Enclosure 2

Draft Whitepaper
On PRA Technical
Adequacy For MSPI

Dated August 29, 2012

# Whitepaper
# 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 configuration control program 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 Configuration Control Program 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 3 times the median Birnbaum value from the associated cross comparison group for pumps/diesels and 3 times the plant values for valves/breakers technically sound?
- 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 in determining 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 5), NUREG/CR-6928 (Reference 6), and NUREG/CR-6890 (Reference 7) indicate that there are no statistically significant trends in either initiating event frequency or generic component reliability data over periods of up to ten years. Therefore, it is proposed that data maintenance intervals of no greater than 10 years be used for PRA models supporting MSPI.

In general, the data maintenance process shall be consistent with the supporting requirements in the ASME/ANS PRA Standard Initiating Event Analysis (IE), Data Analysis (DA), and Human Reliability Analysis (HR) technical elements. However, there are some additional considerations not explicitly covered by the ASME/ANS PRA Standard that are considered important for MSPI. These include:

a) The data update process shall ensure consistency in the time period applied across parameters. Where different time frames are used for subsets of the data, they should be justified on the basis of statistical analysis or modifications to plant design or operating practice that led to a condition where past data are no longer representative of current performance.
b) All initiating event data and component reliability data should be developed based on available industry experience data over a time frame,

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.

b) The evaluation process for pending PRA model changes should include consideration of the cumulative impact of pending changes on MSPI in determining whether a PRA model update is needed.
c) The interval between maintenance updates of the initiating event frequencies, component reliability and unavailability data, and the human reliability analysis shall be performed on an should not exceed ten years.
d) Data updates shall encompass the entirety of the data category (i.e., initiating event frequencies, component reliability and unavailability, or human reliability) using available data sources and a common time period for the data collection unless shorter periods can be justified for a subgroup of the data based on statistical analysis or modifications to plant design or operating practice that led to a condition where past data are no longer representative of current performance.
e)

### 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 8) 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 three 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 standard 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.

## 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." 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.* In this appendix, the general guidance requires a peer review be performed for all PRA upgrades involving application of new methodology or a change in PRA scope or capability that impacts the significant accident sequences or the significant accident progression sequences. 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 a thorough 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. 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. ~~The Standard has been endorsed by the staff in RG 1.200, which has been issued for trial use.~~

Licensees should assure that their PRA is of sufficient technical adequacy to support the MSPI application ~~by one of the following alternatives~~as follows:

#### G 2.1.1 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 attributes specific to 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.
b) The evaluation process for pending PRA model changes should consider the cumulative impact of pending changes on MSPI results in determining the need for a PRA model update.
c) The interval between maintenance updates of the initiating event frequencies, component reliability and unavailability data, and the human reliability analysis shall be performed on an should not exceed ten years.
d) Data updates shall encompass the entirety of the data category (i.e., initiating event frequencies, component reliability and unavailability, or human reliability) using available data sources and a common time period for the data collection unless shorter periods can be justified for a subgroup of the data based on statistical analysis or modifications to plant design or operating practice that led to a condition where past data are no longer representative of current performance.

#### G 2.1.2 Treatment of Open Peer Review Findings

Open peer review findings associated with the ASME/ANS PRA Standard supporting requirements applicable to MSPI (Table G 5) shall be assessed consistent with the above PRA Configuration Control program. If the cumulative impact of proposed resolutions for the open peer review findings results in a predicted change in the indicator color for an MSPI monitored train or component, a modified Birnbaum value equal to the value calculated in the applicable

sensitivity analysis for affected trains or components should be used in the MSPI calculation at the index, system or component level, as appropriate, until the F&O is resolved.

### G 2.1.3 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 a thorough 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 2.1.1 and evaluated as described in Section G 2.1.2.

~~**G 2.1.1 Alternative A (Consistent with MSPI PRA Task Group recommendations)**~~

~~a) 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.~~

~~And~~

~~b) Perform a self assessment using the NEI 00-02 process as modified by Appendix B of RG 1.200 for the ASME PRA Standard supporting level requirements identified by the MSPI PRA task group and resolve any identified issues or document the basis for a determination that any open issues will not significantly impact the MSPI calculation. Identified issues are considered significant if they impact 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 identified issue 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 value for valves/breakers should be used in the MSPI calculation at the index, system or component level, as appropriate, until the issue is resolved.~~

~~G 2.1.2 Alternative B (Consistent with RG 1.174 guidance)~~

~~a) 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.~~

~~And~~

~~b) Disposition any candidate outlier issues identified by the industry PRA cross comparison activity. The disposition of candidate outlier issues can be accomplished by:~~

- ~~Correcting or updating the PRA model;~~
- ~~Demonstrating that outlier identification was due to valid design or PRA modeling methods; or~~
- ~~Using a modified Birnbaum value equal to a factor of 3 times the median value from the associated cross comparison group for pumps/diesels and 3 times the plant value for valves/breakers until the PRA model is corrected or updated.~~

## 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 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.
   ~~1.~~2. Justification for the determination that any open ~~category A or B~~finding level F&Os do not impact use of the PRA model for MSPI. ~~that will not be resolved prior to April 1, 2006.~~
   ~~2.~~3. ~~Justification~~ Documentation of the determination that ~~for any~~ candidate outliers for the plant from updated group cross-comparison studies are due to valid differences in plant design or PRA methods or a description of how the candidate outlier was addressed through changes in the PRA model.~~open issues from:~~

~~3. the self-assessment performed for the supporting requirements (SR) identified in Table 5, taking into consideration Appendix B of RG 1.200 (trial), with particular attention to the notes in Table 4 of the MSPI PRA task group report.~~

~~4. -- OR --~~

~~5. identification of any candidate outliers for the plant from the group cross-comparison studies.~~

C. Licensees should document in their PRA archival documentation:

1. A description of the resolution of the ~~A and B category~~finding level F&Os identified by the peer review team.
2. Results of sensitivity studies 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.
~~2.~~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)<br>*(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 | |
|---|---|
| ~~+~~Supporting Requirement | Comments |
| IE-A5~~4~~ | 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~~7~~ | 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~~6, 7, 8, 9~~) |
| ~~IE-A9~~ | ~~Category II for plants that choose fault trees to model support systems. Watch for initiating event frequencies that are substantially (e.g., more than 3 times) below generic values.~~ |
| IE-C1 | Focus on loss of offsite power (LOOP) frequency as a function of duration |
| IE-C4~~2~~ | Focus on LOOP and medium and small LOCA frequencies including stuck open PORVs |
| IE-C8~~6~~ | For plants that choose fault trees for support systems, attention to loss of cooling systems initiators. |
| IE-C11~~9~~ | ~~Category II~~ 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 | Focus on credit for alternate sources, e.g., gas turbines, CRD, fire water, SW cross-tie, recovery of FW |
| AS-A4 | Focus on credit for alternate sources, e.g., gas turbines, CRD, fire water, SW cross-tie, recovery of FW |
| AS-A5 | Focus on credit for alternate sources, e.g., gas turbines, CRD, fire water, SW cross-tie, recovery of FW |
| AS-A9 | Category II for MSPI systems and components and for systems such as CRD, fire water, SW cross-tie, recovery of FW |
| AS-A10 | Category II in particular for alternate systems where the operator actions may be significantly different, e.g., more complex, more time limited. |
| AS-B3 | Focus on credit for injection post-venting (NPSH issues, environmental survivability, etc.) |
| AS-B7~~6~~ | Focus on (a) time phasing in LOOP/SBO sequences, including battery depletion, and (c) adequacy of CRD as an adequate injection source. |

| TABLE G 5. ASME/ANS PRA Standard Supporting Requirements Requiring Self-Assessment | |
|---|---|
| ~~I~~Supporting Requirement | Comments |
| SC-A3~~4~~ | Focus on modeling of shared systems and cross-ties in multi-unit sites |
| SC-B~~1~~4 | Focus on proper application of the computer codes for T/H calculations, especially for LOCA, IORV, SORV, and F&B scenarios. |
| SC-C1 | ~~Category II~~MET |
| SY-A4 | Category II/III for MSPI systems and components |
| SY-A10~~+~~ | Focus on (d) modeling of shared systems |
| SY-A22~~0~~ | Focus on credit for alternate injection systems, alternate seal cooling |
| SY-B1 | Should include EDG, AFW, HPI, RHR CCFs |
| SY-B5 | Focus on dependencies of support systems (especially cooling water systems) to the initiating events |
| ~~SY-B9~~ | ~~Focus on credit for injection post-venting (NPSH issues, environmental survivability, etc.)~~ |
| SY-B14~~5~~ | Focus on credit for injection post-venting (NPSH issues, environmental survivability, etc.) |
| HR-E1 | Focus on credit for cross ties, depressurization, use of alternate sources, venting, core cooling recovery, initiation of F&B |
| HR-E2 | Focus on credit for cross ties, depressurization, use of alternate sources, venting, core cooling recovery, initiation of F&B |
| HR-G1 | Category II , though Category I for the critical HEPs would produce a more sensitive MSPI (i.e., fewer failures to change a color) |
| HR-G2 | Focus on credit for cross ties, depressurization, use of alternate sources, venting, core cooling recovery, initiation of F&B |
| HR-G3 | Category I. See note on HR-G1. Attention to credit for cross ties, depressurization, use of alternate sources, venting, core cooling recovery, initiation of F&B |
| HR-G5 | Category II. See note on HR-G1. |
| HR-H2 | Focus on credit for cross ties, depressurization, use of alternate sources, venting, core cooling recovery, initiation of F&B |
| HR-H3 | 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 |

| TABLE G 5. ASME/ANS PRA Standard Supporting Requirements Requiring Self-Assessment | |
|---|---|
| ~~1~~Supporting Requirement | Comments |
| | 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 | Focus on service condition (clean vs. untreated water) for SW systems |
| DA-C1 | Focus on LOOP recovery |
| DA-C16~~5~~ | Focus on recovery from LOSP and loss of SW events |
| DA-D1 | For BWRs with isolation condenser, focus on the likelihood of a stuck open SRV |
| QU-B2 | Truncation limits should be chosen to be appropriate for F-V calculations. |
| QU-B3 | 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. |
| QU-D4~~3~~ | 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~~5~~ | Category II/III for those who have used fault tree models to address support system initiators. |
| QU-E4 | ~~Category II~~ MET for the issues that directly affect the MSPI |