ELECTRIC POWER
RESEARCH INSTITUTE

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U. S. Nuclear Regulatory Commission
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Attention: Tanya Mensah

Subject: Transmittal of RAI Responses on Report; *Nondestructive Evaluation: Probabilistic Risk Assessment Technical Adequacy Guidance for Risk-informed Inservice Inspection Programs.* EPRI, Palo Alto, CA: 2008. 1018427

Reference: EPRI Project Number 669

Enclosed are responses to Request for Additional Information (RAIs) issued on EPRI Report "Nondestructive Evaluation: Probabilistic Risk Assessment Technical Adequacy Guidance for Risk-Informed Inservice Inspection Programs," 1018427. This report was transmitted as a means of exchanging information with the NRC for the purposes of supporting generic regulatory improvements with respect to application of risk-informed technology to inservice inspection (RI-ISI) programs.

EPRI report 1018427 has been develop to provide guidance in defining which technical elements and supporting requirements of the plant PRA are applicable to RI-ISI programs. Also, for those supporting requirements that are applicable to RI-ISI programs, this report provides guidance on the appropriate capability category. This guidance is provided for both EPRI's traditional RI-ISI methodology (EPRI TR-112657) and our streamlined RI-ISI methodology (ASME Code Case N716).

If you have any questions on this subject, please contact Patrick O'Regan (poregan@epri.com, 508-497-5045).

Sincerely,

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Tuan Nguyen
Acting Vice President, Nuclear

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REQUEST FOR ADDITIONAL INFORMATION

NONDESTRUCTIVE EVALUATION: PROBABILISTIC RISK ASSESSMENT

TECHNICAL ADEQUACY GUIDELINES FOR RISK-INFORMED IN-SERVICE

INSPECTION PROGRAMS

The staff has reviewed the EPRI Report, "Nondestructive Evaluation: Probabilistic Risk Assessment Technical Adequacy Guidelines For Risk-Informed In-Service Inspection Programs," 1018427 (Topical), and finds that additional information is needed before we can complete the review. The Topical references the Probabilistic Risk Assessment (PRA) Standard (ASME RA-sb-2005) that was prepared by ASME in 2005 as endorsed by Regulatory Guide 1.200 Revision 1 in 2007, with respect to PRA technical adequacy.

1 The Topical fails to provide general guidelines which describe the overarching framework from which acceptable capability categories (CCs) for individual supporting requirement (SRs) for the internal events PRA can be determined. An example of a general guideline that is included is the Topical's explanation that SRs that solely address quantitative attributes are of limited importance. The risk ranking and change is risk estimates in EPRI's risk-informed inservice inspection (RI-ISI) methods use an order of magnitude approach which reduces the influence of PRA elements that might only change the quantitative results slightly. However, other general elements such as importance of logic modeling and human actions in the internal events PRA should be likewise generally characterized. For example, it would appear that the internal event PRA logic models need to be of relatively high quality (i.e., accurate and high resolution) because multiple consequential SSCs failures need to be evaluated using these logic models. Please identify general guidelines for the technical elements that compose an internal events Level 1/LERF PRA based on how EPRI's RI-ISI method relies on these elements.

Proposed Response:

Background

The Electric Power Research Institute (EPRI) alternative piping selection methodologies are based on risk-informed insights, operating experience, and an inspection for cause philosophy. These methodologies have been validated in several NRC-approved pilot applications, by numerous additional plant applications, and subsequently embodied in ASME Standards (for example, Code Cases, non-mandatory Appendix). As previously determined by EPRI and NRC, when the risk-informed methods are used, changes to the number and the locations for inspection are accompanied with increases in plant safety or a negligible change in plant risk.

It is important to recognize that the RI-ISI programs are alternatives to deterministic ISI programs. That is, the deterministic ISI programs do not account for consequence of failure or failure potential in defining the number or location of inspection. Several examples are cited below:

Class 1 piping (exam Category B-J):

- 25 percent of the piping is required to be inspected
- No requirement to preferentially select piping whose failure would result in a LOCA (e.g. between the RPV and 1st isolation valve)
- No requirement to preferentially select piping whose failure would result in a LOCA outside containment (e.g. BWR feedwater piping penetrating containment)
- No requirement to preferentially select piping with higher susceptibility to degradation

Class 2 piping (exam Categories C-F-1 and C-F-2):

- 7.5 percent of the piping is required to be inspected
- No requirement to preferentially select piping whose failure would result in an initiating event (e.g. loss of feedwater)
- No requirement to assess the impact of spatial interactions

Class 3 and non Class piping:

- No inspection requirements

Additionally, augmented programs (e.g. FAC, MIC, IGSCC-BWR categories B-G) continue to be implemented.

Internal events plant-specific PRAs are used in the development of the RI-ISI program. Use of the plant-specific PRA includes the following:

- Success criteria are used to define safety functions and backup trains.
- Conditional core damage probabilities (CCDP), and identification of event sequences that provide the dominant contributors, are developed.
- PRA system and/or train unavailabilities are used to determine the equivalent train worth for each backup train.
- Conditional large early release probability (LERP), given pressure boundary failure, and identification of event sequences that provide the dominant contribution to LERF, are developed.
- Plant-specific failure data are used where potentially important to the methodology (e.g., for isolation valves).
- Internal flood results, when used, help define spatial effects associated with postulate piping failure.

As discussed in RG 1.200 and other related documents (for example, Regulatory Guide 1.174), the confidence in the information derived from the PRA is an important issue in that the accuracy of the technical content must be sufficient to justify the specific results and insights that are used to support the decision under consideration—in this case, the development of the RI-ISI program. It is also recognized that necessary sophistication of the evaluation, including the use of the PRA, depends on the contribution that the risk assessment makes to the integrated decision making, which depends to some extent on the magnitude of the potential risk impact of the application. That is, for applications that may have a more substantial impact, an in-depth and comprehensive PRA analysis would be required. Whereas in other applications, bounding estimates, simplified analyses, and/or qualitative assessments are sufficient.

With respect to risk-informed applications, the PRA Standard provides a process for determining the capability of a PRA needed to support a particular risk-informed application. Key aspects, and comments related to RI ISI, of this process include the following:

- Role of the PRA in the application and extent of reliance of the decision on the PRA results

  In RI ISI, PRA results are used as summarized above. The categorization approach to determining potential risk significance reduces the influence of any bias in PRA results. This has been previously acknowledged in the SERs supporting the EPRI RI ISI methodology. This includes the consideration of uncertainties. As previously determined, the use of high, medium and low consequence categories adequately addresses uncertainties. Thus, in general, capability category 1 is sufficient. For the EPRI Streamlined approach, bounding generic criteria is used augmented with plant-specific criteria.

- Risk metrics to be used to support the application and associated decision criteria

  In RI ISI, CCDP and CLERP (and corresponding Delta CDF and Delta LERF) are used. These are established using categorization and screening approaches which again minimize the influence of any bias. Thus, in general, capability category 1 is sufficient.

- Significance of the risk contribution from the hazard group to the decision

  In RI ISI the internal events PRA is used. Please see response to RAIs for other hazards.

- Degree to which bounding or conservative methods for the PRA or in a given portion of the PRA would lead to inappropriately influencing the decisions made in the application and approach(es) for accounting for this in the decision-making process

  In the RI ISI methodology, the categorization process minimizes the impact of bias. Conservative methods would increase the number of inspections. Thus, in general, capability category 1 is sufficient.

- Degree of accuracy and evaluation of uncertainties and sensitivities required of the PRA results

  The RI ISI methodology addresses uncertainties by developing and using categories (groups) with significant ranges (e.g. for CCDP) or uses bounding generic criteria. Thus the accuracy obtained from a capability category 1 PRA is in general sufficient and explicit consideration of uncertainties and sensitivities are not needed. Where additional accuracy is appropriate a higher capability category has been established and identified in EPRI Report 1018427.

- Degree of confidence in the results that are required to support the decision

  For RI ISI the potential impact on changes in risk attributable to implementation of RI ISI is extremely small as has been demonstrated on the numerous applications of the methodology. The acceptance criteria from RG 1.174 are addressed using a screening approach to provide this assurance and defense in depth and safety margin are explicitly addressed. Thus, in general, capability category 1 is sufficient. Additionally, important augmented inspections programs (e.g. FAC, IGSCC categories B through G) are not changed by the RI-ISI programs.

- Extent to which the decisions made in the application will impact the plant design basis

  RI ISI does not change the design basis.

General Guidelines

As noted in the RAI, an example of a general guideline that is included in the report is that SRs that solely address quantitative attributes are of limited importance because the risk ranking and change in risk estimates in EPRI's risk-informed in-service inspection (RI-ISI) methods use an order of magnitude approach which reduces the influence of PRA elements that might only change the quantitative results slightly. In the RAI, an example of other general elements is provided, such as the importance of logic modeling and human actions. The RAI notes "For example, it would appear that the internal event PRA logic models need to be of relatively high quality (i.e., accurate and high resolution) because multiple consequential SSCs failures need to be evaluated using these logic models."

As noted above in the background, in general a category 1 internal events PRA is sufficient. Overall, an internal events PRA meeting capability category 1 will provide high quality for areas such as logic modeling and HRA. Where a higher capability category PRA is appropriate the report provides a basis. The general guidelines are provided below.

General Guideline 1: SRs that solely address quantitative attributes are of limited importance because the risk ranking and change in risk estimates in EPRI's risk-informed in-service inspection (RI-ISI) methods use an order of magnitude approach which reduces the influence of PRA elements that might only change the quantitative results slightly.

General Guideline 2: Capability Category 1 is generally sufficient because, based on the PRA Standard:

- **Scope and Level of Detail:** For CC 1, the resolution and specificity are sufficient to establish the relative importance at the system and train level. The RI ISI approach further addresses relative importance by grouping as previously discussed.
- **Plant-specificity:** For CC 1, generic data and models are sufficient except where noted in the RI ISI methodology (e.g. failure rates of isolation valves, failure data for internal flooding analyses)
- **Realism:** For CC 1, where departures from realism could have a more than moderate impact the capability category has been increased or features of the methodology which compensate for the potential impact are addressed. Note that the RI ISI absolute ranking, grouping and / or bounding generic criteria further reduces the potential for influencing the conclusions. However, where appropriate, a higher capability category is identified.

General Guideline 3: Even if a PRA meets the requirements of the Standard at the specified capability categories, there will still be variability in the methods used by different licensees for dealing with certain issues, e.g., the assessment of human error probabilities. Some of this will not have a significant impact. However, there is a subset of issues that could have a direct and potentially significant impact on the RI ISI results. Of particular concern are those PRA features whose treatment may vary significantly from licensee to licensee. From the RI ISI perspective, the concern is with those issues that have the potential for inappropriate modeling that reduces the categorization from, e.g., high to low. Prior implementation of the RI ISI methodology to numerous plant sites and plant designs and the discussion provided above were considered in determining the capability category guidance of EPRI Report 1018427. This approach is consistent with prior evaluation of PRA adequacy such as for MSPI.

2 Due to the lack of general guidelines, many of the discussion on individual SR's appear to be simply conclusions with no justification. Based on the general guidelines developed for RAI 1, please revaluate target categories for the specific SR's in the internal events PRA and indentify which general guideline supports the selected category.

Proposed Response:

No changes to the guidance provided in EPRI Report 1018427 were identified that would substantially impact the results of the RI-ISI program.

3 The Topical only provides guidance in defining the applicable ASME PRA Standard supporting requirements (SRs) and the appropriate capability category (CC) for the Levels 1 and 2 analyses of internal events while at power. The EPRI report states that, "As future revisions to RG 1.200 occur, this work will be updated to support future RI-ISI application and maintenance."

a) It is acknowledged that ASME and ANS have issued a combined standard "ASME/ANS RA-Sa-2009" in February 2009 and endorsed in RG 1.200 Revision 2 in March 2009. EPRI should provide its position on this combined standard in support of the RI-ISI PRA technical adequacy including the following hazard groups:

- Internal Fires
- Seismic Events
- High Winds
- External Floods, and
- Other External Hazards

Proposed Response:

The RI-ISI supporting analyses (e.g. consequence assessment) are based upon the internal events PRA. The purpose of developing a RI-ISI program is to define an alternative in-service inspection strategy for piping systems (e.g. non destructive examination (NDE) of a piping weld). The use of the internal events PRA only, can be justified by the following:

- The very small changes in the potential for piping failure due to changes in ISI, when augmented inspection programs such FAC, IGSCC-BWR categories B through G, localized corrosion (e.g. MIC) are left unchanged or improved
- The small contribution of piping failure, which would be influenced by changes in ISI, to the risk attributable to external events such as fire
- The use of defense in depth and safety margin to provide additional assurance of piping integrity

Thus any potential quantitative insights from the analyses of other hazards groups would not impact conclusions with respect to acceptance criteria. This approach was and is consistent with risk informed decision making as discussed, for example, in Regulatory Guide 1.174. However, for completeness, the RI-ISI methodologies were originally developed to assess the impact, as appropriate, on a qualitative basis, of other hazard groups. Experience with RI-ISI application to almost the entire US fleet has shown that these hazard groups do not impact the RI-ISI conclusions.

With respect to RG 1.200, rev 2, please note that Regulatory Guide 1.174, "AN APPROACH FOR USING PROBABILISTIC RISK ASSESSMENT IN RISK-INFORMED DECISIONS ON PLANT-SPECIFIC CHANGES TO THE LICENSING BASIS", including the draft version of revision 2 to this regulatory guide, includes provision for a qualitative approach when the decision would not be impacted. As noted this has been the experience to date, and as discussed below is the basis for not needing to quantify other hazards in the future.

Consider the following (Note 1: language from Draft Regulatory Guide DG-1226, which provides a proposed revision to this RG 1.174 is used here. The language in the existing regulatory guide is essentially the same. Note 2: Relevant guidance is noted in italic font.):

> From Section 2.2: "The necessary sophistication of the evaluation, including the scope of the risk assessment (e.g., internal hazards only, at-power only), *depends on the contribution the risk assessment makes to the integrated decisionmaking*, which *depends to some extent on the magnitude of the potential risk impact*. For LB changes that may have a more substantial impact, an in-depth and comprehensive risk assessment, in the form of a PRA (i.e., one appropriate to derive a quantified estimate of the total impact of the proposed LB change) will be necessary to provide adequate justification. In other applications, calculated risk importance measures or bounding estimates will be adequate. *In still others, a qualitative assessment of the impact of the LB change on the plant's risk may be sufficient.*"
>
> From Section 2.3: "The technical acceptability of a PRA analysis used to support an application is measured in terms of its appropriateness with respect to scope, level of detail, technical adequacy, and plant representation. The scope, level of detail, and technical adequacy of the PRA *are to be commensurate with the application for which it is intended and the role the PRA results play in the integrated decision process*. The more emphasis that is put on the risk insights and on PRA results in the decisionmaking process, the more requirements that have to be placed on the PRA in terms of both scope and how well the risk and the change in risk is assessed.
>
> Conversely, emphasis on the PRA scope, level of detail, and technical adequacy can be reduced if a proposed change to the LB results in a risk decrease *or a change that is very small, or if the decision could be based mostly on traditional engineering arguments,* or if compensating measures are proposed such that it can be convincingly argued that the change is very small.
>
> From Section 2.3.1 Scope: The scope of a PRA is defined in terms of the causes of initiating events and the plant operating modes it addresses. The causes of initiating events are classified into hazard groups. A hazard group is defined as a group of similar hazards that are assessed in a PRA using a common approach, methods, and likelihood data for characterizing the effect on the plant. Typical hazard groups considered in a nuclear power plant PRA include: internal hardware faults (internal events), internal floods, internal fires, seismic events, high winds, external floods, and transportation accidents. Although the assessment of the risk implications in light of the acceptance guidelines discussed in Section 2.4 of this guide requires that all plant operating modes and hazard groups be addressed, it is not always necessary to have a PRA of such scope. *A qualitative treatment of the missing modes and hazard groups may be sufficient when the licensee can demonstrate that those risk contributions would not affect the decision; that is, they do not alter the results of the comparison with the acceptance guidelines in Section 2.4 of this guide.* However, when the risk associated with a particular hazard group or operating mode

is significant to the decision being made, it is the Commission's policy that, if a staff-endorsed PRA standard exists for that hazard group or operating mode, then the risk will be assessed using a PRA that meets that standard (Ref. 13). Section 2.5 of this guide discusses this further."

Each Hazard group is addressed below.

Internal Fire Events– The potential contribution of piping failure to internal fire risk is insignificant as the failure probability of piping is insignificant compared to the failure probability of other systems, structures and components (SSCs), such as pumps, valves and power supplies. Fire events are also not likely to present significantly different challenges to the piping in the scope of this application. Meeting defense in depth and safety margin principles provides additional assurance that this conclusion will remain valid. ISI is an integral part of defense in depth, and the RI ISI process will maintain the basic intent of ISI (i.e. identifying and repairing flaws) and thus provide reasonable assurance of an ongoing substantive assessment of piping condition. In addition, there are no changes to design basis events and thus Safety Margins are maintained.

Seismic Events - Well engineered systems and structures (e.g. piping systems) are seismically rugged. IPEEE and other industry and NRC studies (e.g. EPRI TR-1000895, NUREG/CR-5646) have shown piping systems to have seismic fragility capacities greater than the screening values typically used in seismic assessment and are not considered likely to fail during a seismic event. ISI is not considered in establishing fragilities of such SSCs. Meeting defense in depth and safety margin principles provides assurance that this conclusion will remain valid. ISI is an integral part of defense in depth, and the RI ISI process will maintain the basic intent of ISI (i.e. identifying and repairing flaws) and thus provide reasonable assurance of an ongoing substantive assessment of piping condition. In addition, there are no changes to design basis events and thus Safety Margins are maintained.

High Winds, External Floods, and Other External Hazards - As discussed above, the purpose of developing a RI-ISI program is to define an alternative in-service inspection strategy for piping systems. Other hazards (e.g. high wind, external floods) are not considered in the development of an in-service inspection program for piping. The reasons include: the structural ruggedness of the piping systems, location, as relevant systems are typically inside well engineered structure, and the consequence assessment for internal events already includes the consideration of spatial impacts. In addition, the substantial industry experience with plants implementing RI-ISI programs has not identified changes based upon insight from the evaluation of these other external hazards. The very small potential impact on the potential for piping failure of a RI ISI process, and the approaches to maintaining defense in depth and safety margins summarized above, provide confidence in this conclusion.

Conclusion: Quantification of other hazard groups will not change the conclusions derived from the RI ISI process. As such, EPRI 1018427 guidance on meeting Regulatory Guide 1.200, revision 2 and Regulatory Guide 1.174 is sufficient for developing RI-ISI programs. Based on RG 1.174:

- The magnitude of the potential risk impact is not significant.
- Traditional engineering arguments including defense in depth and safety margin are applied.
- Including other hazard groups would not affect the decision; that is, they would not alter the results of the comparison with the acceptance guidelines.

The above discussion and conclusions will be incorporated into EPRI Report 1018427.

b) Discuss whether the guidance provided in the Topical would be treated differently for operating plants and plants licensed under Part 52.

Proposed Response:

The technical guidance provided in the Topical would not be treated differently for operating plants or plants licensed under Part 52. However, there is one difference between an operating plant and a plant licensed under Part 52. That is, the operating plant is currently built and operating while a Part 52 plant may be in varying stages of construction/operation. As such, some of the supporting requirements discussed in the topical can not met until the Part 52 plant is operational.

Development of a RI-ISI program for a Part 52 plant is still possible and desirable for the following reasons:

- Fundamental aspects of developing a PRA can be met at the design stage. As an example, success criteria are not expected to change when the Part 52 plant transitions from the construction phase to the operational phase.
- The two most important impacts identified during a RI-ISI consequence assessment are piping failures that cause an initiating event and piping failures that impact mitigative trains/systems.
    - Initiating events typically consists of LOCAs or transients. The importance of these events is a function of success criteria (as opposed to something like plant specific data) which is not expected to be impacted by the stage of construction. Additionally, determining the conditional core damage probability/conditional large early release probabilities (CCDP/CLERP) is straightforward for these events.
    - Based on experience with the operating fleet, other than success criteria, mitigative systems are typically impacted by indirect effects caused by the postulated piping failure, which are controlled by the level of spatial separation and redundancy. Each of the Part 52 plants is committing to meeting SRP Section 3.6.1 (Plant Design for Protection Against Postulated Piping Failures in Fluid Systems Outside Containment)

and 3.6.2 (Determination of Rupture Locations and Dynamic Effects Associated with the Postulated Rupture of Piping). Based upon the experience with the operating fleet, meeting the requirements of these two SRP sections provides a significant level of spatial separation.

- RI-ISI programs contain a living program component. As such, as the plant transitions to the operating phase and gains operating experience, the RI-ISI program will be updated to reflect the as-operated plant. The RI-ISI program contains means for adding or deleting inspections based upon current and future program updates (e.g. periodic and interval based updates).

Additionally, the PRA Technical Adequacy Guidelines provided in EPRI Report 1018427 are the same whether the application is to develop a pre-service inspection (PSI) plan or an inservice inspection plan (ISI). The following statement will be added to Section 1 and 3 of the report:

The PRA Technical Adequacy Guidelines contained in this report are the same whether the intended application is to develop a pre-service inspection (PSI) plan or an inservice inspection plan (ISI). The timing of when these guidelines can be met for PSI programs is a function of the status and timeline of the actual plant design, construction and ITAAC implementation.

4 Page V, second paragraph "Results and Findings," the second sentence states that "The technical adequacy of the PRA is determined by demonstrating that the PRA meets technical elements and associated supporting requirements (SRs) of NRC RG 1.200." It should be noted that RG 1.200 provides the NRC position on supporting requirements (including clarifications as needed), but does not provide supporting requirements as stated in the above statement. Clarify the above sentence.

Proposed Response:

The sentence will be revised as follows:

The technical adequacy of the PRA is determined by demonstrating that the PRA meets technical elements and associated supporting requirements (SRs) of the ASME PRA Standard as clarified in USNRC RG 1.200.

5 Page V, last paragraph "EPRI Perspective" states that "The vast majority of U.S. plants that implement RI-ISI programs have used tools and products developed by the EPRI. This report reviews these tools and products against the ASME PRA Standard and the NRC RG 1.200." Define "tools and products" mentioned in this paragraph.

Proposed Response:

The sentence will be revised as follows:

The vast majority of U.S. plants that implemented RI-ISI programs have used methodologies (e.g. EPRI TR-112657, ASME Code Case N716) developed by the EPRI. This report reviews these methodologies against the ASME PRA Standard and USNRC RG 1.200

6 Based on the review of previous RI-ISI submittals that are based, in part, on ASME Code Case N-716, the NRC staff believes that additional work may be needed beyond the CC recommended in the Topical in order too provide confidence that all high-safety-significant (HSS) segments will be identified and that an appropriate change in risk is estimated.

> The Topical proposes CC I/II as being sufficient for SR IF-D3a (IFEV-A3). Capability Category I/II permits grouping or subsuming flood initiated scenarios with existing plant initiating event (IE) groups. Capability category III does not permit subsuming flood IEs with other initiators. A RI-ISI analysis may be done long after the flooding analysis is completed and subsuming flood scenarios into existing plant IE groups would require an extra step in the RI-ISI analyses to retrieve any subsumed scenarios. This requirement is mentioned in the table in Appendix A in the Topical. Please propose changes to the N-716 methodology which clarifies this additional step or change the recommended CC to Category III.

Proposed Response:

Propose to revise 2.0(a)(5) of N716 as follows:

> "any piping segment, <u>including segments grouped or subsumed with existing plant initiating event (IE) groups</u>, whose contribution to core damage frequency is greater than 1E-06, or whose contribution to large early release frequency is greater than 1E-07, based upon a plant-specific probabilistic risk assessment (PRA) of pressure boundary failures (e.g., pipe whip, jet impingement, spray, and inventory losses). This may include exempt, Class 3, or Non-Class piping.

This change will be brought through the ASME consensus process as part of revision 1 to N716. Additionally, Appendix B to EPRI Report 1018427 will be revised to reflect this change.

> The Topical propose CC II as being sufficient for SR IF-C6 (IFSN-A14) and IF-C8 (IFSN-A16). Capability category II permits screening-out of flood areas and sources respectively based on, in part, the success of human actions to isolate and terminate the flood before equipment is damaged. Capability Category III does not permit screening out areas and sources based on reliance on operator actions. Qualitative screening of flood scenarios based on possible human intervention does not appear to be fully consistent with the CCDP/CLERP or significant determination. The Topical simply states that the qualitative screening provides confidence in the high reliability of the human actions. Please explain how the qualitative screening in CC II provides confidence that the quantitative guidelines will not be exceeded or change the recommended CC to Category III.

Proposed Response:

Supporting requirements IF-C6/IF-C8 pertain to screening of plant areas and sources. The intent of these SRs is that the screening approach be conservative for lower capability categories and more realistic for higher capability categories. This is a general, although not absolute trend, in the philosophy upon which the PRA Standard is founded. That is, Capability Category I SRs typically have a conservative bias while Capability Category III SRs typically represent more realism in the analysis. With this in mind, the only way that screening can be performed on the basis of human actions and meet Capability Category I for these SRs, is if the bounding amount of time for damage is **significantly greater** than the time required to diagnose and isolate the flood scenario, **for the worst flood initiator**. Said in another way, if there is any realistic potential for failure to isolate the flood scenario and it is not modeled in the PRA, this SR would be considered "Not Met".

The use of the internal flooding study in the EPRI Streamlined RI-ISI approach (i.e. N716) is to identify any plant-specific piping that may have a substantial impact on plant risk that is not captured by the criteria in section 2(a)(1) through 2(a)(4) of the approach. Capability Category I and its conservative bias (e.g. relative to Capability II and III), would only act to add piping to the high safety significant (HSS) scope as compared to meeting a higher Capability Category. Thus, meeting Capability Category I for these SRs, for this application, is acceptable.

Consistent with the general premise of the PRA Standard, higher capability categories for these SRs requires that more realism be input into the evaluation. For example, Capability Category II for these SRs allows screening based on very reliable human actions, for the worst flood. Capability Category III also allows for crediting operators actions for these scenarios, however, these scenarios must be retained in the PRA model for Capability Category III, while they do not need to be included quantitatively in the PRA model to meet Capability Category II.

Given the above, Capability II is potentially non conservative, from a quantitative perspective relative to Capability Category III with regard to the need to incorporate additional flood scenarios into the PRA model. However, from a realistic perspective, these Capability Category II "screened scenarios" will have a negligible impact on plant risk. This is due to a combination of: the nature of the screening process itself (e.g. use of the worst flood source/initiator), applicability to a single flood zone at a time, initiating frequency and highly reliable operator actions.

Thus, an internal flooding PRA done to Capability Category II for these SRs is more than sufficient to support a RI-ISI application using either the traditional EPRI RI-ISI approach or the EPRI streamlined RI-ISI approach (e.g. an N716 application). And, as discussed above, Capability Category I is also acceptable.

To further illustrate the above, the following screening evaluation is provided:

Upper bound plant piping failure rate of 1E-02/year is conservative for a variety of reasons, for example;

- This value contains a number of failures due to FAC failures. The FAC program is not altered in any way by application of EPRI's RI-ISI methodologies
- This value contains a large fraction of failures in low energy systems which tend to leak versus rupture (see Generic Letter 90-05)
- This value includes contributions from non-piping sources

Given the above, a more realistic yet conservative value of 1E-03/year is proposed

Plants typically have ~ 100 flood zones

HEP for IF-C6/C8 Capability Category II ~ 1E-03

Thus, if one were to quantitatively assess the screening allowed by Capability Category II for SRs IF-C-6/8, one could reasonably conclude a CDF contribution of less than 1E-08/year as follows:

> 1E-03/year (pipe break frequency per plant) * 1E-02 (Number of zones per plant) * 1E-03 (HEP for CCII) or CDF contribution < 1E-08/year

Even taking into account that some flood zones may be more heavily weighted with sources (e.g. more piping) than others, the simplified example above illustrates that meeting CCII for these two SRs will still assure that any zones/sources screened out will have a negligible impact on plant risk.

From a broader perspective, it is important to note that one of the objectives of an internal flood PRA is to identify and quantify scenarios/sequences that contribute to core damage frequency and large early release frequency. In addition to SRs IF-C-6 and IF-C-8, several Internal Flood SRs address the identification, quantification and review of significant sequences, where significance is established at the systemic or functional level at a value of 1% of total calculated CDF/LERF. See, for example, SRs IFQU-A3, IFQU-A7, and QU-D6. Therefore several SRs and the objectives set forth for an internal flood PRA provide reasonable assurance that segments with a CDF/LERF greater than 1E-6/1E-7 per year are not qualitatively screened.

The above discussion and conclusions will be added to EPRI Report 1018427.