HPR from multi-train system to an operator action = 3. Add a footnote that says, an operator action is required to close the mini-flow valve (OALPMINI) with a HEP value of 1.0E-3.

7) Globally change the total credit for Containment heat removal (CONT) from 2 multi-train system to one multi-train system accounting for common support systems for fan coolers and CS.

8) Add a footnote under LLOCA that RBCCW and ESF room cooling is not needed for LPSI pump cooling.

9) Simplify the SGTR event tree to require both EIHP and AFW if not isolated.

10) Modify the event tree and the sequences for loss of a DC bus to account for possibility of SORV and RCP seal LOCA. As a result of loss of a DC bus, the associated AC bus should be assumed failed. Therefore, the would be no power to close the block valve associated with the open PORV. Also loss of DC causes loss of one train of RBCCW. Thereby seal cooling would be lost to the associated RCPs. The PSA currently assumes that seal LOCA would be

inevitable and operation of either the remaining charging pump or HPSI pump is required to prevent core damage.

11) Remove the worksheet and the event tree for LVAC1030.

12) In loss of IA, credit feed and bleed. For HPI use the criteria of 2/2 HPSI and 1/3 charging pump.

13) Each diesel oil supply tank has a T.S. volume of 12,000 gallons (T-48A and T-48B). This would be sufficient to provide diesel fuel oil for both EDGs for a period of 24 hours, and then one EDG to continue for approximately 3.5 days. Two trains of fuel transfer would supply fuel to diesel oil supply tank from an under ground tank. The fuel oil transfer pumps are fed from vital power sources. However, there are not seismically qualified and the underground tank is considered as a non-safety component.

14) The battery chargers are of sufficient capacity to provide the SI loads if the associated battery is not available.

3.2 Generic Change in IMC 0609 for Guidance to NRC Inspectors

No specific recommendation for changes to IMC 0609 was identified as a result of this benchmarking exercise.

3.3 Generic Change to the SDP Notebook

No generic change was identified.

4. Discussion on External Events

The PSA for MP2 currently does not integrate the external events; therefore no activity was performed on this item during the benchmarking site visit.