Enclosure 2

White papers discussed during the February 21, 2013 ROP WG Public Meeting

ROP Task Force Whitepaper on
Timeliness of FAQ Submittals

Issue

Pursuant to NEI 99-02, Revision 6, *Regulatory Assessment Performance Indicator Guideline*, Frequently Asked Questions (FAQ) may be submitted by licensees to the Industry / NRC ROP Working Group for resolving interpretation issues with NEI 99-02 guidance. However, the timeline for licensees to submit FAQs to the Working Group for consideration is not sufficiently defined in NEI 99-02 to ensure consistent implementation within the industry. This lack of clarity could result in an FAQ being submitted well after an issue has been identified that requires interpretation. Delay in the submittal of an FAQ could also result in inaccurate PI quarterly data being reported (either conservatively or non-conservatively) in the INPO Consolidated Data Entry (CDE) database and posted on the NRC ROP website for an extended period of time until the FAQ has been initiated, reviewed and dispositioned.

Background

As stated in NEI 99-02, Appendix E, "The Frequently Asked Question (FAQ) process is the mechanism for resolving interpretation issues with NEI 99-02. FAQs and responses are posted on the NRC Website….They represent NRC approved interpretations of performance indicator guidance and should be treated as an extension of NEI 99-02." The timeframe for submitting an FAQ once an item requiring interpretation has been identified is loosely described in NEI 99-02 using the terms, "as soon as possible" and "expeditiously." As these terms are subjective, they may be interpreted differently among licensees regarding the time frame used for initiating and submitting FAQs.

Discussion

To address the need for timeliness when preparing and submitting FAQs to the Industry / NRC ROP Working Group for consideration, additional guidance needs to be incorporated into NEI 99-02 to more clearly define the specific expectations regarding the timing of FAQ submittals following issue identification.

The existing, applicable NEI 99-02 guidance that discusses FAQ submittal timeliness is as follows:

1. Appendix D, *Plant Specific Design Issues,* states on page D-1, lines 7-12: "FAQs should be submitted as soon as possible once the Licensee and resident inspector or region has identified an issue on which there is not agreement. If the Licensee is not sure how to interpret a situation and the quarterly report is due, an FAQ should be submitted and a comment in the PI comment field would be appropriate. It is incumbent on NRC and the Licensee to work expeditiously and cooperatively, sharing concerns, questions and data in order that the issue can be resolved quickly."

2. Appendix E, *Frequently Asked Questions,* states on page E-1, Section 1, *Issue Identification*, lines 38-40: "FAQs should be submitted as soon as possible once the licensee and resident inspector or region have identified an issue on which there is not agreement." Page E-2, Section 2, *Expeditiousness, Completeness and Factual Agreement*, lines 6-8, state: "In order for the performance indicators to be a timely element of the ROP, it is incumbent on NRC and the licensee to work expeditiously and cooperatively, sharing concerns, questions and data in order that the issue can be resolved quickly."

ROP Task Force Whitepaper on
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These two sections require revision to address the timeliness of FAQ submittals. An administrative change is also necessary to clarify that FAQs may be submitted when the licensee and NRC both *agree* that guidance clarification is necessary, not just for disagreements. (Minor editorial changes have also been incorporated.)

Recommended NEI 99-02 Changes

The intent of 99-02 is clear in that an FAQ submittal should occur as promptly after issue identification as possible. Consequently, the recommended changes are simply clarifications to include greater specificity in the guidance. The recommended changes are as follows:

1. Revision of Appendix D of NEI 99-02, page D-1, lines 7-12, is proposed as follows:

   FAQs should be submitted as soon as possible, but generally no later than the quarter following identification of the issue requiring interpretation, once the ~~L~~licensee and resident inspector or region ~~has~~ have identified an issue on which there is either ~~not~~ disagreement or where both parties agree that guidance clarification is necessary.

2. Revision of Appendix E of NEI 99-02, page E-1, lines 38-40, is proposed as follows:

   FAQs should be submitted as soon as possible, but generally no later than the quarter following identification of the issue requiring interpretation, once the licensee and resident inspector or region have identified an issue on which there is either ~~not~~ disagreement or where both parties agree that guidance clarification is necessary.

   What constitutes "submitted" page E-1 (FAQ) *the licensee submits the FAQ by email to pihelp@nei.org*.

   Concerns with above recommended change:

   - Issue still may not be reviewed by ROP working group up to 7 months after event
   - Potential 10 months until final (additional months if appealed)
   - Delay potential regional supplemental inspection
   - PIs need to be a timely element of the ROP
   - Consequences if the FAQ submittal is delayed for a long period – no assessment response (only SLIV). Licensees would rather have the Traditional Enforcement violation than a 9500X.
   - FAQ should be presented at the next ROP WG meeting and no later than the subsequent WG meetings (or unless agreed upon by the resident/region/licensee that the issue is complex and that the submittal may be delayed)

   Staff recommendation:

   Once the licensee and resident inspector or region have identified an issue on which there is either disagreement or where both parties agree that guidance clarification is necessary, FAQs should be submitted as soon as possible. The FAQ should preferably be submitted by the next scheduled ROP ~~Working Group~~Task Force meeting; ~~and~~ however, no later than the subsequent meeting. If both the resident inspector and licensee agree that the issue is complex and more time is required (e.g., RCE, Vendor evaluations, Simulator runs, etc.), the FAQ submittal may be delayed until the issue is sufficiently understood.

Simulation of MSPI Indicator Reaction to Plant In Long Term Shutdown and Initial Startup

Background and Purpose

The MSPI indicator is a 12 quarter rolling index of system performance for five systems in each US power plant. It consists of the summation of an unreliability indicator (URI) and an unavailability indicator (UAI). URI is driven by component group failure rates that are largely immune to plant mode, but UAI is directly driven by critical hours and system train/segment unavailable hours that are only collected when the unit is at power. This study simulates the reaction of MSPI to an extended shutdown and following initial plant startup from construction.

Method

The simulation software is a Microsoft ACCESS© emulation of the Microsoft SQL Server© software that derives the URI, UAI, PLE, and MSPI values stations use in their ROP submittal files. There are two important differences:

- The rounding algorithms in ACCESS and SQL Server are not identical, so minor differences are to be expected in extended calculations. The differences between the SQL Server and ACCESS programs have been verified to be due to this rounding algorithm.
- The simulation software has the ability to use independently varying months of inputs for the UAI and URI calculations.

Both simulations use the industry's actual June 2012 MSPI values as a starting point, then modify the inputs and rerun the calculations to determine new MSPI values as the plant moves forward one quarter at a time, from normal operation to extended shutdown or from new construction to operation. Said differently, MSPI values are calculated for each of the five systems included in MSPI for each unit, for 11 trailing quarters plus the current quarter of the simulation. As the shutdown simulation window rolls forward to include another quarter of shutdown values to the front end of the 12 quarter calculation, the values from plant operation 12 quarters ago roll off. The simulation works by holding the 36 months of failures, demands and run hours constant. Since the number of demands and run hours on standby components will continue to be reported, this simulates the continuation of failure exposure for the components. The critical hours and unavailable hours are then removed one quarter at a time as though the experience were moving forward into a zone of 0 critical hours and unavailable hours.

For a startup simulation, the 12 quarter calculation begins with 12 quarters of values reflecting zero critical hours and 0 unavailable hours, demands and run hours and failures. After startup, the simulation then rolls in a new quarter of operation and rolls off the "zero critical hours" values from pre-startup conditions 12 quarters ago. This roll-in of operating hours and roll-off of the oldest month's data continues until 12 quarters of operating data fills the entire 12 quarter calculation window.

Units in Extended Shutdowns

The following characteristics are assumed:

- URI calculated values remain the same since most MSPI component groups have the same test requirements and failure opportunities after the shutdown.

- URI would only change if the calculated UAI value pushed the non-risk-capped MSPI above 1E-05. Since the simulation software checks for this and turns the risk cap off appropriately, this is covered in the calculation of the risk capped URI.
- No opportunities for additional critical hours or system train/segment unavailable hours exist after the unit enters extended shutdown.
- Competing effects may drive the MSPI value higher or lower over time
    - Quarters with extensive unavailable hours may drop off as the window of opportunity shrinks
    - A lowering number of critical hours may overwhelm the loss of quarters of unavailable hours
    - The unrisk-capped MSPI may exceed 1E-05, removing the risk cap.

The results are shown in the following table.

Table 1: Effects on MSPI of Long Term Shutdown

MSPI Metrics/Quarters Shutdown	0	6	8	10	11
>1E-06	4*/520	5/520	8/520	16/520	15/520
>1E-05	0/520	0/520	0/520	0/520	0/520
Less Positive	0/520	225/520	227/520	244/520	254/520
No Change	0/520	51/520	50/520	42/520	40/520
More Positive	0/520	244/520	243/520	234/520	226/520

* Means "4 MSPI values of 520 calculated for 104 units"

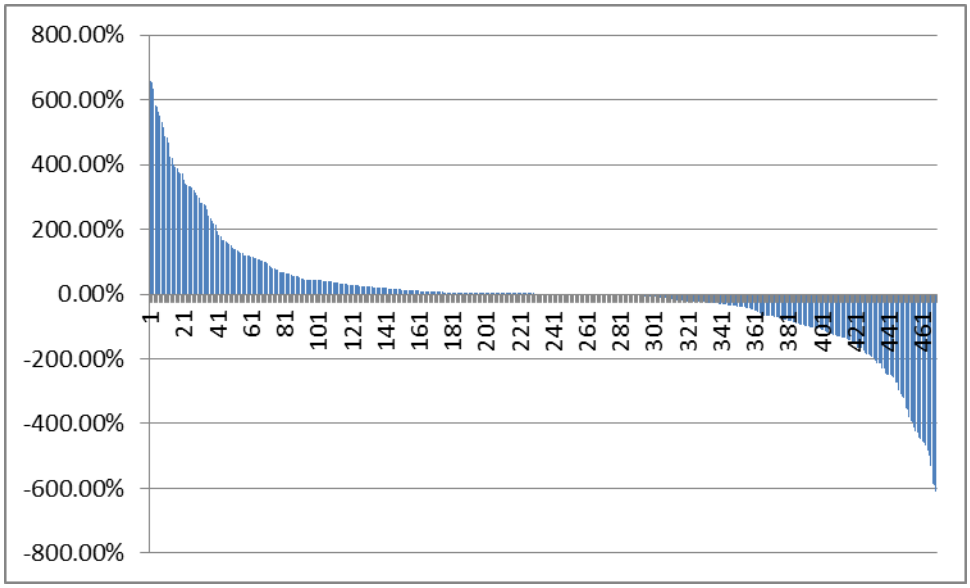
Several points should be made concerning these results:

1. Though the number of indices above the thresholds remains remarkably constant, the same indices for the same units are not in the group above the threshold as the shutdown extends. The indices do not go white for a specific unit and system, stay white and are joined by other units and systems as time goes on. The not green specific units and systems vary as time goes on with the competing influences of critical hours decreasing and chunks of unavailable hours roll off, moving different systems and units into the white zone.

2. In Figure 1 below, excluding the upper and lower 5% of the changes, the distribution of the changes at the 33 month shutdown point is very symmetrical. The initial hypothesis was that all MSPI values would to go up as the critical hours roll off, but that did not happen. The facts are that for about 10% of the indicators, there was virtually no change, of the others, half went up and half went down. For the majority, the change was less than an order of magnitude.

3. The hypothesis that all the values go up as critical hours roll off is not valid. The competing effects of the terms and parameters in the equations make the situation more complex. From the results, most units and indicators can sustain an 18-24 month extended shutdown without the indicator being driven white by changes in critical hours.

Figure 1: Distribution of Changes from Initial Individual MSPI Values after 33 Months Shutdown



The graph compares the original indicator value with the values after 33 months shutdown. The horizontal axis has one point for each of the 520 calculated indicators. It simply points out that distribution of the change in the indicators is symmetrical, unexpectedly.

Units in Initial Operation

The results of the simulated startup are shown in Table 2. The following characteristics are assumed:

- URI calculated values change after startup as operation proceeds because no opportunities for failures or successes exist before startup.
- No opportunities for additional critical hours or system train/segment unavailable hours exist before unit startup

Table 2: Effects on MSPI of Initial Startup

Metrics/Months Since Startup	3	6	9	12
>1E-06	15/520	11/520	7/520	3/520
>1E-05	0/520	0/520	0/520	0/520
Less Positive	0/520	377/520	380/520	374/520
No Change	0/520	0/520	0/520	0/520
More Positive	0/520	143/520	140/520	146/520

As seen in table 2, within 12 months, the number of indices exceeding 1E-06 is at or below the number in the 36 month calculation of the actual MSPI June 2012 indices (as shown in Table 1).

1. After 12 months of operation, the indicator produces relatively normal values.
2. For about 1/3 of the indicators, the indicator value gets worse after startup, not better.

ROP Task Force Recommendations

The data from this study (Figure 1) shows that MSPI is very reactive when critical hours are low. This indicates that these situations should be treated on a case-by-case basis. Fortunately, these situations have been uncommon over the life of the ROP, so that it is practical to consider a case-by-case approach. As a starting point for these case-by-case discussions, the ROP Task Force recommends the following decision rules for the display of MSPI on the NRC web page:

- Gray out MSPI when a unit has been shut down for six months.
    - On plant startup, if the calculated MSPI is greater than 1.0E-6 (White) for the quarter prior to startup, MSPI will remain grayed out until 12 months of operation have accumulated after startup.
    - On plant startup, if the calculated MSPI is less than or equal to 1.0E-6 (Green) for the quarter prior to startup, MSPI will remain grayed out until there is a total of 12 months of operation in the 3-year monitoring period.
- Gray out MSPI for the startup of new plants until 12 months of operation have accumulated.

PRA Technical Adequacy for MSPI

Introduction/Background

NEI 99-02 (Reference 1), Appendix G contains guidance regarding methods by which the licensee can establish the technical adequacy of their probabilistic risk assessment (PRA) to support the Mitigating System Performance Index (MSPI). This guidance has not been updated to reflect the latest approved versions of the ASME/ANS PRA Standard (Reference 2). In addition, questions have recently arisen regarding the need for guidance on the maintenance and update of PRA models used to support MSPI. This paper explores some of the issues raised and provides recommended approaches for resolving each issue. A proposed revision of NEI 99-02 Appendix G incorporating the proposed changes is included as an attachment.

Summary of Issues

In addition to general update of NEI 99-02 Appendix G to reflect current references, several technical issues have been raised concerning PRA technical adequacy for MSPI. These issues may be grouped into the following categories:

- Characteristics and Attributes for the PRA Maintenance and Upgrade Process Applicable to MSPI
  - Should thresholds for a PRA model update based on impact on the MSPI resulting from pending model changes be established?
  - Should a recommended frequency and scope for PRA data updates be established?
  - Should guidance be provided concerning the frequency and scope of PRA model updates (e.g., incorporation of credit for alternate portable equipment, incorporation of consensus methods)?
- Treatment of Outstanding Peer Review Findings
  - Is the current guidance requiring use of a modified Birnbaum value equal to a factor of three times the median Birnbaum value from the associated cross comparison group for pumps/diesels and three times the plant values for valves/breakers technically sound?
  - What constitutes adequate resolution of a Peer Review Finding
- Assessment of PRA Model Maintenance and Upgrade
  - Is a peer review of upgraded methodologies required prior to use of PRA results in MSPI?

Each of these issues is discussed in detail in the remainder of this paper.

Characteristics and Attributes for the PRA Configuration Control Program Applicable to MSPI

The characteristics and attributes of a PRA Configuration Control program are described in ASME/ANS Standard Section 1-5 (Reference 2). The industry peer review process described in

NEI 00-02 (Reference 3) includes a Maintenance and Update (MU) checklist that can be used as a guide to indicate specific items that should be considered with respect to the PRA Configuration Control program. NEI05-04 (Reference 4) references use of this checklist as a means to determine that a utility PRA Configuration Control program satisfies the requirements of ASME/ANS PRA Standard Section 1-5. It is expected that a PRA Configuration Control program that has been peer reviewed and found to be consistent with the guidance of the ASME/ANS PRA Standard Section 1-5 will generally maintain the technical adequacy of the PRA model to a sufficient level to support MSPI. However, there are some clarifications that may be needed with respect to MSPI.

ASME/ANS PRA Standard paragraph 1-5.2(b) states that the PRA Configuration Control program shall include "a process that maintains and upgrades the PRA to be consistent with the as-built, as operated plant." ASME/ANS PRA Standard paragraph 1-5.2(c) states that the PRA Configuration Control program shall include "a process that ensures that the cumulative impact of pending changes is considered when applying the PRA." Taken together, it is recommended that the PRA Configuration Control program consider the cumulative impact of pending changes on the indicators for MSPI monitored systems to determine whether a PRA model update is needed. Pending model changes related to plant design changes, credit for alternate portable equipment, peer review findings, and other changes to the PRA model to correct identified issues are expected to be tracked as pending changes. This will ensure that the PRA model is maintained sufficiently consistent with the as-built, as-operated plant for the MSPI application.

Analysis of data trends documented in NUREG/CR-5750 (Reference 6), NUREG/CR-6928 (Reference 7), and NUREG/CR-6890 (Reference 8) indicate that there are no statistically significant trends in either initiating event frequency or generic component reliability data over periods of five to ten years. Therefore, update of this data on a frequency of at least once per 10 years is considered adequate for PRA models supporting MSPIThe recommendations of the MSPI PRA Quality Task Group (Reference 5) noted that the MSPI pilot program did not find that parameter values were a significant source of concern for MSPI sensitivity. However, the data maintenance process shall be consistent with the above guidance for the PRA Configuration Control program and supporting requirements in the ASME/ANS PRA Standard Initiating Event Analysis (IE), Data Analysis (DA), and Human Reliability Analysis (HR) technical elements.

The recommendations of the MSPI PRA Quality Task Group (Reference 5) also include the Task Group's assessment of the ASME standard capability categories required to support the MSPI application. NEI 99-02 Table G 5 incorporated part of this assessment by detailing those supporting requirements requiring additional self-assessment to address differences between the criteria used to review the PRA using the NEI-00-02 process to support MSPI implementation. Table 3-1 in Reference 5 included the recommended capability category for each supporting requirement considered applicable to MSPI based on ASME PRA Standard RA-Sa-2003. To clarify the applicable supporting requirements and the required capability category for each applicable supporting requirement, Table G 5 should be updated to include the current ASME/ANS PRA Standard supporting requirements corresponding to Reference 5 Table 3-1 with applicable capability categories and clarifying notes. The revised Table G 5 will then provide a basis for determination of which peer review F&Os need to be assessed for

impact on MSPI. Prior to updating Table G.5 of NEI 99-02, the previous conclusions of the MSPI PRA Quality Task Group should be reviewed to determine if the conclusions are applicable to the current post-implementation status of MSPI.

The industry has established practices to ensure that the PRA is sufficient to be used for regulatory decisions. These methods include:

- Use of personnel qualified for the analysis.
- Use of procedures that ensure control of documentation, including revisions, and provide for technical review, verification, or checking of calculations and information used in the analyses.
- Provision for documentation and maintenance of records.
- Use of procedures that ensure that appropriate actions are taken in accordance with established plant practices if assumptions, analyses, or information used in previous decision-making are changed (e.g., licensee voluntary action) or determined to be in error.

Based on these factors, the following conclusions are reached with regard to the PRA Configuration Control program for support of MSPI:

a) Pending model changes to be considered for MSPI are those related to implemented plant design and operational changes, identified errors in the PRA model, and finding level F&Os related to those supporting requirements identified in Table G 5 of NEI 99-02. Note that finding level F&Os related to changes required to meet Capability Category II are not considered pending model changes for MSPI if Table G 5 indicates that Capability Category I is sufficient.
b) The evaluation process for pending PRA model changes should include consideration of the consider the cumulative impact of pending changes on MSPI inputs in determining the need for a PRA model update (FAQ 477).
c) Update of the initiating event frequencies, component reliability and unavailability data, and the human reliability analysis should be performed on a frequency sufficient to ensure that the data represents the as-built, as-operated plant.
d) PRA changes should be performed consistent with the ASME/ANS PRA Standard.
e) Personnel that develop and review the PRA supporting the MSPI program should be qualified for the analysis in accordance with the applicable utility processes for personnel qualification.
f) The PRA model and any supplementary analyses supporting the MSPI program should be subject to an technical review covering both the inputs and results of the analyses prior to their use.

Treatment of Open Peer Review Findings

The current guidance in NEI 99-02 states the following with respect to the treatment of peer review findings:

> Resolve the peer review Facts and Observations (F&Os) for the plant PRA that are classified as being in category A or B, or document the basis for a determination that any open A or B F&Os will not significantly impact the MSPI calculation. Open A or B F&Os are significant if collectively their resolution impacts any Birnbaum values used in MSPI by more than a factor of 3. Appropriate sensitivity studies may be performed to quantify the impact. If an open A or B F&O cannot be resolved by April 1, 2006 and significantly impacts the MSPI calculation, a modified Birnbaum value equal to a factor of 3 times the median Birnbaum value from the associated cross comparison group for pumps/diesels and 3 times the plant values for valves/breakers should be used in the MSPI calculation at the index, system or component level, as appropriate, until the F&O is resolved.

This guidance was developed to support initial implementation of MSPI and has several problems with respect to the current implementation status of MSPI.

Reviews of several PRA models indicate that a modified Birnbaum value based on three times the median Birnbaum value reported in WCAP-16464 (Reference 6) may actually be lower than the plant-specific Birnbaum value for one or more pump groups. This indicates that the use of the current guidance may not produce consistent impact for all plants.

The use of modified Birnbaum values based on plant-specific sensitivity results used to determine the impact of open peer review findings or based on two times the plant-specific Birnbaum values for all monitored components affected by the finding will provide a more consistent adjustment. However, this also may not be appropriate for all peer review findings. For example, if the peer review finding is associated with deficiencies in the common cause failure modeling, a restriction on the use of plant-specific CCF adjustment factors lower than the generic values until the issue is resolved may be more appropriate.

Therefore, it is recommended that the fixed adjustment value be eliminated and that any modified Birnbaum values applied for open finding level F&Os (equivalent to NEI 00-02 categories A and B) be based on plant-specific sensitivity analysis of the potential impact of model changes required to address the finding.

To ensure that Peer Review findings are appropriately incorporated in a model revision, a review of the actions taken to address the finding should be provided by a technically qualified individual. If the review determines that the finding was appropriately addressed, that finding can be considered closed with respect to MSPI.

Assessment of PRA Model Maintenance and Upgrades

The ASME/ANS PRA Standard defines a PRA upgrade as “the incorporation into a PRA model of a new methodology or significant changes in scope or capability that impact the significant accident sequences or the significant accident progression sequences.” For MSPI, the PRA maintenance and upgrade activities of concern are those that impact the scope of the PRA

model used for developing MSPI inputs. This excludes PRA maintenance and upgrades related only to analysis of internal flooding, Level 2/LERF, fire, seismic, and other external events.

For MSPI, inputs from PRA maintenance (e.g., updates of reliability and unavailability data, incorporation of procedure changes in the HRA, etc.) or upgrade may be used as long as an internal technical review has been completed under the utility's PRA Configuration Control program. However, those changes classified as upgrades should be included in the scope of any subsequent peer review scheduled for another reason. Any findings resulting from that subsequent peer review will be addressed as pending model changes and treated consistent with the above guidance for treatment of open peer review findings.

References

1. NEI 99-02, *Regulatory Assessment Performance Indicator Guideline*, Revision 6, Nuclear Energy Institute, October 2009.
2. ASME/ANS RA-Sa-2009, *Addenda to ASME/ANS RA-S-2008 Standard for Level 1/Large Early Release Frequency Probabilistic Risk Assessment for Nuclear Power Plant Applications*, American Society of Mechanical Engineers, New York, NY, February 2009.
3. NEI 00-02, *Probabilistic Risk Assessment (PRA) Peer Review Process Guidance*, Revision A3, Nuclear Energy Institute, March 2000.
4. NEI 05-04, *Process for Performing Internal Events PRA Peer Reviews Using the ASME/ANS PRA Standard*, Revision 2, Nuclear Energy Institute, November 2008.
5. NUREG/CR-5750, *Rates of Initiating Events at US Commercial Nuclear Power Plants: 1987-1995*, U.S. Nuclear Regulatory Commission, February 1999.
6. NUREG/CR-6928, *Industry-Average Performance for Components and Initiating Events at U.S. Commercial Nuclear Power Plants*, U.S. Nuclear Regulatory Commission, February 2007.
7. NUREG/CR-6890, Volume 1, *Reevaluation of Station Blackout Risk at Nuclear Power Plants Analysis of Loss of Offsite Power Events: 1986-2004*, U.S. Nuclear Regulatory Commission, December 2005.
8. Recommendations of the MSPI PRA Quality Task Group, ML043510095, December 16, 2004.
9. WCAP-16464-NP, *Westinghouse Owner's Group Mitigating Systems Performance Index Cross Comparison (PA-RMSC-0209)*, Revision 0, Westinghouse Electric Company LLC, August 2005.

APPENDIX G

MSPI Basis Document Development

To implement the Mitigating Systems Performance Index (MSPI), Licensees will develop a plant specific basis document that documents the information and assumptions used to calculate the Reactor Oversight Program (ROP) MSPI. This basis document is necessary to support the NRC inspection process, and to record the assumptions and data used in developing the MSPI on each site. A summary of any changes to the basis document are noted in the comment section of the quarterly data submission to the NRC.

The Basis document will have two major sections. The first described below will document the information used in developing the MSPI. The second section will document the conformance of the plant specific PRA to the requirements that are outlined in this appendix.

G 1. MSPI Data

The basis document provides a separate section for each monitored system as defined in Section 2.2 of NEI 99-02. The section for each monitored system contains the following subsections:

G 1.1 System Boundaries

This section contains a description of the boundaries for each train of the monitored system. A plant drawing or figure (training type figure) should be included and marked adequately (i.e., highlighted trains) to show the boundaries. The guidance for determining the boundaries is provided in Appendix F, Section 1.1 of NEI 99-02.

G 1.2 Risk Significant Functions

This section lists the risk significant functions for each train of the monitored system. Risk Significant Functions are defined in section 2.2 of NEI 99-02. Additional detail is given in Appendix F, Section 1.1.1 and Section 5 “Additional Guidance for Specific Systems”. A single list for the system may be used as long as any differences between trains are clearly identified. This section may also be combined with the section on Success Criteria if a combination of

information into a table format is desired. If none of the functions for the system are considered risk significant, identify the monitored function as defined in section F 1.1.1

G 1.3 Success Criteria

This section documents the success criteria as defined in Section 2.2 of NEI 99-02 for each of the identified monitored functions for the system. Additional detail is given in Appendix F, Section 2.1.1. **The criteria used are the documented PRA success criteria.**

- If the licensee has chosen to use design basis success criteria in the PRA, then provide a statement in this section that states the PRA uses design basis success criteria.
- If success criteria from the PRA are different from the design basis, then the specific differences from the design basis success criteria shall be documented in this section. Provide the actual values used to characterize success such as: *The time required in the PRA for the EDG to successfully reach rated speed and voltage is 15 seconds.*

Where there are different success criteria for different monitored functions or different success criteria for different initiators within a monitored function, all should be recorded and the most restrictive shown as the one used, with the exception of ATWS related success criteria which are not in the scope of MSPI.

G 1.4 Mission Time

This section documents the risk significant mission time, as defined in Section 2.3.6 of Appendix F, for each of the identified monitored functions identified for the system. The following specific information should be included in support of the EDG mission time if a value less than 24 hours is used:

- EDG Mission Time with highest Birnbaum
- Basic Event and Description (basis for Birnbaum)
- Other Emergency Power Failure to Run Basic Events, Descriptions, mission time and Birnbaums (those not selected)
- Method for reduced mission time (e.g., Convolution, Multiple Discrete LOOP (Loss of Offsite Power) Initiating Events, Other)
- Loss of Offsite Power (LOOP) Initiating Events, Description and Frequency
- Basis for LOOP Frequency (Industry/NRC Reference)
- Basis for LOOP Non-recovery Failure (Industry/NRC Reference)
- Credit for Emergency Power Repair (Yes/No)
- If repair credited, failure probability of repair and basis

G 1.5 Monitored Components

This section documents the selection of monitored components as defined in Appendix F, Section 2.1.2 of NEI 99-02 in each train of the monitored system. A listing of all monitored pumps, breakers and emergency power generators should be included in this section. A listing of AOVs, HOVs , SOVs and MOVs that change state to achieve the monitored functions should be provided as potential monitored components. The basis for excluding valves and breakers in this list from monitoring should be provided. Component boundaries as described in Appendix F, Section 2.1.3 of NEI 99-02 should be included where appropriate.

G 1.6 Basis for Demands/Run Hours (estimate or actual)

The determination of reliability largely relies on the values of demands, run hours and failures of components to develop a failure rate. This section documents how the licensee will determine the demands on a component. Several methods may be used.

- Actual counting of demands/run hours during the reporting period
- An estimate of demands/run hours based on the number of times a procedure or other activities are performed plus either actual ESF demands/run hours or "zero" ESF demands/run hours
- An estimate based on historical data over a year or more averaged for a quarterly average plus either actual ESF demands/run hours or "zero" ESF demands/run hours

The method used, either actual or estimated values, shall be stated. If estimates are used for test or operational demands or run hours then the process used for developing the estimates shall be described and estimated values documented. If the estimates are based on performance of procedures, list the procedures and the frequencies of performance that were used to develop the estimates.

G 1.7 Short Duration Unavailability

This section provides a list of any periodic surveillances or evolutions of less than 15 minutes of unavailability that the licensee does not include in train unavailability. The intent is to minimize unnecessary burden of data collection, documentation, and verification because these short durations have insignificant risk impact.

G 1.8 PRA Information used in the MSPI

G 1.8.1 Unavailability FV and UA

This section includes a table or spreadsheet that lists the basic events for unavailability for each train of the monitored systems. This listing should include the probability, FV, and FV/probability ratio and text description of the basic event or component ID. An example format is provided as Table 1 at the end of this appendix. If the event chosen to represent the train is not the event that results in the largest ratio, provide information that describes the basis for the choice of the specific event that was used.

G 1.8.1.1 Unavailability Baseline Data

This section includes the baseline unavailability data by train for each monitored system. The discussion should include the basis for the baseline values used. The detailed basis for the baseline data may be included in an appendix to the MSPI Basis Document if desired.

The basis document should include the specific values for the planned and unplanned unavailability baseline values that are used for each train or segment in the system.

G 1.8.1.2 Treatment of Support System Initiator(s)

This section documents whether the cooling water systems are an initiator or not. This section provides a description of how the plant will include the support system initiator(s) as described in Appendix F of NEI 99-02. If an analysis is performed for a plant specific value, the calculation must be documented in accordance with plant processes and referred to here. The results should also be included in this section. A sample table format for presenting the results of a plant specific calculation for those plants that do not explicitly model the effect on the initiating event contribution to risk is shown in Table 4 at the end of this appendix.

G 1.8.2 Unreliability FV and UR

There are two options described in Appendix F for the selection of FV and UR values, the selected option should be identified in this section. This section also includes a table or spreadsheet that lists the PRA information for each monitored component. This listing should include the Component ID, event probability, FV, the common cause adjustment factor and

FV/probability ratio and text description of the basic event or component ID. An example format is provided as Table 2 at the end of this appendix. If individual failure mode ratios (vice the maximum ratio) will be used in the calculation of MSPI, then each failure mode for each component will be listed in the table.

A separate table should be provided in an appendix to the basis document that provides the complete set of basic events for each component. An example of this for one component is shown in Table 3 at the end of this appendix. Only the basic event chosen for the MSPI calculation requires completion of all table entries.

G 1.8.2.1 Treatment of Support System Initiator(s)

This section documents whether the cooling water systems are an initiator or not. This section provides a description of how the plant will include the support system initiator(s) as described in Appendix F of NEI 99-02. If an analysis is performed for a plant specific value, the calculation must be documented in accordance with plant processes and referred to here. The results should also be included in this section. A sample table format for presenting the results of a plant specific calculation for those plants that do not explicitly model the effect on the initiating event contribution to risk is shown in Table 4 at the end of this appendix.

G 1.8.2.2 Calculation of Common Cause Factor

This section contains the description of how the plant will determine the common cause factor as described in Appendix F of NEI 99-02. If an analysis is performed for a plant specific value, the calculation must be documented in accordance with plant processes and referred to here. The results should also be included in this section.

G 1.9 Assumptions

This section documents any specific assumptions made in determination of the MSPI information that may need to be documented. Causes for documentation in this section could be special methods of counting hours or runtimes based on plant specific designs or processes, or other instances not clearly covered by the guidance in NEI 99-02.

G 2. PRA Requirements

G 2.1 Discussion

The MSPI application can be considered a Phase 2 application under the NRC's phased approach to PRA quality. The MSPI is an index that is based on internal initiating events, full-power PRA, for which the ASME/ANS PRA Standard has been written.

Licensees should assure that their PRA is of sufficient technical adequacy to support the MSPI application as follows:

G 2.1.1 PRA Model Scope and Level of Detail

The PRA supporting the MSPI program should meet the following requirements:

a) The scope of the PRA to be used for MSPI is a Level 1 internal events model covering full power operation. Level 2/LERF, internal floods and fires are excluded from the internal events scope for MSPI.
b) The PRA should be of sufficient detail to support the development of plant-specific Birnbaum importance measures for the components and trains/segments within the scope of MSPI.
c) The PRA should be of sufficient detail to ensure the impacts of designed-in dependencies (e.g., support system dependencies, functional dependencies, and dependencies on operator actions) are correctly captured.

G 2.1.2 Characteristics and Attributes of the PRA Configuration Control Program

The characteristics and attributes of a PRA Configuration Control program are described in ASME/ANS Standard Section 1-5. These attributes include:

a) a process for monitoring PRA inputs and collecting new information
b) a process that maintains and upgrades the PRA to be consistent with the as-built, as operated plant
c) a process that ensures that the cumulative impact of pending changes is considered when applying the PRA
d) a process that maintains configuration control of computer codes used to support PRA quantification
e) documentation of the PRA Maintenance and Upgrade process

For use in MSPI, the plant PRA shall be under a PRA Configuration Control program consistent with the attributes specified above and the following clarifications.

a) Pending model changes to be considered for MSPI are those related to implemented plant design and operational changes, identified errors in the PRA model, and finding level F&Os related to those supporting requirements identified in Table G 5. Note that finding level F&Os related to changes required to meet Capability Category II are not considered pending model changes for MSPI if Table G 5 indicates that Capability Category I is sufficient.
b) The evaluation process for pending PRA model changes should consider the cumulative impact of pending changes on MSPI inputs in determining the need for a PRA model update.
c) Update of the initiating event frequencies, component reliability and unavailability data, and the human reliability analysis should be performed on a frequency sufficient to ensure that the data represents the as-built, as-operated plant.
d) PRA changes should be performed consistent with the ASME/ANS PRA Standard Supporting Requirements applicable to MSP, which are identified in Table G 5.
e) Personnel that develop and review the PRA supporting the MSPI program should be qualified for the analysis in accordance with the applicable utility processes for personnel qualification.
f) The PRA model and any supplementary analyses supporting the MSPI program should be subject to a technical review covering both the inputs and results of the analyses prior to their use.

G 2.1.3 Treatment of Pending Model Changes

To ensure that Peer Review findings are appropriately incorporated in a model revision, a review of the actions taken to address the finding should be provided by a technically qualified individual. If the review determines that the finding was appropriately addressed, that finding can be considered resolved with respect to MSPI.

Pending model changes that cannot be incorporated into a revision to the site PRA of record prior to the next reporting quarter should be assessed consistent with the PRA Configuration Control program.

If analysis of the cumulative impact of proposed resolutions for the pending model changes results in a predicted factor of three change in the corrected Birnbaum value of an MSPI monitored train or component, the following shall be performed:

a) Supplementary analysis should be performed and documented to demonstrate that the pending change(s) have no significant impact on the MSPI results (i.e., there is no change in the calculated indicator colors), or
b) A modified Birnbaum value equal to the value calculated in the applicable supplementary analysis or a factor of two times the current value for affected trains or components (whichever is greater) should be used in the MSPI calculation at the index, system or component level, as appropriate, until the pending model change(s) is incorporated in a new site PRA of record.

If the analysis of pending changes indicate that the Birnbaum value for a component previously excluded from monitoring will be greater than 1.0E-06, the MSPI basis document should be updated to reflect the new Birnbaum values the quarter following identification of the increased impact. Note that the use of supplemental analysis to estimate the revised MSPI inputs is allowed as an interim alternative until the site PRA of record is revised.

G 2.1.4 Assessment of PRA Model Maintenance and Upgrades

The ASME/ANS PRA Standard defines a PRA upgrade as "the incorporation into a PRA model of a new methodology or significant changes in scope or capability that impact the significant accident sequences or the significant accident progression sequences." For MSPI, the PRA maintenance and upgrade activities of concern are those that impact the scope of the PRA model used for developing MSPI inputs. This excludes PRA maintenance and upgrades related only to analysis of internal flooding, Level 2/LERF, fire, seismic, and other external events.

The differentiation between PRA maintenance and upgrades is further discussed in Non-mandatory Appendix 1-A, *PRA Maintenance, PRA Upgrade, and the Advisability of Peer Review.* For MSPI, inputs from PRA maintenance (e.g., updates of reliability and unavailability data, incorporation of procedure changes in the HRA, etc.) or upgrade may be used as long as an internal technical review has been completed under the utility's PRA Configuration Control program. However, those changes classified as upgrades should be included in the scope of any subsequent peer review scheduled for another reason. Any findings resulting from that subsequent peer review will be identified as pending PRA model changes as described in Section G 2.1.2 and evaluated as described in Section G 2.1.3.

G 2.2 PRA MSPI Documentation Requirements

A. Licensees should provide a summary of their PRA models to include the following:

1. Approved version and date of the site PRA of record used to develop MSPI data
2. Plant base CDF for MSPI
3. Truncation level used to develop MSPI data

B. Licensees should document the technical adequacy of their PRA models, including:

1. Description of the PRA Configuration Control program.
2. Justification for any open finding level F&Os that are determined to have no impact on the use of the PRA model for MSPI.
3. Justification for the determination that any pending PRA model changes do not impact the MSPI results and/or justification for the adjusted Birnbaum values applied to reflect pending model changes as an interim alternative until the site PRA of record is revised.

C. Licensees should document in their PRA archival documentation:

1. A description of the resolution of the finding level F&Os identified by the peer review team.
2. Results of supplementary analysis used to assess the impact of pending PRA model changes on MSPI monitored trains or components.
3. Documentation of internal technical reviews of PRA model updates and/or supplementary analyses performed to support the MSPI program.
4. Technical bases for the PRA.

G 3. TABLES

Table G 1 Unavailability Data HPSI (one table per system)

Train	Basic Event Name	Basic Event Description	Basic Event Probability (UAP)	Basic Event FVUAP [1]	FVUAP/UAP
A	1SIAP02----MP6CM	HPSI Pump A Unavailable Due to Mntc	3.20E-03	3.19E-03	9.97E-01
B	1SIBP02----MP6CM	HPSI Pump B Unavailable Due to Mntc	3.20E-03	3.85E-03	1.20E+00

1. Adjusted for IEF correction if used

Table G 2 – AFW System Monitored Component PRA Information

Component	Basic Event	Description	Basic Event Probability (URPC)	Basic Event FVURC	[FV/UR]*ind*	CC Adjustment Factor (A)	CC Adjustment Used	Adjusted Birnbaum
1MAFAP01	1AFASYS----AFACM	Train A Auxiliary Feedwater Pump Fails to Start	2.75E-03	2.33E-02	8.49E+00	1	Generic	1.1E-04
1MAFBP01	1AFBP01----MPAFS	Train B Auxiliary Feedwater Pump Fails to Start	6.73E-04	4.44E-02	6.59E+01	1.25	Generic	1.1E-03
1MAFNP01	1AFNSYS----AFNCM	Train N Auxiliary Feedwater Pump Fails to Start	1.05E-03	1.10E-02	1.05E+01	1.25	Generic	1.7E-04
1JCTAHV0001	1CTAHV001--MV-FO	CST to AFW Pump N Supply Valve HV1 Fails to Open (Local Fault)	3.17E-03	2.48E-02	7.83E+00	2	Generic	2.0E-04
1JCTAHV0004	1CTAHV004--MV-FO	CST to AFW Pump N Supply Valve HV4 Fails to Open (Local Fault)	3.17E-03	2.48E-02	7.83E+00	2	Generic	2.0E-04

Table G 3 - Unreliability Data (one table per monitored component)

Component Name and ID: HPSI Pump B - 1SIBP02

Basic Event Name	Basic Event Description	Basic Event Probability (URPC)	Basic Event FVURC [1]	[FV/UR]*ind*	Common Cause Adjustment Factor (CCF)	Common Cause Adjustment Generic or Plant Specific	Adjusted Birnbaum
1SIBP02---XCYXOR	HPSI Pump B Fails to Start Due to Override Contact Failure	6.81E-04	7.71E-04	1.13E+00	3.0	Generic	5.0E-05
1SIBP02----MPAFS	HPSI Pump B Fails to Start (Local Fault)	6.73E-04	7.62E-04	1.13E+00			
1SIBP02----MP-FR	HPSI Pump B Fails to Run	4.80E-04	5.33E-04	1.11E+00			
1SABHP-K125RXAFT	HPSI Pump B Fails to Start Due to K125 Failure	3.27E-04	3.56E-04	1.09E+00			
1SIBP02----CB0CM	HPSI Pump B Circuit Breaker (PBB-S04E) Unavailable Due to Mntc	2.20E-04	2.32E-04	1.05E+00			
1SIBP02----CBBFT	HPSI Pump B Circuit Breaker (PBB-S04E) Fails to Close (Local Fault)	2.04E-04	2.14E-04	1.05E+00			

1. Adjusted for IEF correction if used

Table G 4 Cooling Water Support System FV Calculation Results (one table per train/component/failure mode)

FV*a (or FVc)*	**FV*ie***	**FV*sa (orFVsc)***	**UA (or UR)**	**Calculated FV (per appendix F)** ***(result is put in Basic Event column of table 1 or table 2 as appropriate)***

TABLE G 5. ASME/ANS PRA Standard Supporting Requirements Requiring Self-Assessment (Note: Revision of this table to represent the full scope of SRs applicable to MSPI will be addressed following review of Table 3-1 of the MSPI PRA Quality Task Group report.)		
Supporting Requirement	**Required Capability Category[1]**	**Comments**
IE-A5	II	Focus on plant specific initiators and special initiators, especially loss of DC bus, Loss of AC bus, or Loss of room cooling type initiators
IE-A9	I	Category I in general. However, precursors to losses of cooling water systems in particular, e.g., from fouling of intake structures, may indicate potential failure mechanisms to be taken into account in the system analysis (IE-C8, 11)
IE-C1	MET	Focus on loss of offsite power (LOOP) frequency as a function of duration
IE-C4	II	Focus on LOOP and medium and small LOCA frequencies including stuck open PORVs
IE-C8	MET	For plants that choose fault trees for support systems, pay attention to modeling of loss of cooling systems initiators.
IE-C11	MET	For plants that choose fault trees for support systems, pay attention to initiating event frequencies that are substantially (i.e., more than 3 times) below generic values
AS-A3	MET	Focus on credit for alternate sources, e.g., gas turbines, CRD, fire water, SW cross-tie, recovery of FW
AS-A4	MET	Focus on credit for alternate sources, e.g., gas turbines, CRD, fire water, SW cross-tie, recovery of FW
AS-A5	MET	Focus on credit for alternate sources, e.g., gas turbines, CRD, fire water, SW cross-tie, recovery of FW
AS-A9	II	Category II for MSPI systems and components and for systems such as CRD, fire water, SW cross-tie, recovery of FW
AS-A10	II	Category II in particular for alternate systems where the operator actions may be significantly different, e.g., more complex, more time limited.

TABLE G 5. ASME/ANS PRA Standard Supporting Requirements Requiring Self-Assessment (Note: Revision of this table to represent the full scope of SRs applicable to MSPI will be addressed following review of Table 3-1 of the MSPI PRA Quality Task Group report.)		
Supporting Requirement	**Required Capability Category[1]**	**Comments**
AS-B3	MET	Focus on credit for injection post-venting (NPSH issues, environmental survivability, etc.)
AS-B7	MET	Focus on (a) time phasing in LOOP/SBO sequences, including battery depletion, and (c) adequacy of CRD as an adequate injection source.
SC-A3	MET	
SC-B4	MET	Focus on proper application of the computer codes for T/H calculations, especially for LOCA, IORV, SORV, and F&B scenarios.
SC-C1	MET	
SY-A4	II/III	Category II/III for MSPI systems and components
SY-A10	MET	Focus on (d) modeling of shared systems
SY-A22	II	Focus on credit for alternate injection systems, alternate seal cooling
SY-B1	I	Should include EDG, AFW, HPI, RHR CCFs
SY-B5	MET	Focus on dependencies of support systems (especially cooling water systems) to the initiating events
SY-B9	MET	~~Focus on credit post-venting (NPSH issues, environmental survivability, etc.).~~
SY-B14	MET	Focus on credit for injection post-venting (NPSH issues, environmental survivability, etc.)
HR-E1	MET	Focus on credit for cross ties, depressurization, use of alternate sources, venting, core cooling recovery, initiation of F&B
HR-E2	MET	See comment on HR-E1.
HR-G1	II	However, Category I for the critical HEPs would produce a more sensitive MSPI (i.e., fewer failures to change a color)

TABLE G 5. ASME/ANS PRA Standard Supporting Requirements Requiring Self-Assessment (Note: Revision of this table to represent the full scope of SRs applicable to MSPI will be addressed following review of Table 3-1 of the MSPI PRA Quality Task Group report.)		
Supporting Requirement	**Required Capability Category[1]**	**Comments**
HR-G2	MET	Focus on credit for cross ties, depressurization, use of alternate sources, venting, core cooling recovery, initiation of F&B
HR-G3	I	Category I. See comment on HR-G1. Pay attention to credit for cross ties, depressurization, use of alternate sources, venting, core cooling recovery, initiation of F&B
HR-G5	II	See comment on HR-G1.
HR-H2	MET	Focus on credit for cross ties, depressurization, use of alternate sources, venting, core cooling recovery, initiation of F&B
HR-H3	MET	The use of some systems may be treated as a recovery action in a PRA, even though the system may be addressed in the same procedure as a human action modeled in the accident sequence model (e.g., recovery of feedwater may be addressed in the same procedure as feed and bleed). Neglecting the cognitive dependency can significantly decrease the significance of the sequence.
DA-B1	I	Focus on service condition (clean vs. untreated water) for SW systems
DA-C1	MET	Focus on LOOP recovery
DA-C16	MET	Focus on recovery from LOSP and loss of SW events
DA-D1	I	For BWRs with isolation condenser, focus on the likelihood of a stuck open SRV
QU-B2	MET	Truncation limits should be chosen to be appropriate for F-V calculations.
QU-B3	MET	This is an MSPI implementation concern and should be addressed in the guidance document. Truncation limits should be chosen to be appropriate for F-V calculations.

TABLE G 5. ASME/ANS PRA Standard Supporting Requirements Requiring Self-Assessment (Note: Revision of this table to represent the full scope of SRs applicable to MSPI will be addressed following review of Table 3-1 of the MSPI PRA Quality Task Group report.)		
Supporting Requirement	**Required Capability Category[1]**	**Comments**
QU-D4	II	Understanding the differences between plant models, particularly as they affect the MSPI, is important for the proposed approach to the identification of outliers recommended by the task group.
QU-D6	II/III	Category II/III for those who have used fault tree models to address support system initiators.
QU-E4	MET	MET for the issues that directly affect the MSPI.

1. The Required Capability Category for Supporting Requirements where the action statement spans all three categories is designated as “MET” consistent with the guidance of NEI 05-04, Revision 2, Table 1.