Enclosure 2

White papers and presentations discussed during the

June 26, 2013 ROP WG Public Meeting

U.S.NRC

United States Nuclear Regulatory Commission

Protecting People and the Environment

Effectiveness of Reactor Oversight Process Baseline Inspection Program Public Meeting

July 17, 2013

Components of ROP Internal Assessment

Ongoing Feedback (IMC 0801)

Individuals (Inspector, IP Owner, SME)
Via Feedback Process

Collectives (Working Groups, SMEs)
Via Interface Meetings

Annual Review (IMC 0307)

ROP Self-Assessment

Biennial Internal Survey

Biennial Review (IMC 0307B)

ROP Realignment

FY 2013 Enhancement Project BIP
(in lieu of ROP Realignment)

FY 2013 Independent Assessment (SECY 12-0081)
(will inform ROP Enhancement Project)

Components of ROP Enhancement Project

- Baseline Inspection Program
- Assessment
- Communication

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Project Goal

Enhance baseline inspection program to:

- incorporate needed inspection areas for the current environment,
- eliminate redundant inspection areas,
- ensure efficient and effective use of agency resources, and
- incorporate flexibility where appropriate.

Meeting Goals

Have a dialogue with external stakeholders on identified baseline inspection program topics.

Obtain public comments on the baseline inspection program.

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Additional Information

- *Effectiveness of the Reactor Oversight Process Baseline Inspection Program; Public Meeting and Request for Comment [NRC-2013-0125]* **Tuesday, June 11, 2013; 78 FR 35056**. http://www.gpo.gov/fdsys/pkg/FR-2013-06-11/pdf/2013-13794.pdf
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White Paper on “Additional Failures” for MS05

Date of White Paper: March 28, 2013
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Performance Indicator: MS05, Safety System Functional Failures

NEI 99-02 Guidance needing interpretation: Page 29, lines 22-25 discussion on Additional Failures.
Current guidance states:

Additional failures: *a failure leading to an evaluation in which additional failures are found is only counted as one failure; new problems found during the evaluation are not counted, even if the causes or failure modes are different. The intent is to not count additional events when problems are discovered while resolving the original problem.*

Response Section:

This section of the guidance doesn’t clearly define the types of evaluations that can be considered when grouping additional failures into a single Performance Indicator occurrence. Causal Evaluations undertaken in response to an original issue that discover additional failures will result in grouping all those SSFFs into a single PI occurrence. However, evaluations undertaken while performing Design Basis reconstitutions or large scale transitions to new programs, such as NFPA-805, should also result in a single SSFF PI occurrence.

IMC-0305, OPERATING REACTOR ASSESSMENT PROGRAM, Definition 4.18 of an Old Design Issue:

An inspection finding involving a past design related problem in the engineering calculations or analyses, the associated operating procedure, or installation of plant equipment that does not reflect a performance deficiency associated with existing licensee programs, policy, or procedures.

Section 11.05, Treatment of Items Associated with Enforcement Discretion, goes on to state that:

The intent of this section is to establish ROP guidance that supports the objective of enforcement discretion, which is to encourage licensee initiatives to identify and resolve problems, especially those subtle issues that are not likely to be identified by routine efforts.

The purpose of this approach is to place a premium on licensees initiating efforts to identify and correct safety-significant issues which are not likely to be identified by routine efforts, before degraded safety systems are called upon to work. The assessment program evaluates present performance issues, and this approach excludes old design issues from consideration of overall licensee performance in the Action Matrix.

IMC-0305 clearly encourages licensee program reviews or changes that uncover old design issues which, if left unresolved, could challenge safety systems. Additional failures discovered during programmatic reviews, design basis reconstitutions or transitions to new engineering programs such as NFPA-805, should have Safety System Functional Failures discovered during these reviews grouped into a single PI occurrence to align with the existing guidance in IMC-0305 and to encourage licensee identification and resolution of problems.

White Paper on “Additional Failures” for MS05

Recommend the following clarifications to the definition of Additional Failures in NEI 99-02:

*22 **Additional failures:** a failure leading to an evaluation in which additional failures are found is 23 only counted as one failure; new problems found during the evaluation are not counted, even if 24 the causes or failure modes are different. The intent is to not count additional events when 25 problems are discovered while resolving the original problem. Evaluation types which may discover these additional failures include Causal Evaluation Extent of Condition or Extent of Cause reviews that are undertaken as a result of a discrete event reported in an LER. Additional failures discovered during these reviews would not count as separate PI occurrences. ~~Additional failures discovered during design basis reconstitutions or evaluations conducted during significant programmatic engineering changes (e.g., NFPA-805 transition) where possible, should be treated as Old Design Issues as discussed in IMC-0305, Operating Reactor Assessment Program, and reported as a single SSFF PI occurrence if the error was introduced within three years of the time of discovery. If the Old Design error was introduced more than three years prior to the time of discovery, no SSFF PI Occurrence shall be counted, even if the error impacts currently active calculations, documents or equipment.~~*

A comment should be added to the publicly viewable quarterly CDE submittal file explaining that newly discovered additional failures, even if reported under a new LER number, only count as a single SSFF PI occurrence. ~~if the original error was introduced within the three year reporting window. If the error was introduced outside the three year reporting window, no SSFF PI occurrence shall be counted even if the event was reported under 10 CFR 50.73(a)(2)(v).~~

NRC Staff White Paper
Objective of the RCS Leakage Performance Indicator

06/21/2013

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Issue:

A potential disconnect exists between the objective of the Reactor Coolant System (RCS) leakage performance indicator (PI) and the measured metric. The RCS leakage PI does not monitor the attributes described in the PI's technical basis objective in IMC 0308, Attachment 1, "Technical Basis for Performance Indicator," because RCS identified leakage does not constitute RCS pressure boundary leakage as defined by the technical specifications (TS).

Background:

1. Reactor Oversight Process (ROP) and NEI Guidance

a. NEI 99-02 and IMC 0308, Attachment 1: (Ref. 19-20)

The RCS leakage PI purpose or objective, as described in both documents, is to monitor the integrity of the RCS pressure boundary, the second of the three barriers to prevent the release of fission products. The PI measures RCS identified leakage as a percentage of the technical specification allowable identified leakage to provide an indication of RCS integrity. Most BWR and some PWR plants report total leakage because they do not have identified leakage defined within their plant technical specifications.

NEI 99-02 described the barrier integrity cornerstone purpose as a cornerstone to provide reasonable assurance that the physical design barriers (fuel cladding, reactor coolant system, and containment) protect the public from radionuclide releases caused by accidents or events. These barriers play an important role in supporting the NRC Strategic Plan goal for nuclear reactor safety, "Prevent radiation-related deaths or illnesses due to civilian nuclear reactors." The defenses in depth provided by the physical design barriers which comprise this cornerstone allow achievement of the reactor safety goal. The performance indicators for this cornerstone cover two of the three physical design barriers. The first barrier is the fuel cladding. Maintaining the integrity of this barrier prevents the release of radioactive fission products to the reactor coolant system, the second barrier. Maintaining the integrity of the reactor coolant system reduces the likelihood of loss of coolant accident initiating events and prevents the release of radioactive fission products to the containment atmosphere in transients and other events. Performance indicators for reactor coolant system activity and reactor coolant system leakage monitor the integrity of the first two physical design barriers.

There are three desired results associated with the barrier integrity cornerstone. These are to maintain the functionality of the fuel cladding, the reactor coolant system, and the containment which matches the description in SECY 99-007.

b. IMC 2515, Appendix D: (Ref. 21)

Unidentified leakage is monitored by NRC inspectors using licensee's RCS leakage rate data. This guidance is in IMC 2515 App. D Att.1 (Ref. 9). Inspectors verify the mean value (μ) and the standard deviation (σ) of RCS unidentified leakage rate per month. There are three action level triggers that are determine using the mean value and the standard deviation calculated with the spreadsheet.

The following action levels are used to determine if there is a potential adverse trend and to decide what kind of action to take if needed, which are described in IMC 2515 App. D Att.1.

Action Level I:	Nine (9) consecutive leakage measurements above the mean (μ)
Action Level II:	Two (2) of three (3) consecutive measurements exceed the $\mu+2\sigma$
Action Level III:	One (1) measurement of leak rate exceeds the $\mu+3\sigma$

When action level 1 is entered the NRC inspector has to continue to monitor licensee's actions and determine if the licensee is increasing awareness of other containment parameters. In action level II, in addition to level I actions, the inspector has to determine if other data such as sump chemistry samples, containment atmosphere radioactivity, and humidity levels indicate no RCs leakage. If there are any indications of RCS leakage activity the inspector most review

2. Relevant FAQs

FAQ 79 - Use of Total Leakage Value

We have implemented ITS and have TS definitions for Reactor Coolant leakage. We have a defined limit for "Total Leakage" (25 gpm) and "Un-identified Leakage" (5 gpm). We do not have a specified limit for "Identified Leakage". You can infer directly from our TS limits an identified leakage limit of no more than 20 gpm (25 gpm total minus 5 gpm the amount of leakage we call "unidentified leakage"). Using this approach, the Tech Spec limit for the PI could vary between 25 and 20 gpm depending on the amount of "un-identified leakage" we have. Why can't we use the 20-25 gpm as the limit for the PI as can others who do not have a total leakage TS limit? The best indicator of barrier performance seems to be "Un-identified Leakage" rather than identified leakage. Unidentified is the amount of leakage falling outside designed collection systems. Trending the percentage of "Un-identified Leakage" presents a clearer picture of how well a plant is maintaining their Reactor Coolant system. It is also very well defined. It also seems to meet the SECY objective to be an indication of the "probability of more catastrophic failure potential" as specified in paragraph C.4.5. Why is this PI concerned with identified and not Unidentified leakage?

Response
NEI 99-02 states that total leakage will be used for those plants that do not have a Technical Specification limit on Identified Leakage. This is considered acceptable to provide consistency in reporting for those plants. Not all plants track total leakage. Identified leakage was chosen as capturing most of the allowed leakage.

3. 10 CFR Requirements on Reactor Coolant System Leakage

The CFR has the following definitions and design criteria pertaining to the RCS and RCPB.

a. *10 CFR 50.2 Definitions –* Reactor coolant pressure boundary means all those pressure-containing components of boiling and pressurized water-cooled nuclear power reactors, such as pressure vessels, piping, pumps, and valves, which are:

(1) Part of the reactor coolant system, or
(2) Connected to the reactor coolant system, up to and including any and all of the following:

(i) The outermost containment isolation valve in system piping which penetrates primary reactor containment,

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(ii) The second of two valves normally closed during normal reactor operation in system piping which does not penetrate primary reactor containment,
(iii) The reactor coolant system safety and relief valves.

For nuclear power reactors of the direct cycle boiling water type, the reactor coolant system extends to and includes the outermost containment isolation valve in the main steam and feedwater piping.

b. *10 CFR 50, Appendix A General Design Criteria (GDC) for Nuclear Power Plants:*

Criterion 14 – *Reactor coolant pressure boundary*. The reactor coolant pressure boundary shall be designed, fabricated, erected, and tested so as to have an extremely low probability of abnormal leakage, of rapidly propagating failure, and of gross rupture.

Criterion 15 – *Reactor coolant system design.* The reactor coolant system and associated auxiliary, control, and protection systems shall be designed with sufficient margin to assure that the design conditions of the reactor coolant pressure boundary are not exceeded during any condition of normal operation, including anticipated operational occurrences.

Criterion 30 - *Quality of reactor coolant pressure boundary*. Components which are part of the reactor coolant pressure boundary shall be designed, fabricated, erected, and tested to the highest quality standards practical. Means shall be provided for detecting and, to the extent practical, identifying the location of the source of reactor coolant leakage.

Criterion 55 - *Reactor coolant pressure boundary penetrating containment*. Each line that is part of the reactor coolant pressure boundary and that penetrates primary reactor containment shall be provided with containment isolation valves as follows, unless it can be demonstrated that the containment isolation provisions for a specific class of lines, such as instrument lines, are acceptable on some other defined basis:

(1) One locked closed isolation valve inside and one locked closed isolation valve outside containment; or

(2) One automatic isolation valve inside and one locked closed isolation valve outside containment; or

(3) One locked closed isolation valve inside and one automatic isolation valve outside containment. A simple check valve may not be used as the automatic isolation valve outside containment; or

(4) One automatic isolation valve inside and one automatic isolation valve outside containment. A simple check valve may not be used as the automatic isolation valve outside containment.

Isolation valves outside containment shall be located as close to containment as practical and upon loss of actuating power, automatic isolation valves shall be designed to take the position that provides greater safety.

Other appropriate requirements to minimize the probability or consequences of an accidental rupture of these lines or of lines connected to them shall be provided as necessary to assure adequate safety. Determination of the appropriateness of these requirements, such as higher quality in design, fabrication, and testing, additional provisions for inservice inspection, protection against more severe natural phenomena, and additional isolation valves and containment, shall include consideration of the population density, use characteristics, and physical characteristics of the site environs.

4. Regulatory Guide (RG) 1.45, "Guidance on Monitoring and Responding to Reactor Coolant System Leakage," Revision 1

This guide describes methods that are acceptable to detect, monitor and respond to RCS leakage. RG 1.45 provides the following definitions and guidance for various types of RCS leakage:

Identified Leakage

- Leakage (such as pump seal or valve packing leakage) that is captured, flow-metered, and conducted to a sump, collecting tank, or collection system
- Leakage into the containment atmosphere from a known source, which does not interfere with the operation of unidentified leakage monitoring systems and is not attributable to leakage in the RCPB (as defined below)
- Leakage from the RCS to the secondary system at PWRs is termed primary-to-secondary leakage. This leakage is not considered RCPB leakage and is treated as a special form of identified leakage in plant TS. Primary-to-secondary leakage in PWRs is considered a form of identified leakage because it can be monitored separately from other forms of leakage and it does not affect the operation of unidentified leakage detection systems.
- The reactor vessel closure seals and safety and relief valves should not have significant leakage; however, if leakage occurs through these paths or through pump and valve seals, it should be detectable and collectable, and the system should isolate it from the containment atmosphere to the extent practical so as not to mask any potentially serious leakage that may occur. This leakage is "identified leakage," and it should discharge to tanks or sumps so that the plant operator can measure or calculate, monitor, and analyze the flow rate and trend in flow rate during plant operation.

Unidentified Leakage

- Unidentified leakage encompasses all other leakage.
- Until the source of any unidentified leakage is known, such leakage may be RCPB leakage (as defined below); therefore, plants should identify the source as quickly as practicable.
- Leakage to the containment atmosphere, which is not collected (such as from valve stem packing glands and other sources), increases the humidity of the containment. The moisture removed from the atmosphere by air coolers, together with any associated liquid leakage to the containment, is "unidentified leakage," and the system should collect it in tanks or sumps separate from the identified leakage so that the plant operator can establish, monitor, and analyze the flow rate and the trend in flow rate of the unidentified leakage during plant operation.
- It is important to note that there may be leakage into the containment from systems other than the RCS (e.g., secondary-side steam leakage in a PWR). This non-RCS leakage may increase the unidentified leakage rate. Chemical analysis of samples of the unidentified leakage may provide an indication of whether the unidentified leakage is from the RCS or from other sources.

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<u>RCPB Leakage</u>

- RCPB leakage is leakage from a nonisolable fault in the material of an RCS component, pipe wall (including welds), or vessel wall. Leakage from seals, gaskets, and mechanical connections (e.g., bolts, valve seals) is not considered RCPB leakage although these components are part of the RCPB, as defined in 10 CFR 50.2, "Definitions." Thus, RCPB leakage is indicative of degradation of pressure-retaining components that could ultimately result in a loss of component structural integrity.
- Plants should monitor critical components of the RCPB for leakage. These components include the reactor vessel head, control rod penetration nozzles, pressurizer nozzles, and dissimilar metal weld regions.

Reactor coolant pump seal injection and leakoff at PWRs is not considered leakage for plant technical specification purposes, although such leakoff typically satisfies the definition of identified leakage. Reactor coolant pump seals are commonly designed to permit controlled leakage for cooling and lubrication purposes. This leakage is not indicative of degradation in the RCPB and does not affect the operation of the unidentified leakage detection systems because the leakage is collected.

5. RCS Operational Leakage Standard Technical Specifications (STS)

a. The STS for the various reactor types define RCS identified leakage, unidentified leakage, total leakage (BWRs only), and RCPB Leakage as follows:

<u>Identified leakage</u>

PWRs:

- leakage, such as that from pump seals or valve packing (except reactor coolant pump (RCP) seal water injection or leakoff), that is captured and conducted to collection systems or a sump or collecting tank
- leakage into the containment atmosphere from sources that are both specifically located and known either not to interfere with the operation of leakage detection systems or not to be pressure boundary leakage
- RCS leakage through a steam generator to the Secondary System (primary to secondary leakage)

BWRs:

- leakage into the drywell, such as that from pump seals or valve packing that is captured and conducted to a sump or collecting tank
- leakage into the drywell atmosphere from sources that are both specifically located and known either not to interfere with the operation of leakage detection systems or not to be pressure boundary leakage

<u>Unidentified leakage</u>

PWRs: All leakage (except RCP seal water injection or leakoff) that is not identified leakage

BWRs: All leakage into the drywell that is not identified leakage

Total Leakage (BWRs and some PWRs)

Sum of the identified and unidentified leakage

Pressure Boundary leakage

PWRs: Leakage (except primary to secondary leakage) through a nonisolable fault in an RCS component body, pipe wall, or vessel wall.
BWR: Leakage through a nonisolable fault in a RCS component body, pipe wall, or vessel wall.

b. The STS for the various reactor types define the limiting conditions for operation related to RCS Leakage as follows:

The RCS operational leakage for Pressurized Water Reactors (PWR) shall be limited to:

a. No pressure boundary leakage,
b. 1 gpm unidentified leakage,
c. 10 gpm identified leakage, and
d. 150 gallons per day primary to secondary leakage though any one steam generator

For Boiling Water Reactors (BWR) shall be limited to:

a. No pressure boundary leakage,
b. ≤ 5 gpm unidentified leakage, and
c. ≤ 30 gpm total leakage averaged over the previous 24 hour period, and
d. ≤ 2 gpm increase in unidentified leakage within the previous 4 hour period in Mode 1

c. The STS Bases for various reactor types describe the bases for the limiting conditions for operation related to RCS leakage as follow:

The purpose of the RCS operational leakage limiting condition for operation (LCO) is to limit system operation in the presence of leakage to amount that do not compromise safety. Separating the identified leakage from the unidentified leakage is necessary to provide quantitative information to the operators, allowing them to take corrective action should a leak occur detrimental to the safety of the facility and the public.

The STS Bases defines the limit of each type of leakage as follow:

PWRs:

Pressure Boundary Leakage: No pressure boundary leakage is allowed, being indicative of material deterioration. Leakage of this type is unacceptable as the leak itself could cause further deterioration, resulting in higher leakage. Violation of this LCO could result in continued degradation of the RCPB. Leakage past seals and gaskets is not pressure boundary leakage.

Unidentified Leakage: One gpm of unidentified leakage is allowed as a reasonable minimum detectable amount that the containment air monitoring and containment

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sump level monitoring equipment can detect within a reasonable time period. Violation of this LCO could result in continued degradation of the RCPB, if the leakage is from the pressure boundary.

Identified Leakage: Up to 10 gpm of identified leakage is considered allowable because leakage is from known sources that do not interfere with detection of unidentified leakage and is well within the capability of the RCS makeup system. Identified Leakage includes leakage to the containment from specifically known and located sources, but does not include pressure boundary leakage or controlled reactor coolant pump (RCP) seal leakoff (a normal function not considered leakage). Violation of this LCO could result in continued degradation of a component or system.

Primary to Secondary Leakage through any One SG: The limit of 150 gallons per day per SB is based on the operational leakage performance criterion in NEI 97-06, Steam Generator Program Guidelines. The Steam Generator Program operational leakage performance criterion in NEI 97-06 states, "The RCS operational primary to secondary leakage through any one SG shall be limited to 150 gallons per day." The limit is based on operating experience with SG tube degradation mechanisms that result in tube leakage. The operational leakage rate criterion in conjunction with the implementation of Steam Generator Program is an effective measure for minimizing the frequency of steam generator tube ruptures.

<u>BWRs:</u>

Pressure Boundary Leakage: No pressure boundary leakage is allowed, being indicative of material deterioration. Leakage of this type is unacceptable as the leak itself could cause further deterioration, resulting in higher leakage. Violation of this LCO could result in continued degradation of the RCPB. Leakage past seals and gaskets is not pressure boundary leakage.

Unidentified Leakage: Five gpm of unidentified leakage is allowed as a reasonable minimum detectable amount that the drywell air monitoring, drywell sump level monitoring, and drywell air cooler condensate flow rate monitoring equipment can detect within a reasonable time period. Violation of this LCO could result in continued degradation of the RCPB.

Total Leakage: The total leakage limit is based on a reasonable minimum detectable amount. The limit also accounts for leakage from known sources (identified leakage). Violation of this LCO indicates an unexpected amount of leakage and, therefore, could indicate new or additional degradation in an RCPB component or system.

Unidentified Leakage Increase: An unidentified leakage increase of > 2 gpm within the previous 4 hour period indicates a potential flaw in the RCPB and must be quickly evaluated to determine the source and extent of the leakage. The

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increase is measured relative to the steady state value; temporary changes in leakage rate as a result of transit conditions (e.g., startup) are not considered. As such, the 2 gpm increase limit is only applicable in MODE 1 when operating pressures and temperatures are established. Violation of this LCO could result in continued degradation of the RCPB.

6. SECYs

Below are relevant SECY papers that document the development of the ROP and the results of the annual ROP self-assessments. Several self-assessments document discussions and actions related to RCS Leakage PI and the RCPB.

a. SECY 99-007

Performance indicators were developed in support of the cornerstone approach to licensee performance assessment. The barrier integrity cornerstone provides reasonable assurance that the physical design barriers (fuel cladding, reactor coolant system and containment) protect the public from radionuclide releases caused by accidents or events. These barriers play an important role in supporting the NRC Strategic Plan goal for nuclear reactor safety, "Prevent radiation-related deaths or illnesses due to civilian nuclear reactors." The defenses in depth provided by the physical design barriers which comprise this cornerstone allow achievement of the reactor safety goal.

The first barrier is the fuel cladding. Maintaining the integrity of this barrier prevents the release of radioactive fission products to the reactor coolant system, the second barrier. Maintaining the integrity of the reactor coolant system reduces the likelihood of loss of coolant accident initiating events and prevents the release of radioactive fission products to the containment atmosphere in transients and other events. Even if significant quantities of radionuclides are released into the containment atmosphere, maintaining the integrity of the third barrier, the containment, will limit radioactive releases to the environment and limit the threat to the public health and safety. Therefore, there are three desired results associated with the barrier integrity cornerstone. These are to maintain the functionality of the fuel cladding, the reactor coolant system, and the containment.

The scope of the reactor coolant system barrier includes piping and pressure retaining components such as valves, pumps, seals, and gaskets. It also includes portions of connected systems when the plant configuration is such that these connected systems form a part of the reactor coolant system pressure barrier.

Two PIs were proposed to measure equipment and barrier performance for the RCS. These two PIs are the “RCS leak rate” and the “occurrence rate of individual RCS pressure boundary leaks.” The RCS leak rate PI is a potential indication of a breach of the RCS integrity and a reduction in the defense-in-depth for protection against fission product release because the RCS leakage is a direct indicator of the performance of the RCS pressure boundary. This indicator relies upon existing technical specification definitions of identified leakage plus unidentified leakage. It is the maximum calculated reactor coolant system leak rate per month. The “occurrence rate of individual RCS pressure boundary (as defined by STS) leaks, measured on a per fuel cycle basis, that contribute to identified RCS leakage, that are not primary-to-secondary leakage, and that exist when RCS integrity is required by technical specifications,” required development.

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Appendix C - Barrier Integrity Cornerstone

C.4.5 Barrier and Equipment Performance
RCS leakage is the most direct measure of RCS barrier performance. All other key attributes under RCS integrity are aimed at measuring or inspecting areas that are known to contribute to the increased probability that RCS integrity could fail. An actual RCS leak is, by definition, a breach of RCS integrity and a direct indicator of the performance of the RCS pressure boundary. Research sponsored by the industry and NRC has determined that the RCS pressure boundary passive components have a high probability of experiencing a leak prior to a rupture (i.e., "leak-before-break" analysis). Therefore, two performance indicators have been identified that can offer an objective perspective on the probability of more catastrophic failure potential: the rate of occurrence and magnitude of small RCS pressure boundary leaks.

The condition of passive RCS pressure boundary components such as piping, welds, and valves is monitored by the licensee to maintain confidence in LOCA frequency estimates as degradation can potentially impact the RCS strength margins and the likelihood of an RCS pressure boundary rupture. A performance indicator has been proposed for this area (i.e., Inservice Inspection Results). In addition to this performance indicator or until the indicator is fully developed, the baseline inspection program will assess the effectiveness of the inservice inspection program in a risk-informed manner.

Active RCS pressure boundary components are defined here to include safety relief valves, power operated relief valves, and reactor coolant pump or recirculation pump seals and associated seal cooling equipment. Failure of active components can have a direct impact on RCS integrity. A high availability and reliability of the active components is expected through the licensee’s implementation of the maintenance rule. Any problems related to these components will be identified through NRC verification of the licensee’s implementation of the maintenance rule.

b. SECY 00-0049

A 6-month pilot program was conducted to evaluate the revised reactor oversight process (RROP) proposed in SECY-99-007. The barrier integrity PIs are fundamentally different from the other indicators used in the ROP. They are intended to provide indications of the integrity of the three barriers to the release of radioactive material from the reactor core. The barrier integrity PI serve primarily a public confidence role to indicate how much margin there is to any safety concern in the performance of these barriers, as oppose to an indication, at least at the green/white threshold, that there is a deviation from nominal industry performance. Since this PI uses TS limit that the plants typically operate very far below them, the green/white threshold would rarely be exceeded. But the data reported varied plant to plant because TS requirements vary from plant to plant (e.g., for RCS leakage, in addition to unidentified leakage some plants measure identified leakage while others measure total leakage) and because licensees use a variety of methods to measure compliance with these TS (e.g., some measure as-found containment leakage while others record only as-left leakage).

The problems with data reporting and the thresholds for these indicators have resulted in a number of stakeholder comments challenging the meaningfulness of the barrier indicators. For initial implementation the staff intended to revise the PI reporting guidance as necessary to clarify the use and meaning of these PIs. The staff was supposed to continue to collect data and lessons learned on these PIs during the first year of implementation to evaluate their continued use in the ROP while awaiting the results of the effort by RES to develop risk-based PIs that may be more meaningful.

Stakeholders suggested that the RCS leakage PI should provide more meaningful information by measuring unidentified leakage instead of identified leakage. The NRC/NEI working group was going to provide a better description of the bases for this indicator, including the use of identified instead of unidentified leakage and was going to reconsider the appropriateness of the green-white thresholds.

c. SECY 03-0062

Some stakeholders believed that the ROP was inadequate because it did not identify the vessel head degradation at Davis-Besse. As a result a multi-disciplined task force was formed to review the NRC's regulatory process associated with the issues at Davis-Besse. Among the more significant ROP-related recommendations was to enhance the barrier integrity PI to more accurately monitor unidentified leakage.

d. SECY 04-0053

The staff expected to address several indications in CY 2004 in the reactor safety arena, including an improved reactor coolant system leakage PI to address the lessons learned from the Davis-Besse event to better trend unidentified leakage.

The Davis-Besse Lessons Learned Task Forced (DBLLTF) recommended that the NRC should continue its ongoing efforts to review and improve the usefulness of the barrier integrity PIs. The staff was considering that all leakage (with the exception of pressure boundary leakage) measurements required by the TS could be monitored by the Primary Coolant System (PCS) PI and compared, in some way, to the allowable TS limit. All parameters could then be displayed and the PI color could be determined by the one closest to its limit.

e. SECY 05-0070

The staff continued to make enhancements to the ROP based on the implementation of DBLLTF action items. These changes will enhance the NRC's ability to detect declining plant performance, including the specific issues that were identified at the Davis-Besse plant. Some changes were completed in 2004, including, several procedures to verify licensees have programs and processes in place to detect, monitor, and take corrective actions for adverse trends of reactor coolant system leakage.

The DBLLTF recommended that the staff continue ongoing efforts to review and improve the usefulness of the barrier integrity PIs and evaluate the feasibility of establishing a PI that tracks the number, duration, and rate of primary system leaks that have been identified but not corrected. One of the primary tasks of the NRC/Industry working group was to continuously review and improve all the PIs. With regard to the RCS Leakage PI, the NRC/industry working group formed a task group to develop a proposal for a new PI. The group agreed that this PI should monitor unidentified leakage rather than identified leakage and that the measured values of unidentified leakage should be averaged over an appropriate time interval to identify baseline values and trends. However, the appropriate averaging methodology was not yet been determined. The second part of the recommendation required a feasibility evaluation of establishing an additional PI for tracking number, duration and rate of primary system leaks, but preliminary discussions indicated that such a measure was not feasible.

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f. SECY 06-0074

The DBLLTF recommended that the staff continue ongoing efforts to review and improve the usefulness of the barrier integrity PIs and evaluate the feasibility of establishing a PI that tracks the number, duration, and rate of primary system leaks that have been identified but not corrected. The NRC/industry task group agreed that this approach was likely not feasible but did, however, agreed that this PI should monitor unidentified leakage (instead of identified leakage) averaged over an appropriate time interval to identify baseline values and trends. The Westinghouse and Boiling-Water Reactors Owners Groups established a working group to examine leakage monitoring. The owners groups were collecting data for a revised PI and expected to have results in the fall of 2006. If these efforts identified a feasible method for improving the PI, it was going to be presented to the ROP working group for further discussion.

The staff revised Appendix D to IMC 2515 in January 2005 to provide guidance and techniques necessary for assessing potential adverse trends and action levels in response to increasing levels of RCS unidentified leakage.

g. SECY 07-0069

The staff and many stakeholders remain concerned that the current set of PIs and thresholds do not provide adequate information to identify outliers and detect declining plant performance. The staff is reviewing and revising several PIs, including reactor coolant system leakage.

During development of the ROP, the industry proposed the reactor coolant system (RCS) leakage PI. The RCS leakage PI would measure identified leakage with a green-white threshold of 50 percent of the allowable limit of the technical specifications (TS) and a white-yellow threshold of 100 percent of the allowable limit. There is no yellow-red limit since plants are required to shut down if RCS leakage exceeds the technical specification limit. In response to the Davis-Besse event, the staff was tasked to evaluate certain PI improvements for RCS leakage. The staff convened an RCS leakage working group composed of three utility representatives and three NRC staff. The working group first agreed upon the need to monitor unidentified leakage rather than identified leakage. For a few months, the staff collected leakage data and explored options for the new RCS leakage PI. Shortly after that effort began, the Westinghouse Owners Group (WOG) began a similar project. The working group decided to hold its efforts and wait for the results of the WOG program. Using the data developed by the WOG, the staff was going to attempt to develop a new and improved RCS leakage PI in CY 2007 and CY 2008. Currently, no changes to the RCS PI have been implemented.

7. Davis-Besse Lessons Learned Task Force (DBLLTF)

After the Reactor Pressure Vessel Head degradation event at the Davis-Besse Nuclear Power Station there was a concern about the integrity of the reactor coolant pressure boundary. The NRC submitted a Lessons Learned Task Force (LLTF) report. Even though the TS set a 1 gpm limit for unidentified leakage and it was kept below 0.2 gpm, the leakage eventually caused the degradation found in the vessel head. The specific LLTF recommendations were focused on reviewing and improving leakage detection requirements.

As documented in LLTF recommendation 3.3.3(3), the intent of the current RCS Leakage PI is to call attention to those plants that have identified primary systems leaks but have not corrected them in a timely manner.

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One of the DBLLTF recommendations was to evaluate the feasibility of a PI that tracks the number, duration and rate of primary leaks that have been identified but not corrected. The industry and NRC staff concluded that at present it is not feasible due to the fact that the licensees have difficulties in determining small leak rates. The LLTF acknowledged that the review and improvements of PIs is a constant and continuing process performed by the ROP Working Group. The ROP Working Group on many occasions discussed ways of improving the RCS Leakage PI, including the possibility of measuring unidentified leakage. Currently, no changes to the RCS PI have been implemented as a result of the ROP Working Group.

Analysis:

The technical basis in IMC 0308, Attachment 1, "Technical Basis for Performance Indicators" and NEI 99-02 for the Reactor coolant System Leakage PI is to monitor the integrity of the RCS pressure boundary, the second of three barriers to prevent the release of fission products. The PI measures RCS identified leakage (or total for BWRs) as a percentage of the technical specification allowable to provide an indication of RCS integrity. The key attributes measured by the RCS Leakage PI is the performance of the RCS equipment and barrier. The concern with this PI is that it monitors the integrity of RCPB by measuring identified leakage which by definition identified leakage is not attributed to leakage in the RCS pressure boundary. Basically there is an inconsistency between the definitions of the RCPB (10 CFR 50.2) and RCPB leakage (STS and RG 1.45).

The 10 CFR 50.2 defines the RCPB as all the pressure containing component, such as pressure vessels, piping, pumps and valves, which are either part of the RCS or connected to the RCS. The STS and RG 1.45 defines RCPB leakage coming from seals, gaskets and mechanical connections. RCPB leakage is from nonisolable faults in the RCS components that could result in a loss of component structural integrity, like pipe wall (including welds) or vessel wall. RCS identified leakage is from pump seals or valve packing, which by the CFR definition is part of the RCPB. RCS unidentified leakage is all other leakage which includes RCPB leakage until proven to the contrary.

Comment [MFB1]: RCPB and RCPB leakage are two different terms. I can't take RCPB definition add leakage to it and equal the definition of RCPB leakage.

The RCS Leakage PI is monitoring a portion of the RCS pressure boundary as defined in 10 CFR 50.2 even though identified leakage is not considered RCPB leakage by RG 1.45 and STS. The 10 CFR 50.2 definition includes every component that contributes to identify leakage as part of the RCS pressure boundary. This can create confusion since the definition of leakage from the RCPB in RG 1.45 and STS can appear that the RCS Leakage PI is not fulfilling its objective.

The PI concern is valid when applying the definitions of leakages contained in RG 1.45 and STS. If the objective of monitoring the RCS pressure boundary is accurate and the PI metric remains the same, this concern could be presented again in the future. This same concern was documented in FAQ 79. The FAQ response highlighted that identified leakage was chosen as capturing most of the allowed leakage.

In response to the vessel head event at the Davis–Besse reactor, the NRC formed a LLTF. Stakeholders were concern that the RCS leakage PI did not foresee the Davis-Besse event. The LLTF acknowledged that the review and improvements of PIs is a constant and continuing process performed by the ROP Working Group. The ROP Working Group on many occasions discussed ways of improving the RCS Leakage PI, including the possibility of

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measuring unidentified leakage. Currently, no changes to the RCS Leakage PI have been implemented as a result of the Davis-Besse event by the ROP Working Group.

By using only identified leakage, some components of the RCS pressure boundary are not monitored by the RCS Leakage PI. Unidentified leakage would account for the remaining components. Potentially, a better measure of integrity of the RCS pressure boundary could be a combination of both identified and unidentified leakage total leakage) as is reported by BWRs.

The ROP Feedback Form initiator recommends retaining the RCS Leakage PI basis but change the PI measured metric. The initiator recommends the PI should measure unidentified leakage and actual occurrences of issues that result in an inoperable RCS pressure boundary.

Proposed Solutions:

The intention of this proposal is to identify potential actions to address the concern that the RCS Leakage PI objective is inconsistent with the measured metric (identified leakage). The recommendations in the FBF are to retain the basis of having a performance indicator that monitors the integrity of the reactor coolant system pressure boundary, but change the PI measured metric to monitor a combination of unidentified leakage and actually occurrences of RCPB leakage. Other possible solutions are proposed below.

1. Leave the PI as is but modify the Technical Basis objective of the RCS Leakage PI.

    a. The objective of the PI could be change so that it follows the definition of identified leakage. By doing this there is no need to change the metric of the PI.
    b. This effort requires low resources.

2. Change the current RCS Leakage PI metric to monitor unidentified leakage instead of identified leakage.

    a. The measured metric (unidentified leakage) will measure possible RCPB leakage.
    b. It will formalize a regulatory response to unidentified leakage values crossing a threshold.
    c. It will need the industry approval.

3. Create a new PI that monitors unidentified leakage and leave the current PI monitoring identified leakage.

    a. By unidentified leakage definition the PI will actually measure possible RCPB leakage.
    b. It will formalize a regulatory response to unidentified leakage values crossing a threshold.
    c. Identified leakage PI will not be eliminated.
    d. This solution will require a lot of resources and efforts.
    e. It will need the industry approval.

4. Create a new PI that counts RCPB leakage events, similar to the USwC.
    a. It will cover the objective of the cornerstone.
    b. It requires lots of effort.

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c. It will need industry approval.

5. Create a performance limit exceeded (PLE) that counts RCPB leakage events, similar to MSPI PLE.
    a. Continue to monitor identified leakage.
    b. Counts number of RCPB leakage occurrences in a specified timeframe.
    c. It will cover the objective of the cornerstone.
    d. It will need industry approval.

6. Change the current RCS Leakage PI metric to monitor total leakage (identified plus unidentified leakage).

    a. 10 CFR 50 definition of RCPB includes all components included in identified and unidentified leakage. By measuring total leakage the PI will fully meet its objective. Also it will cover the objective of the barrier integrity cornerstone.
    b. This will required effort to change the NRC guidance, minimal effort.
    c. Only PWRs (some PWRs report total leakage) will have to modify their procedures since BWRs already monitor total leakage for their RCS leakage PI.
    d. The PI charts will not have a statistically difference than what they report right now. The impact in the action matrix column will not be change.
    e. It will need the approval of industry.

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White Paper on "DEP and Participation Credit for Non-active SRO (Generic)"

Plant: TVA
Date of White Paper: June 20, 2013 (original FAQ submitted April 23, 2013)
Contact: Walt Lee Tel/email: 423.751.8577 whlee@tva.gov

Performance Indicator: EP01, Drill/Exercise Performance and EP01, Emergency Response Organization Drill Participation

NEI 99-02 Guidance needing interpretation (include page and line citation):

Page 52 Lines 19-35
19 If a person is assigned to more than one Key Position, it is expected that the person be counted in
20 the denominator for each position and in the numerator only for drill participation that addresses
21 each position. Where the skill set is similar, a single drill might be counted as participation in
22 both positions.
23
24 Assigning a single member to multiple Key Positions and then only counting the performance for
25 one Key Position could mask the ability or proficiency of the remaining Key Positions. The
26 concern is that an ERO member having multiple Key Positions may never have a performance
27 enhancing experience for all of them, yet credit for participation will be given when any one of
28 the multiple Key Positions is performed; particularly, if more than one ERO position is assigned
29 to perform the same Key Position.
30
31 ERO participation should be counted for each Key Position, even when multiple Key Positions
32 are assigned to the same ERO member. In the case where a utility has assigned two or more Key
33 Positions to a single ERO member, each Key Position must be counted in the denominator for
34 that ERO member and credit given in the numerator when the ERO member performs each Key
35 Position.

Questions:

This question addresses an issue that involves the participation credit for a qualified TSC Emergency Director who is also a non-active SRO qualified Shift Manager Emergency Director. For an individual with this qualification status, NEI 99-02 requires that the individual be included as a TSC Emergency Director participant but does not provide specific guidance as to the requirement to include or not include the individual as a Shift Manager Emergency Director participant when the individual attends License Operator Requalification training as a staff license.

Question 1: Should DEP and ERO participation credit be counted for a non-active SRO Shift Manager/Emergency Director for LOR opportunities?

Question 2: Should DEP and ERO participation credit be counted for a non-active SRO Shift Manager Emergency Director for LOR opportunities if the individual is being given credit for DEP and ERO participation as an Emergency Director in the TSC?

Response Section:

Answer to Question 1: Simulator LOR opportunities (DEP and ERO Participation) should not be counted for a non-active SRO Shift Manager Emergency Director credit because non-active SROs are not able to fill the shift position of Shift Manager without meeting reactivation time criteria (i.e., the individual is not a member of the on-shift ERO).

White Paper on "DEP and Participation Credit for Non-active SRO (Generic)"

Answer to Question 2: Simulator LOR opportunities (DEP and ERO Participation) should not be counted for a non-active SRO Shift Manager Emergency Director credit even if the individual is being given credit for DEP and ERO participation as an Emergency Director in the TSC in that the individual is not filling the Shift Manager Key Position.

Recommend the following clarifications to NEI 99-02:

Insert the following statement after line 35 on page 52

ERO participation should be counted for each Key Position, even when multiple Key Positions are assigned to the same ERO member. In the case where a utility has assigned two or more Key Positions to a single ERO member, each Key Position must be counted in the denominator for that ERO member and credit given in the numerator when the ERO member performs each Key Position.

Non-active SRO's participating in Licensed Operator Requalification training filling the position of Shift Manager (not filing a Key ERO Position of Shift Manager – Emergency Director) are not provided credit for DEP or ERO Participation.

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 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 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 MSPI. The recommendations of the MSPI PRA Quality Task Group (Reference 8) 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 8) 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 8 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 8 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. The configuration control program supporting the MSPI program should meet the following requirements~~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.

The following clarifications are applicable.

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 F&Os characterized as findings related to those supporting requirements identified in Table G 5. NEI 05-04 defines a finding as an observation (an issue or discrepancy) that is necessary to address to ensure: 1) the technical adequacy of the PRA (relative to a Capability Category), 2) the capability/robustness of the PRA update process, or 3) the process for evaluating the necessary capability of the PRA technical elements (to support applications). Note that F&Os characterized as findings related to model 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 impact on MSPI inputs in determining the need for a PRA model update.
c) The PRA supporting the MSPI program should be developed and reviewed by qualified personnel.
d) The PRA model and any supplemental 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.

~~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 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 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~~evaluation 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. A Phase 2 application refers to an application where the baseline PRA that supports the application meets the applicable consensus PRA standards. 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. The configuration control program supporting the MSPI program should meet the following requirements~~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 t~~The following clarifications are applicable.

~~a)~~e) 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 characterized as findings related to those supporting requirements identified in Table G 5. NEI 05-04 defines a finding as an observation (an issue or discrepancy) that is necessary to address to ensure: 1) the technical adequacy of the PRA (relative to a Capability Category), 2) the capability/robustness of the PRA update process, or 3) the process for evaluating the necessary capability of the PRA technical elements (to support applications). Note that ~~finding level~~ F&Os characterized as findings related to model 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)~~f) The evaluation process for pending PRA model changes should ~~consider~~ include consideration of the ~~cumulative impact of pending changes~~impact 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)~~g) ~~Personnel that develop and review t~~The PRA supporting the MSPI program should be developed and reviewed by qualified personnel~~qualified for the analysis in accordance with the applicable utility processes for personnel qualification~~.

~~f)~~h) The PRA model and any ~~supplementary~~supplemental 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~~ an evaluation of the cumulative impact of proposed resolutions for the pending model changes results in greater than or equal to a predicted factor of three change in the corrected Birnbaum value of an MSPI monitored train or component, the ~~following shall be performed:~~

~~The~~ MSPI basis document should be updated to ~~calculate~~include revised CDE inputs ~~using an updated PRA model~~ the quarter following identification of the increased impact~~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~~

~~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~~. ~~Note that the~~ 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. This may be the analysis used to determine the need for the change or a more refined model.

If ~~analysis~~an evaluation of the cumulative impact of proposed resolutions for the pending model changes results in less than a predicted factor of three change in the corrected Birnbaum value of an MSPI monitored train or component, the ~~Supplementary analysis~~evaluation 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~~

If the ~~analysis~~ an evaluation 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 t~~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. This may be the analysis used to determine the need for the change or a more refined model.

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 and identification of applicable procedures.
2. Description of the process used to qualify personnel involved in the preparation and technical review of the PRA analyses supporting MSPI.
~~2.~~3. Justification for any open finding level F&Os associated with those SRs identified in Table G5 that are determined to have no impact on the use of the PRA model for MSPI.
~~3.~~4. ~~Justification for the determination that any pending PRA model changes do not impact the MSPI results and/or justification for~~ The basis of the adjusted Birnbaum values applied to reflect pending model changes ~~as an interim alternative until the site PRA of record is revised~~(e.g., supplemental analysis or penalty factor).

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~~ supplemental 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~~supplemental 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[1]	Required Capability ~~Category~~[1]Category[2]	Comments
IE-A1	MET	
IE-A2	MET	
IE-A3	MET	
IE-A4	I/II	
IE-A5	~~II~~I	~~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-A6	I	
IE-A7	MET	
IE-A8	I	
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-A10	MET	
IE-B1	MET	
IE-B2	MET	
IE-B3	I	
IE-B4	MET	
IE-B5	MET	
IE-C1	MET	~~Focus on loss of offsite power (LOOP) frequency as a function of duration~~
IE-C2	MET	
IE-C3	N/A	Not crediting recovery actions is conservative with respect to MSPI. If recovery actions are credited, IE-C3 must be MET.

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[1]	Required Capability ~~Category~~[1]Category[2]	Comments
IE-C4	~~II~~Met	~~Focus on LOOP and medium and small LOCA frequencies including stuck open PORVs~~
IE-C5	I/II	
IE-C6	MET	
IE-C7	I/II	
IE-C8	MET	~~For plants that choose fault trees for support systems, pay attention to modeling of loss of cooling systems initiators.~~
IE-C9	MET	
IE-C10	MET	
IE-C11	MET	
IE-~~C11~~C12	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
IE-C13	I/II	
IE-C14	N/A	Should not impact the Birnbaum importance measure for MSPI monitored components/trains/segments.
IE-C15	N/A	Characterization of uncertainty is only required in this SR for the calculation of mean initiating event frequencies. For the level of accuracy required for MSPI, the use of point estimate values as opposed to mean values for initiating event frequencies is unlikely to make a significant difference.
IE-D1	N/A	Technical issues will be addressed in the appropriate non-documentation SR. Documentation issues will not impact MSPI results.
IE-D2	N/A	Technical issues will be addressed in the appropriate non-documentation SR. Documentation issues will not impact MSPI results.

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[1]	Required Capability Category[1]Category[2]	Comments
IE-D3	N/A	Documentation of uncertainty is not germane to MSPI.
AS-A1	MET	Item b is not required to be met for MSPI.
AS-A2	MET	
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-A6	MET	
AS-A7	I/II	
AS-A8	MET	
AS-A9	III	Category I, provided that the generic thermal-hydraulic analysis is conservative. Category II for MSPI systems and components and for systems such as CRD, fire water, SW cross-tie, recovery of FW
AS-A10	III	Meeting CC I provides a bounding approach that should result in conservative results for MSPI.Category II in particular for alternate systems where the operator actions may be significantly different, e.g., more complex, more time limited.
AS-A11	MET	
AS-B1	MET	
AS-B2	MET	
AS-B3	MET	Focus on credit for injection post-venting (NPSH issues, environmental survivability, etc.)

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[1]	Required Capability Category[1]Category[2]	Comments
AS-B4	MET	
AS-B5	MET	
AS-B6	MET	
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.
AS-C1	N/A	Technical issues will be addressed in the appropriate non-documentation SR. Documentation issues will not impact MSPI results.
AS-C2	N/A	Technical issues will be addressed in the appropriate non-documentation SR. Documentation issues will not impact MSPI results.
AS-C3	N/A	Documentation of uncertainty is not germane to MSPI.
SC-A1	MET	
SC-A2	I	
SC-A3	MET	
SC-A4	MET	
SC-A5	I	
SC-A6	MET	
SC-B1	I	
SC-B2	I	
SC-B3	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.

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[1]	Required Capability Category[1]Category[2]	Comments
SC-B5	MET	
SC-C1	N/AMET	Technical issues will be addressed in the appropriate non-documentation SR. Documentation issues will not impact MSPI results.
SC-C2	N/A	Technical issues will be addressed in the appropriate non-documentation SR. Documentation issues will not impact MSPI results.
SC-C3	N/A	Documentation of uncertainty is not germane to MSPI.
SY-A1	MET	
SY-A2	MET	
SY-A3	MET	
SY-A4	II/IIII	Category II/III for MSPI systems and components
SY-A5	MET	
SY-A6	MET	
SY-A7	I/II	
SY-A8	MET	For MSPI, SY-A8 is limited to the modeling of shared components. To be consistant with DA-A2, mismatch between component and data boundaries are not expected to have a significant impact on MSPI results.
SY-A9	MET	
SY-A10	MET	Focus on (d) modeling of shared systems
SY-A11	MET	
SY-A12	MET	
SY-A13	MET	
SY-A14	MET	

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[1]	**Required Capability Category**[1]**Category**[2]	**Comments**
SY-A15	MET	
SY-A16	I/II	
SY-A17	MET	
SY-A18	MET	
SY-A19	MET	
SY-A20	MET	
SY-A21	MET	
SY-A22	III	Focus on credit for alternate injection systems, alternate seal cooling
SY-A23	MET	
SY-A24	MET	
SY-B1	I	Should include EDG, AFW, HPI, RHR CCFs
SY-B2	I/II	
SY-B3	MET	
SY-B4	MET	
SY-B5	MET	Focus on dependencies of support systems (especially cooling water systems) to the initiating events
SY-B6	MET	
SY-B7	I	
SY-B8	MET	
SY-B9	MET	Focus on credit post-venting (NPSH issues, environmental survivability, etc.).
SY-B10	I	

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[1]	**Required Capability Category[1]Category[2]**	**Comments**
SY-B11	MET	
SY-B12	MET	
SY-B13	MET	
SY-B14	MET	Focus on credit for injection post-venting (NPSH issues, environmental survivability, etc.)
SY-B15	MET	
SY-C1	N/A	Technical issues will be addressed in the appropriate non-documentation SR. Documentation issues will not impact MSPI results.
SY-C2	N/A	Technical issues will be addressed in the appropriate non-documentation SR. Documentation issues will not impact MSPI results.
SY-C3	N/A	Documentation of uncertainty is not germane to MSPI.
HR-A1	MET	
HR-A2	MET	
HR-A3	MET	
HR-B1	I	For the level of accuracy required for MSPI, contributions from failures to restore following maintenance or test are unlikely to make a significant difference.
HR-B2	MET	
HR-C1	MET	
HR-C2	I	For the level of accuracy required for MSPI, contributions from failures to restore following maintenance or test are unlikely to make a significant difference.
HR-C3	MET	

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[1]	Required Capability Category[1]Category[2]	Comments
HR-D1	MET	
HR-D2	I	For the level of accuracy required for MSPI, the use of screening values for pre-initiator HEPs is unlikely to make a significant difference.
HR-D3	I	For the level of accuracy required for MSPI, the use of screening values for pre-initiator HEPs is unlikely to make a significant difference.
HR-D4	MET	
HR-D5	MET	
HR-D6	N/A	For the level of accuracy required for MSPI, the use of mean values for pre-initiator HEPs is unlikely to make a significant difference.
HR-D7	I/II	
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-E3	II/III	For MSPI purposes a detailed talkthrough with operations OR training personnel is sufficient.
HR-E4	II/III	
HR-F1	I/II	
HR-F2	II	Category II ensures that the complexity of the task if fully understood.
HR-G1	III	However, Category I for the critical HEPs would produce a more sensitive MSPI (i.e., fewer failures to change a color).
HR-G2	MET	Focus on credit for cross ties, depressurization, use of alternate sources, venting, core cooling recovery, initiation of F&B

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[1]	**Required Capability Category[1]Category[2]**	**Comments**
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&BMeeting Category I requires consideration of some measure of scenario-induced stress. The PSFs listed in Category II/III should not have a significant impact on the final HEP. Therefore, Category I is sufficient for MSPI.
HR-G4	I	
HR-G5	II	See comment on HR-G1.
HR-G6	MET	
HR-G7	MET	
HR-G8	N/A	For the level of accuracy required for MSPI, the use of mean values for post-initiator HEPs is unlikely to make a significant difference.
HR-H1	N/A	Not crediting recovery actions is conservative with respect to MSPI.
HR-H2	N/AMET	Not crediting recovery actions is conservative with respect to MSPI.Focus on credit for cross ties, depressurization, use of alternate sources, venting, core cooling recovery, initiation of F&B If recovery actions are credited, HR-H3 must be MET.
HR-H3	METMET	If recovery actions are credited, then HR-H3 must be 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.

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[1]	Required Capability ~~Category[1]~~Category[2]	Comments
HR-I1	N/A	Technical issues will be addressed in the appropriate non-documentation SR. Documentation issues will not impact MSPI results.
HR-I2	N/A	Technical issues will be addressed in the appropriate non-documentation SR. Documentation issues will not impact MSPI results.
HR-I3	N/A	Documentation of uncertainty is not germane to MSPI.
DA-A1	MET	
DA-A2	N/A	Mismatch between component and data boundaries are not expected to have a significant impact on MSPI results.
DA-A3	MET	
DA-A4	MET	
DA-B1	I	~~Focus on service condition (clean vs. untreated water) for SW systems~~
DA-B2	I/II	
DA-C1	MET	To be consistent with DA-A2, mismatch between component and data boundaries are not expected to have a significant impact on MSPI results. ~~Focus on LOOP recovery~~
DA-C2	N/A	The MSPI pilot program did not find plant-specific data to be significant sources of concern for MSPI sensitivity.
DA-C3	MET	Required only if plant-specific data is used.
DA-C4	MET	Required only if plant-specific data is used.
DA-C5	MET	Required only if plant-specific data is used.
DA-C6	MET	Required only if plant-specific data is used.
DA-C7	I	

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[1]	**Required Capability Category[1]Category[2]**	**Comments**
DA-C8	I	
DA-C9	I/II	
DA-C10	I	
DA-C11	MET	
DA-C12	MET	
DA-C13	I	
DA-C14	MET	
DA-C15	MET	
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
DA-D2	MET	
DA-D3	N/A	Characterization of uncertainty is only required in this SR for the calculation of mean basic event probabilities. For the level of accuracy required for MSPI, the use of point estimate values as opposed to mean values for basic event probabilities is unlikely to make a significant difference.
DA-D4	I, II/III	If a Bayesian approach is used, its validity should be examined at CC II/III.
DA-D5	I	
DA-D6	I	
DA-D7	MET	
DA-D8	I	

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[1]	Required Capability ~~Category~~[1]Category[2]	Comments
DA-E1	N/A	Technical issues will be addressed in the appropriate non-documentation SR. Documentation issues will not impact MSPI results.
DA-E2	N/A	Technical issues will be addressed in the appropriate non-documentation SR. Documentation issues will not impact MSPI results.
DA-E3	N/A	Documentation of uncertainty is not germane to MSPI.
QU-A1	MET	
QU-A2	MET	
QU-A3	I	It is judged that performing a point estimate calculation, rather than using a formal propagation of uncertainty, will not have significant impact on the accident sequences and cutsets involving the MSPI systems.
QU-A4	MET	
QU-A5	N/A	Not crediting recovery actions is conservative with respect to MSPI.
QU-B1	MET	
QU-B2	N/A~~MET~~	Truncation requirements specific to MSPI are already established.~~Truncation limits should be chosen to be appropriate for F-V calculations.~~
QU-B3	N/A~~MET~~	Truncation requirements specific to MSPI are already established.~~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-B4	MET	
QU-B5	MET	

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[1]	Required Capability Category[1]Category[2]	Comments
QU-B6	N/A	Accounting for successes is only important for accident sequence determination. As MSPI focuses on overall CDF and does not consider LERF, the accident sequences have no impact on MSPI. Therefore, this SR is not applicable for MSPI.
QU-B7	MET	
QU-B8	MET	
QU-B9	N/A	For MSPI, not setting flags to TRUE is conservative.
QU-B10	MET	
QU-C1	MET	
QU-C2	MET	
QU-C3	MET	
QU-D1	MET	
QU-D2	MET	
QU-D3	MET	
QU-D4	III	For MSPI, it is not expected that comparison with other plants would yield significant changes to the PRA.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-D5	MET	
QU-D6	N/AII/III	Identification of risk insights is not required for MSPI.Category II/III for those who have used fault tree models to address support system initiators.
QU-D7	MET	
QU-E1	N/A	Uncertainty characterization does not play a role in MSPI.

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[1]	**Required Capability Category**[1]**Category**[2]	**Comments**
QU-E2	N/A	Uncertainty characterization does not play a role in MSPI.
QU-E3	N/A	Uncertainty characterization does not play a role in MSPI.
QU-E4	N/AMET	Uncertainty characterization does not play a role in MSPI.MET for the issues that directly affect the MSPI.
QU-F1	N/A	Technical issues will be addressed in the appropriate non-documentation SR. Documentation issues will not impact MSPI results.
QU-F2	N/A	Technical issues will be addressed in the appropriate non-documentation SR. Documentation issues will not impact MSPI results.
QU-F3	N/A	Technical issues will be addressed in the appropriate non-documentation SR. Documentation issues will not impact MSPI results.
QU-F4	N/A	Documentation of uncertainty is not germane to MSPI.
QU-F5	N/A	Technical issues will be addressed in the appropriate non-documentation SR. Documentation issues will not impact MSPI results.
QU-F6	N/A	Technical issues will be addressed in the appropriate non-documentation SR. Documentation issues will not impact MSPI results.

1. LERF and internal flood are outside the scope of MSPI; therefore, all SRs related to LERF and internal flood are N/A and are not included in the table.
1.2. 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.