5/2006

NEI-00-02 Appendix D

Self Assessment Process for addressing ASME PRA Standard RA-Sb-2005, as endorsed by NRC Regulatory Guide 1.200

Appendix D1 – Self Assessment Process

Appendix D2 – ASME Supporting Requirements Comparison Table

Appendix D3 – Peer Review Subtier Criteria

Appendix D1

Self Assessment Process

Summary:

Appendices D1 through D3 provide guidance for using the results of existing industry PRA peer reviews (guidance document: NEI 00-02), along with supplemental self-assessments, to satisfy the peer review requirements of the ASME PRA Standard (ASME-RA-Sb-2005) as endorsed/modified by the NRC in Regulatory Guide 1.200.

The supplemental self-assessment process (i.e., beyond the peer review process) results in documentation delineating the technical adequacy of a PRA with respect to ASME PRA Standard technical requirements (as clarified or endorsed by NRC) that were not fully supported by the original peer review process of NEI 00-02. This information will be used to support more effective and efficient NRC reviews of risk-informed regulatory applications. The self-assessment process does not require that the PRA itself be upgraded or modified to meet the ASME PRA Standard. This decision is a function of the application.

An important objective of the self assessment process is to increase the familiarity of plant personnel with the details of the PRA. In many instances, the original PRA was performed by a contractor, or the plant personnel involved in the original PRA may no longer be involved in its maintenance. Performing the self assessment process will enable a better understanding of the PRA by those now using it for applications.

Regulatory Framework

NRC Regulatory Guide 1.174 provides that PRA capability should be commensurate with the regulatory application, and provides guidance for demonstration of sufficient PRA capability. The regulatory guide recognizes that PRA is one element of an integrated decision-making process to support a regulatory application. The importance of the PRA information to a regulatory application is a function of many factors, including defense-in-depth, deterministic analyses, and conservatism in the decision process. Thus, both the ASME PRA Standard and the industry PRA peer review process recognize multiple levels of PRA capability (or technical adequacy).

Industry PRA Peer Review Process

Prior to development of the ASME PRA Standard, industry developed and implemented a process for performance of peer reviews to address the strengths and weaknesses of plant-specific PRA models. NEI 00-02, "Industry PRA Peer Review Process Guidance," provides the process and criteria for the peer review. Peer reviews have been performed at all US plants (one plant had their PRA peer review performed directly to the criteria of the ASME standard rather than the NEI-00-02 criteria). The NEI PRA peer review process (NEI 00-02) addresses 11 technical elements of the PRA, broken down into 209 subelements. Each of these is graded to convey the ability of the PRA subelement to support particular types of risk-informed applications.

The four grade levels are used to indicate the relative capability of the subelement to support risk-informed applications, ranging from applications with less rigor (grade 1) to most rigorous (grade 4). No overall grade is assigned to the PRA. Subtier criteria are provided for each subelement to differentiate the technical basis for grades two through four. The subtier criteria were not included in the original version of NEI 00-02, and have been provided as Appendix D3 to this guidance.

A peer review report is issued containing the subelement grades, and associated facts and observations. Conditional grades may be issued with specific associated conditions. In general, grade 3 corresponds to a typical risk-informed regulatory application.

ASME PRA Standard

The American Society of Mechanical Engineers (ASME) originally issued a consensus standard, ASME RA-S-2002, "Standard for Probabilistic Risk Assessment for Nuclear Power Plant Applications," dated April 5, 2002. The standard provides technical requirements for both Level 1 (core damage frequency) and a simplified large early release frequency assessment. Following initial trial application, Addendum A to this standard was issued on December 5, 2003 by ASME. In February 2004, NRC issued Regulatory Guide 1.200, "An Approach For Determining the Technical Adequacy of Probabilistic Risk Assessment results for Risk-informed Activities. This Regulatory Guide was issued for trial use and contained an Appendix providing objections and clarifications to the ASME Standard including Addendum A.

ASME issued Addendum B to their Standard on November 9, 2005. The ASME PRA Standard as modified by Addendum B addresses many of the

NRC objections and clarifications identified in the trial use version of Regulatory Guide 1.200. This revision to the standard (incorporating both addenda and referred to as ASME RA-Sb-2005) provides technical requirements for an internal events, at-power PRA. The self assessment process is intended to address ASME RA-Sb-2005, as modified by NRC Regulatory Guide 1.200.

The ASME standard contains the following sections:

1. Introduction
2. Acronyms and Definitions
3. Risk Assessment Application Process
4. Risk Assessment Technical Requirements
5. PRA Configuration Control
6. Peer Review

Section 4 of the standard, Risk Assessment Technical Requirements, contains requirements for nine elements of the PRA, as follows:

1. Initiating Events Analysis (IE)
2. Accident Sequence Analysis (AS)
3. Success Criteria (SC)
4. Systems Analysis (SY)
5. Human Reliability Analysis (HR)
6. Data Analysis (DA)
7. Internal Flooding (IF)
8. Quantification (QU)
9. LERF Analysis (LE)

For each of the above elements, the standard identifies a set of high level requirements. These high level requirements are delineated in the standard as “shall” statements, and, in order to meet the standard, a PRA is expected to comply with each of the high level requirements, regardless of the application for which the PRA is intended.

The standard provides supporting requirements for each of the above high level requirements. The supporting requirements provide more detailed information on how the high level requirements may be met, and are presented in a three-column format, with each column corresponding to a “Capability Category.” The categories represent the capability of the PRA to support different levels of applications, with a higher category corresponding to greater reliance on the PRA results to support a decision. In general, Capability Category II corresponds to a typical risk-informed regulatory application. Capability Category II is generally equivalent to Grade 3 of the NEI-00-02 peer review process.

Comparison of NEI 00-02 and ASME Standard

Section 6 of the Standard discusses the need for a peer review team to review a PRA with respect to how it meets the Standard, and provides qualifications for the peer review team. NRC has concluded that the peer review requirements of Section 6 of the ASME standard may be considered met through the performance of the existing peer reviews. The peer review team qualifications of the Standard are intended to apply to future peer reviews, and credit may be taken for previous peer reviews (those conducted prior to the issuance of the final version of Regulatory Guide 1.200) based on the peer reviewer qualification guidance of NEI-00-02. Thus, no additional peer reviews need be performed to address the peer review requirement of the ASME PRA Standard (see note below); however, the technical requirements of Section 4 of the Standard must still be addressed through the self-assessment process.

> Note: Section 5 of the ASME Standard discusses PRA configuration control. If, as a result of the self assessment findings (or other factors) the PRA is upgraded (as defined in Definitions, Section 2 of the Standard), new peer reviews may be required to meet paragraph 5.4 of the ASME standard. Such peer reviews may be limited to those parts of the PRA that have been upgraded. NEI-05-04, "Process for Performing Follow-on PRA Peer Reviews Using the ASME PRA Standard" provides guidance in this regard. NRC has not endorsed NEI-05-04.

Many of the technical requirements of Section 4 of the ASME PRA Standard RA-Sb-2005, as modified by the NRC in RG 1.200, are consistent with the peer review process; and for these requirements the existing peer review results can be used to demonstrate compatibility with the Standard and Regulatory Guide. However, in some areas the requirements are not sufficiently supported by NEI 00-02 to make this conclusion, and the differences in technical requirements between the peer review process and the Standard need to be dispositioned such that a plant can determine the degree to which the PRA is consistent with the Standard. That is the purpose of the self-assessment process.

Industry has reviewed and compared the technical contents of the peer review process and ASME RA-Sb-2005 as clarified or endorsed by NRC in Regulatory Guide 1.200. Appendix D2 of this guidance provides this comparison in tabular form. Since the purpose of this comparison table was to address risk-informed regulatory applications, the peer review guidance (subtier criteria) corresponding to a grade 3 for each subelement was compared against the Capability Category II supporting requirements from the ASME PRA Standard. The table does not address other grade or capability levels of either process.

There are 305 supporting requirements in Addendum B. Four of these do not specify Capability Category II requirements. Each of the 301 supporting requirements applicable to PRA Capability Category II from the ASME PRA Standard has been binned into one of three categories:

- 141 supporting requirements (47%) addressed by peer review process
- 72 supporting requirements (24%) partially addressed by peer review process
- 88 supporting requirements (29%) not addressed by peer review process*

  * 50 of these 88 requirements relate to modeling of internal flooding, which is not addressed by the peer review process

  * Note: The above numerical comparison of criteria between NEI-00-02 and the ASME standard as addressed by RG 1.200 is for information purposes and is not specifically endorsed by NRC

General Notes for Self-Assessment Process

The following general considerations were used in developing the comparison table, and must be considered in performing the self-assessment:

1. There are some subtier criteria for which the difference in the grading criteria involve the use of the term "should" (for grade level 3) versus "shall" (for grade level 4). In performing the peer reviews, the peer review teams generally interpreted the "should" statements as meaning that the peer review subcriteria were to be met, or, if alternative approaches or substantially different interpretations were used, these were to be documented in the peer review report.

   NRC staff has taken the position that their review of the NEI comparison of the subtier criteria to the ASME PRA standard was performed under the condition that all of the requirements in the NEI subtier criteria be mandatory. Thus, the NRC position on the self-assessment process is predicated on the requirement that all of the requirements in the NEI subtier criteria where the verb “should” is used, it is interpreted as “shall.” The self-assessment process needs to verify that, when the verb “should” was used in a subtier criterion, it was interpreted as “shall”. Otherwise, the peer review report needs to identify if an alternate approach or substantially different interpretation was used.

2. In a number of cases, the requirements of the ASME PRA Standard and the peer review process are similar, but are denoted in greater detail in the standard. The peer review process was not intended to be an instruction manual for the performance of a PRA, but rather a guideline for review by knowledgeable individuals. Thus, certain of the ASME PRA Standard requirements were determined to be addressed “in practice" during a peer review, but are not explicitly stated in the peer review criteria or the subtier criteria. Credit may be taken for meeting these ASME requirements subject to confirmation in the self-assessment that the requirements were in fact addressed by the peer review. These are noted in the table (Appendix D2)

3. The NRC has provided clarifications and objections to portions of the ASME standard in Appendix A to Regulatory Guide 1.200 . The comparison table (Appendix D2 of this document) addresses these exceptions (e.g., it is a comparison of the peer review process to the ASME standard Addendum B, as endorsed/modified by NRC in Regulatory Guide 1.200).

<u>Self Assessment Process Attributes</u>

The self assessment may be performed in its entirety in advance of any specific application, or may be performed in stages, as necessary to support ongoing risk-informed regulatory applications.

The following attributes are necessary to ensure regulatory acceptance of the process:

- The process should be performed by knowledgeable PRA engineers with experience in the plant-specific PRA.

- The self assessment should be reviewed by an independent group within the plant organization.

The following attributes of the process are desirable:

- An applicability statement should be developed regarding the PRA and its capability to support specific applications under consideration.

- A sign off of the preparers and reviewers attesting to the validity of the self assessment should be considered.

Overall Peer Review Process and Decision

The overall process for using peer review results and the ASME PRA Standard to support a regulatory application is shown in **Figure 1**.

As noted in this figure, the process includes the identification of the elements of the PRA pertinent to a given application, and the necessary Capability Categories for those elements that support the application. In general, Capability Category II is expected to be used to support regulatory applications.

Alternatively, the entire PRA may be assessed irrespective of application. This process would provide the foundation for future applications without the need for additional base PRA reviews.

An additional alternative to the self assessment is to perform a new peer review directly to the requirements of the ASME Standard. The decision as to whether to perform a self assessment or new peer review could be based on several factors, including:

- Age of existing peer review
- Documentation level of existing peer review
- Degree of significant changes to the PRA since the peer review
- Overall degree of effort to perform the self assessment versus new peer review

Figure 2 depicts the detailed process for determining if a particular ASME supporting requirement is met. This process is repeated for each supporting requirement that is assessed.

Figure 1

Overall process for self assessment for a regulatory application

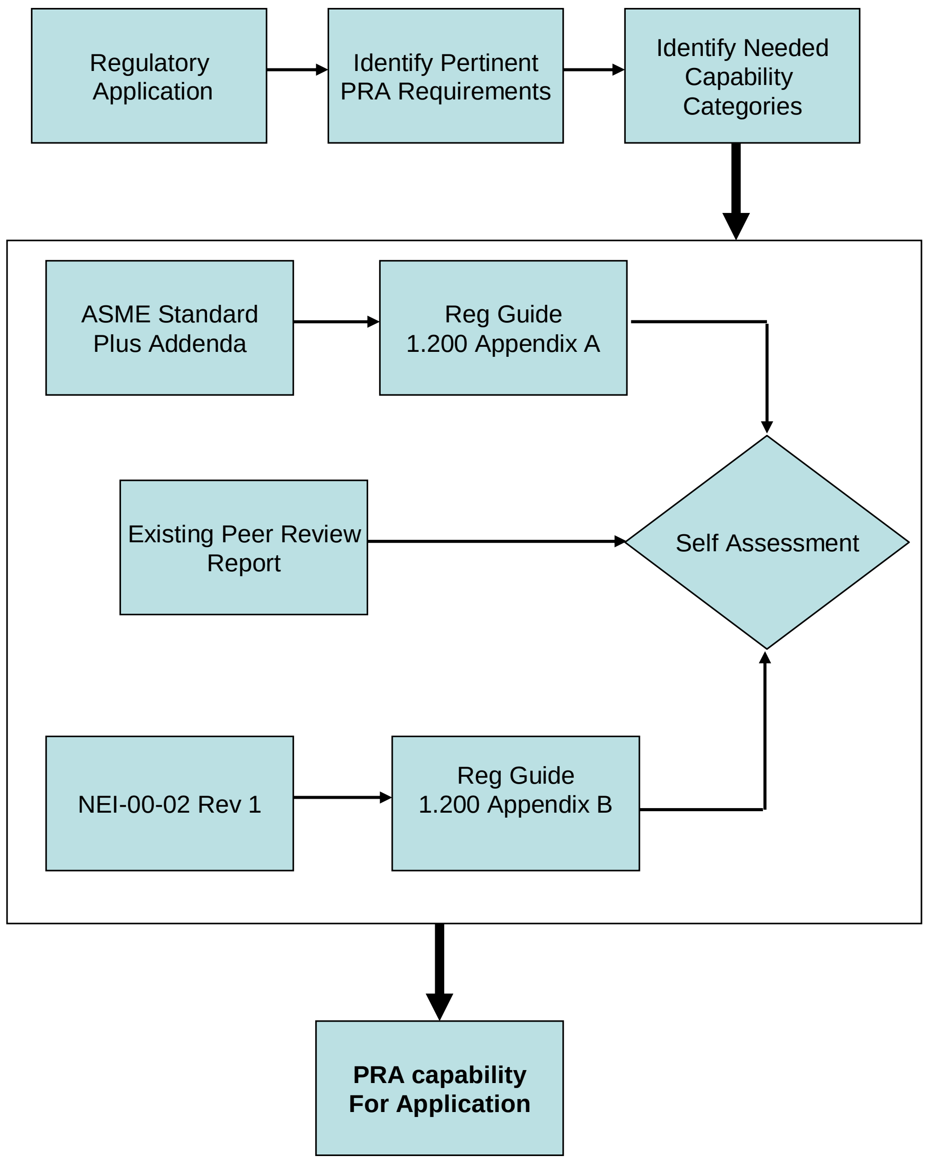
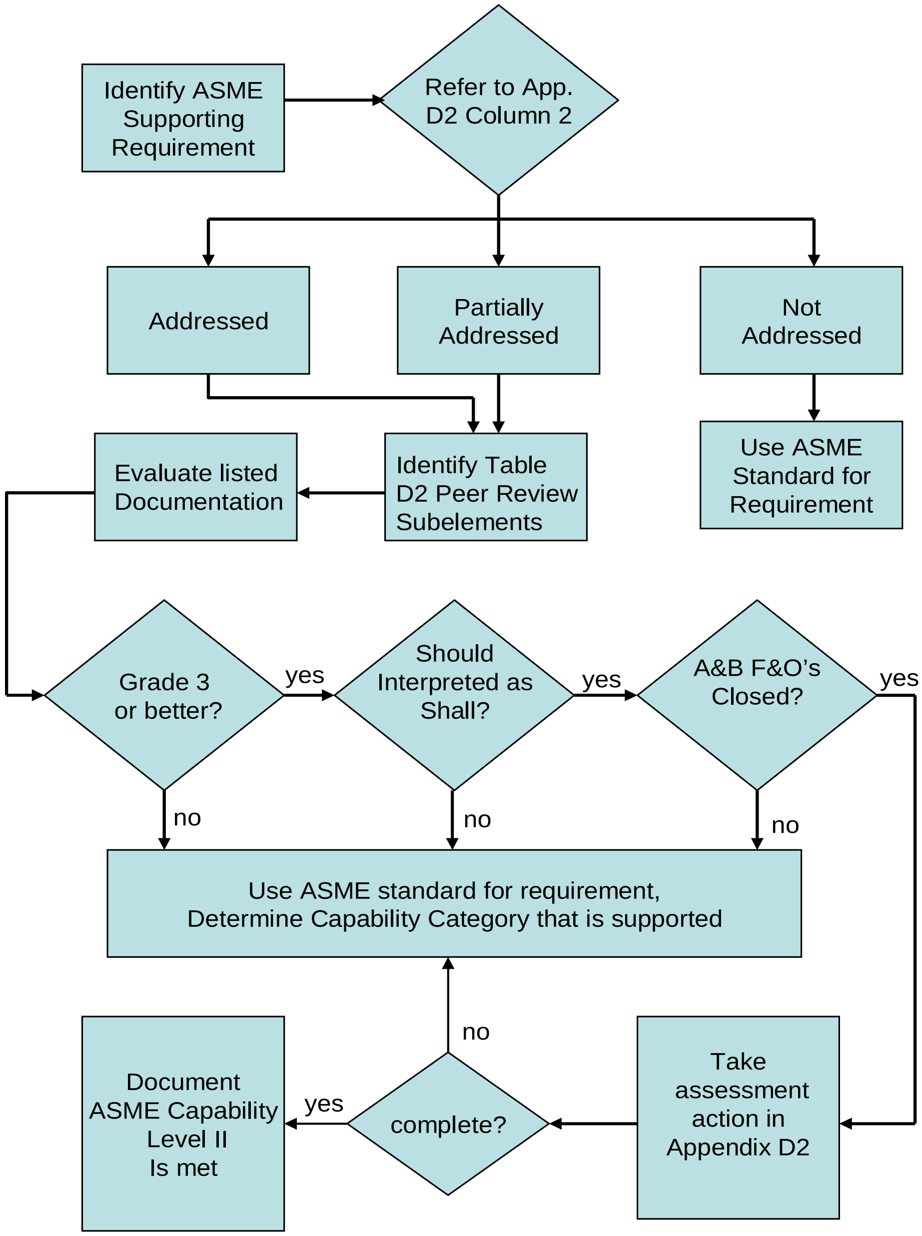


Figure 2

Process to address an ASME supporting requirement



<u>Self Assessment Process Steps – refer to Figure 2</u>

1. Compile the following information

    a) Plant PRA and associated documentation

    b) ASME PRA Standard - RA-Sb-2005 (includes Addenda A and B) (Note: The Standard is copyrighted and must be obtained from ASME for the purposes of the review.)

    c) NEI 00-02, Revision 1 (including appendices below)

    d) Appendix D1, self assessment process

    e) Appendix D2, comparison table for supporting requirements

    f) Appendix D3, subtier criteria for peer review process

    g) Plant PRA Peer Review Report

    h) NRC Regulatory Guide 1.200, including Appendices A and B addressing, objections and clarifications to the ASME standard and NEI-00-02, respectively.

2. In order to support regulatory applications, the self assessment process should be performed at the PRA subelement level.(i.e the NEI-00-02 PRA subelements should be compared to the ASME standard supporting requirements).

3. Identity the ASME supporting requirement of interest (e.g., IE-A1)

4. Refer to Appendix D2 of this document. Using the table, determine if the supporting requirement was "Addressed", "Partially Addressed", or "Not Addressed" by the industry peer review process

5. If the supporting requirement was "Not Addressed", the peer review results cannot be used to assess the ASME supporting requirement. Follow the action in the Table of Appendix D2, which is generally to "use the ASME Standard for requirements." Go to step 14 below.

6. If the supporting requirement is identified as "Addressed", or "Partially Addressed", the next step is to evaluate the peer review results to determine if credit can be taken for a Grade 3 (as conditioned in this process). The third column of the table in Appendix B2

identifies the peer review subelements corresponding to the ASME supporting requirement. In some cases the peer review subelement is listed in bold, where NRC has determined this to be the specific subelement that addresses the ASME supporting requirement. However, all listed subelements must be address in the process.

7. For each peer review subelement identified in the above step, review the information listed in item (1) above, and confirm the following:,

    a. A grade of 3 or above was assigned during the peer review for this subelement. If a grade less than 3, or a conditional grade 3 was provided, or if significant facts and observations (A or B level facts and observations) need to be reconciled, the subelement cannot be credited toward meeting the corresponding ASME supporting requirement. If the conditional grade items have been resolved, and/or any A or B level facts or observations have been resolved, then the subelement can be credited towards meeting the corresponding ASME supporting requirement, and this determination should be documented.

    b. The peer review interpreted the "should" wording in the subelement as "shall" in making the grading determination. The self-assessment process needs to verify that, when the verb "should" was used in a subtier criterion, it was interpreted as "shall". Otherwise, the peer review report needs to identify if an alternate approach or substantially different interpretation was used. This should be evaluated by reviewing the peer review documentation. If this cannot be confirmed, the subelement cannot be credited toward meeting the corresponding ASME supporting requirement.

8. If items 7(a) and 7(b) above are confirmed for each listed peer review subelement, identify the actions described in the fourth column of the table in Appendix D2. If items 7(a) and 7(b) cannot be confirmed for each subelement, go to step 14 below.

9. If "yes" appears in the "addressed by NEI-00-02" column of the table in Appendix D2, and an action is listed, it is believed that the peer review process addressed the ASME supporting requirement. Review the comment, and unless it is suspected that a problem exists, no further action is required. Document that the ASME supporting level requirement has been met for Capability Category II.

10. If "partial" appears in the "addressed by NEI-00-02" column of the table in Appendix D2, complete the stated actions, and document the results. Document that the ASME supporting level requirement has been met for Capability Category II. If the stated actions cannot be completed, go to step 14 below.

11. If "none" appears in the action column, document that the ASME supporting level requirement has been met for Capability Category II.

12. Following assessment of all supporting requirements associated with a particular high level requirement of the ASME Standard, review the information produced and make a determination whether the high level requirement is met. Repeat for all high level requirement in a given section of the Standard (e.g., for the Initiating Events Analysis section, Table 4.5.1-1 of the Standard provides the high level requirements). Document this determination.

13. Repeat the above process for sections 4.5.1 through 4.5.9 of the ASME Standard (or, if performing the self-assessment on an application-specific basis, for those sections necessary to support a particular application).

14. If the peer review results cannot be used to substantiate an ASME supporting requirement has been met, then a self assessment should be performed directly to the ASME standard supporting requirement. This should include a determination of which Capability Category is met. This action is depicted on the flowchart (Figure 2) as "Use the ASME Standard for Requirements". NEI-05-04, "Process for Performing Follow-on PRA Peer Reviews Using the ASME PRA Standard" provides information that may be useful in this regard, particularly Section 3.0, "Grading Process". While written to support peer review, this document provides information that is also relevant to self assessments.

Appendix D2

Comparison of ASME RA-Sb-2005, Section 4, Supporting Level Requirements (Capability Level 2), to NEI-00-02 peer review process subelements (Grade 3)

Text of the "Addressed By NEI" column and the "Industry Self Assessment Actions" column	Actions Utilities Need to Take in Self Assessment Actions
YES and None in Action Column	None
YES and clarifications included in action column	Review comment. It is believed Peer Review Process addressed the requirements. Unless it is suspected a problem exists, no further action is required.
PARTIAL	Take action(s) specified in comments column.
NO	Take action(s) specified in comments column.

ASME STD SR	ADDRESSED BY NEI 00-02?	APPLICABLE NEI 00-02 ELEMENTS[8]	Industry Self Assessment Actions
INITIATING EVENTS			
IE-A1	YES	IE-7, IE-8, IE-9, IE-10	None
IE-A2	YES	IE-5, **IE-7**, IE-9, IE-10	Confirm that initiators, (including human-induced initiators, and steam generator tube rupture (PWRs)) were included. This can be done by either citing peer review documentation/conclusions or examples from your model. NEI 00-02 does not explicitly mention human-induced initiators but in practice peer reviews have addressed this.
IE-A3	YES	**IE-8**, IE-9	None
IE-A3a[1]	YES	**IE-8**, IE-9	None
IE-A4	PARTIAL	IE-5, IE-7, IE-9, **IE-10**	Check for initiating events that can be caused by a train failure as well as a system failure.
IE-A4a[1]	PARTIAL	IE-5, IE-7, IE-9, **IE-10**	Check for initiating events that can be caused by multiple failures, if the equipment failures result from a common cause or from routine system alignments.

ASME STD SR	ADDRESSED BY NEI 00-02?	APPLICABLE NEI 00-02 ELEMENTS[8]	Industry Self Assessment Actions
IE-A5	YES	IE-8	Confirm requirement met. Identification of low power and shutdown events not explicitly addressed in NEI 00-02, but in practice, the peer reviews have addressed events resulting in a controlled shutdown that include a scram prior to reaching low power.
IE-A6	YES	IE-16	Confirm requirement met. Specifying plant Operations, etc review and participation is not explicitly addressed in NEI 00-02, but in practice, the peer reviews have addressed the need for examination of plant experience (e.g., LERs), and input from knowledgeable plant personnel. Interviews conducted at similar plants are not acceptable.
IE-A7	YES	IE-16, IE-10	none
IE-A8	DELETED	--	--
IE-A9	DELETED	--	--
IE-A10	YES	IE-6	None
IE-B1	YES	AS-4, IE-4	None
IE-B2	YES	IE-4, IE-7	None
IE-B3	YES	IE-4, IE-12	Confirm that the grouping does not impact significant accident sequences.
IE-B4	YES	IE-4	None
IE-B5[3]	YES	IE-6	None
IE-C1	YES	IE-13, IE-15, **IE-16**, IE-17	none
IE-C1a[1]	YES	IE-13, IE-15, **IE-16**, IE-17	None
IE-C1b[1]	YES	IE-13, IE-15, **IE-16**, IE-17	Justify recovery credit as evidenced by procedures or training.
IE-C2	YES	IE-13, **IE-16**	Justify informative priors used in Bayesian update.
IE-C3	NO		Document that the ASME standard requirements were met. NEI 00-02 does not address this supporting requirement.

ASME STD SR	ADDRESSED BY NEI 00-02?	APPLICABLE NEI 00-02 ELEMENTS[8]	Industry Self Assessment Actions
IE-C4	NO		Document that the ASME standard requirements were met. Specific screening criteria were not used in NEI 00-02, but bases for screening of events were examined in the peer reviews. The text of the ASME standard needs to be assessed.
IE-C5	No requirement for Category II	N/A	
IE-C6	YES	IE-15, IE-17	Check that fault tree analysis when used to quantify IE's, meet the appropriate systems analysis requirements.
IE-C7	NO		Document that the ASME standard requirements were met. NEI 00-02 does not address this supporting requirement.
IE-C8	NO		Document that the ASME standard requirements were met. NEI 00-02 does not address this supporting requirement.
IE-C9	YES	IE-15, IE-16	Check that the recovery events included in the IE fault trees meet the appropriate recovery analysis requirements. This can be done by either citing peer review F&O's or examples from your model.
IE-C10	YES	IE-13	None
IE-C11	YES	IE-12, IE-13, **IE-15**	Check that the expert elicitation requirements in the ASME PRA Standard were used when expert judgement was applied to quantifying extremely rare events.
IE-C12	YES	IE-14	Confirm that secondary pipe system capability and isolation capability under high flow or differential pressures are included.
IE-C13[3]	NO	none	Confirm IE-C13 is met.
IE-D1	PARTIAL	IE-9, IE-18, IE-19, IE-20	Action is to confirm availability of documentation. In general specified documentation items not explicitly addressed in NEI 00-02 checklists were addressed by the peer review teams. If not available, documentation may need to be generated to support particular applications or respond to NRC RAIs relative to applications.
IE-D2	PARTIAL	IE-9, IE-18, IE-19, IE-20	Action is to confirm availability of documentation. In general specified documentation items not explicitly addressed in NEI 00-02 checklists were addressed by the peer review teams. If not available, documentation may need to be generated to support particular applications or respond to NRC RAIs relative to applications.
IE-D3	PARTIAL	QU-27, QU-28, QU-29, QU-34	Confirm that the key assumptions and key sources of uncertainty consistent with the definitions of the ASME PRA Standard are documented.

ASME STD SR	ADDRESSED BY NEI 00-02?	APPLICABLE NEI 00-02 ELEMENTS(8)	Industry Self Assessment Actions
ACCIDENT SEQUENCE ANALYSIS			
AS-A1	YES	AS-4, AS-8	None
AS-A2	YES	**AS-6**, AS-7, AS-8, AS-9, AS-17	None
AS-A3	YES	AS-7, SY-17, **AS-17**	None
AS-A4	YES	**AS-19**, SY-5	None
AS-A5	YES	AS-5, AS-18, AS-19, SY-5	None
AS-A6	YES	AS-8, AS-13, AS-4	None
AS-A7	YES	AS-4, AS-5, AS-6, AS-7, AS-8, AS-9	None
AS-A8	PARTIAL	AS-20, AS-21, AS-22, AS-23	Since there is no explicit requirement for steady state condition for end state in NEI 00-02 checklists, this should be evaluated even though this was an identified issue in some reviews. This can also be done by either citing peer review documentation/conclusions or examples from your model. Refer to SC-A5.
AS-A9	YES	AS-18, TH-4	Verify AS-A9 is met. Note that AS-A9 is related to the environmental conditions challenging the equipment during the accident sequence, AS-18 and TH-4 are focused on the initial success criteria.
AS-A10	YES	**AS-4**, AS-5, AS-6, **AS-7**, AS-8, AS-9, AS-19, SY-5, SY-8, HR-23	None
AS-A11	YES	AS-8, AS-10, AS-15, DE-6, AS Checklist Note 8	The guidance in AS-15 must be followed. AS-8 states that transfers may be treated quantitatively or qualitatively while AS-15 states that transfers between event trees should be explicitly treated in the quantification. .
AS-B1	YES	IE-4, IE-5, IE-10, **AS-4**, AS-5, AS-6, AS-7, AS-8, AS-9, AS-10, AS-11, DE-5	None

ASME STD SR	ADDRESSED BY NEI 00-02?	APPLICABLE NEI 00-02 ELEMENTS(8)	Industry Self Assessment Actions
AS-B2	YES	**AS-10**, **AS-11**, DE-4, DE-5, DE-6	None
AS-B3	YES	DE-10, **SY-11**, TH-8, **AS-10**	None
AS-B4	YES	AS-8, AS-9, AS-10, AS-11	Confirm requirement met.
AS-B5	YES	DE-4, DE-5, **DE-6**, **AS-10**, **AS-11**, **QU-25**	None
AS-B5a(1)	YES	DE-4, DE-5, **DE-6**, **AS-10**, **AS-11**, **QU-25**	Confirm that system alignments that may affect dependencies among systems or functions are modeled.
AS-B6	YES	AS-13	None
AS-C1(2)	YES	AS-11, AS-24, AS-25, AS-26	None
AS-C2(2)	PARTIAL	AS-11, AS-24, AS-25, **AS-26**	Action is to confirm availability of documentation. In general, specified documentation items not explicitly addressed in NEI 00-02 checklists were addressed by the peer review teams. If not available, documentation may need to be generated to support particular applications or respond to NRC RAIs relative to applications.
AS-C3(2)	PARTIAL	QU-27, QU-28, QU-29, QU-34	Confirm that the key assumptions and key sources of uncertainty consistent with the definitions of the ASME PRA Standard are documented.
SUCCESS CRITERIA			
SC-A1	YES	AS-20, AS-22, AS FOOTNOTE 4	None
SC-A2	YES	TH-4, TH-5, TH-7, AS-22, AS FOOTNOTE 4	None
SC-A3	DELETED	--	--
SC-A4	YES	AS-7, AS-17, AS-18, SY-17, TH-9, IE-6, DE-5, SY-8	None

ASME STD SR	ADDRESSED BY NEI 00-02?	APPLICABLE NEI 00-02 ELEMENTS[8]	Industry Self Assessment Actions
SC-A4a[1]	YES	IE-6, DE-5	Confirm that this requirement is met. This can be done by either citing peer review documentation/conclusions or examples from your model. Although there is no explicit requirement in NEI 00-02 that mitigating systems shared between units be identified, in practice, review teams have evaluated this.
SC-A5	PARTIAL	AS-21, AS-23, AS-20	Ensure mission times are adequately discussed as per the ASME PRA Standard. Since there are no explicit requirements for steady state condition for end state, refer to the ASME PRA Standard for requirements or cite peer review documentations/conclusions or examples from your model. Refer to AS-A8.
SC-A6	YES	AS-5, AS-18, AS-19, TH-4, **TH-5**, TH-6, TH-8, ST-4, ST-5, ST-7, ST-9, SY-5	None
SC-B1	YES	AS-18, SY-17, TH-4, TH-6, TH-7	None
SC-B2	NO	TH-4, TH-8	NEI 00-02 does not address this supporting requirement. Use the ASME standard for requirements. Refer to SC-C2.
SC-B3	YES	AS-18, TH-4, TH-5, TH-6, TH-7	None
SC-B4	YES	AS-18, TH-4, TH-6, TH-7	None
SC-B5	YES	TH-9, **TH-7**	None
SC-C1[2]	YES	ST-13, SY-10, SY-17, SY-27, TH-8, **TH-9**, **TH-10**, AS-17, AS-18, AS-24, HR-30	None
SC-C2[2]	PARTIAL	ST-13, SY-10, SY-17, SY-27, TH-8, **TH-9**, **TH-10**, AS-17, AS-18, AS-24, HR-30	Action is to confirm availability of documentation. In general specified documentation items not explicitly addressed in NEI 00-02 checklists were addressed by the peer review teams. If not available, documentation may need to be generated to support particular applications or respond to NRC RAIs relative to applications.
SC-C3[2]	PARTIAL	QU-27, QU-28, QU-29, QU-34	Confirm that the key assumptions and key sources of uncertainty consistent with the definitions of the ASME PRA Standard are documented.

ASME STD SR	ADDRESSED BY NEI 00-02?	APPLICABLE NEI 00-02 ELEMENTS[8]	Industry Self Assessment Actions
SYSTEMS ANALYSIS			
SY-A1	YES	SY-4, **SY-19**	None
SY-A2	YES	AS-19, **SY-5**, SY-13, **SY-16**	None
SY-A3	YES	SY-5, SY-6, SY-8, SY-12, SY-14	None. Although there are no explicit requirements in NEI-00-02 that match SY-A3, performance of the systems analysis would require a review of plant-specific information sources.
SY-A4	PARTIAL	DE-11, SY-10, SY FOOTNOTE 5	Confirm that this requirement is met. This can be done by either citing peer review results or example documentation. NEI 00-02 does not address interviews with system engineers and plant operators to confirm that the model reflects the as-built, as-operated plant.
SY-A5	PARTIAL	QU-12, QU-13, SY-8, SY-11	Confirm this requirement is met, and that the PRA considered both normal and abnormal system alignments. This can be done by either citing peer review results or example documentation. Although NEI 00-02 does not explicitly address both normal and abnormal alignments, their impacts are generally captured in the peer review of the listed elements.
SY-A6	YES	SY-7, SY-8, SY-12, SY-13, SY-14	None
SY-A7	YES	SY-6, SY-7, SY-8, SY-9, SY-19	Check for simplified system modeling as addressed in SY-A7.
SY-A8	PARTIAL	SY-6, SY-9	Check to ensure boundaries are properly established. This can be done by either citing peer review results or example documentation. NEI 00-02 does not address component boundaries except for EDGs. There is no explicit requirement that addresses modeling shared portions of a component boundary. In practice, the peer reviews have examined consistency of component and data analysis boundaries.
SY-A9	DELETED	--	--
SY-A10	PARTIAL	SY-9	Action is to determine if the requirements of the ASME standard are met. NEI 00-02 does not address all aspects of modularization.
SY-A11	YES	AS-10, AS-13, AS-16, AS-17, AS-18, SY-12, SY-13, SY-17, SY-23	None

ASME STD SR	ADDRESSED BY NEI 00-02?	APPLICABLE NEI 00-02 ELEMENTS(8)	Industry Self Assessment Actions
SY-A12	PARTIAL	SY-6, SY-7, SY-8, SY-9, SY-12, SY-13, SY-14	Document that modeling is consistent with exclusions provided in SY-A14.–Consistent with subelement SY-A12 of the ASME PRA standard, critical passive components whose failure affect system operability should be included in system models.
SY-A12a(1)	PARTIAL	SY-6, SY-7, SY-8, SY-9, SY-12, SY-13, SY-14	Document that modeling is consistent with exclusions provided in SY-A12a.–The criteria in SY-7 states that passive components should be included in a Grade 3 PRA if they **influence** the CDF or LERF. No definition of the word **influence** is provided.
SY-A12b(3)	PARTIAL	SY-15, SY-17	Document that modeling incorporates flow diversion failure modes.
SY-A13	YES	DA-4, SY-15, SY-16	None
SY-A14	NO		Use the ASME standard for requirements. NEI 00-02 does not address this supporting requirement.
SY-A15	YES	**SY-8**, **HR-4**, HR-5, HR-7	None
SY-A16	YES	**SY-8**, **HR-8**, HR-9, HR-10	None
SY-A17	YES	AS-13, SY-10, SY-11, SY-13, SY-17	None. SY-17 is evaluated in the NEI 00-02 PRA Peer Review as follows: SY-10 Failures or system termination (trip) due to spatial or environmental effects. SY-11 Failure modes induced by accident conditions. SY-13 System Termination (failure or trip) due to exhaustion of inventory (water, air). SY-17 Success Criteria evaluation determined by plant specific analysis that includes system trips or isolations on plant parameters. AS-13 Failure of systems due to time phased effects such as loss of battery voltage.
SY-A18	YES	**DA-7**, SY-8, SY-22	None
SY-A18a(3)	NO		Confirm this is accounted for in the PRA. NEI 00-02 does not explicitly identify the criteria for tracking and modeling of coincident maintenance actions that may lead to unavailability of multiple redundant trains or systems..

ASME STD SR	ADDRESSED BY NEI 00-02?	APPLICABLE NEI 00-02 ELEMENTS(8)	Industry Self Assessment Actions
SY-A19	YES	AS-18, DE-10, SY-11, SY-13, SY-17, TH-8	Verify SY-A19 has been met. Ensure there is a documented basis (engineering calculations are not necessary) for modeling of the conditions addressed. NEI-00-02 focusses on environmental limiations.
SY-A20	PARTIAL	AS-19, SY-5, SY-11, SY-13, SY-22, TH-8	Document component capabilities where applicable. NEI 00-02 does not explicitly require a check for crediting components beyond their design basis.
SY-A21	YES	SY-18	None. Comment: footnote to SY-18 explains lack of Grade provision for this sub-element.
SY-A22	YES	SY-24, DA-15, QU-18, **SY-12**	None
SY-A23	DELETED	--	--
SY-B1	YES	DA-8, DA-14, DE-8, DE-9, SY-8	None
SY-B2	NOT REQUIRED FOR CAPABILITY CATEGORY II		None
SY-B3	YES	DE-8, DE-9, DA-10, DA-12	None
SY-B4	YES	**DA-8**, DA-10, DA-11, DA-12, DA-13, DA-14, DE-8, DE-9, QU-9, SY-8	None
SY-B5	YES	DE-4, DE-5, DE-6, SY-12,	None
SY-B6	YES	SY-12, SY-13	Self assessment needs to confirm that the support system success criteria reflect the variability in the conditions that may be present during postulated accidents.
SY-B7	YES	AS-18, SY-13, SY-17, TH-7, TH-8	None
SY-B8	YES	DE-11, **SY-10**	None
SY-B9	DELETED	--	--

ASME STD SR	ADDRESSED BY NEI 00-02?	APPLICABLE NEI 00-02 ELEMENTS[8]	Industry Self Assessment Actions
SY-B10	YES	SY-12, SY-13	None
SY-B11	YES	SY-8, SY-12, SY-13,	Confirm by either citing peer review documentation/conclusions or examples from your model. NEI 00-02 does not explicitly address permissives and control logic. In practice, the items in SY-B11 have generally been examined in the peer reviews.
SY-B12	YES	SY-13	None
SY-B13	NO		Use the ASME standard for requirements. NEI 00-02 does not address this supporting requirement.
SY-B14	PARTIAL	DE-6, AS-6	Confirm that by either citing peer review documentation/conclusions or examples from your model. Ensure that modeling includes situations where one component can disable more than one system.
SY-B15	YES	SY-11	None
SY-B16	YES	SY-8	None
SY-C1[2]	YES	SY-5, SY-6, SY-9, SY-18, SY-23, SY-25, SY-26, SY-27	None
SY-C2[2]	PARTIAL	SY-5, SY-6, SY-9, SY-18, SY-23, SY-25, SY-26, SY-27	Action is to confirm availability of documentation. In general specified documentation items not explicitly addressed in NEI 00-02 checklists were addressed by the peer review teams. If not available, documentation may need to be generated to support particular applications or respond to NRC RAIs relative to applications. Comment: footnote to SY-18 explains lack of Grade provision for this sub-element.
SY-C3[2]	PARTIAL	QU-27, QU-28, QU-29, QU-34	Confirm that the key assumptions and key sources of uncertainty consistent with the definitions of the ASME PRA Standard are documented.
HUMAN RELIABILITY ANALYSIS			
HR-A1	YES	HR-4, HR-5	Determine if analysis has included and documented failure to restore equipment following test or maintenance.
HR-A2	YES	HR-4, HR-5	None
HR-A3	YES	DE-7, HR-5	None
HR-B1	YES	HR-5, **HR-6**	None

ASME STD SR	ADDRESSED BY NEI 00-02?	APPLICABLE NEI 00-02 ELEMENTS[(8)]	Industry Self Assessment Actions
HR-B2	PARTIAL	HR-5, HR-6, HR-7, HR-26, DA-5, DA-6	Ensure single actions with multiple train consequences are evaluated in pre-initiators, since the screening rules in HR-6 do not preclude screening of activities that can affect multiple trains of a system,.
HR-C1	YES	HR-27, SY-8, SY-9	None
HR-C2	YES	HR-7, HR-27, SY-8, SY-9	Confirm that this requirement is met. The specific list of impacts in HR-C2 is not included in NEI 00-02, but in practice the peer reviewers (in reviewing sub-elements HR-7 and related sub-elements) addressed these items.
HR-C3	YES	HR-5, HR-27, SY-8, SY-9	None
HR-D1	YES	HR-6	None
HR-D2	YES	HR-6	None
HR-D3	NO		Action is to confirm that HR-D3 is met. This item was implicitly included in the peer review of HRA by virtue of the assessment of the crew's ability to implement the procedure in an effective and controlled manner. The pre-initiator HRA adequacy is determined reasonable and representative considering the procedure quality.
HR-D4	PARTIAL	HR-6	Use the ASME standard for requirements. NEI 00-02 does not explicitly cite the treatment of recovery actions for pre-initiators. PRA implementation varied among utilities with some using screening values and others incorporating recovery. The Peer Review team examines this treatment.
HR-D5	YES	DE-7, **HR-26**, HR-27	None
HR-D6	NO		Use the ASME standard for requirements. NEI 00-02 does not address this supporting requirement.
HR-D7	NOT REQUIRED FOR CAPABILITY CATEGORY II		None
HR-E1	YES	AS-19, HR-9, **HR-10**, HR-16, SY-5	None.

ASME STD SR	ADDRESSED BY NEI 00-02?	APPLICABLE NEI 00-02 ELEMENTS(8)	Industry Self Assessment Actions
HR-E2	YES	**HR-8**, HR-9, HR-10, HR-21, HR-22, HR-23, HR-25	None
HR-E3	PARTIAL	HR-10, HR-14, HR-20	The ASME standard supporting requirements are to be used during the self-assessment to confirm that the ASME intent is met for this requirement. NEI 00-02 does not explicitly specify the same level of detail that is included in the ASME Standard. The peer review team experience is relied upon to investigate the PRA given general guidance and criteria.
HR-E4	PARTIAL	HR-14, HR-16	The ASME standard supporting requirements are to be used during the self-assessment to confirm that the ASME intent is met for this requirement. NEI 00-02 does not explicitly specify the same level of detail that is included in the ASME Standard. The peer review team experience is relied upon to investigate the PRA given general guidance and criteria.
HR-F1	YES	AS-19, HR-16, SY-5	None
HR-F2	PARTIAL	AS-19, HR-11, HR-16, HR-17, HR-19, HR-20, SY-5	Determine whether the requirements of the ASME standard are met. HR-F2 is generally addressed by NEI 00-02 and the PRA Peer Review. One additional item is highlighted to be checked. NEI 00-02 does not explicitly cite indication for detection and evaluation. However, by invoking the standard HRA methodologies the treatment of cues and other indications for detecting the need for action are included.
HR-G1	YES	HR-15, HR-17, HR-18	None
HR-G2	YES	HR-2, HR-11	None. NEI 00-02 criteria for Grade 3 requires a methodology that is consistent with industry practice. This includes the incorporation of both the cognitive and execution human error probabilities in the HEP assessment. HR-11 provides further criteria to ensure that the cognitive portion of the HEP uses the correct symptoms to formulate the crew response.
HR-G3	PARTIAL	HR-17, HR-18	The ASME standard supporting requirements are to be used during the self-assessment to confirm that the ASME intent is met for this requirement. NEI 00-02 does not explicitly enumerate the same level of detail that is included in the ASME Standard. However, by invoking the standard HRA methodologies the performance shape factors are necessarily evaluated. The peer review team experience is relied upon to investigate the PRA given general guidance and criteria.

ASME STD SR	ADDRESSED BY NEI 00-02?	APPLICABLE NEI 00-02 ELEMENTS[8]	Industry Self Assessment Actions
HR-G4	PARTIAL	AS-13, HR-18, **HR-19**, HR-20	The ASME standard supporting requirements are to be used during the self-assessment to confirm that the ASME intent is met for this requirement NEI 00-02 does not explicitly cite the necessity to define the time at which operators are expected to receive indications. However, invoking the standard HRA methods leads to the necessity for the analysts to define this input to the HRA. The peer review team experience is relied upon to investigate the PRA given general guidance and criteria.
HR-G5	PARTIAL	HR-16, HR-18, HR-20	Evaluate proper inputs per the ASME standard or cite peer review F&O's or examples from your model. NEI 00-02 explicitly addresses observations and operations staff input for time required. ASME PRA Standard requires time measurements.
HR-G6	YES	HR-12	Check to ensure they are met by citing peer review documentation/conclusions or examples from your model. HR-12 does not explicitly address all the items of the ASME standard list. In practice peer reviews addressed these items.
HR-G7	PARTIAL	DE-7, HR-26	Check to see if factors that are typically assumed to lead to dependence were included, e.g., use of common indications and/or cues to alert control room staff to need for action; and a common procedural direction that leads to the actions. This can also be done by either citing peer review documentation/conclusiions or examples from your model. NEI 00-02 does not provide explicit criteria that address the degree of dependence between HFEs that appear in the same accident sequence cutset. However, invoking the standard HRA methods leads to the necessity for the analysts to define this input to the HRA. In general, the peer reviews addressed this. See also QU-C2.
HR-G8	DELETED	--	--
HR-G9	NO		Use the ASME standard for requirements. NEI 00-02 does not address this supporting requirement.
HR-H1	YES	**HR-21**, HR-22, HR-23	None
HR-H2	YES	HR-22, HR-23	None
HR-H3	YES	HR-26	None
HR-I1[2]	PARTIAL	HR-28, HR-30	None

ASME STD SR	ADDRESSED BY NEI 00-02?	APPLICABLE NEI 00-02 ELEMENTS(8)	Industry Self Assessment Actions
HR-I2(2)	PARTIAL	HR-28, HR-30	Action is to confirm availability of documentation. In general, specified documentation items not explicitly addressed in NEI 00-02 checklists were addressed by the peer review teams. If not available, documentation may need to be generated to support particular applications or respond to NRC RAIs relative to applications.
HR-I3(2)	PARTIAL	QU-27, QU-28, QU-29, QU-34	Confirm that the key assumptions and key sources of uncertainty consistent with the definitions of the ASME PRA Standard are documented.
DATA ANALYSIS			
DA-A1	YES	DA-4, DA-5, DA-15, SY-8	None
DA-A1a(1)	NO		Confirm that the component boundary is consistent with the data applied.
DA-A2	NO		Use the ASME standard for requirements. NEI 00-02 does not address this supporting requirement.
DA-A3	YES	DA-4, DA-5, DA-6, DA-7, SY-8	None
DA-B1	YES	DA-5	None
DA-B2	YES	DA-5, DA-6	Confirm that this requirement is met. NRC comment: Grouping criteria listed in DA-5 should be supplemented with a caution to look for unique components and/or operating conditions and to avoid grouping them. Peer Review Teams were careful to assess plant specific data evaluations to identify cases where outlier data values or components were not properly accounted for.
DA-C1	YES	DA-4, DA-7, DA-9, DA-19, DA-20	None
DA-C2	YES	DA-4, DA-5, DA-6, DA-7, DA-14, DA-15, DA-19, DA-20, MU-5	None
DA-C3	PARTIAL	DA-4, DA-5, DA-6, DA-7, MU-5	Use the ASME standard for requirements. NEI 00-02 does not enumerate the items considered appropriate in a plant specific data analysis.
DA-C4	NO		Use the ASME standard for requirements. NEI 00-02 does not explicitly cite this definition of failure and degraded state.

ASME STD SR	ADDRESSED BY NEI 00-02?	APPLICABLE NEI 00-02 ELEMENTS[(8)]	Industry Self Assessment Actions
DA-C5	NO		Use the ASME standard for requirements. NEI 00-02 does not address this supporting requirement.
DA-C6	YES	DA-6, DA-7	Confirm that this requirement is met. NEI 00-02 addresses data needs when the standby failure rate model is used for demands. There are no stated criteria for the demand failure model; however, in practice this was addressed during peer reviews.
DA-C7	YES	DA-6, DA-7	None
DA-C8	YES	DA-4, DA-6, DA-7	Confirm that this requirement is met. Although there is no specific criteria for determining operational time of components in operation or in standby, the development needs to include these times. These issues were addressed during peer reviews.
DA-C9	YES	DA-4, DA-6, DA-7	Confirm that this requirement is met. Although there is no specific criteria for determining operational time of components in operation or in standby, the development needs to include these times. These issues were addressed during peer reviews.
DA-C10	NO		Use the ASME standard for requirements. NEI 00-02 does not address this supporting requirement.
DA-C11	NO		Use the ASME standard for requirements. NEI 00-02 does not address this supporting requirement.
DA-C11a[(3)]	NO		Use the ASME PRA Standard for requirements. PRA Peer Review Teams found that support system unavailabilities are treated within the support system and not within the associated frontline system.
DA-C12	NO		Use the ASME standard for requirements. NEI 00-02 does not address this supporting requirement.
DA-C13	NO		Use the ASME standard for requirements. NEI 00-02 does not address this supporting requirement.
DA-C14	YES	**DA-15**, AS-16, SY-24	None

ASME STD SR	ADDRESSED BY NEI 00-02?	APPLICABLE NEI 00-02 ELEMENTS[8]	Industry Self Assessment Actions
DA-C15	YES	IE-13, IE-15, IE-16, AS-16, DA-15, SY-24, QU-18	Confirm that this requirement is met. Although, it is relatively rare to see credit taken for repair of failed equipment in PRA's (except in modeling of support system initiating events), any credit taken for repair should be well justified, based on ease of diagnosis, the feasibility of repair, ease of repair, and availability of resources, time to repair and actual data. This can be done by either citing peer review results or example documentation.
DA-D1	NO		Use the ASME standard for requirements. NEI 00-02 does not address this supporting requirement.
DA-D2	NO		Use the ASME standard for requirements. NEI 00-02 does not address this supporting requirement.
DA-D3	PARTIAL	QU-30	The guidance in the qualification o fDA-D3 provided in Reg Guide 1.200 Appendix A should be followed. A requirement for establishing the parameter distributions is not in the data analysis section but could be inferred from QU-30. QU-30 does not provide guidance on which events to include in the uncertainty analysis.
DA-D4	NO		Use the ASME standard for requirements. NEI 00-02 does not address this supporting requirement. This was performed as part of the Peer Review Team implementation of NEI 00-02 (See DE-9).
DA-D5	PARTIAL	DE-9, DA-8, DA-9, DA-10, DA-11, DA-12, DA-13, DA-14	Check for acceptable common cause failure models. This can be done by either citing peer review documentation/conclusions or example documentation. This was performed as part of the Peer Review Team implementation of NEI 00-02 (See DE-9). The criteria for NEI 00-02 elements DA-13 & DA-14 only apply to Grade 4.
DA-D6	PARTIAL	DE-9, DA-8, DA-9, DA-10, DA-11, DA-12, DA-13, DA-14	None
DA-D6a[3]	NOT REQUIRED FOR CAPABILITY CATEGORY II	DA-14	DA-D6a is not an SR that is required to be implemented. However, if this approach is used, DA-D6a should be confirmed to be met. If it is peformed see DE-9 from NEI 00-02.
DA-D7	NO		Use the ASME standard for requirements. NEI 00-02 does not specifically address how to deal with data for equipment that has been changed.

ASME STD SR	ADDRESSED BY NEI 00-02?	APPLICABLE NEI 00-02 ELEMENTS[8]	Industry Self Assessment Actions
DA-E1[2]	PARTIAL	DA-1, DA-19, DA-20, DE-9	None
DA-E2[2]	PARTIAL	DA-1, DA-19, DA-20, DE-9	Action is to confirm availability of documentation. In general specified documentation items not explicitly addressed in NEI 00-02 checklists were addressed by the peer review teams. If not available, documentation may need to be generated to support particular applications or respond to NRC RAIs relative to applications..
DA-E3[2]	PARTIAL	QU-27, QU-28, QU-29, QU-34	Confirm that the key assumptions and key sources of uncertainty consistent with the definitions of the ASME PRA Standard are documented.

ASME STD SR	ADDRESSED BY NEI 00-02?	APPLICABLE NEI 00-02 ELEMENTS(8)	Industry Self Assessment Actions
INTERNAL FLOODING			
IF-A1	NO		Use the ASME standard for requirements. NEI 00-02 does not address this supporting requirement.
IF-A1a(1)	NO		Use the ASME standard for requirements. NEI 00-02 does not address this supporting requirement.
IF-A1b(4)	NO		Use the ASME standard for requirements. NEI 00-02 does not address this supporting requirement.
IF-A3	NO		Use the ASME standard for requirements. NEI 00-02 does not address this supporting requirement.
IF-A4	NO		Use the ASME standard for requirements. NEI 00-02 does not address this supporting requirement.
IF-B1	NO		Use the ASME standard for requirements. NEI 00-02 does not address this supporting requirement.
IF-B1a(4)	NO		Use the ASME standard for requirements. NEI 00-02 does not address this supporting requirement.
IF-B1b(3)	NO		Use the ASME standard for requirements. NEI 00-02 does not address this supporting requirement.
IF-B2	NO		Use the ASME standard for requirements. NEI 00-02 does not address this supporting requirement.
IF-B3	NO		Use the ASME standard for requirements. NEI 00-02 does not address this supporting requirement.
IF-B3a(3)	NO		Use the ASME standard for requirements. NEI 00-02 does not address this supporting requirement.
IF-C1	NO		Use the ASME standard for requirements. NEI 00-02 does not address this supporting requirement.
IF-C2	NO		Use the ASME standard for requirements. NEI 00-02 does not address this supporting requirement.

ASME STD SR	ADDRESSED BY NEI 00-02?	APPLICABLE NEI 00-02 ELEMENTS[(8)]	Industry Self Assessment Actions
IF-C2a[(1)]	NO		Use the ASME standard for requirements. NEI 00-02 does not address this supporting requirement.
IF-C2b[(2)]	NO		Use the ASME standard for requirements. NEI 00-02 does not address this supporting requirement.
IF-C2c[(5)]	NO		Use the ASME standard for requirements. NEI 00-02 does not address this supporting requirement.
IF-C3	NO		Use the ASME standard for requirements. NEI 00-02 does not address this supporting requirement.
IF-C3a[(1)]	NO		Use the ASME standard for requirements. NEI 00-02 does not address this supporting requirement.
IF-C3b[(3)]	NO		Use the ASME standard for requirements. NEI 00-02 does not address this supporting requirement.
IF-C3c[(6)]	NO		Use the ASME standard for requirements. NEI 00-02 does not address this supporting requirement.
IF-C4	NO		Use the ASME standard for requirements. NEI 00-02 does not address this supporting requirement.
IF-C4a[(4)]	NO		Use the ASME standard for requirements. NEI 00-02 does not address this supporting requirement.
IF-C5	NO		Use the ASME standard for requirements. NEI 00-02 does not address this supporting requirement.
IF-C5a[(1)]	NO		Use the ASME standard for requirements. NEI 00-02 does not address this supporting requirement.
IF-C6	NO		Use the ASME standard for requirements. NEI 00-02 does not address this supporting requirement.
IF-C7[(3)]	NO		Use the ASME standard for requirements. NEI 00-02 does not address this supporting requirement.
IF-C8[(3)]	NO		Use the ASME standard for requirements. NEI 00-02 does not address this supporting requirement.

ASME STD SR	ADDRESSED BY NEI 00-02?	APPLICABLE NEI 00-02 ELEMENTS[8]	Industry Self Assessment Actions
IF-C9[3]	NO		Use the ASME standard for requirements. NEI 00-02 does not address this supporting requirement.
IF-D1	NO		Use the ASME standard for requirements. NEI 00-02 does not address this supporting requirement.
IF-D3	NO		Use the ASME standard for requirements. NEI 00-02 does not address this supporting requirement.
IF-D3a[3]	NO		Use the ASME standard for requirements. NEI 00-02 does not address this supporting requirement.
IF-D4	NO		Use the ASME standard for requirements. NEI 00-02 does not address this supporting requirement.
IF-D5	NO		Use the ASME standard for requirements. NEI 00-02 does not address this supporting requirement.
IF-D5a[1]	NO		Use the ASME standard for requirements. NEI 00-02 does not address this supporting requirement.
IF-D6[3]	NO		Use the ASME standard for requirements. NEI 00-02 does not address this supporting requirement.
IF-D7[3]	NO		Use the ASME standard for requirements. NEI 00-02 does not address this supporting requirement.
IF-E1	NO		Use the ASME standard for requirements. NEI 00-02 does not address this supporting requirement.
IF-E3	NO		Use the ASME standard for requirements. NEI 00-02 does not address this supporting requirement.
IF-E3a[3]	NO		Use the ASME standard for requirements. NEI 00-02 does not address this supporting requirement.
IF-E4	NO		Use the ASME standard for requirements. NEI 00-02 does not address this supporting requirement.
IF-E5	NO		Use the ASME standard for requirements. NEI 00-02 does not address this supporting requirement.

ASME STD SR	ADDRESSED BY NEI 00-02?	APPLICABLE NEI 00-02 ELEMENTS[8]	Industry Self Assessment Actions
IF-E5a[1]	NO		Use the ASME standard for requirements. NEI 00-02 does not address this supporting requirement.
IF-E6	NO		Use the ASME standard for requirements. NEI 00-02 does not address this supporting requirement.
IF-E6a[1]	NO		Use the ASME standard for requirements. NEI 00-02 does not address this supporting requirement.
IF-E6b[1]	NO		Use the ASME standard for requirements. NEI 00-02 does not address this supporting requirement.
IF-E7	NO		Use the ASME standard for requirements. NEI 00-02 does not address this supporting requirement.
IF-E8[3]	NO		Use the ASME standard for requirements. NEI 00-02 does not address this supporting requirement.
IF-F1[2]	NO		Use the ASME standard for requirements. NEI 00-02 does not address this supporting requirement.
IF-F2[2]	NO		Use the ASME standard for requirements. NEI 00-02 does not address this supporting requirement.
IF-F3[2]	NO		Use the ASME standard for requirements. NEI 00-02 does not address this supporting requirement.
QUANTIFICATION ANALYSIS			
QU-A1	YES	AS-4, AS-5, AS-6, AS-7, AS-8, AS-9, AS-10, AS-19	None
QU-A2a	YES	QU-8	None
QU-A2b[1]	NO		ASME PRA Standard SR should be addressed. “State of knowledge correlation” is not explicitly cited in NEI 00-02 to be checked.
QU-A3	YES	QU-4, QU-8, QU-9, QU-10, QU-11, QU-12, QU-13	None
QU-A4	YES	QU-18, QU-19	None

ASME STD SR	ADDRESSED BY NEI 00-02?	APPLICABLE NEI 00-02 ELEMENTS(8)	Industry Self Assessment Actions
QU-B1	YES	QU-6	None
QU-B2	YES	**QU-21**, QU-22, **QU-23**, QU-24	Confirm that this requirement is met. In practice, the industry peer reviews have generally used the stated guidance as a check on the final cutset level quantification truncation limit applied in the PRA.
QU-B3	PARTIAL	QU-21, QU-22, QU-23, **QU-24**	The self assessment should confirm that the final truncation limit is such that convergence towards a stable CDF is achieved.
QU-B4	YES	QU-4	None
QU-B5	YES	QU-14	None
QU-B6	YES	AS-8, AS-9, QU-4, QU-20, QU-25	Check for proper accounting of success terms. The NEI 00-02 guidance adequately addresses this requirement, but QU-25 should not be restricted to addressing just delete terms.
QU-B7a	YES	QU-26	None
QU-B7b(1)	YES	QU-26	None
QU-B8	NO		Use the ASME standard for requirements. NEI 00-02 does not explicitly cite the details of Boolean logic code implementation.
QU-B9	PARTIAL	SY-9	The warnings in SY-A10 should be considered in the modularization process. SY-9 addresses the traceability of basic events in modules but does not address the correct formulation of modules that are truly independent.
QU-C1	YES	**QU-10**, **QU-17**, **HR-26**, **HR-27**	None
QU-C2	YES	QU-10, QU-17	Verify dependencies in cutsets/sequences are assessed
QU-C3	YES	QU-20	Confirm that this requirement is met. QU-20 does not explicitly require that the critical characteristic, not just the frequency, be transferred, but in practice during peer reviews this was addressed.
QU-D1a	YES	**QU-8**, QU-9, QU-10, QU-11, QU-12, QU-13, QU-14, QU-15, QU-16, QU-17	None

ASME STD SR	ADDRESSED BY NEI 00-02?	APPLICABLE NEI 00-02 ELEMENTS(8)	Industry Self Assessment Actions
QU-D1b(1)	YES	**QU-8**, QU-9, QU-10, QU-11, QU-12, QU-13, QU-14, QU-15, QU-16, QU-17, QU-34	None
QU-D1c(1)	YES	**QU-8**, QU-9, QU-10, QU-11, QU-12, QU-13, QU-14, QU-15, QU-16, QU-17	None
QU-D2	DELETED	--	--
QU-D3	YES	QU-8, QU-11, QU-31	None
QU-D4	YES	QU-15	None
QU-D5a	YES	QU-8, QU-31	Confirm that this requirement is met. The subject matter in QU-D5a is partially addressed in NEI 00-02 in element QU-31 (QU-8 checks the reasonableness of the results). The contributions from IE's, component failures, common cause failures, and human errors are not addressed. In practice, these were addressed during peer reviews.
QU-D5b(1)	NO		Confirm that this requirement is met.
QU-E1	YES	QU-27, QU-28, QU-30	Confirm that QU-E1 is addressed. The definition of the key sources of model uncertainty is provided by the ASME PRA Standard Addendum B. This nomenclature was not available when NEI 00-02 was implemented. The PRA Peer Review did examine the PRAs to see if modeling uncertainties were addressed appropriately.
QU-E2	YES	QU-27, QU-28, QU-30	Confirm that this requirement is met. QU-27 and QU-28 focus on the assumptions and unusual sources of uncertainty. Assumptions and unusual sources of uncertainty correspond to plant specific hardware, procedural, or environmental issues that would significantly alter the degree of uncertainty relative to plants that have been assessed previously, such as NUREG-1150 or RMIEP, Unusual sources of uncertainty could also be introduced by the PRA methods and assumptions. In practice, when applying NEI 00-02 sub-elements QU-27 and QU-28, the reviewers considered the appropriateness of the assumptions.

ASME STD SR	ADDRESSED BY NEI 00-02?	APPLICABLE NEI 00-02 ELEMENTS(8)	Industry Self Assessment Actions
QU-E3	PARTIAL	QU-30	The uncertainty band associated with each risk metric is to be estimated. The parametric uncertainty band is to be estimated taking into account the “state of knowledge correlation”. This was to be checked by the Peer Review team.
QU-E4	PARTIAL	QU-28, QU-29, QU-30	Use the ASME standard for requirements. NEI 00-02 does not explicitly specify that sensitivity studies of logical combinations of assumptions and parameters be evaluated.
QU-F1(2)	PARTIAL	QU-31, QU-32, QU-34	None
QU-F2(2)	YES	MU-7, QU-4, QU-12, QU-13, QU-27, QU-28, QU-31, QU-32	No action required for (m). Normal industry practice requires documentation of computer code capabilities.
QU-F3(2)	PARTIAL	QU-31	Use the ASME standard for requirements at the time of doing an application.
QU-F4(2)	NO	QU-27, QU-28, QU-32	Use the ASME standard for requirements at the time of doing an application. NEI 00-02 does not address this supporting requirement.
QU-F5(2)	NO		Use the ASME standard for requirements at the time of doing an application. NEI 00-02 does not address this supporting requirement.
QU-F6(3)	NO		Use the ASME standard for requirements at the time of doing an application. NEI 00-02 does not address this supporting requirement.

ASME STD SR	ADDRESSED BY NEI 00-02?	APPLICABLE NEI 00-02 ELEMENTS(8)	Industry Self Assessment Actions
LERF ANALYSIS			
LE-A1	PARTIAL	AS-14, AS-21, AS-23, L2-7	Confirm that the specifics identified in LE-A1 are included in the PRA. NUREG/CR-6595 methodology is not adequate for Capability Category II and III. It is further noted that NEI 00-02 does not address criteria for the grouping into PDSs, i.e., there are no criteria provided as to what information has to be transferred from the Level 1 to the Level 2 analysis. L2-7 states the transfer from Level 1 to Level 2 should be done to maximize the transfer of relevant information, but does not specifically identify the type of information that must be transferred. L2-7 does refer to grouping sequences with similar characteristics and cautions care in transferring dependencies on accident conditions, equipment status and operator errors, In practice this step included review of the process for developing and binning the plant damage states (PDSs) and ensuring consistency between the PDSs and the plant state.
LE-A2	PARTIAL	L2-7, L2-8, AS-21	Confirm that the specifics identified in LE-A2 are included in the PRA. NUREG/CR-6595 methodology is not adequate for Capability Category II and III. It is noted that NEI 00-02 does not address criteria for the grouping into PDSs, i.e., there are no criteria provided as to what information has to be transferred from the Level 1 to the Level 2 analysis. L2-7 states the transfer from Level 1 to Level 2 should be done to maximize the transfer of relevant information, but does not identify the type of information that must be transferred.
LE-A3	PARTIAL	L2-7, L2-8	Confirm that the specifics identified in LE-A3 are included in the PRA. NUREG/CR-6595 methodology is not adequate for Capability Category II and III. It is further noted that NEI 00-02 does not address criteria for the grouping into PDSs, i.e., there are no criteria provided as to what information has to be transferred from the Level 1 to the Level 2 analysis. L2-7 states the transfer from Level 1 to Level 2 should be done to maximize the transfer of relevant information, but does not identify the type of information that must be transferred.

ASME STD SR	ADDRESSED BY NEI 00-02?	APPLICABLE NEI 00-02 ELEMENTS(8)	Industry Self Assessment Actions
LE-A4	PARTIAL	L2-7, L2-8, L2-9, L2-24, L2-25	Confirm that the specifics identified in LE-A4 are included in the PRA. NUREG/CR-6595 methodology is not adequate for Capability Category II and III. It is further noted that NEI 00-02 does not address criteria for the grouping into PDSs, i.e., there are no criteria provided as to what information has to be transferred from the Level 1 to the Level 2 analysis. L2-7 states the transfer from Level 1 to Level 2 should be done to maximize the transfer of relevant information, but does not identify the type of information that must be transferred.
LE-A5	PARTIAL	L2-7, L2-8, L2-9, L2-24, L2-25	Confirm the specifics identified in LE-A5 are included in the PRA. NUREG/CR-6595 methodology is not adequate for Capability Category II and III. It is further noted that NEI 00-02 does not address criteria for the grouping into PDSs, i.e., there are no criteria provided as to what information has to be transferred from the Level 1 to the Level 2 analysis. L2-7 states the transfer from Level 1 to Level 2 should be done to maximize the transfer of relevant information, but does not identify the type of information that must be transferred. L2-24 and L2-25 clearly indicate that the dependencies of systems, crew actions, and phenomena in the entire PRA need to be integrated into the model.
LE-B1	YES	L2-8, L2-10, L2-15, L2-16, L2-17, L2-19	None
LE-B2	YES	L2-13, L2-14	None
LE-B3(3)	NO		NEI 00-02 does not address this supporting requirement. Use the ASME PRA Standard for requirements.
LE-C1	YES	**L2-24**, L2-5, L2-8, L2-13, L2-14, L2-15, L2-16, L2-17, L2-19, L2-20	Confirm that the specifics identified in LE-C1 with regard to the basis for assigning sequences to the LERF and non-LERF category meet the intent of LE-C1.
LE-C2a	YES	L2-9, L2-12, L2-25	Confirm that the actions credited are supported by AOPs, EOPs, SAMGs, TSC guidance or other procedural or guidance information as noted in LE-C2a.

ASME STD SR	ADDRESSED BY NEI 00-02?	APPLICABLE NEI 00-02 ELEMENTS[8]	Industry Self Assessment Actions
LE-C2b[1]	PARTIAL	L2-9, L2-12, L2-25	Confirm that the specifics identified in LE-C2b are included in the PRA. Repair of equipment would be subsumed under recovery actions in L2-9 and L2-5. If credit was taken for repair, actual data and sufficient time must be available and justified.
LE-C3	PARTIAL	L2-8, L2-24, L2-25	Confirm that the justification for inclusion of any of the features listed in LE-C3 meet the revised requirements of LE-C3 in Addendum B of the ASME standard.
LE-C4	PARTIAL	L2-4, L2-5, L2-6	The self assessment needs to confirm the revised requirements of LE-C4 in Addendum B of the ASME Standard.
LE-C5	YES	AS-20, AS-21, L2-7, **L2-11**, L2-25	None
LE-C6	YES	**L2-12**, L2-24, L2-25	None
LE-C7	PARTIAL	L2-7, L2-11, L2-12, L2-24	Confirm that the requirements in LE-C7 are included in the PRA.
LE-C8a	PARTIAL	L2-11, L2-12	Confirm that the treatment of environmental impacts meet the revised requirements in LE-C8a in Addendum B of the ASME Standard.
LE-C8b[1]	PARTIAL	L2-11, L2-12	Confirm requirements of LE-C8b are implemented in the PRA.
LE-C9a	PARTIAL	AS-20, L2-11, L2-12, L2-16, L2-24, L2-25	Confirm that the treatment of environmental impacts meet the revised requirements of LE-C9a in Addendum B of the ASME Standard. NEI 00-02 does not differentiate between containment harsh environments and containment failure effects on systems and operators. This was typically addressed during peer reviews.
LE-C9b[1]	PARTIAL	AS-20, L2-11, L2-12, L2-16, L2-24, L2-25	Confirm the treatment of containment failure meets the revised requirements of LE-C9b. NEI 00-02 includes the effects of containment harsh environments and containment failure effects on systems and operators. This was typically verified during peer reviews.
LE-C10	PARTIAL	L2-7, L2-8, L2-13, L2-24, L2-25	The revised requirements of LE-C10 in Addendum B of the ASME Standard need to be considered in the self-assessment. Containment bypass is explicitly identified in the failure modes addressed by the LERF analysis.

ASME STD SR	ADDRESSED BY NEI 00-02?	APPLICABLE NEI 00-02 ELEMENTS[(8)]	Industry Self Assessment Actions
LE-D1a	PARTIAL	L2-14, L2-15, L2-16, L2-17, L2-18, L2-19, L2-20, ST-5, ST-6	Confirm that the containment performance analysis meets the revised requirements of LE-D1a in Addendum B of the ASME Standard.
LE-D1b[(1)]	PARTIAL	L2-14, L2-15, L2-16, L2-17, L2-18, L2-19, L2-20, ST-5, ST-6	Confirm requirements of LE-D1b are implemented.
LE-D2	PARTIAL	L2-14, L2-19	Confirm the requirements of LE-D2 are implemented. NEI 00-02 does not explicitly enumerate this supporting requirement. However, the containment failure analysis includes by its nature for Capability Category II the location of the failure mode. Therefore, both the analysis and the peer review have typically addressed this SR.
LE-D3	PARTIAL	IE-14, ST-9	Confirm the requirements of LE-D3 are implemented in accordance with Addendum B. In practice, peer review teams evaluated the ISLOCA frequency calculation. F&O's under IE and AS would be written if this was not adequate.
LE-D4	NO		NEI 00-02 does not address this supporting requirement. Use the ASME PRA Standard for Supporting Requirement LE-D4.
LE-D5	NO		NEI 00-02 does not address this supporting requirement. Use the ASME PRA Standard for Supporting Requirement LE-D5.
LE-D6	PARTIAL	L2-16, L2-18, L2-19, L2-24, L2-25	Confirm that the containment isolation treatment meets the revised requirements of LE-D6 in Addendum B of the ASME Standard. The guidance provided in NEI 00-02 does not explicitly enumerate the requirements in LE-D6. However, the PRAs were constructed to address the requirements of NUREG-1335 which explicitly required containment isolation evaluation. Therefore, the PRAs and the Peer Reviews have typically addressed this SR.
LE-E1	YES	L2-11, L2-12	None
LE-E2	PARTIAL	DA-4, HR-15, L2-12, L2-13, L2-17, L2-18, L2-19, L2-20	Confirm that the requirements of LE-E2 of Addendum B are met.
LE-E3[(3)]	NO		NEI 00-02 does not address this supporting requirement. Use the ASME PRA Standard for Supporting Requirement LE-E3.

ASME STD SR	ADDRESSED BY NEI 00-02?	APPLICABLE NEI 00-02 ELEMENTS(8)	Industry Self Assessment Actions
LE-E4(7)	PARTIAL	QU sub-elements applicable to LERF	The self-assessment needs to confirm that the parameter estimation meets the revised requirements of LE-E4 in Addendum B of the ASME Standard.
LE-F1a	YES	QU-8, QU-9, QU-10, QU-11, QU-31, **L2-26**	None
LE-F1b(1)	YES	**L2-26**	None
LE-F2	NO	QU-27, L2-26	NEI 00-02 does not address this supporting requirement. Use the ASME PRA Standard for Supporting Requirement LE-F2.
LE-F3(3)	NO		NEI 00-02 does not address this supporting requirement. Use the ASME PRA Standard for Supporting Requirement LE-F3.
LE-G1(2)	YES	L2-26, L2-27, L2-28	None
LE-G2(2)	PARTIAL	L2-26, L2-27, L2-28	In general, specified documentation items not explicitly addressed in NEI 00-02 checklists were addressed by the peer review teams. Action is to confirm availability of documentation. If not available, documentation may need to be generated to support particular applications or respond to NRC RAIs relative to applications.
LE-G3(2)	PARTIAL	L2-26, L2-27, L2-28	In general, specified documentation items not explicitly addressed in NEI 00-02 checklists were addressed by the peer review teams. Action is to confirm availability of documentation. If not available, documentation may need to be generated to support particular applications or respond to NRC RAIs relative to applications.
LE-G4(2)	PARTIAL	QU-27, QU-28, QU-29, QU-34	Confirm that the key assumptions and key sources of uncertainty consistent with the definitions of the ASME PRA Standard are documented.
LE-G5(2)	PARTIAL	L2-26, L2-27, L2-28	In general, specified documentation items not explicitly addressed in NEI 00-02 checklists were addressed by the peer review teams. Action is to confirm availability of documentation. If not available, documentation may need to be generated to support particular applications or respond to NRC RAIs relative to applications.
LE-G6(3)	NO		NEI 00-02 does not address this supporting requirement. Use ASME PRA Standard Addendum B SR LE-G6 for requirements.

<u>Notes to Appendix D2:</u>

(1) Subdivided from a previous SR in Addendum A. It is noted that Addendum B has subdivided a number of SRs for the purpose of clarifying and separating the assignment of Capability Category of the SR in a clearly delineated fashion.

(2) Revised to reflect new format for documentation section and SRs.

(3) New SR added.

(4) SR added to address multi-unit sites.

(5) Formerly IF-A2.

(6) Formerly IF-E2.

(7) Formerly LE-E3.

(8) It is noted that the NRC in RG 1.200 has identified in some cases the specific NEI 00-02 subelement that they consider to address the ASME PRA Standard Supporting Requirement. These designations are represented by “bold” entries in the attached tables.

Appendix 3

Peer Review Subtier Criteria

The subtier criteria are intended to support the self assessment process by documenting the distinctions among the grades for the PRA peer review process. The grades are categorized as follows:

Grade Category	Qualitative Characterization
2	Risk Ranking Prioritization
3	Risk-Informed Decisions
4	Risk-Based Decisions

Considerations for Table D3:

1. These subtier criteria were originally developed for BWR applications. Certain criteria may include BWR-specific terminology. Where appropriate, PWR guidance has been included.
2. For the purposes of the self assessment, the "risk-informed decisions" (grade 3) category of the following tables is of primary importance in comparing to Capability Category II of the ASME Standard. The other categories are provided for information and general consideration in performing the self assessment.
3. The lowest grade category (Grade 1) has not been explicitly broken out with separate subtier criteria. By process of elimination, it can be assumed that if the PSA being reviewed is inadequate to meet Grade 2, then it would be placed in Grade 1 or possibly be identified as "Not Applicable", if the particular criteria does not apply.

This Appendix consists of a series of tables, titled to correspond to the peer review process technical elements. Each table provides the subtier criteria for the specific element.

Table	Element
D3-1	Initiating Event Assessment
D3-2	Accident Sequence Evaluation
D3-3	Success Criteria and Thermal Hydraulic Analysis
D3-4	Systems Analysis
D3-5	Data Analysis
D3-6	Human Reliability Analysis
D3-7	Structural Response
D3-8	Quantification & Results Interpretation
D3-9	Level 2/LERF Evaluation

Table D3-1

INDUSTRY PRA PEER REVIEW SUBTIER CRITERIA: INITIATING EVENT

Designat-or	CRITERIA	SUBTIER CRITERIA		
		Risk Ranking Prioritization	Risk-Informed Decisions	Risk-Based Decisions
IE-1	GUIDANCE • Describes the process used	General description of the initiating event process is provided.	The documentation of the initiating events and its quantification should be sufficiently well described in the documented results to act as guidance for future updates and revisions.	A specific guidance document should be available that specifies the process for initiating event development and quantification including the updating process.
IE-2	• Consistent with industry practices	General adherence to accepted industry approaches is included	The guidance should provide a reasonable basis for performing the initiating event analysis and should maintain consistency with proven approaches.	The guidance for initiating event analyses should be complete and detailed and should maintain consistency with proven approaches.
IE-3	• Sufficient detail provided for reproducing the evaluation	Guidance may be available to supply general approaches used.	The guidance should be sufficient to provide a means to obtain equivalent results.	The guidance shall be sufficiently detailed to reproduce the results.
IE-4	IDENTIFICATION AND GROUPING • Grouped initiators by plant response consistent with event tree structure and success criteria.	Grouping criteria from Risk Significance apply except there may be a relatively high level of conservatism encountered by subsuming initiating events into broad categories.	Grouping of initiating events should be performed only when the following can be assured: • Events can be considered similar in terms of: - Plant response - success criteria - timing - recovery probability OR • Events can be subsumed into a group and bounded by the worst case impacts within the "new" group, however, to avoid excess conservatism the event frequency for subsumed events should not be negligible within a group AND its consequences far worse than other group contributors	Criteria from Risk Significance apply except grouping of initiating events should be minimized to the maximum practical extent to limit conservatisms in the best estimate model.

Table D3-1

INDUSTRY PRA PEER REVIEW SUBTIER CRITERIA: INITIATING EVENT

Designat-or	CRITERIA	SUBTIER CRITERIA		
		Risk Ranking Prioritization	Risk-Informed Decisions	Risk-Based Decisions
			Initiating events with significantly different plant response impacts or which may have more severe radionuclide release potential (e.g., LERF) should be treated separately from other initiating event groups. This includes such initiators as: • excessive LOCA • ISLOCA • Unisolated breaks outside containment Non-conservative grouping (subsuming of initiators into broader categories not bounded by the worst case accident) shall not be performed.	
IE-5	• The class of initiating events that is caused by failure of part or all of a system that supports the front-line safety function are addressed: - Cooling water systems (e.g., service water, component cooling water, etc.) - AC Power - DC Power - HVAC - Instrument/ Station Air	Addressing support system failures may include truncation or subsuming within broader groups if it can be shown that the quantitative contribution is expected to be small.	Support system failures should be quantitatively included in the PSA in a realistic fashion. This means that the individual support systems (or trains) that can cause a scram should be treated explicitly in the initiating event quantification.	In addition to the risk significance requirements, detailed fault tree quantifications should be included in the model for quantification. This quantification should be checked against plant specific and generic data and any significant discrepancies identified including a technical bases for resolution identified. Model initiating events (especially those that result from the loss of support systems) using a fault tree (or equivalent) approach so that system dependencies are fully understood and accounted for.

Table D3-1

INDUSTRY PRA PEER REVIEW SUBTIER CRITERIA: INITIATING EVENT

Designat-or	CRITERIA	SUBTIER CRITERIA		
		Risk Ranking Prioritization	Risk-Informed Decisions	Risk-Based Decisions
IE-6	• For multi-unit sites with shared systems, the impact of initiators requiring simultaneous response (e.g., LOOP, loss of cooling source due to ice, loss of an AC or DC bus, etc.) are included.	Multi-unit sites with shared systems should acknowledge that dual unit initiators may impact the model. A qualitative evaluation should be performed.	Multi-unit site initiators such as dual unit LOOP events or total loss of service water should be treated and quantified explicitly.	Multi-unit site initiators such as dual unit LOOP events or total loss of service water should be treated and quantified explicitly
IE-7	• Initiators considered cover the spectrum of internal event challenges	A structured process for identifying initiating event groups may be used. The spectrum of internal event challenges may include the following general categories and within each category should be quantitatively incorporated in the model: • Transients - Separate events with different impacts on PCS and PCS recovery - LOOP/SBO - Manual Shutdowns • LOCAs - Small - Medium -- Include stuck open safeties (to the drywell) - Large -- Include inadvertent ADS -- Include component ruptures	A structured process for identifying initiating event groups should be used. The spectrum of internal event challenges should include the following general categories and within each category should be quantitatively incorporated in the model: • Transients - Separate events with different impacts on PCS and PCS recovery - LOOP/SBO - Manual Shutdowns • LOCAs - Small - Medium -- Include stuck open safeties (to the drywell) - Large -- Include inadvertent ADS -- Include component ruptures	A structured process for identifying initiating event groups shall be used. The spectrum of internal event challenges shall include at least the following general categories and within each category should be quantitatively incorporated in the model: • Transients - Separate events with different impacts on PCS and PCS recovery - LOOP/SBO - Manual Shutdowns • LOCAs - Small - Medium -- Include stuck open safeties (to the drywell) - Large -- Include inadvertent ADS -- Include component ruptures

Table D3-1

INDUSTRY PRA PEER REVIEW SUBTIER CRITERIA: INITIATING EVENT

Designat-or	CRITERIA	SUBTIER CRITERIA		
		Risk Ranking Prioritization	Risk-Informed Decisions	Risk-Based Decisions
IE-7 (cont'd)		- Excessive LOCA -- Include RPV Rupture - LOCAs Outside Containment -- BOC -- ISLOCA • Special Initiators - Support system failures - Instrument line breaks Internal Flood contributors may be quantified for all non-screened compartments	- Excessive LOCA -- Include RPV Rupture - LOCAs Outside Containment -- BOC -- ISLOCA • Special Initiators - Support system failures - Instrument line breaks Internal Flood contributors should be quantified for all non-screened compartments	- Excessive LOCA -- Include RPV Rupture - LOCAs Outside Containment -- BOC -- ISLOCA • Special Initiators - Support system failures - Instrument line breaks Internal Flood contributors should be quantified for all non-screened compartments
IE-8	• All experienced initiators are accounted for in the model	Qualitatively assess the operating experience reviews cited in the Risk Significance requirements. Incorporate those events that are considered important. Document the dismissal of any observed events, including any credit for rectification.	Qualitatively reflect in the model the results of the following: • A review of plant specific operating experience of all initiators should be performed qualitatively to assess whether the list of challenges accounts for plant experience • A review of similar plants should be performed to assess whether the list of challenges included in the model accounts for industry experience.	Qualitatively reflect in the model the results of the following: • A review of plant specific operating experience of all initiators should be performed qualitatively to assess whether the list of challenges accounts for plant experience • A review of similar plants should be performed to assess whether the list of challenges included in the model accounts for industry experience.
IE-9	• If typical initiators cited in NUREG-1150 or industry PSAs have been excluded, the basis is documented	Exclusion of initiators previously identified in the industry PSAs or NUREG-1150 are justified qualitatively.	Initiators previously identified in industry PSAs NUREG-1150 should be included.	Initiators previously identified in industry PSAs NUREG-1150 shall be included if applicable.

Table D3-1

INDUSTRY PRA PEER REVIEW SUBTIER CRITERIA: INITIATING EVENT

Designat-or	CRITERIA	SUBTIER CRITERIA		
		Risk Ranking Prioritization	Risk-Informed Decisions	Risk-Based Decisions
IE-10	• A structured approach for plant support systems is performed to determine if a loss of support system initiator presents a unique challenge to the plant	At least a qualitative review of system impacts should be performed	A Structured Approach (such as a system by system review of initiating event potential, or an FMEA or fault tree) should be used to assess and document the possibility of an initiating event resulting from support system failures. The search for initiating events should consider initiating event precursors and should consider each system alignment and alignments of supporting systems.	A detailed model of system interfaces including fault tree development should be performed. An FMEA shall be performed to assess and document the possibility of an initiating event resulting from individual systems or train failures.
IE-11	<u>Subsumed Initiating Events</u> • Treatment of subsumed initiating events is traceable		The documentation should provide a detailed accounting of discrete plant upsets and how they transfer into the final initiating event categories, including a focus on numerical details.	The documentation should provide a detailed accounting of discrete plant upsets and how they transfer into the final initiating event categories, including a focus on numerical details.
IE-12	• Subsumed initiating events are included <u>OR</u> • Subsumed initiating events are included, in non-risk significant sequences or non-risk significant initiators <u>OR</u> Complete list of initiating events within the state of the technology. Detailed plant specific development.	Subsumed initiating events are included	Subsumed initiating events are included, in non-risk significant sequences or non-risk significant initiators	Complete list of initiating events within the state of the technology. Detailed plant specific development.

Table D3-1

INDUSTRY PRA PEER REVIEW SUBTIER CRITERIA: INITIATING EVENT

Designat-or	CRITERIA	SUBTIER CRITERIA		
		Risk Ranking Prioritization	Risk-Informed Decisions	Risk-Based Decisions
IE-13	<u>DATA</u> • Initiating event frequencies and recovery are consistent with industry experience or analysis	The process for comparing initiating events and recovery probabilities may be formalized and documented. The results of the initiating event analysis may be compared with generic data sources to provide a reasonableness check of the quantitative and qualitative results.	The process for comparing initiating events and recovery probabilities should be formalized and documented. The calculated frequencies and any associated recovery should be consistent with industry experience unless a design or procedural difference exists that would provide the basis for a difference. The results of the initiating event analysis should be compared with generic data sources to provide a reasonableness check of the quantitative and qualitative results. A documented review/comparison with industry generic data should be performed.	The process for comparing initiating events and recovery probabilities shall be formalized and the results documented for review by the peer review process. The calculated frequencies and any associated recovery should be consistent with industry experience unless a design or procedural difference exists that would provide the basis for a difference. The results of the initiating event analysis shall be compared with generic data sources to provide a reasonableness check of the quantitative and qualitative results. A documented review/comparison with industry generic data should be performed.
IE-14	• The features that lead to the frequency of interfacing system LOCA (e.g., surveillance test practices, start up procedures, etc.) are modeled explicitly or identified in the PSA documentation.	Interfacing system LOCA analysis may address the most dominant features of plant and procedures that may influence the ISLOCA frequency.	Interfacing system LOCA analysis should address the most dominant features of plant and procedures that may influence the ISLOCA frequency.	The ISLOCA frequency should explicitly address the plant and procedural features that influence the calculation: • Surveillance procedure steps should be evaluated • Surveillance test intervals should be explicitly included • One-line surveillance testing should be quantitatively assessed • Pipe rupture probability should be quantified • Valve design (e.g., air operated testable check valves) are explicitly addressed • Valve isolation capability given the high to low pressure differential should be quantitatively included

Table D3-1

INDUSTRY PRA PEER REVIEW SUBTIER CRITERIA: INITIATING EVENT

Designat-or	CRITERIA	SUBTIER CRITERIA		
		Risk Ranking Prioritization	Risk-Informed Decisions	Risk-Based Decisions
IE-15	• Plant specific features are reflected in the initiating event frequency and recovery inputs where appropriate	For rare events, industry generic data may be used or augmented with a plant specific fault tree evaluation which accounts for plant specific features. For extremely rare events, engineering judgment may be used augmented by applicable generic data sources.	The plant specific features that may influence initiating events and recovery probabilities should be included in the quantification. Examples of plant specific features which should be included are the following: • Plant geography for LOOP and LOOP recovery • Service water intake characteristics and plant experience • LOCA frequency calculation For rare events, industry generic data should be used or augmented with a plant specific fault tree evaluation which accounts for plant specific features. For extremely rare events, engineering judgment may be used and should be augmented by applicable generic data sources.	The plant specific features that may influence initiating events and recovery probabilities should be included in the quantification. Examples of plant specific features which should be included: • Plant location for LOOP and LOOP recovery • Service water intake characteristics and plant experience • LOCA frequency calculation For rare events, industry generic data shall be investigated and its appropriateness evaluated. In addition, a plant specific fault tree evaluation which accounts for plant specific features shall be developed. The use of the generic data or the fault tree shall be documented and the comparison provided. For extremely rare events, engineering judgment may be used and should be augmented by applicable generic data sources.

Table D3-1

INDUSTRY PRA PEER REVIEW SUBTIER CRITERIA: INITIATING EVENT

Designat-or	CRITERIA	SUBTIER CRITERIA		
		Risk Ranking Prioritization	Risk-Informed Decisions	Risk-Based Decisions
IE-16	• Plant specific experience is <u>reflected</u> in the initiating event definitions and frequency plus recovery inputs where appropriate	Plant specific data may be used to characterize the initiating event frequency. Recovery probabilities may reflect plant specific features of procedures.	The initiating event frequency should be calculated directly from plant specific data, if sufficient data is available. The initiating event frequency should use the most recent available data to quantitatively characterize the initiating event frequencies. Rectification actions that are credited should be documented. The initiating event frequency should use a Bayesian update process of generic industry data if only limited data is available. The initiating event frequency should not use data from the initial year of commercial operation. Recovery data may be even more difficult to justify. However, plant specific information should be used in the assessment where available.	Plant specific data shall be used for all initiating events that have occurred. The initiating event frequency should use the most recent available data to quantitatively characterize the initiating event frequencies. Rectification actions that are credited should be documented. The initiating event frequency should use a Bayesian update process of generic industry data if only limited data is available. The initiating event frequency should not use data from the initial year of commercial operation. Recovery data may be even more difficult to justify. However, plant specific information should be used in the assessment where available.
IE-17	• A systematic process is used to identify the need for and application of techniques such as plant specific models or FMEAs, to quantify initiating event frequencies and recovery. (See also SY-21)	A systematic qualitative evaluation of each system should be performed to assess the possibility of an initiating event occurring due to the system.	A systematic evaluation should be performed to ascertain whether a technique such as an FMEA or fault tree should be developed for a given system with the intent of identifying whether an initiating event should be included for the given system or train.	A systematic evaluation should be performed using a defined process (FMEA or Fault tree analysis) to assess the possibility of an initiating event due to each plant system and train.
IE-18	<u>DOCUMENTATION</u> • Documentation provides the basis of the quantified values and is traceable	The initiating event frequencies shall be documented.	Documentation should provide the derivation of the initiating event frequencies and the recoveries used in conjunction with the initiating event.	Documentation should provide the derivation of the initiating event frequencies and the recoveries used in conjunction with the initiating event.

Table D3-1

INDUSTRY PRA PEER REVIEW SUBTIER CRITERIA: INITIATING EVENT

Designat-or	CRITERIA	SUBTIER CRITERIA		
		Risk Ranking Prioritization	Risk-Informed Decisions	Risk-Based Decisions
IE-19	• Documentation reflects the process used	Documentation may reflect process features.	Documentation should provide the basis for meeting each of the criteria IE-4 through IE-17. The documentation shall describe the results consistent with the process.	Documentation shall provide the basis for meeting each of the criteria IE-4 through IE-17. The documentation shall describe the results consistent with the process.
IE-20	• Documentation provides the basis for the initiating event frequency groupings	The initiating event analysis should be reviewed.	Documentation should provide the basis for grouping of initiating events.	Documentation shall provide the basis for grouping of initiating events.
IE-21	• Independent review provided for the documented results	The initiating event analysis should be reviewed.	Independent review should be performed and documented by knowledgeable personnel.	Independent review should be performed and documented by knowledgeable personnel. Independent review of the initiating event interpretation and categorization process should be performed by operations personnel or equivalent.

Table D3-2

INDUSTRY PRA PEER REVIEW SUBTIER CRITERIA: ACCIDENT SEQUENCE EVALUATION

Designator	CRITERIA	SUBTIER CRITERIA		
		Risk Ranking	Risk Significance	Risk Input as Sole Basis
AS-1	GUIDANCE • Describes the process used	General description of the accident sequence analysis process is provided.	The documentation of the accident sequence analysis should be sufficiently well described in the documented results to act as guidance for future updates and revisions.	A specific guidance document should be available that specifies the process for accident sequence analysis including the updating process.
AS-2	• Consistent with industry practices	General adherence to accepted industry approaches is included.	The guidance should provide a reasonable basis for performing the accident sequence analysis and should maintain consistency with proven approaches.	The guidance for accident sequence analysis should be complete and detailed and should maintain consistency with proven approaches.
AS-3	• Sufficient detail provided for reproducing the evaluation	Guidance may be available to supply general approaches used.	The guidance should be sufficient to provide a means to obtain equivalent results.	The guidance shall be sufficiently detailed to reproduce the results.
AS-4	ACCIDENT SCENARIO EVALUATION • The event trees reflect the initiating event groupings	Event trees should reflect the initiating event groups. The plant response to the different initiating event groups shall be modeled. This includes: timing, system success criteria, operator actions. There should be a direct correlation between the initiating event groups and the event tree modeled response. Note: while event trees should be developed, other logic models may be justified to replace the event tree structure (e.g., single top fault tree).	Event trees shall reflect the initiating event groups. The plant response to the different initiating event groups shall be modeled. This includes: timing, system success criteria, operator actions. There should be a direct correlation between the initiating event groups and the event tree modeled response. The event trees should reflect the initiating events and their potential for impact on mitigation systems. Note, while event trees should be developed, other logic models may be justified to replace the event tree structure (e.g., single top fault tree).	Event trees shall reflect the initiating event groups. The plant response to the different initiating event groups shall be modeled. This includes: timing, system success criteria, operator actions. There should be a direct correlation between the initiating event groups and the event tree modeled response. The event trees should reflect the initiating events and their potential for impact on mitigation systems. Note: While event trees should be developed, other logic models may be justified to replace the event tree structure (e.g., single top fault tree).

Table D3-2

INDUSTRY PRA PEER REVIEW SUBTIER CRITERIA: ACCIDENT SEQUENCE EVALUATION

Designator	CRITERIA	SUBTIER CRITERIA		
		Risk Ranking	Risk Significance	Risk Input as Sole Basis
AS-5	• The models and analysis are consistent with the as-built plant (as could be confirmed during the Peer Review process)(6)	The models and analysis should be consistent with the as-built plant. Conservative modeling of the as-built plant may result from lack of available information. System analysis and dependency evaluation tasks of the PRA shall provide input to the accident sequence model development.	The models and analysis shall be consistent with the as-built plant. Realistic modeling of the as-built plant should be performed as supported by available information. System analysis and dependency evaluation tasks of the PRA shall provide input to the accident sequence model development.	The models and analysis shall be consistent with the as-built plant. Realistic modeling of the as-built plant shall be performed as supported by available information. System analysis and dependency evaluation tasks of the PRA shall provide input to the accident sequence model development.
AS-6	• The necessary critical safety functions are modeled in each sequence	The necessary critical safety functions to reach a safe stable state shall be included in the model. Critical safety functions may be addressed quantitatively or qualitatively in the PRA. Typical critical safety functions that may be left out of a risk ranking model may include: • Vapor Suppression • RPT • ARI • Containment heat removal following: - successful ATWS mitigation - successful AC power recovery	The necessary critical safety functions to reach a safe stable state shall be included in the model. Each necessary critical safety function should be explicitly included in the quantitative model. Exceptions to the critical safety functions should be clearly defined.	The necessary critical safety functions to reach a safe stable state shall be included in the model. Each necessary critical safety function shall be explicitly included in the quantitative model. Exceptions to the critical safety functions should be clearly defined.
AS-7	• All relevant systems are credited for each function	All relevant systems may be included quantitatively in the model.	All relevant systems should be credited in the quantified model.	All relevant systems to support the critical safety functions shall be included in the quantified model.

Table D3-2

INDUSTRY PRA PEER REVIEW SUBTIER CRITERIA: ACCIDENT SEQUENCE EVALUATION

Designator	CRITERIA	SUBTIER CRITERIA		
		Risk Ranking	Risk Significance	Risk Input as Sole Basis
AS-8	• The branching structure and transfers among event trees maintain and resolve the failure paths	The branching structure and transfers among event trees should maintain and resolve the failure paths. A reasonably complete set of event sequences involving core damage that could result from each modeled initiating event should be developed. The level of discrimination in the event tree structure should be sufficient to represent the key procedurally directed operator actions and critical safety function challenges. The transfers among event trees should preserve the dependencies that are part of the transferred sequence. This includes functional, system, initiating event, operator, and spatial or environmental dependencies.	The branching structure and transfers among event trees shall maintain and resolve the failure paths. Transfers between event trees should be clearly defined and may be treated quantitatively or qualitatively. A reasonably complete set of event sequences involving core damage that could result from each modeled initiating event shall be developed. The level of discrimination in the event tree structure should be sufficient to represent the key procedurally directed operator actions and critical safety function challenges. The transfers among event trees should preserve the dependencies that are part of the transferred sequence. This includes functional, system, initiating event, operator, and spatial or environmental dependencies.	The branching structure and transfers among event trees shall maintain and resolve the failure paths. Transfers between event trees shall be clearly defined and treated quantitatively. A reasonably complete set of event sequences involving core damage that could result from each modeled initiating event shall be developed. The level of discrimination in the event tree structure should be sufficient to represent the key procedurally directed operator actions and critical safety function challenges. The transfers among event trees should preserve the dependencies that are part of the transferred sequence. This includes functional, system, initiating event, operator, and spatial or environmental dependencies.
AS-9	• Success paths are defined correctly	Success paths shall be defined correctly. Conservative bias to the treatment of success paths may be included.	Success paths shall be defined correctly. Realistic treatment of success paths should be implemented.	Success paths shall be defined correctly. Realistic treatment of success paths shall be implemented.

Table D3-2

INDUSTRY PRA PEER REVIEW SUBTIER CRITERIA: ACCIDENT SEQUENCE EVALUATION

Designator	CRITERIA	SUBTIER CRITERIA		
		Risk Ranking	Risk Significance	Risk Input as Sole Basis
AS-10	• Dependencies among top events are identified and addressed	Dependencies among top events should be identified and may be treated quantitatively or qualitatively. Accident sequence dependencies may be accounted for: Functional: Functional failures due to the accident sequence may be addressed, e.g.: a) LOCA initiator causes debris clogging of ECCS Suction b) turbine driven system dependency on SORV, depressurization, and containment heat removal (suppression pool cooling). c) low pressure system injection success dependent on need for RPV depressurization. Intra and Intersystem: Common cause may be treated per dependency criteria. System dependencies can be assessed in system notebooks, dependency matrices, or linked fault trees. Human: Adverse environment or sequence timing influences on operator actions may be included in the HRA. Spatial/Environmental: Spatial/ Environmental dependencies that may result from initiating events and subsequent sequences may be included in the accident sequence evaluation.	Dependencies among top events shall be identified and should be included quantitatively in the model. Accident sequence dependencies should be accounted for: Functional: Functional failures due to the accident sequence should be addressed, e.g.: a) LOCA initiator causes debris clogging of ECCS Suction b) turbine driven system dependency on SORV, depressurization, and containment heat removal (suppression pool cooling). c) low pressure system injection success dependent on need for RPV depressurization. Intra and Intersystem: Common cause should be treated per dependency criteria. System dependencies should be assessed in system notebooks, dependency matrices, or linked fault trees. Human: Adverse environment or sequence timing influences on operator actions should be included in the HRA. Spatial/Environmental: Spatial/Environmental dependencies that may result from initiating events and subsequent sequences should be included in the accident sequence evaluation.	Dependencies among top events shall be identified and shall be quantitatively included in the model. Accident sequence dependencies shall be accounted for: Functional: Functional failures due to the accident sequence shall be addressed, e.g.: a) LOCA initiator causes debris clogging of ECCS Suction b) turbine driven system dependency on SORV, depressurization, and containment heat removal (suppression pool cooling). c) low pressure system injection success dependent on need for RPV depressurization. Intra and Intersystem: Common cause shall be treated per dependency criteria. System dependencies shall be assessed in system notebooks, dependency matrices, or linked fault trees. Human: Adverse environment or sequence timing influences on operator actions shall be included in the HRA. Spatial/Environmental: Spatial/ Environmental dependencies that may result from initiating events and subsequent sequences shall be included in the accident sequence evaluation.
AS-11	• The method of treating dependencies is documented and consistently applied to capture the dependencies among top events.	The method of treating dependencies should be documented and consistently applied to capture the dependencies among top events. Conservative bias to the treatment of dependencies may be incorporated into the model.	The method of treating dependencies should be documented and consistently applied to capture the dependencies among top events. A realistic treatment of the dependencies should be implemented.	The method of treating dependencies shall be documented and consistently applied to capture the dependencies among top events. A realistic treatment of the dependencies shall be implemented.

Table D3-2

INDUSTRY PRA PEER REVIEW SUBTIER CRITERIA: ACCIDENT SEQUENCE EVALUATION

Designator	CRITERIA	SUBTIER CRITERIA		
		Risk Ranking	Risk Significance	Risk Input as Sole Basis
AS-12	• PWRs: An appropriate model for the reactor coolant pump seal LOCA, which may result from a loss of seal cooling due to various causes, is used and documented. Appropriate seal cooling dependencies are considered. OR BWRs: The recirculation pump seal LOCA which may result after a loss of offsite power, or a loss of seal cooling is addressed for the isolation condenser plants	Pump seal LOCA should be explicitly incorporated in the PSA model.	Pump seal LOCA should be explicitly incorporated in the PSA model.	Pump seal LOCA shall be explicitly incorporated in the model.
AS-13	• Time phased evaluation is included for sequences with significant time dependent failure modes (e.g., batteries for SBO, PWR RCP seal LOCA) and significant recoveries (e.g., AC recovery for SBO)	Time phased analysis for accident sequences with well defined potential for recovery may be included in the quantified model.	Time phased analysis for accident sequences with well defined potential for recovery should be included in the quantified model.	Time phased analysis for accident sequences with well defined potential for recovery shall be included in the quantified model.

Table D3-2

INDUSTRY PRA PEER REVIEW SUBTIER CRITERIA: ACCIDENT SEQUENCE EVALUATION

Designator	CRITERIA	SUBTIER CRITERIA		
		Risk Ranking	Risk Significance	Risk Input as Sole Basis
AS-13 (cont'd)			The following time phased events may be included in a realistic assessment of the accident sequences and the procedurally directed operator actions resulting for LOOP/SBO; • AC power recovery • DC battery adequacy (time dependent discharge) • Environmental conditions (e.g., room cooling) for operating equipment and the control room • Suppression pool temperature (i.e., HCTL) • Containment pressure • CST inventory • Drywell temperature • Recirc Pump Seal Failure • RPV Pressure (as it is needed for turbine driven systems IC effectiveness, low pressure injection systems) • Isolation Condenser Makeup Similarly, for ATWS/failure to scram events, key time dependent actions which may be included: • SBLC initiation • RPV level control • ADS inhibit	The following time phased events should be included in a realistic assessment of the accident sequences and the procedurally directed operator actions resulting for LOOP/SBO; • AC power recovery • DC battery adequacy (time dependent discharge) • Environmental conditions (e.g., room cooling) for operating equipment and the control room • Suppression pool temperature (i.e., HCTL) • Containment pressure • CST inventory • Drywell temperature • Recirc Pump Seal Failure • RPV Pressure (as it is needed for turbine driven systems IC effectiveness, low pressure injection systems) • Isolation Condenser Makeup Similarly, for ATWS/failure to scram events, key time dependent actions which should be included: • SBLC initiation • RPV level control • ADS inhibit

Table D3-2

INDUSTRY PRA PEER REVIEW SUBTIER CRITERIA: ACCIDENT SEQUENCE EVALUATION

Designator	CRITERIA	SUBTIER CRITERIA		
		Risk Ranking	Risk Significance	Risk Input as Sole Basis
			Other events that may be subject to strong time dependent characterization include: • CRD as an adequate RPV injection source As part of the time dependence assessment, the following should be addressed: • Mission time of diesel generators • Mission time of RPT, ARI, scram system	Other events that may be subject to strong time dependent characterization include: • CRD as an adequate RPV injection source As part of the time dependence assessment, the following should be addressed: • Mission time of diesel generators • Mission time of RPT, ARI, scram system
AS-14	• Functions and structure are adequate to discriminate among plant conditions necessary for Level 2 analysis	LERF only should be able to be determined from the Level 1 end state results.	LERF shall be able to be determined from the Level 1 end state results. Accident sequences with significantly different plant response impacts or which may have more severe radionuclide release potential (e.g., LERF) should be treated explicitly. This includes: • excessive LOCA • ATWS • ISLOCA • Breaks in high energy lines outside containment These should be evaluated in a realistic manner and have the capability to be assessed in sensitivity studies. Non-conservative grouping (subsuming of sequences into broader categories not bounded by the worst case accident) shall not be performed.	LERF shall be able to be determined from the Level 1 end state results. Accident sequences with significantly different plant response impacts or which may have more severe radionuclide release potential (e.g., LERF) should be treated explicitly. This includes: • excessive LOCA • ATWS • ISLOCA • Breaks in high energy lines outside containment These shall be evaluated in a realistic manner and have the capability to be assessed in sensitivity studies. Non-conservative grouping (subsuming of sequences into broader categories not bounded by the worst case accident) shall not be performed.

Table D3-2

INDUSTRY PRA PEER REVIEW SUBTIER CRITERIA: ACCIDENT SEQUENCE EVALUATION

Designator	CRITERIA	SUBTIER CRITERIA		
		Risk Ranking	Risk Significance	Risk Input as Sole Basis
AS-15	Transfers among event trees are performed correctly to avoid loss of information in the transfer	Transfers among event trees should be explicitly treated in the quantification except for cases that are noted in the documented descriptions of the sequences. Treatment of single top fault tree as the base model shall conform to all applicable requirements. Requirements that cannot be met should be identified and justification provided.	Transfers among event trees should be explicitly treated in the quantification and shall be documented. Treatment of single top fault tree as the base model shall conform to all applicable requirements. Requirements that cannot be met should be identified and justification provided.	Transfers among event trees shall be explicitly treated in the quantification and documented. Treatment of single top fault tree as the base model shall conform to all applicable requirements. Requirements that cannot be met should be identified and justification provided.
AS-16	System/component repair and recovery, if included in the accident sequences, are correctly modeled	Conservative evaluations of repair and recovery may be incorporated in the model.	Repair and recovery included in the PSA model should be based on data or accepted models applicable to the plant and should account for accident sequence dependencies such as time available, adverse environment, and lack of access, lighting, or room cooling.	Repair and recovery included in the PSA model shall be based on data or accepted models applicable to the plant and shall account for accident sequence dependencies such as time available, adverse environment, and lack of access, lighting, or room cooling.
AS-17	SUCCESS CRITERIA • Functional success criteria are identified	Functional success criteria should be identified and documented. The critical safety functions that should have technical bases developed to support the probabilistic analyses include the following: • Reactivity Control - Control Rods - Boron Injection - RPV Water Level Control • RPV Makeup Injection for Core Cooling - High Pressure Injection - Low Pressure Injection - Depressurization - Containment Flooding	Functional success criteria should be identified and documented. The critical safety functions that should have technical bases developed to support the probabilistic analyses include the following: • Reactivity Control - Control Rods - Boron Injection - RPV Water Level Control • RPV Makeup Injection for Core Cooling - High Pressure Injection - Low Pressure Injection - Depressurization - Containment Flooding	Functional success criteria shall be identified and documented. The critical safety functions that shall have technical bases developed to support the probabilistic analyses include the following: • Reactivity Control - Control Rods - Boron Injection - RPV Water Level Control • RPV Makeup Injection for Core Cooling - High Pressure Injection - Low Pressure Injection - Depressurization - Containment Flooding

Table D3-2

INDUSTRY PRA PEER REVIEW SUBTIER CRITERIA: ACCIDENT SEQUENCE EVALUATION

Designator	CRITERIA	SUBTIER CRITERIA		
		Risk Ranking	Risk Significance	Risk Input as Sole Basis
		• RPV Pressure Control - SRVs/SVs/TBVs - Feedwater Trip - RPT - ARI - Control rods - IC • Containment Pressure Control - Vapor Suppression - Containment Heat Removal - Containment Venting	• RPV Pressure Control - SRVs/SVs/TBVs - Feedwater Trip - RPT - ARI - Control rods - IC • Containment Pressure Control - Vapor Suppression - Containment Heat Removal - Containment Venting	• RPV Pressure Control - SRVs/SVs/TBVs - Feedwater Trip - RPT - ARI - Control rods - IC • Containment Pressure Control - Vapor Suppression - Containment Heat Removal - Containment Venting
AS-18	<u>SUCCESS CRITERIA BASES</u> • Success criteria are consistent with generic and realistic analyses but may be conservative <u>OR</u> • Success criteria are based on realistic thermal hydraulic analyses <u>OR</u> • Success criteria reflect plant specific thermal hydraulic analysis	Success criteria should be consistent with generic and realistic analyses but may be conservative. The success criteria used for the initiating event group and its associated event tree shall represent the most limiting of the initiating events and system failures encompassed by the initiating event group and accident sequence representation. The TH Element addresses the technical bases to support these success criteria.	Success criteria should be based on realistic thermal hydraulic analyses. The success criteria used for the initiating event group and its associated event tree shall represent the most limiting of the initiating events and system failures encompassed by the initiating event group and accident sequence representation. The TH Element addresses the technical bases to support these success criteria.	Success criteria should reflect realistic plant specific thermal hydraulic analysis. The success criteria used for the initiating event group and its associated event tree shall represent the most limiting of the initiating events and system failures encompassed by the initiating event group and accident sequence representation. The TH Element addresses the technical bases to support these success criteria.

Table D3-2

INDUSTRY PRA PEER REVIEW SUBTIER CRITERIA: ACCIDENT SEQUENCE EVALUATION

Designator	CRITERIA	SUBTIER CRITERIA		
		Risk Ranking	Risk Significance	Risk Input as Sole Basis
AS-19	<u>INTERFACE WITH EOPs/AOPs</u> • Reflects the EOPs and AOPs. (The functions and structure of the event trees are consistent with the EOPs and abnormal procedures). (See also SY-5)	The functions and structure of the event trees should be consistent with the EOPs and abnormal procedures. Exceptions may be noted; or level of detail may be less deep.	The functions and structure of the event trees shall be consistent with the EOPs and abnormal procedures. Procedurally directed operator actions (both positive and negative impacts) that substantially influence the accident sequence progression or its probability should be accounted for in the accident sequence structure or the supporting fault tree analysis. This should include operator training input on the interpretation of proceduralized steps.	(The functions and structure of the event trees shall be consistent with the EOPs and abnormal procedures). Procedurally directed operator actions (both positive and negative impacts) that substantially influence the accident sequence progression or its probability shall be accounted for in the accident sequence structure or the supporting fault tree analysis. This shall include operator training input on the interpretation of proceduralized steps.
AS-20	<u>ACCIDENT SEQUENCE END-STATES (PLANT DAMAGE STATES)</u> [(5)] • The development of plant damage states, their relationship to functional failures, and their relationship to Level 1 event tree end states or linked fault tree cut sets is documented.	The Level 1 end state shall be clearly defined as core damage or a safe stable state. The core damage definition may be consistent with the PSA Applications Guide. The PSA Applications Guide has identified definitions of core damage that would meet the intent of a core damage to be used for PRA applications as follows: • Collapsed liquid level less than 1/3 core height (BWR) • Collapsed liquid level below top of active fuel (PWR) • Core peak nodal temperature > 1800°F • Core exit thermocouple reading > 1200°F (PWR) • Core maximum fuel temperature approaching 2200°F Other end states such as “core vulnerable” should be resolved into core damage or safe stable states. This resolution should clearly address the treatment of the impact of containment failure or vent on continued RPV makeup capability.	The Level 1 end state shall be clearly defined as core damage or a safe stable state. The core damage definition should be consistent with the PSA Applications Guide. The PSA Applications Guide has identified definitions of core damage that would meet the intent of a core damage to be used for PRA applications as follows: • Collapsed liquid level less than 1/3 core height (BWR) • Collapsed liquid level below top of active fuel (PWR) • Core peak nodal temperature > 1800°F • Core exit thermocouple reading > 1200°F (PWR) • Core maximum fuel temperature approaching 2200°F Other end states such as “core vulnerable” shall be resolved into core damage or safe stable states. This resolution shall clearly address the treatment of the impact of containment failure or vent on continued RPV makeup capability.	The Level 1 end state shall be clearly defined as core damage or a safe stable state. The core damage definition shall be consistent with the PSA Applications Guide. The PSA Applications Guide has identified definitions of core damage that would meet the intent of a core damage to be used for PRA applications as follows: • Collapsed liquid level less than 1/3 core height (BWR) • Collapsed liquid level below top of active fuel (PWR) • Core peak nodal temperature > 1800°F • Core exit thermocouple reading > 1200°F (PWR) • Core maximum fuel temperature approaching 2200°F Other end states such as “core vulnerable” shall be resolved into core damage or safe stable states. This resolution shall clearly address the treatment of the impact of containment failure or vent on continued RPV makeup capability.

Table D3-2

INDUSTRY PRA PEER REVIEW SUBTIER CRITERIA: ACCIDENT SEQUENCE EVALUATION

Designator	CRITERIA	SUBTIER CRITERIA		
		Risk Ranking	Risk Significance	Risk Input as Sole Basis
AS-21	• Plant damage states are sufficient to support the transfer of information to Level 2	Level 1 plant damage states should provide adequate information to support Level 2 analysis with minimal loss of information. If individual sequence cut sets are assigned to Plant Damage States (PDS), sufficient information may be imbedded in the cutset basic events to unambiguously assign a unique PDS.	Level 1 plant damage states shall provide adequate information to support Level 2 analysis with minimal loss of information. If individual sequence cut sets are assigned to Plant Damage States (PDS), sufficient information should be imbedded in the cutset basic events to unambiguously assign a unique PDS.	All accident sequences are transferred directly to Level 2 for processing with no loss of information. If individual sequence cut sets are assigned to Plant Damage States (PDS), sufficient information shall be imbedded in the cutset basic events to unambiguously assign a unique PDS.
AS-22	• Plant damage states are based on a clear, consistent definition of CDF that is consistent with industry usage	The CDF definition is conservative and may bias the results of the quantified model.	The CDF definition should be realistic and avoid biasing the results of the Level 1 PRA.	The CDF definition shall be realistic and avoid biasing the results of the Level 1 PRA.
AS-23	• Plant damage states are based on mission time of 24 hours or separately justified	The mission time may be defined to be 24 hours or an appropriate representation for the accident sequence. Alternative mission times may be included if additional justification is provided.	The mission time should be defined to be 24 hours or an appropriate representation for the accident sequence. Alternative mission times may be included if additional justification is provided.	The mission time should be defined to be 24 hours or an appropriate representation for the accident sequence. Alternative mission times may be included if additional justification is provided.
AS-24	<u>DOCUMENTATION</u> • Documentation provides the basis of event tree structure and is traceable to plant specific or generic analysis	Examples of methods of documentation include: event sequence diagrams, text descriptions dependency matrices.	Examples of methods of documentation include: event sequence diagrams, text descriptions dependency matrices. Documentation should provide the basis for meeting each of the criteria AS-4 through AS-23. The documentation shall describe the results consistent with the process.	Examples of methods of documentation include: event sequence diagrams, text descriptions dependency matrices. Documentation shall provide the basis for meeting each of the criteria AS-4 through AS-23. The documentation shall describe the results consistent with the process.
AS-25	• Documentation reflects the process used	Documentation may reflect process features.	Documentation should provide the basis for accident sequence process.	Documentation shall provide the basis for accident sequence process.

Table D3-2

INDUSTRY PRA PEER REVIEW SUBTIER CRITERIA: ACCIDENT SEQUENCE EVALUATION

Designator	CRITERIA	SUBTIER CRITERIA		
		Risk Ranking	Risk Significance	Risk Input as Sole Basis
AS-26	• Documentation includes an independent review for the documented results	The accident sequence analysis should be reviewed.	Independent review of documented results is one of the pillars on which the integrity and quality of engineering work rests. Because of the complexity of the PSA model, it is desirable to have a thorough independent review of the accident sequence modeling. A documented summary of the treatment of each initiator and event tree would be useful to support applications. Independent review should be performed and documented by knowledgeable personnel.	Independent review of documented results is one of the pillars on which the integrity and quality of engineering work rests. Because of the complexity of the PSA model, it is desirable to have a thorough independent review of the accident sequence modeling. A documented summary of the treatment of each initiator and event tree would be useful to support applications. Independent review should be performed and documented by knowledgeable personnel. Independent review of the initiating event interpretation and categorization process should be performed by operations personnel or equivalent.

Table D3-3

INDUSTRY PRA PEER REVIEW SUBTIER CRITERIA: SUCCESS CRITERIA AND THERMAL HYDRAULIC ANALYSIS

Designator	CRITERIA	SUBTIER CRITERIA		
		Risk Ranking Prioritization	Risk Informed Decisions	Risk-Based Decisions
TH-1	GUIDANCE • Describes the process used	General description of the derivation of success criteria and the use of thermal hydraulic calculations is provided.	The documentation of the derivation of success criteria and the use of thermal hydraulic calculations should be sufficiently well described in the documented results to act as guidance for future updates and revisions. A description of the approach to be used for determining the need for thermal hydraulic (T&H) calculations and the type of T&H calculation to perform along with the output needed should be provided.	A specific guidance document should be available that specifies the process for derivation of success criteria and the use of thermal hydraulic calculations including the updating process. A description of the approach to be used for determining the need for thermal hydraulic (T&H) calculations and the type of T&H calculation to perform along with the output needed should be provided. An overall guidance document on the construction and maintenance of the PRA should include a description of the types of thermal-hydraulic analyses needed and their applicability.
TH-2	• Consistent with industry practices	General adherence to accepted industry approaches is included.	The guidance should provide a reasonable basis for performing the derivation of success criteria and the use of thermal hydraulic calculations and should maintain consistency with proven approaches.	The guidance for derivation of success criteria and the use of thermal hydraulic calculations should be complete and detailed and should maintain consistency with proven approaches.
TH-3	• Sufficient detail provided for reproducing the evaluation	Guidance may be available to supply general approaches used.	The guidance should be sufficient to provide a means to obtain equivalent results.	The guidance should be sufficiently detailed to reproduce the results.

Table D3-3

INDUSTRY PRA PEER REVIEW SUBTIER CRITERIA: SUCCESS CRITERIA AND THERMAL HYDRAULIC ANALYSIS

Designator	CRITERIA	SUBTIER CRITERIA		
		Risk Ranking Prioritization	Risk Informed Decisions	Risk-Based Decisions
TH-4	<u>T&H ANALYSES</u> • FSAR analyses are used exclusively as basis for Thermal Hydraulic analysis <u>OR</u> • Generic assessments are used as sole basis for Thermal Hydraulic analysis <u>OR</u>	AS-17 provides the criteria that functional success criteria should be established for all critical safety functions. AS-20 provides the criteria that core damage prevention should be the basis for assuring successful end states. This element and subtier criteria establish the technical analysis used to support these success criteria.	AS-17 provides the criteria that functional success criteria should be established for all critical safety functions. AS-20 provides the criteria that core damage prevention should be the basis for assuring successful end states. This element and subtier criteria establish the technical analysis used to support these success criteria.	AS-17 provides the criteria that functional success criteria shall be established for all critical safety functions. AS-20 provides the criteria that core damage prevention shall be the basis for assuring successful end states. This element and subtier criteria establish the technical analysis used to support these success criteria.
TH-4 (cont'd)	• Plant specific best-estimate (e.g., MAAP, RETRAN, etc.) models or equivalent are used for support of Thermal Hydraulic analysis (supported by FSAR or generic analysis)	The critical safety functions that should have technical bases developed to support the probabilistic analyses include the following: • Reactivity Control - Control Rods - Boron Injection - RPV Water Level Control • RPV Makeup Injection for Core Cooling - High Pressure Injection - Low Pressure Injection - Depressurization - Containment Flooding • RPV Pressure Control - SRVs/SVs/TBVs - Feedwater Trip - RPT - ARI - Control rods - IC	The critical safety functions that should have technical bases developed to support the probabilistic analyses include the following: • Reactivity Control - Control Rods - Boron Injection - RPV Water Level Control • RPV Makeup Injection for Core Cooling - High Pressure Injection - Low Pressure Injection - Depressurization - Containment Flooding • RPV Pressure Control - SRVs/SVs/TBVs - Feedwater Trip - RPT - ARI - Control rods - IC	The critical safety functions that should have technical bases developed to support the probabilistic analyses include the following: • Reactivity Control - Control Rods - Boron Injection - RPV Water Level Control • RPV Makeup Injection for Core Cooling - High Pressure Injection - Low Pressure Injection - Depressurization - Containment Flooding • RPV Pressure Control - SRVs/SVs/TBVs - Feedwater Trip - RPT - ARI - Control rods - IC

Table D3-3

INDUSTRY PRA PEER REVIEW SUBTIER CRITERIA: SUCCESS CRITERIA AND THERMAL HYDRAULIC ANALYSIS

Designator	CRITERIA	SUBTIER CRITERIA		
		Risk Ranking Prioritization	Risk Informed Decisions	Risk-Based Decisions
		• Containment Pressure Control - Vapor Suppression - Containment Heat Removal - Containment Venting FSAR analyses may be used exclusively as basis for Thermal Hydraulic analysis	• Containment Pressure Control - Vapor Suppression - Containment Heat Removal - Containment Venting Generic assessments may be used as sole basis for Thermal Hydraulic analysis	• Containment Pressure Control - Vapor Suppression - Containment Heat Removal - Containment Venting Plant specific best-estimate (e.g., MAAP, RETRAN, etc.) models or equivalent should be used for support of Thermal Hydraulic analysis (supported by FSAR or generic analysis)
TH-5	<u>MULTIPLE T&H INPUTS</u> • A combination of plant specific, generic and FSAR calculations are used to support success criteria and HRA timing.	The review of the as-built, as operated plant performed as part of the AS, SY, and HRA elements may be used to confirm that the thermal hydraulic analyses are also current with the plant.	The review of the as-built, as operated plant performed as part of the AS, SY, and HRA elements should be used to confirm that the thermal hydraulic analyses are also current with the plant.	The review of the as-built, as operated plant performed as part of the AS, SY, and HRA elements shall be used to confirm that the thermal hydraulic analyses are also current with the plant.

Table D3-3

INDUSTRY PRA PEER REVIEW SUBTIER CRITERIA: SUCCESS CRITERIA AND THERMAL HYDRAULIC ANALYSIS

Designator	CRITERIA	SUBTIER CRITERIA		
		Risk Ranking Prioritization	Risk Informed Decisions	Risk-Based Decisions
		Reliance on plant specific analysis should include consideration of whether the code is capable of providing the necessary information, and the model is representative of the specific plant to which the results are to be applied. For example, two items are believed not to be well modeled using MARCH, BWRSAR, or MAAP: a) The need or RPT to prevent reactivity and pressure excursion in the RPV within the initial 20 seconds of an ATWS b) The ability of a DBA LOCA to be mitigated in the short term (71 min.) by operation of condensate.	Reliance on plant specific analysis should include consideration of whether the code is capable of providing the necessary information and the model is representative of the specific plant to which the results are to be applied. For example, two items are believed not to be well modeled using MARCH, OR BWRSAR, or MAAP: a) The need or RPT to prevent reactivity and pressure excursion in the RPV within the initial 20 seconds of an ATWS b) The ability of a DBA LOCA to be mitigated in the short term by operation of condensate. The generic BWROG document NEDO-24708A using the code SAFE is judged to be a useful reference for confirming plant specific analyses. This calculation should be used to support results from codes such as MAAP. An example of an area where the use of the NEDO-24708A would prove useful is to identify that RCIC alone as an injection source is not adequate under SORV conditions. Generic calculations from NEDE-24222 should be used to check ATWS success criteria and plant specific calculations.	Reliance on plant specific analysis shall include consideration of whether the code is capable of providing the necessary information and the model is representative of the specific plant to which the results are to be applied. For example, two items are believed not to be well modeled using MARCH or BWRSAR, or MAAP: a) The need or RPT to prevent reactivity and pressure excursion in the RPV within the initial 20 seconds of an ATWS b) The ability of a DBA LOCA to be mitigated in the short term by operation of condensate. The generic BWROG document NEDO-24708A using the code SAFE is judged to be a useful reference for confirming plant specific analyses. This calculation should be used to support results from codes such as MAAP. An example of an area where the use of the NEDO-24708A would prove useful is to identify that RCIC alone as an injection source is not adequate under SORV conditions. Generic calculations from NEDE-24222 should be used to check ATWS success criteria and plant specific calculations.

Table D3-3

INDUSTRY PRA PEER REVIEW SUBTIER CRITERIA: SUCCESS CRITERIA AND THERMAL HYDRAULIC ANALYSIS

Designator	CRITERIA	SUBTIER CRITERIA		
		Risk Ranking Prioritization	Risk Informed Decisions	Risk-Based Decisions
TH-6	GENERIC ASSESSMENTS • Application of the generic assessments account for limitations of the generic analysis when applied to the specific plant	Reliance on generic analysis should include consideration of whether the code is capable of providing the necessary information.	Reliance on generic analysis should include consideration of whether the code is capable of providing the necessary information.	Reliance on generic analysis shall include consideration of whether the code is capable of providing the necessary information.
TH-7	BEST ESTIMATE CALCULATIONS (e.g., MAAP, RETRAN, SAFER-GESTER) • Application of the T & H codes account for the limitations of each of the codes	Confidence in the thermal hydraulic analysis used to support the success criteria may be established by: • comparison with similar plant results • accounting for differences in the unique plant features • comparison with other plant specific code results Realistic thermal hydraulic calculations to support timing estimates may be used in the HRA evaluations.	Confidence in the thermal hydraulic analysis used to support the success criteria should be established by: • comparison with similar plant results • accounting for differences in the unique plant features • comparison with other plant specific code results Success criteria are generally based on models that simulate the conditions during postulated scenarios. However, the adequacy of the simulation varies with the computer model and the scenario. A description of the limitations of the model should be documented for those cases in which the model is used. This should include both potential conservatisms and limitations that may void the use of the computer model. The success criteria should provide a proper basis for the probabilistic analysis. General references should be provided, and the specific case references for each success criteria should be provided to assure traceability if needed in the future. Realistic thermal hydraulic calculations to support timing estimates should be used in the HRA evaluations.	Confidence in the thermal hydraulic analysis used to support the success criteria shall be established by: • comparison with similar plant results • accounting for differences in the unique plant features • comparison with other plant specific code results Success criteria are generally based on models that simulate the conditions during postulated scenarios. However, the adequacy of the simulation varies with the computer model and the scenario. A description of the limitations of the model should be documented for those cases in which the model is used. This should include both potential conservatisms and limitations that may void the use of the computer model. The success criteria should provide a proper basis for the probabilistic analysis. General references should be provided, and the specific case references for each success criteria should be provided to assure traceability if needed in the future. Realistic thermal hydraulic calculations to support timing estimates should be used in the HRA evaluations.

Table D3-3

INDUSTRY PRA PEER REVIEW SUBTIER CRITERIA: SUCCESS CRITERIA AND THERMAL HYDRAULIC ANALYSIS

Designator	CRITERIA	SUBTIER CRITERIA		
		Risk Ranking Prioritization	Risk Informed Decisions	Risk-Based Decisions
TH-8	ROOM HEATUP CALCULATIONS • Documented evaluation available to support the modeling decisions, OR • Plant specific realistic calculations or tests are available to support the modeling decisions regarding room heatup.	System success criteria to assure adequate mission time capability should be established with room cooling calculations or tests. These calculations or tests should coincide with the accident sequence conditions or be justified.	System success criteria to assure adequate mission time capability should be established with room cooling calculations or tests. These calculations or tests should coincide with the accident sequence conditions or be justified. Room heatup calculations may be performed using a computer code such as the GOTHIC code.	System success criteria to assure adequate mission time capability should be established with room cooling calculations or tests. These calculations or tests should coincide with the accident sequence conditions or be justified. Room heatup calculations should be performed using a computer code such as the GOTHIC code.
TH-9	DOCUMENTATION • Documentation provides the basis of the Thermal Hydraulic Analysis, is traceable to plant specific or generic analysis, and demonstrates the reasonableness of the success criteria.	Documentation should provide the basis for meeting each of the criteria TH-4 through TH-8. The documentation shall describe the results consistent with the process. Conservative, optimistic, or simplifying assumptions or conditions may be identified or specific justification may be provided for their use.	Documentation should provide the basis for meeting each of the criteria TH-4 through TH-8. The documentation shall describe the results consistent with the process. Conservative, optimistic, or simplifying assumptions or conditions should be identified or specific justification shall be provided for their use. Specific Success Criteria related items that should be documented including the following: • room cooling treatment • DFP alignment success probability when performed under SBO conditions involving load shedding of all essential lighting (if applicable) • RCIC & DFP success given SBO • RCIC success following Emergency Depressurization • Depressurization requirement for Medium LOCA with RCIC initially available (conservative assumption)	Documentation should provide the basis for meeting each of the criteria TH-4 through TH-8. The documentation shall describe the results consistent with the process. Conservative, optimistic, or simplifying assumptions or conditions shall be identified or specific justification shall be provided for their use. Specific Success Criteria related items that should be documented including the following: • room cooling treatment • DFP alignment success probability when performed under SBO conditions involving load shedding of all essential lighting (if applicable) • RCIC & DFP success given SBO • RCIC success following Emergency Depressurization • Depressurization requirement for Medium LOCA with RCIC initially available (conservative assumption)

Table D3-3

INDUSTRY PRA PEER REVIEW SUBTIER CRITERIA: SUCCESS CRITERIA AND THERMAL HYDRAULIC ANALYSIS

Designator	CRITERIA	SUBTIER CRITERIA		
		Risk Ranking Prioritization	Risk Informed Decisions	Risk-Based Decisions
TH-10	• Documentation reflects the process used	Documentation may reflect process features.	Documentation should provide the basis for the thermal hydraulic analysis methodology and the success criteria development process.	Documentation shall provide the basis for the thermal hydraulic analysis methodology and the success criteria development process.
TH-11	• Documentation includes an independent review for the documented results	Independent review may be performed and documented by knowledgeable personnel.	Independent review should be performed and documented by knowledgeable personnel.	Independent review should be performed and documented by knowledgeable personnel.

Table D3-4

INDUSTRY PRA PEER REVIEW SUBTIER CRITERIA: SYSTEMS ANALYSIS

Designator	CRITERIA	SUBTIER CRITERIA		
		Risk Ranking Prioritization	Risk Informed Decisions	Risk-Based Decisions

Table D3-4

INDUSTRY PRA PEER REVIEW SUBTIER CRITERIA: SYSTEMS ANALYSIS

Designator	CRITERIA	SUBTIER CRITERIA		
		Risk Ranking Prioritization	Risk Informed Decisions	Risk-Based Decisions
SY-1	GUIDANCE • Describes the process used	The Fault Tree Handbook or equivalent may be used to provide general guidance on the logic model constriction.	The documentation of the system analysis should be sufficiently well described in the documented results to act as guidance for future updates and revisions. The development and content of the system notebooks (including the system modeling, e.g., fault trees) and their relationship to the event tree models should be provided by the documentation. This should include: • the operating experience for the system • the system fault tree • model assumptions • the various model uses of the system with its values • the success criteria and bases • supports required • system operation under accident conditions • effects on initiating events • common cause groups identified and included in the system • relationship to critical safety functions The Fault Tree Handbook or equivalent should be used to provide general guidance on the logic model constriction. Guidance for modeling systems, such as naming conventions or standard component failure models, should be included in the guidance and documentation.	A specific guidance document should be available that specifies the process for system analysis including the updating process. The development and content of the system notebooks (including the system modeling, e.g., fault trees) and their relationship to the event tree models should be provided by the documentation. This should include: • the operating experience for the system • the system fault tree • model assumptions • the various model uses of the system with its values • the success criteria and bases • supports required • system operation under accident conditions • effects on initiating events • common cause groups identified and included in the system • relationship to critical safety functions The Fault Tree Handbook or equivalent should be used to provide general guidance on the logic model constriction. Guidance for modeling systems, such as naming conventions or standard component failure models, should be included in the guidance and documentation.

Table D3-4

INDUSTRY PRA PEER REVIEW SUBTIER CRITERIA: SYSTEMS ANALYSIS

Designator	CRITERIA	SUBTIER CRITERIA		
		Risk Ranking Prioritization	Risk Informed Decisions	Risk-Based Decisions
SY-2	• Consistent with industry practices	General adherence to accepted industry approaches is included.	The documentation should provide a reasonable basis for performing the system analysis and should maintain consistency with proven approaches.	The guidance for system analysis should be complete and detailed and should maintain consistency with proven approaches.
SY-3	• Sufficient detail provided for reproducing the evaluation	Guidance may be available to supply general approaches used.	The guidance should be sufficient to provide a means to obtain equivalent results.	The guidance shall be sufficiently detailed to reproduce the results.
SY-4	SYSTEM MODELS (e.g., Fault Trees) • The system models are available for review	The fault tree models and system descriptions should address all trains of a redundant system, not just a single train.	The fault tree models and system descriptions should address all trains of a redundant system, not just a single train.	The fault tree models and system descriptions should address all trains of a redundant system, not just a single train.
SY-5	The models and analyses are consistent with the as-built, as-operated plant including EOPs and AOPs (See also AS-19)	The models and analyses should be consistent with the as-built, as-operated plant including EOPs and AOPs (See also AS-19) Exceptions may be noted; or level of detail may be minimal if justified. The operating experience with the system may be reviewed to ensure that important system characteristics are modeled appropriately.	The models and analyses should be consistent with the as-built, as-operated plant including EOPs and AOPs (See also AS-19) Procedurally directed operator actions (both positive and negative impacts) that substantially influence the fault tree structure or its probability should be accounted for. This should include operator training input on the interpretation of proceduralized steps. The operating experience with the system should be reviewed to ensure that important system characteristics are modeled appropriately.	The models and analyses shall be consistent with the as-built, as-operated plant including EOPs and AOPs (See also AS-19) Procedurally directed operator actions (both positive and negative impacts) that substantially influence the fault tree structure or its probability shall be accounted for. This shall include operator training input on the interpretation of proceduralized steps. The operating experience with the system shall be reviewed to ensure that important system characteristics are modeled appropriately.

Table D3-4

INDUSTRY PRA PEER REVIEW SUBTIER CRITERIA: SYSTEMS ANALYSIS

Designator	CRITERIA	SUBTIER CRITERIA		
		Risk Ranking Prioritization	Risk Informed Decisions	Risk-Based Decisions
SY-6	• The structure of the system model provides detail down to at least the major active component level (e.g., pumps and valves)	The fault tree models should provide detail down to the major active component level. Exceptions for some systems may occur when they are dominated by operator actions, specific phenomenological effects, or are “black-boxed” such as the scram system. Systems that have sometimes not been modeled in detail include: • Power conversion system • Instrument Air • keep fill system The justification for limited modeling should be documented. The component boundaries used in the fault tree model shall be consistent with the boundary definition used in the data analysis element.	The fault tree models should provide detail down to the major active component level. Exceptions for some systems may occur when they are dominated by operator actions, specific phenomenological effects, or are “black-boxed” such as the scram system. Systems that have sometimes not been modeled in detail include: • Power conversion system • Instrument Air • keep fill system The justification for limited modeling should be documented. The component boundaries used in the fault tree model should be consistent with the boundary definition used in the data analysis element.	The fault tree models should provide detail down to the major active component level. Exceptions for some systems may occur when they are dominated by operator actions, specific phenomenological effects, or are “black-boxed” such as the scram system. Systems that have sometimes not been modeled in detail include: • Power conversion system • Instrument Air • keep fill system The justification for limited modeling should be documented. The component boundaries used in the fault tree model shall be consistent with the boundary definition used in the data analysis element.
SY-7	• The level of detail of the system models reflects certain passive components that may impact CDF.[(6)]	Select passive components may be included.	Critical passive components such as check valves, strainers, and tanks should be included if they can influence the CDF or LERF.	Critical passive components such as check valves, strainers, and tanks shall be included if they can influence the CDF or LERF.

Table D3-4

INDUSTRY PRA PEER REVIEW SUBTIER CRITERIA: SYSTEMS ANALYSIS

Designator	CRITERIA	SUBTIER CRITERIA		
		Risk Ranking Prioritization	Risk Informed Decisions	Risk-Based Decisions
SY-8	• The system models contain at a minimum the following (if applicable): - Common cause failure contributors - Test and maintenance unavailabilities - Operator errors that can influence system operability (where appropriate) - False instrument signals that can cause failures of the system[(8)] - Operator interface dependencies across systems or trains	The system models may contain at a minimum the following (if applicable): • Common cause failure contributors • Test and maintenance unavailabilities • Operator errors that can influence system operability (where appropriate) • False instrument signals that can cause failures of the system[(8)] • Operator interface dependencies across systems or trains	The system models should contain at a minimum the following (if applicable): • Common cause failure contributors • Test and maintenance unavailabilities • Operator errors that can influence system operability (where appropriate) • False instrument signals that can cause failures of the system[(8)] • Operator interface dependencies across systems or trains	The system models shall contain at a minimum the following (if applicable): • Common cause failure contributors • Test and maintenance unavailabilities • Operator errors that can influence system operability (where appropriate) • False instrument signals that can cause failures of the system[(8)] • Operator interface dependencies across systems or trains
SY-9	Modules used in the system models are well correlated to their constituent components and capable of providing importance and parametric effects on a component level.	The traceability of basic events to modules and to cutsets may be present in the model and documentation.	The traceability of basic events to modules and to cutsets should be transparent to the user and a reviewer.	The traceability of basic events to modules and to cutsets shall be transparent to the user and a reviewer.

Table D3-4

INDUSTRY PRA PEER REVIEW SUBTIER CRITERIA: SYSTEMS ANALYSIS

Designator	CRITERIA	SUBTIER CRITERIA		
		Risk Ranking Prioritization	Risk Informed Decisions	Risk-Based Decisions
SY-10	• Spatial or environmental dependencies (e.g., internal floods, room cooling, etc.) are addressed for each system within the system model or in the accident sequence evaluation[(5)].	Spatial hazards that may impact system operation may be identified in the system notebook and accounted for in the system fault tree or the accident sequence evaluation. Environmental hazards that may impact system operation may be identified in the system notebook and accounted for in the system fault tree or accident sequence evaluation. Results of plant walkdowns may be used as a source of information and resolution of issues. Explicit treatment of containment vent effects and containment failure effects on system operation should be included. Conservative evaluations of impacts on systems may be part of the model.	Spatial hazards that may impact system operation should be identified in the system notebook and accounted for in the system fault tree or the accident sequence evaluation. Environmental hazards that may impact system operation should be identified in the system notebook and accounted for in the system fault tree or accident sequence evaluation. Results of plant walkdowns should be used as a source of information and resolution of issues. Explicit treatment of containment vent effects and containment failure effects on system operation shall be included. Conservative evaluations should not distort the CDF, LERF, or the risk profile.	Spatial hazards that may impact system operation shall be identified in the system notebook and accounted for in the system fault tree or the accident sequence evaluation. Environmental hazards that may impact system operation shall be identified in the system notebook and accounted for in the system fault tree or accident sequence evaluation. Results of plant walkdowns shall be used as a source of information and resolution of issues. Explicit treatment of containment vent effects and containment failure effects on system operation shall be included. Conservative evaluations should be avoided. This may require substantial deterministic evaluations.

Table D3-4

INDUSTRY PRA PEER REVIEW SUBTIER CRITERIA: SYSTEMS ANALYSIS

Designator	CRITERIA	SUBTIER CRITERIA		
		Risk Ranking Prioritization	Risk Informed Decisions	Risk-Based Decisions
SY-11	In some accident sequences, systems are expected to perform in degraded environments (e.g., inside containment after a LOCA). While equipment is generally qualified for such an environment, there should be some evidence that a search has been made for equipment that is not so qualified (e.g., statements that necessary equipment is qualified.) Other examples of degraded environments include: • SRV Operability (small LOCA, drywell spray, severe accident) (for BWRs) • Steamline breaks outside containment • Debris that could plug screens/filters (both internal and external to the plant), and heating of the water supply (e.g., BWR suppression pool, PWR containment sump) that could affect pump operability • Loss of NPSH • Steam binding of pumps	In some accident sequences, systems are expected to perform in degraded environments (e.g., inside containment after a LOCA). While equipment is generally qualified for such an environment, there should be some evidence that a search has been made for equipment that is not so qualified (e.g., statements that necessary equipment is qualified.) Other examples of degraded environments include: • SRV Operability (small LOCA, drywell spray, severe accident) (for BWRs) • Steamline breaks outside containment • Debris that could plug screens/filters (both internal and external to the plant), and heating of the water supply (e.g., BWR suppression pool, PWR containment sump) that could affect pump operability • Loss of NPSH • Steam binding of pumps The evaluation of plant or accident sequence conditions that may adversely impact system operation should be included.	In some accident sequences, systems are expected to perform in degraded environments (e.g., inside containment after a LOCA). While equipment is generally qualified for such an environment, there should be evidence that a search has been made for equipment that is not so qualified (e.g., statements that necessary equipment is qualified.) Other examples of degraded environments include: • SRV Operability (small LOCA, drywell spray, severe accident) (for BWRs) • Steamline breaks outside containment • Debris that could plug screens/filters (both internal and external to the plant), and heating of the water supply (e.g., BWR suppression pool, PWR containment sump) that could affect pump operability • Loss of NPSH • Steam binding of pumps The evaluation of plant or accident sequence conditions that may adversely impact system operation should be included.	In some accident sequences, systems are expected to perform in degraded environments (e.g., inside containment after a LOCA). While equipment is generally qualified for such an environment, there shall be evidence that a search has been made for equipment that is not so qualified (e.g., statements that necessary equipment is qualified.) Other examples of degraded environments include: • SRV Operability (small LOCA, drywell spray, severe accident) (for BWRs) • Steamline breaks outside containment • Debris that could plug screens/filters (both internal and external to the plant), and heating of the water supply (e.g., BWR suppression pool, PWR containment sump) that could affect pump operability • Loss of NPSH • Steam binding of pumps The evaluation of plant or accident sequence conditions that may adversely impact system operation shall be included.

Table D3-4

INDUSTRY PRA PEER REVIEW SUBTIER CRITERIA: SYSTEMS ANALYSIS

Designator	CRITERIA	SUBTIER CRITERIA		
		Risk Ranking Prioritization	Risk Informed Decisions	Risk-Based Decisions
SY-11 (cont'd)		There may be conditions in which the system or its components are required to operate beyond the licensing design basis. This may be included in the model if justified based on: • expert judgement • test or operational data • calculations • vendor input Examples include: • room temperatures above EQ limits • minimum flow valve fails closed	There may be conditions in which the system or its components are required to operate beyond the licensing design basis. This should be included in the model if justified based on: • expert judgement • test or operational data • calculations • vendor input Examples include: • room temperatures above EQ limits • minimum flow valve fails closed	There may be conditions in which the system or its components are required to operate beyond the licensing design basis. This shall be included in the model if justified based on: • expert judgement • test or operational data • calculations • vendor input Examples include: • room temperatures above EQ limits • minimum flow valve fails closed
SY-12	• Support system requirements are accounted for	Support systems should be explicitly accounted for in the modeling process. This may include: • fault tree linking • dependency matrices that are translated into event tree structure or event tree logic rules or into dependent failure probabilities. Conservative treatment of support system dependencies may be included in the model evaluation.	Support systems should be explicitly accounted for in the modeling process. This may include: • fault tree linking • dependency matrices that are translated into event tree structure or event tree logic rules or into dependent failure probabilities. Support system treatment should be realistic based on realistic success criteria and realistic timing.	Support systems shall be explicitly accounted for in the modeling process. This may include: • fault tree linking • dependency matrices that are translated into event tree structure or event tree logic rules or into dependent failure probabilities. Support system treatment shall be realistic based on realistic success criteria and realistic timing.
SY-13	• The inventories of air, power, and cooling sufficient to support the mission time (or potential deficiencies) are identified and included in the model as appropriate. (Also refer to Elements TH and DE regarding definition of success criteria)	The inventories of air, power, and cooling sufficient to support the mission time (or potential deficiencies) may be identified and included in the model as appropriate. (Also refer to Elements TH and DE regarding definition of success criteria) Conservative evaluations of impacts on systems may be part of the model.	The inventories of air, power, and cooling sufficient to support the mission time (or potential deficiencies) should be identified and included in the model as appropriate. (Also refer to Elements TH and DE regarding definition of success criteria) Conservative evaluations should not distort the CDF, LERF, or the risk profile.	The inventories of air, power, and cooling sufficient to support the mission time (or potential deficiencies) shall be identified and included in the model as appropriate. (Also refer to Elements TH and DE regarding definition of success criteria) Conservative evaluations should be avoided. This may require substantial deterministic evaluations.

Table D3-4

INDUSTRY PRA PEER REVIEW SUBTIER CRITERIA: SYSTEMS ANALYSIS

Designator	CRITERIA	SUBTIER CRITERIA		
		Risk Ranking Prioritization	Risk Informed Decisions	Risk-Based Decisions
SY-14	• The system boundary included in the system model is clearly discerned from a simplified schematic of system	The system boundary included in the system model may be clearly discerned from a simplified schematic of system.	The system boundary included in the system model should be clearly discerned from a simplified schematic of system.	The system boundary included in the system model should be clearly discerned from a simplified schematic of system.
SY-15	• The system model analysis considered generic system failure modes observed in industry[9]	The system model analysis may consider generic system failure modes observed in industry[9]	The system model analysis should consider generic system failure modes observed in industry[9]	The system model analysis shall consider generic system failure modes observed in industry[9]
SY-16	• The system model analysis included plant specific failure modes[7], [9]	Plant specific search of system operating experience may be performed and the results may be used to identify plant specific failure modes for the system.	Plant specific search of system operating experience should be performed and the results may be used to identify plant specific failure modes for the system. An FMEA or equivalent technique may be used to identify component or system failures that are plant specific.	Plant specific search of system operating experience shall be performed and the results may be used to identify plant specific failure modes for the system. An FMEA or equivalent technique should be used to identify component or system failures that are plant specific

Table D3-4

INDUSTRY PRA PEER REVIEW SUBTIER CRITERIA: SYSTEMS ANALYSIS

Designator	CRITERIA	SUBTIER CRITERIA		
		Risk Ranking Prioritization	Risk Informed Decisions	Risk-Based Decisions
SY-17	• The success criteria for the system are based on: - Generic thermal hydraulic analysis OR - Realistic thermal hydraulic analysis OR - Plant specific thermal hydraulic analysis	The success criteria for the system may be based on generic thermal hydraulic analysis. Conservative treatment of system success criteria may be included in the following: • A review of sequence specific conditions (e.g., RPV, containment, reactor building, steam tunnel, control room) may be used to ensure that system operation is not adversely impacted due to those conditions (e.g., trip signal, exhausted inventories, unacceptable operating conditions). • As part of the success criteria assessment there may be cases where the success criteria change during the accident progression. This aspect of time phase analysis may be included for a realistic evaluation. • System success criteria may be consistent with the accident sequence demands, e.g., number of pumps, HRA timing, interlocks necessary to be bypassed.	The success criteria for the system should be based on realistic thermal hydraulic analysis. Certain conservative success criteria may be included in non-risk significant sequences as follows if they do not distort the risk profile: • A review of sequence specific conditions (e.g., RPV, containment, reactor building, steam tunnel, control room) should be used to ensure that system operation is not adversely impacted due to those conditions (e.g., trip signal, exhausted inventories, unacceptable operating conditions). • As part of the realistic success criteria assessment there may be cases where the success criteria change during the accident progression. This aspect of time phase analysis should be included for a realistic evaluation. • System success criteria should be consistent with the accident sequence demands, e.g., number of pumps, HRA timing, interlocks necessary to be bypassed.	The success criteria for the system shall be based on Realistic plant specific thermal hydraulic analysis. • A review of sequence specific conditions (e.g., RPV, containment, reactor building, steam tunnel, control room) shall be used to ensure that system operation is not adversely impacted due to those conditions (e.g., trip signal, exhausted inventories, unacceptable operating conditions). • As part of the realistic success criteria assessment there may be cases where the success criteria change during the accident progression. This aspect of time phase analysis shall be included for a realistic evaluation. • System success criteria shall be consistent with the accident sequence demands, e.g., number of pumps, HRA timing, interlocks necessary to be bypassed.
SY-18	• The system model nomenclature is developed in a consistent manner to allow model manipulation and to represent the same designator when a component failure mode is used in multiple systems or trains.	e system model nomenclature may be developed in a consistent manner to allow model manipulation and to represent the same designator when a component failure mode is used in multiple systems or trains.	e system model nomenclature should be developed in a consistent manner to allow model manipulation and to represent the same designator when a component failure mode is used in multiple systems or trains.	e system model nomenclature shall be developed in a consistent manner to allow model manipulation and to represent the same designator when a component failure mode is used in multiple systems or trains.

Table D3-4

INDUSTRY PRA PEER REVIEW SUBTIER CRITERIA: SYSTEMS ANALYSIS

Designator	CRITERIA	SUBTIER CRITERIA		
		Risk Ranking Prioritization	Risk Informed Decisions	Risk-Based Decisions
SY-19	• The systems used in the event trees have detailed system model development to support them unless they are generally treated with point estimate values, e.g.: - SRVs (for BWRs) - RPS - Diesel Generators - Switchyard The following impact on Grades is suggested for the above sample items: - Point Estimates - Conditional Probabilities (Split Fractions) - Linked Fault Trees or Cutsets	The systems used in the event trees may have detailed system model development to support them.	The systems used in the event trees should have detailed system model development to support them. Exceptions may include: • SRVs (for BWRs) • RPS • Diesel Generators • Switchyard	The systems used in the event trees shall have detailed system model development to support them. Exceptions may include: • SRVs (for BWRs) • RPS • Diesel Generators • Switchyard
SY-20	• The system models are used to quantify the accident sequences by: - Point Estimates Only - Conditional Probabilities (Split Fractions) - Linked Fault Trees or Cut Sets	• The system models are used to quantify the accident sequences by: - Point Estimates Only	The system models are used to quantify the accident sequences by • Conditional Probabilities (Split Fractions) • Linked Fault Trees or Cut Sets	The system models are used to quantify the accident sequences by • Conditional Probabilities (Split Fractions) • Linked Fault Trees or Cut Sets
SY-21	• The impact of the system model on initiating events has been examined (see also IE-10, IE-17)	• The impact of the system model on initiating events should be examined (see also IE-10, IE-17) and may be incorporated into the model in a conservative manner.	• The impact of the system model on initiating events should be examined (see also IE-10, IE-17) and should be incorporated into the model in a realistic manner.	• The impact of the system model on initiating events shall be examined (see also IE-10, IE-17) and should be incorporated into the model in a realistic manner.
SY-22	• The assumptions for the system model logic model are identified	• The assumptions for the system model logic model should be identified	• The assumptions for the system model logic model should be identified	• The assumptions for the system model logic model shall be identified

Table D3-4

INDUSTRY PRA PEER REVIEW SUBTIER CRITERIA: SYSTEMS ANALYSIS

Designator	CRITERIA	SUBTIER CRITERIA		
		Risk Ranking Prioritization	Risk Informed Decisions	Risk-Based Decisions
SY-23	• The system operation under accident conditions is identified in the system notebook	• The system operation under accident conditions should be identified in the system notebook and may be incorporated into the model in a conservative manner.	• The system operation under accident conditions should be identified in the system notebook and should be incorporated into the model in a realistic manner.	• The system operation under accident conditions shall be identified in the system notebook and should be incorporated into the model in a realistic manner.
SY-24	• System/component repair and recovery actions and modeling, if used, are identified and documented (see also QU-18)	• System/component repair and recovery actions and modeling, if used, should be identified and documented (see also QU-18) • Conservative evaluations of impacts on systems may be part of the model.	• System/component repair and recovery actions and modeling, if used, should be identified and documented (see also QU-18) • Conservative evaluations should not distort the CDF, LERF, or the risk profile.	• System/component repair and recovery actions and modeling, if used, shall be identified and documented (see also QU-18) • Conservative evaluations should be avoided. This may require substantial deterministic evaluations.
SY-25	<u>DOCUMENTATION</u> • Reflects the process used		Documentation should provide the basis for meeting each of the criteria SY-4 through SY-24. The documentation should describe the results consistent with the process.	Documentation shall provide the basis for meeting each of the criteria SY-4 through SY-24. The documentation shall describe the results consistent with the process.

Table D3-4

INDUSTRY PRA PEER REVIEW SUBTIER CRITERIA: SYSTEMS ANALYSIS

Designator	CRITERIA	SUBTIER CRITERIA		
		Risk Ranking Prioritization	Risk Informed Decisions	Risk-Based Decisions
SY-26	• Includes an independent review for the documented results	The system analysis should be reviewed.	Independent review of documented results is one of the pillars on which the integrity and quality of engineering work rests. Because of the complexity of the PSA model, it is desirable to have a thorough independent review of the system modeling. Independent review should be performed and documented by knowledgeable personnel, such as the system engineer. Guidance for modeling systems, such as naming conventions or standard component failures models, should be included in the guidance and documentation.	Independent review of documented results is one of the pillars on which the integrity and quality of engineering work rests. Because of the complexity of the PSA model, it is desirable to have a thorough independent review of the system analysis modeling. Independent review shall be performed and documented by knowledgeable personnel, such as the system engineer. Guidance for modeling systems, such as naming conventions or standard component failures models, shall be included in the guidance and documentation.
SY-27	• Provides the basis of the system model and is traceable to plant specific or generic analysis	Documentation may reflect process features.	Documentation should provide the basis for system analysis process.	Documentation shall provide the basis for system analysis process.

Table D3-5

INDUSTRY PRA PEER REVIEW PROCESS SUBTIER CRITERIA: DATA ANALYSIS

Designator	CRITERIA	SUBTIER CRITERIA		
		Risk Ranking Prioritization	Risk Informed Decisions	Risk-Based Decisions
DA-1	<u>GUIDANCE</u> • Describes the process used	General description of the data analysis may be provided. The data guidance document may provide guidance on the selection of generic data from industry sources. The treatment of rectification in the data analysis should have clear guidance. Guidance should be provided on the development of the disallowed maintenance or mutually exclusive maintenance file.	The documentation of the data analysis should be sufficiently well described in the documented results to act as guidance for future updates and revisions. The document should provide guidance on the use of plant specific data, common cause data and methods, and the selection of generic data from industry sources. The document should provide guidance in the assignment of the proper error factor to assign for particular component failure rates when the error factors are not provided in the reference. The document should include guidance on data compilation and interpretation, component boundaries, Bayesian approach, and examples. The treatment of rectification in the data analysis should be clearly stated. Guidance should be provided on the development of the disallowed maintenance or mutually exclusive maintenance file.	A specific guidance document should be available that specifies the process for data analysis including the updating process. Guidance on the incorporation of plant specific data into initiating event frequencies, component failure rates, and common cause data shall be provided. The data guidance document shall provide guidance on the selection of generic data from industry sources. The data guidance document may provide guidance in the assignment of the proper error factor to assign for particular component failure rates when the error factors are not provided in the reference. The data guidance document should include direction on data compilation and interpretation, component boundaries, Bayesian approach, and examples. A description of the overall process used for selecting and applying data should be provided. The treatment of rectification in the data analysis should have clear guidance. Guidance should be provided on the development of the disallowed maintenance or mutually exclusive maintenance file.

Table D3-5

INDUSTRY PRA PEER REVIEW PROCESS SUBTIER CRITERIA: DATA ANALYSIS

Designator	CRITERIA	SUBTIER CRITERIA		
		Risk Ranking Prioritization	Risk Informed Decisions	Risk-Based Decisions
DA-2	• Consistent with industry practices	General adherence to accepted industry approaches is included.	The documentation should provide a reasonable basis for performing the data analysis and should maintain consistency with proven approaches.	The guidance for data analysis should be complete and detailed and should maintain consistency with proven approaches.
DA-3	• Sufficient detail provided for reproducing the evaluation	Guidance may be available to supply general approaches used.	The guidance should be sufficient to provide a means to obtain equivalent results.	The guidance shall be sufficiently detailed to reproduce the results.
DA-4	FAILURE PROBABILITIES • The random independent component failure probability data used in the evaluation are based on generic data sources that may be conservative. OR	The random independent component failure probability data used in the evaluation may be based on generic data sources that may be conservative.	The random independent component failure probabilities should be realistic compared with past generic data evaluations at least for dominant contributors.	The random independent component failure probability data used in the evaluation and where it can be justified shall be based on accumulated plant specific experience; otherwise, realistic generic data is used
	• The random independent component failure probabilities are realistic compared with past generic data evaluations at least for dominant contributors. OR	The use of generic data should involve the use of reasonable generic data sources that represent recent nuclear power experience, if available. The definition of component failures should encompass only those failures that would disable the component function over the PRA mission time.	The use of generic data should involve the use of reasonable generic data sources that represent recent nuclear power experience, if available. The definition of component failures should encompass only those failures that would disable the component function over the PRA mission time.	The plant specific data evaluation should be based on a plant specific Bayesian update of accumulated industry experience for similar components. The definition of component failures shall encompass only those failures that would disable the component function over the PRA mission time.
	• The random independent component failure probability data used in the evaluation and where it can be justified is based on accumulated plant specific experience; otherwise, realistic generic data is used.	Some limited plant specific data may be incorporated into the PRA as it supports specific risk ranking applications. This data analysis shall be consistent with the risk-informed decision requirements.	The treatment of rectification in the data analysis should have clear guidance. Some limited plant specific data may be incorporated into the PRA as it supports specific risk informed applications. This data analysis shall be consistent with the risk-based decision requirements.	Plant specific data collection shall include failures of equipment coupled with either data on success or reasonable estimates of total demands. "Run" failure rates may be difficult to obtain because of limited run times of equipment. Plant specific estimates may therefore be unrealistic.

Table D3-5

INDUSTRY PRA PEER REVIEW PROCESS SUBTIER CRITERIA: DATA ANALYSIS

Designator	CRITERIA	SUBTIER CRITERIA		
		Risk Ranking Prioritization	Risk Informed Decisions	Risk-Based Decisions
DA-4 (cont'd)				The data collection period should be generally consistent with the as-built, as-operated plant being analyzed. The treatment of rectification in the data analysis should be realistic and the bases well documented. Selection of components requiring plant specific data shall be based on a stated criteria, e.g., RAW > 2 or FV > 1.005.
DA-5	• For plant specific data development, similar components have been grouped together in a reasonable manner and the grouping is supported by the documentation.	Plant specific data development, as applicable, shall meet the requirements in the risk-informed decisions.	Grouping of components for data collection purposes should account for the following: • Size • Service condition • Frequency of demands • Environmental condition The groups should be sufficiently similar to justify the derivation of plant specific data. The component boundary should be explicitly defined such that the PRA model, the data collection, the use of common cause BETA or MGL factors, and the use of generic data for Bayesian update are all consistent.	Grouping of components for data collection purposes shall account for the following: • Size • Service condition • Frequency of demands • Environmental condition The groups shall be sufficiently similar to justify the derivation of plant specific data. The component boundary shall be explicitly defined such that the PRA model, the data collection, the use of common cause BETA or MGL factors, and the use of generic data for Bayesian update are all consistent.

Table D3-5

INDUSTRY PRA PEER REVIEW PROCESS SUBTIER CRITERIA: DATA ANALYSIS

Designator	CRITERIA	SUBTIER CRITERIA		
		Risk Ranking Prioritization	Risk Informed Decisions	Risk-Based Decisions
DA-6	• For basic events derived using standby failure rate data, the plant specific surveillance test intervals have been identified and used in the analysis.	Surveillance test intervals identified in maintenance procedures or surveillance test requirements may be used to estimate the intervals between component testing. For components not normally tested or tested at relatively long intervals, the demand failure rates from generic data sources may not be appropriate. To account for the longer surveillance intervals, a standby failure rate (/ hr) and the approximation λ T/2 for the failure probability may be used.	Surveillance test intervals identified in maintenance procedures or surveillance test requirements should be used to estimate the intervals between component testing. For components not normally tested or tested at relatively long intervals, the demand failure rates from generic data sources may not be appropriate. To account for the longer surveillance intervals, a standby failure rate (/ hr) and the approximation λ T/2 for the failure probability should be used.	Surveillance test intervals identified in maintenance procedures or surveillance test requirements shall be used to estimate the intervals between component testing and this evaluation shall be augmented by confirmation of these results with plant staff. For components not normally tested or tested at relatively long intervals, the demand failure rates from generic data sources may not be appropriate. To account for the longer surveillance intervals, a standby failure rate (/ hr) and the approximation λ T/2 for the failure probability should be used.
DA-7	<u>SYSTEM/TRAIN MAINTENANCE UNAVAILABILITIES</u> (1) • The system/train maintenance unavailabilities are derived based on generic data sources. <u>OR</u> • The maintenance unavailabilities reflect plant specific practices and are reasonable or are higher than the projected maintenance goals used by the utility. <u>OR</u> • The system/train maintenance unavailabilities are derived based on plant specific data.	The system/train maintenance unavailabilities may be derived based on generic data sources or data from similar plants. The disallowed maintenance (or mutually exclusive) file should be developed based on plant Technical Specifications or procedures.	The maintenance unavailabilities reflect plant specific practices and should be reasonable or higher than the projected Maintenance Rule goals used by the utility. The use of vendor data bases should be avoided. The disallowed maintenance (or mutually exclusive) file should be developed based on plant Technical Specifications or procedures.	The system/train maintenance unavailabilities shall be derived based on plant specific data representing the as-built, as-operated plant. The use of vendor data bases should be avoided. The disallowed maintenance (or mutually exclusive) file should be developed based on plant Technical Specifications or procedures.

Table D3-5

INDUSTRY PRA PEER REVIEW PROCESS SUBTIER CRITERIA: DATA ANALYSIS

Designator	CRITERIA	SUBTIER CRITERIA		
		Risk Ranking Prioritization	Risk Informed Decisions	Risk-Based Decisions
DA-8	COMMON CAUSE FAILURE PROBABILITIES • The common cause failure probabilities are referenced to acceptable data sources.[2]	The CCF data should reference an up to date source, e.g., the NRC INEL report. This latest NRC compilation of CCF probabilities is considered to be the best available CCF assessment. (See NUREG/CR-6268) The component boundaries should be consistent with the common cause data used to characterize the component.	The CCF data should reference an up to date source, e.g., the NRC INEL report. This latest NRC compilation of CCF probabilities is considered to be the best available CCF assessment. (See NUREG/CR-6268) The component boundaries shall be consistent with the common cause data used to characterize the component.	The CCF data should reference an up to date source, e.g., the NRC INEL report. This latest NRC compilation of CCF probabilities is considered to be the best available CCF assessment. (See NUREG/CR-6268) The component boundary should be explicitly defined such that the PRA model, the data collection, the use of common cause BETA or MGL factors, and the use of generic and plant specific data for Bayesian update are all consistent.
DA-9	• The common cause failure probabilities are realistic based on generic data source comparisons.	Conservative bias may exist in the common cause failure probabilities and their implementation. Common cause failure modes of “fail to run” and “fail to start” should be applied as appropriate and as available data would support.	Mostly realistic common cause failure probabilities and modeling should be used consistent with available data. Common cause failure modes of “fail to run” and “fail to start” should be applied as appropriate and as available data would support.	Realistic estimates of common cause failure probabilities shall be used including plant specific mapping of failure modes. Common cause failure modes of “fail to run” and “fail to start” shall be applied as appropriate and as available data would support.
DA-10	• Common cause groups to which the common cause failure probability applies have been derived based on sound judgment and are documented.	Common cause groups should be established using a logical, systematic process that considers similarity in: • service conditions (standby vs. running) • environment • design • maintenance • lubrication • fuel • spatial interactions	Common cause groups shall be established using a logical, systematic process that considers similarity in: • service conditions (standby vs. running) • environment • design • maintenance • lubrication • fuel • spatial interactions	Common cause groups shall be established using a logical, systematic process that considers similarity in: • service conditions (standby vs. running) • environment • design • maintenance • lubrication • fuel • spatial interactions

Table D3-5

INDUSTRY PRA PEER REVIEW PROCESS SUBTIER CRITERIA: DATA ANALYSIS

Designator	CRITERIA	SUBTIER CRITERIA		
		Risk Ranking Prioritization	Risk Informed Decisions	Risk-Based Decisions
DA-11	• Justification is provided for treatment of common cause failure of on-site AC sources that include consideration of: - Design diversity - Common maintenance crews - Common I&C technicians - Similarity of procedures - Common fuel oil - Common lube oil - Common heating/cooling designs		The consideration of CCF of on-site AC power sources should specifically address all the on-site diesels in detail. While there may be design diversity, there are important CCF considerations remaining including: • Common maintenance crews • Common I&C Techs. • Similarity of Procedures • Common fuel oil • Common lube oil • Possible similarity of heating/ cooling loops • Testing similarities (e.g., unloaded)	The consideration of CCF of on-site AC power sources shall specifically address all the on-site diesels in detail. While there may be design diversity, there are important CCF considerations remaining including: • Common maintenance crews • Common I&C Techs. • Similarity of Procedures • Common fuel oil • Common lube oil • Possible similarity of heating/ cooling loops • Testing similarities (e.g., unloaded) The common cause failure probability for all on-site diesels shall include a quantitative assessment that shall be reflected in the PRA model.
DA-12	• NUREG/CR-4780 (EPRI NP-5613 or equivalent) systematic approach used to provide plant specific grouping of similar system components for CCF treatment	---	NUREG/CR-4780 (EPRI NP-5613 or equivalent) systematic approach should be used to provide plant specific grouping of similar system components for CCF treatment	NUREG/CR-4780 (EPRI NP-5613 or equivalent) systematic approach shall be used to provide plant specific grouping of similar system components for CCF treatment
DA-13	• Dominant contributors for sequences include MGL for more than 2 redundant trains	The Beta factor method may be used for more than 2 redundant components.	Dominant contributors for sequences should include the MGL or equivalent methodology for more than 2 redundant trains	Dominant contributors for sequences shall include the MGL or equivalent methodology for more than 2 redundant trains
DA-14	• Full intent of NUREG/CR-4780 (EPRI NP-5613 or equivalent) included: - Plant specific screening of common cause data	---	---	Full intent of NUREG/CR-4780 (EPRI NP-5613 or equivalent) shall be included: • Plant specific screening of common cause data

Table D3-5

INDUSTRY PRA PEER REVIEW PROCESS SUBTIER CRITERIA: DATA ANALYSIS

Designator	CRITERIA	SUBTIER CRITERIA		
		Risk Ranking Prioritization	Risk Informed Decisions	Risk-Based Decisions
DA-15	UNIQUE UNAVAILABILITIES OR MODELING ITEMS • Documentation of the failure probabilities from plant specific or generic sources that do not fit into the basic event database, e.g.: - AC Power Recovery - EDG Mission Time - Repair and Recovery Model - LOOP Given Transient	The bases for the unique unavailability items may be based on generic data, conservative estimates, or plant specific data. AC recovery may be based on available generic data.	The unique unavailabilities should be based on plant specific data (if available) otherwise realistic estimates based on plant specific as-built, as-operated features. AC recovery should be based on available and applicable data.	The unique unavailabilities shall be based on plant specific data (if available) otherwise realistic estimates based on plant specific as-built, as-operated features. AC recovery shall be based on available and applicable data.
	- BOP Unavailability - Pipe/tank Rupture Failure Probability - ATWS-related RPS Failures - RCP Seal Failure (for PWRs) - % of time Pressurizer PORVs blocked during operation (PWRs) - PORV demand probability given an initiating event - % of time SG PORVs or atmospheric dump valves blocked during operation - ARI (for BWRs) - RPT (for BWRs) - PCS Recovery (for BWRs) - SORV (for BWRs)	Repair modeling should in general be applied only if extended times are available. Recovery modeling shall be tied with repair modeling when equipment must be restored to a usable condition. Recovery modeling may address issues related to operator interaction (HRA), repair (failure mode dependent), access, environment, etc.	Repair modeling should in general be applied only if extended times are available. Recovery modeling shall be tied with repair modeling when equipment must be restored to a usable condition. Recovery modeling should address issues related to operator interaction (HRA), repair (failure mode dependent), access, environment, etc.	Repair modeling should in general be applied only if extended times are available. Recovery modeling shall be tied with repair modeling when equipment must be restored to a usable condition. Recovery modeling shall address issues related to operator interaction (HRA), repair (failure mode dependent), access, environment, etc.

Table D3-5

INDUSTRY PRA PEER REVIEW PROCESS SUBTIER CRITERIA: DATA ANALYSIS

Designator	CRITERIA	SUBTIER CRITERIA		
		Risk Ranking Prioritization	Risk Informed Decisions	Risk-Based Decisions
DA-16	• Conservatively biased values OR • The values are judged conservative only for those contributors of non-dominant sequences OR • These failure probabilities are justified to the current state of the technology	Conservatively biased values may be used.	The values should be conservative only for those contributors of non-dominant sequences	These failure probabilities shall be justified to the current state of the technology
DA-17	DOCUMENTATION • Reflects the process used		Documentation should provide the basis for meeting each of the criteria DA-4 through DA-16. The documentation shall describe the results consistent with the process.	Documentation shall provide the basis for meeting each of the criteria DA-4 through DA-16. The documentation shall describe the results consistent with the process.
DA-18	• Includes an independent review for the documented results		Independent review should be performed and documented by knowledgeable personnel.	Independent review shall be performed and documented by knowledgeable personnel.
DA-19	• Provides the basis of the data treatment and is traceable to plant specific or generic analysis.		Documentation should provide the basis for data analysis process.	Documentation shall provide the basis for data analysis process.
DA-20	• The generic and plant specific data bases are available for inspection and use.		The data base should be documented and traceable to the sources of plant specific, and generic data sources for failure and maintenance events, demands and operating time, common cause events, treatment of restoration of components in the maintenance data, and the assumptions and methods used to derive data parameter values.	The data base shall be documented and traceable to the sources of plant specific, and generic data sources for failure and maintenance events, demands and operating time, common cause events, treatment of restoration of components in the maintenance data, and the assumptions and methods used to derive data parameter values.

Table D3-6

INDUSTRY PRA PEER REVIEW SUBTIER CRITERIA: HUMAN RELIABILITY ANALYSIS

Designator	CRITERIA	SUBTIER CRITERIA		
		Risk Ranking Prioritization	Risk Informed Decision Making	Risk Based Decision Making
HR-1	GUIDANCE • Describes the process used	N/A	The documentation of the HRA should be sufficiently well described in the documented results to act as guidance for future updates and revisions.	A specific guidance document should be available that specifies the process for HRA including the updating process. Guidance on the rules used for replacing screening HEPs with best estimate HEPs in Post Processors (so-called "Recovery" substitutions) shall be provided (if applicable). The explanation should include the specific steps performed in the recovery process. The guidance should address the PSF for complexity, limited resources, time, stress, and uncertainty in instrumentation.
HR-2	• Consistent with industry practices	General adherence to accepted industry approaches should be included.	The documentation should provide a reasonable basis for performing the HRA and should maintain consistency with proven approaches.	The guidance for HRA should be complete and detailed and should maintain consistency with proven approaches.
HR-3	• Sufficient detail provided for reproducing the evaluation	Guidance may be available to supply general approaches used.	The guidance should be sufficient to provide a means to obtain equivalent results.	The guidance shall be sufficiently detailed to reproduce the results.
HR-4	PRE-INITIATOR HUMAN ACTIONS • Pre-initiator Human Interactions (HIs) were considered in the PRA	Pre-initiators may be included in the PRA explicitly, especially for latent failures that can cause multiple redundant components to fail or may be included with failure rate data for independent failures.	Pre-initiators should be included in the PRA explicitly, especially for latent failures that can cause multiple redundant components to fail.	Pre-initiators shall be included in the PRA explicitly, especially for latent failures that can cause multiple redundant components to fail.
HR-5	• A systematic process is used to identify the Pre-Initiator Human Errors to be included in the PRA (e.g., miscalibration of instruments)	A systematic process may be used to identify the Pre-Initiator Human Errors to be included in the PRA (e.g., miscalibration of instruments)	A systematic process should be used to identify the Pre-Initiator Human Errors to be included in the PRA (e.g., miscalibration of instruments) This should include a review of plant procedures and training in order to identify those latent failures that may defeat multiple redundant equipment.	A systematic process shall be used to identify the Pre-Initiator Human Errors to be included in the PRA (e.g., miscalibration of instruments) This shall include a review of plant procedures and training in order to identify those latent failures that may defeat multiple redundant equipment.

Table D3-6

INDUSTRY PRA PEER REVIEW SUBTIER CRITERIA: HUMAN RELIABILITY ANALYSIS

Designator	CRITERIA	SUBTIER CRITERIA		
		Risk Ranking Prioritization	Risk Informed Decision Making	Risk Based Decision Making
HR-6	• Screening HEPs are used in the quantification of the pre-initiator HEPs OR • Best estimate HEPs are used in the quantification of pre-initiator HEPs for dominant contributors OR • Assessment of plant procedures and plant specific operating experience are explicitly included in the identification and quantification process for the HIs.	Preinitiator HEPs may be screened from further consideration if: • Equipment position is monitored • Equipment is automatically re-aligned • Post maintenance functional test is performed. Screening HEPs may be used in the quantification of the pre-initiator HEPs.	Preinitiator HEPs may be screened from further consideration if: • Equipment position is monitored • Equipment is automatically re-aligned • Post maintenance functional test is performed. Best estimate HEPs should be used in the quantification of pre-initiator HEPs for dominant contributors, including recovery.	Preinitiator HEPs may be screened from further consideration if: • Equipment position is monitored • Equipment is automatically re-aligned • Post maintenance functional test is performed. Best estimate HEPs shall be used in the quantification of pre-initiator HEPs for dominant contributors, including recovery Assessment of plant procedures and plant specific operating experience shall be explicitly included in the identification and quantification process for the HIs.
HR-7	• Those pre-initiator actions with the possibility of adversely impacting baseline CDF or LERF are included in the quantification.	Those pre-initiator actions with the possibility of adversely impacting baseline CDF or LERF should be included in the quantification.	Those pre-initiator actions with the possibility of adversely impacting baseline CDF or LERF shall be included in the quantification.	Those pre-initiator actions with the possibility of adversely impacting baseline CDF or LERF shall be included in the quantification.
HR-8	POST-INITIATOR HUMAN ACTIONS • Post-Initiator HIs were considered in the PRA	HEPs for initiation, control, isolation, and alignment of prevention and mitigation systems should be included.	HEPs for initiation, control, isolation, and alignment of prevention and mitigation systems shall be included.	HEPs for initiation, control, isolation, and alignment of prevention and mitigation systems shall be included.
HR-9	• A systematic process is used to identify the Post-Initiator Human Errors to be included in the PRA.	A systematic process may be used to identify the Post-Initiator Human Errors to be included in the PRA.	A systematic process should be used to identify the Post-Initiator Human Errors to be included in the PRA.	A systematic process shall be used to identify the Post-Initiator Human Errors to be included in the PRA.

Table D3-6

INDUSTRY PRA PEER REVIEW SUBTIER CRITERIA: HUMAN RELIABILITY ANALYSIS

Designator	CRITERIA	SUBTIER CRITERIA		
		Risk Ranking Prioritization	Risk Informed Decision Making	Risk Based Decision Making
HR-10	• Assessment of plant procedures and plant specific operating experience are explicitly included in the identification and quantification process for the HIs.	Assessment of plant procedures and plant specific operating experience should be explicitly included in the identification and quantification process for the HIs.	Assessment of plant procedures and plant specific operating experience should be explicitly included in the identification and quantification process for the HIs. Interviews with operators, trainers, or supervisors should be included in the assessment.	Assessment of plant procedures and plant specific operating experience shall be explicitly included in the identification and quantification process for the HIs. Interviews with operators, trainers, or supervisors shall be included in the assessment.
HR-11	• The symptoms available during the postulated accident sequence are evaluated and input into the HRA process.	The accident sequence specific symptoms should be used as part of the input to the HRA process.	The accident sequence specific symptoms shall be used as part of the input to the HRA process.	The accident sequence specific symptoms shall be used as part of the input to the HRA process.
HR-12	• HEP values are internally consistent within the PRA.	HEP values should provide the correct relative error probabilities within the PRA. This means that the use of screening HEPs should be minimized.	HEP values should provide the correct relative error probabilities within the PRA. This means that the use of screening HEPs shall be minimized.	HEP values shall provide the correct relative error probabilities within the PRA.
HR-13 [(1)]	• Screening HEPs are used in the quantification of dominant contributors.	Screening HEPs shall not be used in the quantification of dominant contributors to CDF or LERF.	Screening HEPs shall not be used in the quantification of dominant contributors to CDF or LERF.	Screening HEPs shall not be used in the quantification of dominant contributors to CDF or LERF.
HR-14	• Operator actions have been reviewed by the operating staff and their impact is included in the HRA evaluation; OR • Dominant operator actions have been reviewed by the operating staff and their input has been included in the HRA evaluation.	Operator actions may be reviewed by the operating staff and their impact is included in the HRA evaluation; AND Dominant operator actions may be reviewed by the operating staff and their input has been included in the HRA evaluation.	Operator actions should be reviewed by the operating staff and their impact is included in the HRA evaluation; OR Dominant operator actions shall be reviewed by the operating staff and their input has been included in the HRA evaluation. AND	Operator actions shall be reviewed by the operating staff and their impact is included in the HRA evaluation; AND

Table D3-6

INDUSTRY PRA PEER REVIEW SUBTIER CRITERIA: HUMAN RELIABILITY ANALYSIS

Designator	CRITERIA	SUBTIER CRITERIA		
		Risk Ranking Prioritization	Risk Informed Decision Making	Risk Based Decision Making
HR-14 (cont'd)			HRA assumptions and assertions should be consistent with operator training and procedures. One way to ensure the assumptions are consistent with training and actual conditions is to obtain a review by operations or training personnel. Therefore, the operating staff (or equivalent personnel should review the HRA calculations, especially the assumptions made in the analysis.	HRA assumptions and assertions should be consistent with operator training and procedures. One way to ensure the assumptions are consistent with training and actual conditions is to obtain a review by operations or training personnel. Therefore, the operating staff (or equivalent personnel should review the HRA calculations, especially the assumptions made in the analysis.
HR-15 (1)	• Best estimate HEPs are used in the quantification of dominant contributors.	Conservative HEPs may be used in the PRA quantification.	Best estimate HEPs shall be used in the quantification of dominant contributors.	Best estimate HEPs shall be used in the quantification of dominant contributors.
HR-16	• Emphasis of the Human Reliability Analysis is to identify that the HI is folded correctly into the model and that the HI: - Reflects the procedures (EOPs & AOPs) - Reflects training - Reflects simulator results (if applicable)	The HEP should be developed such that it accurately reflects the: • Procedures (EOPs and AOPs) • Training on the implementation • Simulator Responses These should all be reflective of the accident sequence that is being modeled. The HEP should then be included in the model to represent those sequence specific actions for which it was developed.	The HEP should be developed such that it accurately reflects the: • Procedures (EOPs and AOPs) • Training on the implementation • Simulator Responses These should all be reflective of the accident sequence that is being modeled. The HEP should then be included in them model to represent those sequence specific actions for which it was developed.	The HEP shall be developed such that it accurately reflects the: • Procedures (EOPs and AOPs) • Training on the implementation • Simulator Responses These shall all be reflective of the accident sequence that is being modeled. The HEP shall then be included in them model to represent those sequence specific actions for which it was developed.
HR-17	• The performance shaping factors such as time available, time to perform, stress, complexity, etc. are included in the quantification.	Performance shaping factors formulated for the specific accident sequence and the associated HEP (including time available, time to perform, stress, complexity, available indication, resource limitations on the back shift etc. may be included in the quantification as applicable. Contributors to the total HEP should be incorporated in the assessment; e.g.: • Diagnosis • Manipulation	Performance shaping factors formulated for the specific accident sequence and the associated HEP (including time available, time to perform, stress, complexity, available indication, resource limitations on the back shift etc. should be included in the quantification as applicable. Contributors to the total HEP shall be incorporated in the assessment; e.g.: • Diagnosis • Manipulation	Performance shaping factors formulated for the specific accident sequence and the associated HEP (including time available, time to perform, stress, complexity, available indication, resource limitations on the back shift etc. shall be included in the quantification as applicable. Contributors to the total HEP shall be incorporated in the assessment; e.g.: • Diagnosis • Manipulation

Table D3-6

INDUSTRY PRA PEER REVIEW SUBTIER CRITERIA: HUMAN RELIABILITY ANALYSIS

Designator	CRITERIA	SUBTIER CRITERIA		
		Risk Ranking Prioritization	Risk Informed Decision Making	Risk Based Decision Making
HR-17 (cont'd)			The post-initiator HEP should address the: • Accident sequence specific timing • Accident sequence specific procedural guidance • Adverse environment associated with the accident sequence • The instrumentation availability for the accident sequence These factors may then result in sequence specific HEPs. The HRA assessment should account for potential delays in the cues to begin actions and account for competing effects if multiple failures have occurred. Ex-control Room human action times for travel and manipulation should be supported by operator interviews, JPMs, or observations. Assumptions to be confirmed by operations, training or a walkdown should include: • Number of personnel available • Indication availability • Availability of keys for key locks (control room or remote) • Security access • Pathway hazards for remote access	The post-initiator HEP shall address the: • Accident sequence specific timing • Accident sequence specific procedural guidance • Adverse environment associated with the accident sequence • The instrumentation availability for the accident sequence These factors may then result in sequence specific HEPs. The HRA assessment shall account for potential delays in the cues to begin actions and account for competing effects if multiple failures have occurred. Ex-control Room human action times for travel and manipulation should be supported by operator interviews, JPMs, or observations. Assumptions to be confirmed by operations, training or a walkdown shall include: • Number of personnel available • Indication availability • Availability of keys for key locks (control room or remote) • Security access • Pathway hazards for remote access
HR-18	• The performance shaping factor for time available for an action and the time required to take an action are developed on a plant specific basis.	The performance shaping factor for time available for an action and the time required to take an action may be developed on a plant specific basis.	The performance shaping factor for time available for an action and the time required to take an action should be developed on a plant specific basis.	The performance shaping factor for time available for an action and the time required to take an action shall be developed on a plant specific basis.

Table D3-6

INDUSTRY PRA PEER REVIEW SUBTIER CRITERIA: HUMAN RELIABILITY ANALYSIS

Designator	CRITERIA	SUBTIER CRITERIA		
		Risk Ranking Prioritization	Risk Informed Decision Making	Risk Based Decision Making
HR-19	• The time available for action is based on: - generic T & H analysis <u>OR</u> - plant specific T & H analysis	The time available for action may be based on: • generic T & H analysis Power uprate effects should be included. The time of cues for taking an operator action may be identified.	The time available for an action to be taken should be based on plant specific thermal hydraulic analysis or appropriate generic analysis that accounts for plant specific features. Power uprate effects should be included. The time of cues for taking an operator action should be identified.	The time available for an action to be taken shall be based on plant specific thermal hydraulic analysis. Power uprate effects shall be included. The time of cues for taking an operator action shall be identified.
HR-20	• The time required to complete the actions is based on observation or operations staff input.	The time required to complete the actions may be based on observation or operations staff input.	The time required to complete the actions should be based on observation or operations staff input.	The time required to complete the actions shall be based on observation or operations staff input.
HR-21	• The recovery actions are included systematically in the model; <u>OR</u> The recovery actions are included selectively in the model for dominant cut sets.	The recovery actions may be included selectively in the model for dominant cut sets.	The recovery actions should be included systematically in the model Model coding of basic events should allow the identification of operator actions: pre-initiators, post-initiators, repair and recovery.	The recovery actions shall be included systematically in the model. Model coding of basic events should allow the identification of operator actions: pre-initiators, post-initiators, repair and recovery.
HR-22	• The models and analysis are consistent with the operating procedures and training.	The models and analysis should be consistent with the operating procedures and training.	The models and analysis shall be consistent with the operating procedures and training.	The models and analysis shall be consistent with the operating procedures and training.
HR-23	• Operator actions including recovery are not credited unless a procedure is available or operator training has included the action as part of crew's training.	Operator actions including recovery should not be credited unless a procedure is available or operator training has included the action as part of crew's training.	Operator actions including recovery should not be credited unless a procedure is available or operator training has included the action as part of crew's training.	Operator actions including recovery are not credited unless a procedure is available or operator training has included the action as part of crew's training.
HR-24	• Inter-unit cross ties are only credited if procedures <u>and</u> training are available.	Inter-unit cross ties should be only credited if procedures <u>and</u> training are available.	Inter-unit cross ties should be only credited if procedures <u>and</u> training are available.	Inter-unit cross ties shall be only credited if procedures <u>and</u> training are available.

Table D3-6

INDUSTRY PRA PEER REVIEW SUBTIER CRITERIA: HUMAN RELIABILITY ANALYSIS

Designator	CRITERIA	SUBTIER CRITERIA		
		Risk Ranking Prioritization	Risk Informed Decision Making	Risk Based Decision Making
HR-25	• Inter-unit cross ties are accurately accounted for under conditions of outage for the other unit and special initiating events.	Inter-unit cross ties should be accurately accounted for under conditions of outage for the other unit and special initiating events.	Inter-unit cross ties should be accurately accounted for under conditions of outage for the other unit and special initiating events.	Inter-unit cross ties shall be accurately accounted for under conditions of outage for the other unit and special initiating events.
HR-26	DEPENDENCE AMONG ACTIONS • The dependence among human actions is evaluated in the PSA process.	The dependence among human actions should be evaluated in the PSA process.	The dependence among human actions shall be evaluated in the PSA process.	The dependence among human actions shall be evaluated in the PSA process.
HR-27	• Identification of sequences that, but for low human error rates in recovery actions, would have been dominant contributors to core damage frequency is included as a test of modeling adequacy. Equivalent techniques may also be used.	Identification of sequences that, but for low human error rates in recovery actions, would have been dominant contributors to core damage frequency may be included as a test of modeling adequacy. Equivalent techniques may also be used. For those HEPs quantified, the total operating crew failure probability is a single cutset or sequence should not be less than 1E-6 unless additional justification is provided. For example, sequences with time lines greater than 24 hours could be justified to have a total HEP contribution less than 5E-7.	Identification of sequences that, but for low human error rates in recovery actions, would have been dominant contributors to core damage frequency should be included as a test of modeling adequacy. Equivalent techniques may also be used. For those HEPs quantified, the total operating crew failure probability is a single cutset or sequence should not be less than 1E-6 unless additional justification is provided. For example, sequences with time lines greater than 24 hours could be justified to have a total HEP contribution less than 5E-7.	Identification of sequences that, but for low human error rates in recovery actions, would have been dominant contributors to core damage frequency shall be included as a test of modeling adequacy. Equivalent techniques may also be used. For those HEPs quantified, the total operating crew failure probability is a single cutset or sequence should not be less than 1E-6 unless additional justification is provided. For example, sequences with time lines greater than 24 hours could be justified to have a total HEP contribution less than 5E-7.
HR-28	DOCUMENTATION • Reflects the process used	NA	Documentation should provide the basis for meeting each of the criteria HR-4 through HR-10. The documentation should describe the results consistent with the process.	Documentation shall provide the basis for meeting each of the criteria HR-4 through HR-10. The documentation shall describe the results consistent with the process.
HR-29	• Includes an independent review for the documented results	Independent review may be performed and documented by knowledgeable personnel.	Independent review should be performed and documented by knowledgeable personnel.	Independent review should be performed and documented by knowledgeable personnel.

Table D3-6

INDUSTRY PRA PEER REVIEW SUBTIER CRITERIA: HUMAN RELIABILITY ANALYSIS

Designator	CRITERIA	SUBTIER CRITERIA		
		Risk Ranking Prioritization	Risk Informed Decision Making	Risk Based Decision Making
HR-30	• Provides the basis of the HRA and is traceable to plant specific or generic analysis.	Documentation may provide the basis for HRA process.	Documentation should provide the basis for HRA process.	Documentation shall provide the basis for HRA process.

Table D3-7

INDUSTRY PRA PEER REVIEW SUBTIER CRITERIA: STRUCTURAL RESPONSE

Designator	CRITERIA	SUBTIER CRITERIA		
		Risk Ranking Prioritization	Risk Informed Decision Making	Risk Based Decision Making
ST-1	<u>GUIDANCE</u> • Describes the process used	---	The documentation of the structural analysis should be sufficiently well described in the documented results to act as guidance for future updates and revisions.	A specific guidance document should be available that specifies the process for structural analysis including the updating process. Guidance for the structural evaluation for the following should be included for both Level 1 and Level 2 challenges: • RPV (ATWS and non-ATWS) • Containment • Pipe • Flood Barriers • Reactor Buildings
ST-2	• Consistent with industry practices	General adherence to accepted industry approaches should be included.	The documentation should provide a reasonable basis for performing the structural analysis and should maintain consistency with proven approaches.	The guidance for structural analysis should be complete and detailed and should maintain consistency with proven approaches.
ST-3	• Sufficient detail provided for reproducing the evaluation	Guidance may be available to supply general approaches used.	The guidance should be sufficient to provide a means to obtain equivalent results.	The guidance shall be sufficiently detailed to reproduce the results.

Table D3-7

INDUSTRY PRA PEER REVIEW SUBTIER CRITERIA: STRUCTURAL RESPONSE

Designator	CRITERIA	SUBTIER CRITERIA		
		Risk Ranking Prioritization	Risk Informed Decision Making	Risk Based Decision Making
ST-4	<u>RPV CAPABILITY (ATWS)</u> • Failure Limit considered, <u>OR</u> • Best estimate failure condition considered (ASME Service Level C used)	The definition of the RPV ultimate capacity for various challenges should be provided. This may include: • Overpressure • Pressurized thermal shock • Debris attack (Level 2/LERF only) This definition may include conservatisms in the evaluation. This may include UFSAR evaluations of Service Level C or number of SRVs required for different challenges (e.g., transient, ATWS).	The definition of the RPV ultimate capacity for various challenges should be provided. This may include: • Overpressure • Pressurized thermal shock • Debris attack (Level 2/LERF only) This definition may include conservatisms in the evaluation.	A best estimate of the RPV ultimate capacity for the following challenges shall be provided. This shall include: • Overpressure • Pressurized thermal shock • Debris attack (Level 2/LERF only)

Table D3-7

INDUSTRY PRA PEER REVIEW SUBTIER CRITERIA: STRUCTURAL RESPONSE

Designator	CRITERIA	SUBTIER CRITERIA		
		Risk Ranking Prioritization	Risk Informed Decision Making	Risk Based Decision Making
ST-5	<u>CONTAINMENT</u> • Conservative estimate of failure probability is used <u>OR</u> • Realistic estimate of failure probability is used based on detailed plant specific structural examination	The containment ultimate capacity for the various challenges that are evaluated in the PRA should be provided. This may include: • Overpressure • High pressure and temperature • Dynamic loading • Combustible gas events • Debris Contact • Steam Explosion • Direct Containment Heating This containment capacity may include conservatisms in the evaluation and may be based on comparison of the plant specific features with a reference plant analysis. Generic containment failure modes may be used as a starting point for the containment failure mode assessment. Containment failure paths and size of failures may be included in the evaluation if they may influence LERF assessment.	The containment ultimate capacity for the various challenges that are evaluated in the PRA should be provided. This should include: • Overpressure • High pressure and temperature • Dynamic loading • Combustible gas events • Debris Contact • Steam Explosion • Direct Containment Heating This containment capacity may include conservatisms in the evaluation. The evaluation of the containment capacity should be plant specific. Generic containment failure modes should be used as a starting point for the containment failure mode assessment. Behavior of containment seals, penetrations, and hatches should be fully addressed beyond the design basis temperature and pressure for contributing failure modes and failure pathways. The PRA should provide a best estimate evaluation of containment structural capability which assesses all potential impacts. This includes: • Impact on Level 1 -- adverse impacts on core damage prevention • Impact on release • Impact on suppression pool bypass	A best estimate plant specific containment ultimate capacity evaluation for the following challenges shall be provided: • Overpressure • High pressure and temperature • Dynamic loading • Combustible gas events • Debris Contact • Steam Explosion • Direct Containment Heating Generic containment failure modes should be used as a starting point for the containment failure mode assessment. Behavior of containment seals, penetrations, and hatches should be fully addressed beyond the design basis temperature and pressure for contributing failure modes and failure pathways. The PRA shall provide a best estimate evaluation of containment structural capability which assesses all potential impacts. This includes: • Impact on Level 1 -- adverse impacts on core damage prevention • Impact on release • Impact on suppression pool bypass

Table D3-7

INDUSTRY PRA PEER REVIEW SUBTIER CRITERIA: STRUCTURAL RESPONSE

Designator	CRITERIA	SUBTIER CRITERIA		
		Risk Ranking Prioritization	Risk Informed Decision Making	Risk Based Decision Making
ST-5 (cont'd)			Unique containment characteristics should be explicitly assessed in the plant specific analysis. Examples include the following: 1. External Ring Header 2. External Wetwell to Drywell Vacuum Breaker Lines 3. Single Ply external expansion bellows 4. Dynamic Torus Loading 5. Reactor Building to torus vacuum breakers 6. Free Standing Steel vs. Concrete Containment failure paths and size of failures should be included in the evaluation if they may influence LERF assessment.	Unique containment characteristics shall be explicitly assessed in the plant specific analysis. Examples include the following: 1. External Ring Header 2. External Wetwell to Drywell Vacuum Breaker Lines 3. Single Ply external expansion bellows 4. Dynamic Torus Loading 5. Reactor Building to torus vacuum breakers 6. Free Standing Steel vs. Concrete Containment failure paths and size of failures shall be included in the evaluation if they may influence LERF assessment.
ST-6	• Level 2 analysis considers multiple pathways from the containment	Multiple containment failure pathways should be included in the evaluation of containment performance for Level 2. (Specifically, DW head, DW shell, wetwell airspace, and wetwell waterspace failures should all be included in the probabilistic assessment and Level 2 evaluation.) In addition, if coincident multiple failure modes are possible during a single accident scenario, the impact on radionuclide release should be incorporated.	Multiple containment failure pathways shall be included in the evaluation of containment performance for Level 2. (Specifically, DW head, DW shell, wetwell airspace, and wetwell waterspace failures shall all be included in the probabilistic assessment and Level 2 evaluation.) In addition, if coincident multiple failure modes are possible during a single accident scenario, the impact on radionuclide release should be incorporated.	Multiple containment failure pathways shall be included in the evaluation of containment performance for Level 2. (Specifically, DW head, DW shell, wetwell airspace, and wetwell waterspace failures shall all be included in the probabilistic assessment and Level 2 evaluation.) In addition, if coincident multiple failure modes are possible during a single accident scenario, the impact on radionuclide release shall be incorporated.
ST-7	REACTOR BUILDING (for BWRs) • Blowout panels considered	Reactor building or auxiliary buildings should be assessed to determine the failure location given a release from the RPV or the containment. This should include the blowout panels.	Reactor building or auxiliary buildings should be assessed to determine the failure location given a release from the RPV or the containment. This should include the blowout panels.	Reactor building or auxiliary buildings should be assessed to determine the failure location given a release from the RPV or the containment. This should include the blowout panels.

Table D3-7

INDUSTRY PRA PEER REVIEW SUBTIER CRITERIA: STRUCTURAL RESPONSE

Designator	CRITERIA	SUBTIER CRITERIA		
		Risk Ranking Prioritization	Risk Informed Decision Making	Risk Based Decision Making
ST-8	• Level 2 analysis considers multiple pathways from the reactor building	Reactor Building failure modes that can lead to reduced decontamination factors and higher releases to the environment should be considered. This should include failure modes involving failures low in the reactor building and coincident failures higher in the Reactor Building leading to accelerated air flow and low DF.	Reactor Building failure modes that can lead to reduced decontamination factors and higher releases to the environment should be considered. This should include failure modes involving failures low in the reactor building and coincident failures higher in the Reactor Building leading to accelerated air flow and low DF.	Reactor Building failure modes that can lead to reduced decontamination factors and higher releases to the environment shall be considered. This shall include failure modes involving failures low in the reactor building and coincident failures higher in the Reactor Building leading to accelerated air flow and low DF.
ST-9	PIPE OVERPRESSURE (ISLOCA) • Conservative estimate is used OR • Generic realistic estimate is used OR • Plant specific realistic estimate is used	The pipe ultimate capacity under the conditions of exposure to high pressure (e.g., RPV pressure for incipient ISLOCA) should be provided. This may include conservatisms in the evaluation.	The pipe ultimate capacity under conditions of exposure to high pressure (e.g., RPV pressure for incipient ISLOCA) shall be provided on a realistic basis using methods specified by NRC in NUREG/CR-5603, NUREG/CR-5124, or their equivalent and may use typical pipe configuration and sizes in the evaluation to provide a realistic but generic or typical failure probability.	The pipe ultimate capacity under conditions of exposure to high pressure (e.g., RPV pressure for incipient ISLOCA) shall be provided on a realistic basis using methods specified by NRC in NUREG/CR-5603, NUREG/CR-5124, or their equivalent and shall use plant specific pipe parameters.

Table D3-7

INDUSTRY PRA PEER REVIEW SUBTIER CRITERIA: STRUCTURAL RESPONSE

Designator	CRITERIA	SUBTIER CRITERIA		
		Risk Ranking Prioritization	Risk Informed Decision Making	Risk Based Decision Making
ST-10	<u>FLOOD BARRIER INTEGRITY</u> • Internal flooding analysis considers flood barrier (e.g., doors) structural capability and features when these barriers are credited for limiting flood propagation	As part of the containment flooding accident sequence evaluation, the spatial effects of flooding should address the flood propagation paths. These path investigations should include: • Flood barrier penetration, failure, or inadvertent openings (e.g., doors) • Ventilation penetration pathways • Spray of the flood waters • Floor gratings • Drains • Drain system check valves Flood propagation should consider the failure modes of each in the assessment of flood accident sequences.	As part of the containment flooding accident sequence evaluation, the spatial effects of flooding should address the flood propagation paths. These path investigations should include: • Flood barrier penetration, failure, or inadvertent openings (e.g., doors) • Ventilation penetrations • Spray of the flood waters • Floor gratings • Drains • Drain system check valves Flood propagation should consider the failure modes of each in the assessment of flood accident sequences.	As part of the containment flooding accident sequence evaluation, the spatial effects of flooding shall address the flood propagation paths. These path investigations shall include: • Flood barrier penetration, failure, or inadvertent openings (e.g., doors) • Ventilation penetrations • Spray of the flood waters • Floor gratings • Drains • Drain system check valves Flood propagation shall consider the failure modes of each in the assessment of flood accident sequences.
ST-11	<u>DOCUMENTATION</u> • Reflects the process used		Documentation should provide the basis for meeting each of the criteria ST-4 through ST-10. The documentation should describe the results consistent with the process.	Documentation shall provide the basis for meeting each of the criteria ST-4 through SY-10. The documentation shall describe the results consistent with the process.
ST-12	• Includes an independent review for the documented results	The system analysis should be reviewed.	Independent review should be performed and documented by knowledgeable personnel, such as a structural engineer.	Independent review should be performed and documented by knowledgeable personnel, such as a structural engineer.
ST-13	• Provides the basis of the treatment and is traceable to plant specific or generic analysis.	Documentation may reflect process features.	Documentation should provide the basis for structural analysis process.	Documentation shall provide the basis for structural analysis process.

Table D3-8

INDUSTRY PRA PEER REVIEW SUBTIER CRITERIA: QUANTIFICATION AND RESULTS INTERPRETATION

Designator	CRITERIA	SUBTIER CRITERIA		
		Risk Ranking Prioritization	Risk Informed Decision Making	Risk Based Decision Making
QU-1	GUIDANCE • Describes the process used	N/A	The documentation of the quantification process should be sufficiently well described in the documented results to act as guidance for future updates and revisions.	A specific guidance document should be available that specifies the process for quantification including the updating process.
QU-2	• Consistent with industry practices	General adherence to accepted industry approaches should be included.	The documentation should provide a reasonable basis for performing the quantification and should maintain consistency with proven approaches.	The guidance for quantification should be complete and detailed and should maintain consistency with proven approaches.

Table D3-8

INDUSTRY PRA PEER REVIEW SUBTIER CRITERIA: QUANTIFICATION AND RESULTS INTERPRETATION

Designator	CRITERIA	SUBTIER CRITERIA		
		Risk Ranking Prioritization	Risk Informed Decision Making	Risk Based Decision Making
QU-3	• Sufficient detail provided for reproducing the evaluation	Guidance may be available to supply general approaches used. (See also QU-4, QU-6, QU-7)	• The guidance should be sufficient to provide a means to obtain equivalent results. • The mutually exclusive event file presents the combinations which are assumed not to occur in the final cutset result due to plant maintenance practices or operation. Examples include technical specifications, administrative procedures and non-physical cutsets. Entries in the mutually exclusive file should be documented regarding the basis for their removal from the final solution.. (See also QU-4, QU-6, QU-7)	• The guidance shall be sufficiently detailed to reproduce the results. • The guidance should include the specific steps performed. • The mutually exclusive event file presents the combinations which are assumed not to occur in the final cutset result due to plant maintenance practices or operation. Examples include technical specifications, administrative procedures and non-physical cutsets. Entries in the mutually exclusive file should be documented regarding the basis for their removal from the final solution. • Guidance should be provided regarding: (1) the treatment of non-minimal sequences and/or cutsets as part of the results interpretation and use of the model; (2) establishing maximum fault tree truncation limits, based on a number of decades below the FT quantification, the number of cutsets obtained, or convergence; (3) The sensitivity/uncertainty analysis to be performed should be identified; (4) description of levels of detail for ET nodes; (5) when and how to use transfers; (6) how to set up the computer files, what truncation limits to use. • This should ensure consistency between updates. (See also QU-4, QU-6, QU-7)

Table D3-8

INDUSTRY PRA PEER REVIEW SUBTIER CRITERIA: QUANTIFICATION AND RESULTS INTERPRETATION

Designator	CRITERIA	SUBTIER CRITERIA		
		Risk Ranking Prioritization	Risk Informed Decision Making	Risk Based Decision Making
QU-4	<u>CODE</u> • The base computer code and its inputs have been tested and demonstrated to produce reasonable answers.(3), (4)	Cutset truncation based on cutset order shall not be performed. For evaluations in which the rare event approximation does not apply, the computer code or its application to the PRA should properly account for this situation. If success branches of event trees are less than 0.9, the numerically correct estimate shall be used.	Cutset truncation based on cutset order shall not be performed. For evaluations in which the rare event approximation does not apply, the computer code or its application to the PRA should properly account for this situation. If success branches of event trees are less than 0.9, the numerically correct estimate shall be used. The same truncation limit used in evaluating system failures shall be used in the complementary success branches. Use of independent modules should not allow reduction in the truncation limit. The review and confirmation of the house event file and the disallowed maintenance (DAM) file should be performed to ensure quality. These files can fundamentally change the model results and are difficult to check intuitively.	Cutset truncation based on cutset order shall not be performed. For evaluations in which the rare event approximation does not apply, the computer code or its application to the PRA should properly account for this situation. If success branches of event trees are less than 0.9, the numerically correct estimate shall be used. The same truncation limit used in evaluating system failures shall be used in the complementary success branches. Use of independent modules should not allow reduction in the truncation limit. The review and confirmation of the house event file and the disallowed maintenance (DAM) file shall be performed to ensure quality. These files can fundamentally change the model results and are difficult to check intuitively.
QU-5	• The simplified model (cutset model) is demonstrated to produce reasonable results for typical applications.(2)	The simplified model (cutset model) may be demonstrated to produce reasonable results for typical applications.	The simplified model (cutset model) may be demonstrated to produce reasonable results for typical applications.	The simplified model (cutset model) may be demonstrated to produce reasonable results for typical applications.

Table D3-8

INDUSTRY PRA PEER REVIEW SUBTIER CRITERIA: QUANTIFICATION AND RESULTS INTERPRETATION

Designator	CRITERIA	SUBTIER CRITERIA: Risk Ranking Prioritization	SUBTIER CRITERIA: Risk Informed Decision Making	SUBTIER CRITERIA: Risk Based Decision Making
QU-6	• Applications are not limited by the capabilities of the computer code.	Each computer code in use has its own inconsistencies that make it difficult for inexperienced users. There should be written guidance or set of code limitations that treat such issues as: • Transfers between event trees may not carry the success terms or previous failure terms • Truncation limits in fault trees different than sequence truncation values • K of N gate limits • For high conditional failure probabilities in event trees, some codes may not quantitatively account for the success branch probability being less than 1.0.	Each computer code in use has its own inconsistencies that make it difficult for inexperienced users. There should be written guidance or set of code limitations that treat such issues as: • Transfers between event trees may not carry the success terms or previous failure terms • Truncation limits in fault trees different than sequence truncation values • K of N gate limits • For high conditional failure probabilities in event trees, some codes may not quantitatively account for the success branch probability being less than 1.0.	Each computer code in use has its own inconsistencies that make it difficult for inexperienced users. There should be written guidance or set of code limitations that treat such issues as: • Transfers between event trees may not carry the success terms or previous failure terms • Truncation limits in fault trees different than sequence truncation values • K of N gate limits • For high conditional failure probabilities in event trees, some codes may not quantitatively account for the success branch probability being less than 1.0.
QU-7	<u>SIMPLIFIED MODEL</u> • The simplified model (e.g., solved cutset) limitations are clearly identified.	The use of the "cutset" model or the "saved sequence" model, or any other simplified model should have a set of limitations documented that allow the user to check whether the limitations would impact the application.	The use of the "cutset" model or the "saved sequence" model, or any other simplified model should have a set of limitations documented that allow the user to check whether the limitations would impact the application. The RISKMAN "saved sequence" model or fault tree linked code cutset models have a number of limitations when it comes to applications. These limitations are in general well known. However the limitations should be documented for both future members of the PSA group or the users of the PSA such as the Maintenance Rule Expert Panel. These limitations include issues related to asymmetry in the model or in conditions related to truncation limits that lead to incorrect or misleading importance measures.	The use of the "cutset" model or the "saved sequence" model, or any other simplified model should have a set of limitations documented that allow the user to check whether the limitations would impact the application. The RISKMAN "saved sequence" model or fault tree linked code cutset models have a number of limitations when it comes to applications. These limitations are in general well known. However the limitations should be documented for both future members of the PSA group or the users of the PSA such as the Maintenance Rule Expert Panel. These limitations include issues related to asymmetry in the model or in conditions related to truncation limits that lead to incorrect or misleading importance measures.

Table D3-8

INDUSTRY PRA PEER REVIEW SUBTIER CRITERIA: QUANTIFICATION AND RESULTS INTERPRETATION

Designator	CRITERIA	SUBTIER CRITERIA Risk Ranking Prioritization	Risk Informed Decision Making	Risk Based Decision Making
QU-8	DOMINANT SEQUENCES/ CUTSETS • The dominant cut sets or sequences(1) - Make physical sense	A review of the dominant cutsets should be performed to demonstrate the reasonableness of the cutset results and to identify that there are no anomalies in the cutset results.	A review of the dominant cutsets shall be performed to demonstrate the reasonableness of the cutset results and to identify that there are no anomalies in the cutset results.	A review of the dominant cutsets shall be performed to demonstrate the reasonableness of the cutset results and to identify that there are no anomalies in the cutset results.
QU-9	- Include common cause potential where appropriate	Common cause failure probabilities may be included for key groups and the use of the latest common cause data may be used.	Common cause failure probabilities should be included for key groups and the latest common cause data should be used.	Common cause failure probabilities shall be included for key groups and the latest common cause data shall be used, plus a search for plant specific applicability of the common cause data shall be performed consistent with NUREG/CR-4780.
QU-10	- Include dependency among human actions when multiple HEPs are in the same cutset or sequence	The dependence among human actions should be evaluated in the PSA process. Identification of sequences that, but for low human error rates, would have been dominant contributors to core damage frequency may be included as a test of modeling adequacy. Equivalent techniques may also be used.	The dependence among human actions shall be evaluated in the PSA process. Identification of sequences that, but for low human error rates, would have been dominant contributors to core damage frequency should be included as a test of modeling adequacy. Equivalent techniques may also be used.	The dependence among human actions shall be evaluated in the PSA process. Identification of sequences that, but for low human error rates in, would have been dominant contributors to core damage frequency shall be included as a test of modeling adequacy. Equivalent techniques may also be used.
QU-11	- Are not missing potentially dominant cut sets or sequences for similar plants. Possible reasons for differences include: (a) physical plant or procedural differences among plants; (b) documented assumptions; (c) detailed modeling or data to supplant assumptions.	The cutsets from similar plants may be reviewed to ensure that dominant cutsets which have been observed at other plants should not be present in the analyzed plant.	The cutsets from similar plants should be reviewed to ensure that dominant cutsets which have been observed at other plants should not be present in the analyzed plant.	The cutsets from similar plants shall be reviewed to ensure that dominant cutsets which have been observed at other plants should not be present in the analyzed plant.

Table D3-8

INDUSTRY PRA PEER REVIEW SUBTIER CRITERIA: QUANTIFICATION AND RESULTS INTERPRETATION

Designator	CRITERIA	SUBTIER CRITERIA		
		Risk Ranking Prioritization	Risk Informed Decision Making	Risk Based Decision Making
QU-12	• Asymmetry: The model asymmetry is well described in terms of: - modeling - plant support systems - normally running equipment - cross-ties to an adjacent unit	The system notebooks, the event tree notebook, or the results summary may provide a description of the asymmetries in systems or in the modeling of systems.	The system notebooks, the event tree notebook, or the results summary should provide a description of the asymmetries in systems or in the modeling of systems. The design, data, operating philosophy, and operating conditions that can lead to asymmetries in the importance of components, systems, or system trains should be documented. This information should be useful in assessing implications of failures, on-line outage decisions, modifications, and accident response.	The system notebooks, the event tree notebook, or the results summary shall provide a description of the asymmetries in systems or in the modeling of systems. The design, data, operating philosophy, and operating conditions that can lead to asymmetries in the importance of components, systems, or system trains should be documented. This information should be useful in assessing implications of failures, on-line outage decisions, modifications, and accident response.
QU-13	• Asymmetry: Any modeling quantitative asymmetry (e.g., one train of dual-train system modeled as in-service, other in standby) is documented and is well understood so that applications affected by asymmetry can be determined.	Asymmetries in quantitative modeling may be explained and examined to provide application users the necessary understanding regarding why such asymmetries are present in the model.	Asymmetries in quantitative modeling should be explained and examined to provide application users the necessary understanding regarding why such asymmetries are present in the model.	Asymmetries in quantitative modeling shall be explained and examined to provide application users the necessary understanding regarding why such asymmetries are present in the model.
QU-14	• Circular logic can sometimes occur when using linked fault trees. The PSA process appropriately accounts for support system dependencies in a consistent fashion that avoids so-called circular logic.	The methods of eliminating circular logic may result in incorrect quantitative results, e.g., non-conservative. The cutting of circular logic in the model should be explained and should not introduce non-conservatisms in the model.	The methods of eliminating circular logic may result in incorrect quantitative results, e.g., non-conservative. The cutting of circular logic in the model should be explained and shall not introduce non-conservatisms in the model.	The methods of eliminating circular logic may result in incorrect quantitative results, e.g., non-conservative. The cutting of circular logic in the model should be explained and shall not introduce non-conservatisms in the model.

Table D3-8

INDUSTRY PRA PEER REVIEW SUBTIER CRITERIA: QUANTIFICATION AND RESULTS INTERPRETATION

Designator	CRITERIA	SUBTIER CRITERIA		
		Risk Ranking Prioritization	Risk Informed Decision Making	Risk Based Decision Making
QU-15	NON-DOMINANT SEQUENCES/CUTSETS[1] • The non-dominant cut sets or sequences - Make physical sense	Non-dominant accident sequences may be reviewed to ensure the cutsets are reasonable and have physical meaning.	Non-dominant accident sequences should be reviewed to ensure the cutsets are reasonable and have physical meaning. The use of conservatisms in the IPE search for vulnerabilities is appropriate. However, in evolving the PSA to be used for risk-informed applications , overly conservative assumptions (even in non-dominant sequences) should be eliminated to avoid biasing the results.	Non-dominant accident sequences shall be reviewed to ensure the cutsets are reasonable and have physical meaning. The use of conservatisms in the IPE search for vulnerabilities is appropriate. However, in evolving the PSA to be used for risk-informed applications , overly conservative assumptions (even in non-dominant sequences) should be eliminated to avoid biasing the results.
QU-16	- Include common cause potential or there are equivalent cutsets that do include the common cause potential	Common cause failure probabilities may be included for key groups and the use of the latest common cause data may be used.	Common cause failure probabilities should be included for key groups and the use of the latest common cause data should be used.	Common cause failure probabilities shall be included for key groups and the use of the latest common cause data shall be used.
QU-17	- Include dependency among human actions when multiple HEPs are in the same cutset or sequence	The dependence among human actions should be evaluated in the PSA process. Identification of sequences that, but for low human error rates, would have been dominant contributors to core damage frequency may be included as a test of modeling adequacy. Equivalent techniques may also be used.	The dependence among human actions shall be evaluated in the PSA process. Identification of sequences that, but for low human error rates, would have been dominant contributors to core damage frequency should be included as a test of modeling adequacy. Equivalent techniques may also be used.	The dependence among human actions shall be evaluated in the PSA process. Identification of sequences that, but for low human error rates in, would have been dominant contributors to core damage frequency shall be included as a test of modeling adequacy. Equivalent techniques may also be used.
QU-18	RECOVERY ANALYSIS • Recovery actions credited in the evaluation are either proceduralized or have reasonable likelihood of success when the TSC/EOF are manned.	Recovery actions credited in the evaluation should be either proceduralized or have reasonable likelihood of success when the TSC/EOF are manned.	Recovery actions credited in the evaluation shall be either proceduralized or have reasonable likelihood of success when the TSC/EOF are manned.	Recovery actions credited in the evaluation shall be either proceduralized or have reasonable likelihood of success when the TSC/EOF are manned.
QU-19	• Recovery actions that are included in the quantification process are included on selected dominant accident sequences; OR	Recovery actions that are included in the quantification process may be included on selected dominant accident sequences.	Recovery actions that are included in the quantification process should be included in all applicable sequences and cut sets.	Recovery actions that are included in the quantification process shall be included in all applicable sequences and cut sets.

Table D3-8

INDUSTRY PRA PEER REVIEW SUBTIER CRITERIA: QUANTIFICATION AND RESULTS INTERPRETATION

Designator	CRITERIA	SUBTIER CRITERIA		
		Risk Ranking Prioritization	Risk Informed Decision Making	Risk Based Decision Making
	• Recovery actions that are included in the quantification process are included in all applicable sequences and cut sets			
QU-20	• Transfers of sequences among event trees are treated explicitly.	Transfers of sequences among event trees may be treated explicitly.	Transfers of sequences among event trees should be treated explicitly.	Transfers of sequences among event trees shall be treated explicitly.
QU-21	<u>TRUNCATION</u> • The truncation of accident sequences based on frequency is a key decision made by PSA analysts that may affect the future PRA applications. The PSA Applications Guide implies that truncation limits be low enough to support the evaluation of dependencies among systems, structures, and components.	The truncation of accident sequences from the model may eliminate some dependencies that are judged insignificant for CDF or LERF.	The truncation of accident sequences should be performed at a sufficiently low cutoff value that significant dependencies that may affect applications are not eliminated. Entire groups of sequences (e.g., ATWS, LOOP) should not be completely truncated unless thorough documentation is provided regarding the technical bases for truncation. It is noted that accident sequences may have been eliminated from the quantified model <u>before</u> the truncation test is applied. The elimination of certain sequences (e.g., LOCA * Failure to scram, or Breaks outside containment) should not be done using the GL 88-20 type screening (or equivalent) and without consideration of the impact on Level 2.	The truncation of accident sequences shall be performed at a sufficiently low cutoff value that significant dependencies that may affect applications are not eliminated. Entire groups of sequences (e.g., ATWS, LOOP) should not be completely truncated unless thorough documentation is provided regarding the technical bases for truncation. It is noted that accident sequences may have been eliminated from the quantified model <u>before</u> the truncation test is applied. The elimination of certain sequences (e.g., LOCA * Failure to scram, or Breaks outside containment) should not be done using the GL 88-20 type screening (or equivalent) and without consideration of the impact on Level 2.
QU-22	• Example truncation values used in a base PSA are given. These should be treated as examples only. The screening truncation of events or failure modes retained in the model are as follows for screened out events: Level 1 LERF (per year)	The screening truncation of events or failure modes may be as follows for screened out events: < 0.01 * CDF Base <u>AND</u> < 0.01 * LERF Base	The screening truncation of events or failure modes should be as follows for screened out events: < 0.0001 * CDF Base <u>AND</u> < 0.0001 * LERF Base	The screening truncation of events or failure modes shall be as follows (or more stringent) for screened out events: < 0.00001 * CDF Base <u>AND</u> < 0.00001 * LERF Base

Table D3-8

INDUSTRY PRA PEER REVIEW SUBTIER CRITERIA: QUANTIFICATION AND RESULTS INTERPRETATION

Designator	CRITERIA	SUBTIER CRITERIA		
		Risk Ranking Prioritization	Risk Informed Decision Making	Risk Based Decision Making
QU-23	• The truncation values used in the system fault trees and accident sequences are sufficiently low to support their use in representative applications.	The truncation of accident sequences from the model may eliminate some dependencies that are judged insignificant for CDF or LERF.	The truncation of accident sequences should be performed at a sufficiently low cutoff value that significant dependencies that may affect applications are not eliminated. Entire groups of sequences (e.g., ATWS, LOOP) should not be completely truncated unless thorough documentation is provided regarding the technical bases for truncation. It is noted that accident sequences may have been eliminated from the quantified model before the truncation test is applied. The elimination of certain sequences (e.g., LOCA * Failure to scram, or Breaks outside containment) should not be done using the GL 88-20 type screening (or equivalent) and without consideration of the impact on Level 2.	The truncation of accident sequences shall be performed at a sufficiently low cutoff value that significant dependencies that may affect applications are not eliminated. Entire groups of sequences (e.g., ATWS, LOOP) should not be completely truncated unless thorough documentation is provided regarding the technical bases for truncation. It is noted that accident sequences may have been eliminated from the quantified model before the truncation test is applied. The elimination of certain sequences (e.g., LOCA * Failure to scram, or Breaks outside containment) should not be done using the GL 88-20 type screening (or equivalent) and without consideration of the impact on Level 2.
QU-24	• There is evidence of convergence towards a stable result	There may be evidence of convergence towards a stable result.	There should be evidence of convergence towards a stable result.	There shall be evidence of convergence towards a stable result.
QU-25	• If the fault tree linking approach is used, “delete” terms (cutset complements) are used to account for the successes in event sequences as appropriate to assure that the correct cut sets are generated.	If the fault tree linking approach is used, “delete” terms (cutset complements) should be used to account for the successes in event sequences as appropriate to assure that the correct cut sets are generated. This includes the treatment of transfers among event trees where the “successes” may not be transferred between event trees.	If the fault tree linking approach is used, “delete” terms (cutset complements) shall be used to account for the successes in event sequences as appropriate to assure that the correct cut sets are generated. This includes the treatment of transfers among event trees where the “successes” may not be transferred between event trees.	If the fault tree linking approach is used, “delete” terms (cutset complements) shall be used to account for the successes in event sequences as appropriate to assure that the correct cut sets are generated. This includes the treatment of transfers among event trees where the “successes” may not be transferred between event trees.
QU-26	• The quantification process identifies and deletes mutually exclusive cutsets.	The quantification process should identify and delete mutually exclusive cutsets. The process for identifying and eliminating mutually exclusive cutsets from the model may be documented.	The quantification process shall identify and delete mutually exclusive cutsets. The process for identifying and eliminating mutually exclusive cutsets from the model should be documented.	The quantification process shall identify and delete mutually exclusive cutsets. The process for identifying and eliminating mutually exclusive cutsets from the model shall be documented.

Table D3-8

INDUSTRY PRA PEER REVIEW SUBTIER CRITERIA: QUANTIFICATION AND RESULTS INTERPRETATION

Designator	CRITERIA	SUBTIER CRITERIA: Risk Ranking Prioritization	SUBTIER CRITERIA: Risk Informed Decision Making	SUBTIER CRITERIA: Risk Based Decision Making
QU-27	UNCERTAINTY • A search is performed for unique or unusual sources of uncertainty not present in the typical or generic plant analysis.	A search may be performed for unique or unusual sources of uncertainty not present in the typical or generic plant analysis.	A search should be performed for unique or unusual sources of uncertainty not present in the typical or generic plant analysis. A qualitative presentation should be available for causes of uncertainty, such as: • possible optimistic or conservative success criteria, • suitability of the reliability data, • possible modeling uncertainties (asymmetry or other modeling limitations due to the method selected), • degree of completeness in the selection of initiating events, • possible spatial dependencies • etc.	A search shall be performed for unique or unusual sources of uncertainty not present in the typical or generic plant analysis. A qualitative presentation should be available for causes of uncertainty, such as: • possible optimistic or conservative success criteria, • suitability of the reliability data, • possible modeling uncertainties (asymmetry or other modeling limitations due to the method selected), • degree of completeness in the selection of initiating events, • possible spatial dependencies • etc.
QU-28	• If there are unusual sources of uncertainty, special sensitivity evaluations or quantitative uncertainty assessments are performed to support the base conclusion and future applications.	If there are unusual sources of uncertainty, special sensitivity evaluations or quantitative uncertainty assessments may be performed to support the base conclusion and future applications.	If there are unusual sources of uncertainty, special sensitivity evaluations or quantitative uncertainty assessments should be performed to support the base conclusion and future applications.	If there are unusual sources of uncertainty, special sensitivity evaluations or quantitative uncertainty assessments shall be performed to support the base conclusion and future applications.
QU-29	• The capability to perform focused sensitivities to support the PSA applications is available.	The capability to perform focused sensitivities to support the PSA applications should be available.	The capability to perform focused sensitivities to support the PSA applications shall be available.	The capability to perform focused sensitivities to support the PSA applications shall be available.
QU-30	• A parametric uncertainty evaluation is performed that propagates the uncertainty distribution through the model sufficient to produce a valid mean value of CDF. <u>OR</u>	A parametric uncertainty evaluation may be performed that propagates the uncertainty distribution through the model sufficient to produce a valid mean value of CDF. <u>OR</u>	---	---

Table D3-8

INDUSTRY PRA PEER REVIEW SUBTIER CRITERIA: QUANTIFICATION AND RESULTS INTERPRETATION

Designator	CRITERIA	SUBTIER CRITERIA		
		Risk Ranking Prioritization	Risk Informed Decision Making	Risk Based Decision Making
QU-30 (cont'd)	• A quantification of selected uncertainties is performed, or the impact of the selected uncertainties on the final risk measures is estimated. OR • A quantitative uncertainty evaluation is performed using selected sensitivities to establish the approximate uncertainty bands. OR • A comparison is made between the plant specific PSA and a similar generic study with "full" uncertainty evaluation. The differences in the plant, model, or data are used to identify whether there are any differences that would impact the calculated uncertainty band or obviate the ability to use the uncertainty band. OR • A complete quantification of all sources of uncertainty is performed and the final estimates for risk measures is presented along with the uncertainty distribution.	A quantification of selected uncertainties may be performed, or the impact of the selected uncertainties on the final risk measures is estimated. OR A quantitative uncertainty evaluation may be performed using selected sensitivities to establish the approximate uncertainty bands.	A quantification of selected uncertainties should be performed, or the impact of the selected uncertainties on the final risk measures is estimated. OR A quantitative uncertainty evaluation should be performed using selected sensitivities to establish the approximate uncertainty bands. OR A comparison should be made between the plant specific PSA and a similar generic study with "full" uncertainty evaluation. The differences in the plant, model, or data are used to identify whether there are any differences that would impact the calculated uncertainty band or obviate the ability to use the uncertainty band.	A comparison shall be made between the plant specific PSA and a similar generic study with "full" uncertainty evaluation. The differences in the plant, model, or data are used to identify whether there are any differences that would impact the calculated uncertainty band or obviate the ability to use the uncertainty band. OR A complete quantification of all sources of uncertainty shall be performed and the final estimates for risk measures is presented along with the uncertainty distribution.

Table D3-8

INDUSTRY PRA PEER REVIEW SUBTIER CRITERIA: QUANTIFICATION AND RESULTS INTERPRETATION

Designator	CRITERIA	SUBTIER CRITERIA		
		Risk Ranking Prioritization	Risk Informed Decision Making	Risk Based Decision Making
QU-31	RESULTS SUMMARY • The PSA results summary identifies the dominant contributors.	The PSA results summary should identify the dominant contributors. The accident sequence results by sequence, sequence types, and total should be reviewed and compared to similar plants to assure reasonableness and to identify any exceptions.	The PSA results summary shall identify the dominant contributors. The accident sequence results by sequence, sequence types, and total should be reviewed and compared to similar plants to assure reasonableness and to identify any exceptions. A detailed description of the Top 10 to 100 accident cutsets should be provided because they are be important in ensuring that the model results are well understood and that modeling assumption impacts are likewise well known. Similarly, the dominant accident sequences or functional failure groups should also be discussed. These functional failure groups should be based on a scheme similar to that identified by NEI in NEI 91-04, Appendix B.	The PSA results summary shall identify the dominant contributors. The accident sequence results by sequence, sequence types, and total shall be reviewed and compared to similar plants to assure reasonableness and to identify any exceptions. A detailed description of the Top 10 to 100 accident cutsets shall be provided because they are be important in ensuring that the model results are well understood and that modeling assumption impacts are likewise well known. Similarly, the dominant accident sequences or functional failure groups shall also be discussed. These functional failure groups should be based on a scheme similar to that identified by NEI in NEI 91-04, Appendix B.
QU-32	• Reflects the process used.	NA	Documentation should provide the basis for meeting each of the criteria QU-4 through QU-30. The documentation should describe the results consistent with the process.	Documentation shall provide the basis for meeting each of the criteria QU-4 through QU-31. The documentation shall describe the results consistent with the process.
QU-33	• Includes an independent review for the documented results.	Independent review may be performed and documented by knowledgeable personnel.	Independent review should be performed and documented by knowledgeable personnel.	Independent review shall be performed and documented by knowledgeable personnel.
QU-34	• Provides the basis and is traceable to plant specific or generic analysis.	Documentation may provide the basis for quantification process.	Documentation should provide the basis for quantification process.	Documentation shall provide the basis for quantification process.

Table D3-9

INDUSTRY PRA PEER REVIEW SUBTIER CRITERIA: LEVEL 2 / LERF EVALUATION

Designator	CRITERIA	SUBTIER CRITERIA		
		Risk Ranking Prioritization	Risk Informed Decision Making	Risk Based Decision Making
L2-1	<u>GUIDANCE</u> • Describes the process used	N/A	The documentation of the Level 2/LERF process should be sufficiently well described in the documented results to act as guidance for future updates and revisions.	A specific guidance document should be available that specifies the process for Level 2/LERF including the updating process.
L2-2	• Consistent with industry practices	General adherence to accepted industry approaches should be included.	The documentation should provide a reasonable basis for performing the quantification and should maintain consistency with proven approaches.	The guidance for Level 2/LERF analyses should be complete and detailed and should maintain consistency with proven approaches.
L2-3	• Sufficient detail provided for reproducing the evaluation	Guidance may be available to supply general approaches used.	The guidance should be sufficient to provide a means to obtain equivalent results.	The guidance shall be sufficiently detailed to reproduce the results.
L2-4	<u>SUCCESS CRITERIA</u> • The success criteria are identified	Success criteria for Level 2/LERF should be documented. Examples include the following: • core cooling adequacy for in-vessel recovery • timing for in-vessel recovery • Prevention of RPV breach due to core melt progression • Hydrogen deflagration survivability • Hydrogen burn impact for steam inerted containment prior to spray initiation. • Containment boundary survivability Those parameters (e.g., containment leakage rate) to be used as the basis for assigning containment bypass or failure should be defined, and acceptable values shall be specified.	Success criteria for Level 2/LERF shall be documented. Examples include the following: • core cooling adequacy for in-vessel recovery • timing for in-vessel recovery • Prevention of RPV breach due to core melt progression • Hydrogen deflagration survivability • Hydrogen burn impact for steam inerted containment prior to spray initiation. • Containment boundary survivability Those parameters (e.g., containment leakage rate) to be used as the basis for assigning containment bypass or failure should be defined, and acceptable values shall be specified.	Success criteria for Level 2/LERF shall be documented. Examples include the following: • core cooling adequacy for in-vessel recovery • timing for in-vessel recovery • Prevention of RPV breach due to core melt progression • Hydrogen deflagration survivability • Hydrogen burn impact for steam inerted containment prior to spray initiation. • Containment boundary survivability Those parameters (e.g., containment leakage rate) to be used as the basis for assigning containment bypass or failure should be defined, and acceptable values shall be specified.

Table D3-9

INDUSTRY PRA PEER REVIEW SUBTIER CRITERIA: LEVEL 2 / LERF EVALUATION

Designator	CRITERIA	SUBTIER CRITERIA		
		Risk Ranking Prioritization	Risk Informed Decision Making	Risk Based Decision Making
L2-5	• The success criteria are supported by thermal hydraulic analysis, system capability evaluations, or industry studies	Generic conclusions formulated for similar plants may be used to define success criteria to prevent LERF. These calculations shall be consistent with the plant being evaluated in the PSA or adjustments shall be made to the success criteria to account for the differences.	Generic conclusions formulated for similar plants may be used to define success criteria to prevent LERF. These calculations shall be consistent with the plant being evaluated in the PSA or adjustments shall be made to the success criteria to account for the differences.	Plant specific thermal hydraulic calculations using a computer code capable of assessing severe accident core melt progression should be used to define the success criteria to prevent LERF. These success criteria should be checked against similar calculations for similar plants.
L2-6	• The success criteria are judged realistic	The success criteria should be judged realistic or conservative.	The success criteria should be judged realistic	The success criteria shall be judged realistic
L2-7	<u>LEVEL 1/LEVEL 2 INTERFACE</u> • The link between the Level 1 and Level 2 is sufficient and adequately documented to provide the transfer of information from the Level 1 analysis to the Level 2 containment evaluation.	The transfer of information between Level 1 and Level 2 may use plant damage states to characterize groups of Level 1 core damage sequences with similar characteristics and impacts on severe accident melt progression. This treatment tends to have a wider uncertainty band on the results than other possible techniques. The use of multipliers (conditional probabilities) (see NUREG/CR-6595) to obtain LERF from CDF avoids the full calculation of Level 2 when the Level 1 changes. However, such multipliers shall be used carefully in developing applications that require LERF calculations because the changes to dependencies in the Level 1 model may not be reflected in the multipliers.	The transfer of information from Level 1 to Level 2 should be performed in a manner that maximizes the ability to accurately reflect dependencies due to conditions, equipment status, or operator errors in Level 1 that may adversely impact the Level 2 mitigation assessment. The use of multipliers (conditional probabilities) (see NUREG/CR-6595) to obtain LERF from CDF avoids the full calculation of Level 2 when the Level 1 changes. However, such multipliers shall be used carefully in developing applications that require LERF calculations because the changes to dependencies in the Level 1 model may not be reflected in the multipliers.	The transfer of information from Level 1 to Level 2 shall be performed in a manner that maximizes the ability to accurately reflect dependencies due to plant conditions, equipment status, or operator errors in Level 1 that may adversely impact the Level 2 mitigation assessment. The use of multipliers (conditional probabilities) (see NUREG/CR-6595) to obtain LERF from CDF avoids the full calculation of Level 2 when the Level 1 changes. However, such multipliers shall not be used in developing applications that require LERF.
L2-8	<u>PHENOMENA CONSIDERED</u>(1),(3) • The phenomena that may control the LERF radionuclide release characterization are included.	The phenomena that may control the LERF radionuclide release characterization should be included qualitatively. The Level 2 should address in a quantitative fashion a substantial number of issues affecting LERF that are believed potential contributors especially during PSA applications involving different plant configurations. These Level 2 issues include the following:	The phenomena that may control the LERF radionuclide release characterization shall be included quantitatively. The Level 2 shall address in a quantitative fashion a substantial number of issues affecting LERF that are believed potential contributors especially during PSA applications involving different plant configurations. These Level 2 issues include the following:	The phenomena that may control the LERF radionuclide release characterization shall be included quantitatively. The Level 2 shall address in a quantitative fashion a substantial number of issues affecting LERF that are believed potential contributors especially during PSA applications involving different plant configurations. These Level 2 issues include the following:

Table D3-9

INDUSTRY PRA PEER REVIEW SUBTIER CRITERIA: LEVEL 2 / LERF EVALUATION

Designator	CRITERIA	SUBTIER CRITERIA		
		Risk Ranking Prioritization	Risk Informed Decision Making	Risk Based Decision Making
		• In-vessel Recovery • RPV vent & Containment Vent • Containment flood • Containment isolation • IC multiple tube rupture (if applicable) • ISLOCA • Deinerted operation	• In-vessel Recovery • RPV vent & Containment Vent • Containment flood • Containment isolation • IC multiple tube rupture (if applicable) • ISLOCA • Deinerted operation	• In-vessel Recovery • RPV vent & Containment Vent • Containment flood • Containment isolation • IC multiple tube rupture (if applicable) • ISLOCA • Deinerted operation
L2-8 (cont'd)		• Steam explosions • Vacuum breaker failure (Internal & External) • Hydrodynamic loads under high pool level • Recriticality • Containment boundary multiple failures, e.g., Shell failure as a subsequent containment failure • DCH • Vapor suppression failure • Direct Containment Heating • Pressurization of the pedestal cavity following vessel failure if there is substantial water in the cavity • High drywell temperatures leading to degradation of penetrations into the wetwell • The use of drywell sprays	• Steam explosions • Vacuum breaker failure (Internal & External) • Hydrodynamic loads under high pool level • Recriticality • Containment boundary multiple failures, e.g., Shell failure as a subsequent containment failure • DCH • Vapor suppression failure • Direct Containment Heating • Pressurization of the pedestal cavity following vessel failure if there is substantial water in the cavity • High drywell temperatures leading to degradation of penetrations into the wetwell • The use of drywell sprays	• Steam explosions • Vacuum breaker failure (Internal & External) • Hydrodynamic loads under high pool level • Recriticality • Containment boundary multiple failures, e.g., Shell failure as a subsequent containment failure • DCH • Vapor suppression failure • Direct Containment Heating • Pressurization of the pedestal cavity following vessel failure if there is substantial water in the cavity • High drywell temperatures leading to degradation of penetrations into the wetwell • The use of drywell sprays

Table D3-9

INDUSTRY PRA PEER REVIEW SUBTIER CRITERIA: LEVEL 2 / LERF EVALUATION

Designator	CRITERIA	SUBTIER CRITERIA		
		Risk Ranking Prioritization	Risk Informed Decision Making	Risk Based Decision Making
L2-9 [(4)]	• (BWRs): The phenomena that may affect accident management actions and planning are included. OR • (PWRs): If plant specific features are not consistent with those assumed in Owners Group SAMG analyses, the L2 model addresses any plant-specific phenomena that may affect accident management actions and planning.	(BWRs): The phenomena that may affect accident management actions and planning should be included.	(BWRs): The phenomena that may affect accident management actions and planning should be included.	(BWRs): The phenomena that may affect accident management actions and planning shall be included.
L2-10	• The phenomena that may influence applications are included.	See L2-8	See L2-8	See L2-8
L2-11	HEPs AND SYSTEM PERFORMANCE • System performance has been evaluated to account for the adverse conditions that may be present during the core melt progression response.	System performance shall be evaluated to account for the adverse conditions that may be present during the core melt progression response. The ability to adequately characterize system performance using solely a Level 1 model may be difficult because of the substantial impacts core melt progression effects may have on the system operability (real or procedural). Level 2 system performance should be explicitly broken out as separate evaluations recognizing the environmental conditions. However, some conservatisms in the system performance evaluation may exist due to the lack of detailed information regarding environmental conditions and equipment survivability.	System performance shall be evaluated to account for the adverse conditions that may be present during the core melt progression response. The ability to adequately characterize system performance using solely a Level 1 model may be difficult because of the substantial impacts core melt progression effects may have on the system operability (real or procedural). Level 2 system performance should be explicitly broken out as separate evaluations recognizing the environmental conditions. However, the best estimate evaluation may have large uncertainties due to uncertainties regarding the environmental conditions and the equipment survivability.	System performance shall be evaluated to account for the adverse conditions that may be present during the core melt progression response. The ability to adequately characterize system performance using solely a Level 1 model may be difficult because of the substantial impacts core melt progression effects may have on the system operability (real or procedural). Level 2 system performance shall be explicitly broken out as separate evaluations recognizing the environmental conditions. Detailed calculations of the environmental conditions and a detailed survey of the equipment survivability (not EQ) shall be performed to support the system performance during severe accident melt progression and provide a realistic estimate of the systems performance.

Table D3-9

INDUSTRY PRA PEER REVIEW SUBTIER CRITERIA: LEVEL 2 / LERF EVALUATION

Designator	CRITERIA	SUBTIER CRITERIA		
		Risk Ranking Prioritization	Risk Informed Decision Making	Risk Based Decision Making
L2-12	• Success of human actions has been evaluated to account for the adverse conditions that may be present during the core melt progression response.	Success of human actions shall be evaluated to account for the adverse conditions that may be present during the core melt progression response. The ability to adequately characterize operator performance using solely a Level 1 model may be difficult because of the substantial impacts core melt progression effects may have on the operator HEP. Level 2 operator actions should be explicitly broken out as separate evaluations recognizing the environmental conditions and the adverse effects of the actions. However, some conservatisms in the human performance evaluation may exist due to the lack of detailed information regarding environmental conditions.	Success of human actions shall be evaluated to account for the adverse conditions that may be present during the core melt progression response. The ability to adequately characterize operator performance using solely a Level 1 model may be difficult because of the substantial impacts core melt progression effects may have on the operator HEP. Level 2 operator actions should be explicitly broken out as separate evaluations recognizing the environmental conditions and the adverse effects of the actions. However, the best estimate evaluation may have large uncertainties due to uncertainties regarding the environmental.	Success of human actions shall be evaluated to account for the adverse conditions that may be present during the core melt progression response. The ability to adequately characterize operator performance using solely a Level 1 model may be difficult because of the substantial impacts core melt progression effects may have on the operator HEP. Level 2 operator actions shall be explicitly broken out as separate evaluations recognizing the environmental conditions and the adverse effects of the actions. Detailed calculations of the environmental conditions shall be performed to support the human performance during severe accident melt progression.
L2-13	• Containment and system functional failures are conservatively treated <u>OR</u> • Containment and system functional failures are treated realistically for dominant contributors	Containment and system functional failures may be conservatively treated.	Containment and system functional failures should be treated realistically for dominant contributors.	Containment and system functional failures should be treated realistically for dominant contributors.
L2-14	<u>CONTAINMENT CAPABILITY ASSESSMENT</u> • Containment capability is analyzed under severe accident conditions for its survivability	Containment should be analyzed under severe accident conditions for its survivability.	Containment shall be analyzed under severe accident conditions for its survivability.	Containment shall be analyzed under severe accident conditions for its survivability.

Table D3-9

INDUSTRY PRA PEER REVIEW SUBTIER CRITERIA: LEVEL 2 / LERF EVALUATION

Designator	CRITERIA	SUBTIER CRITERIA		
		Risk Ranking Prioritization	Risk Informed Decision Making	Risk Based Decision Making
L2-15	• Both static and dynamic effects are included (2), (3)	Both static and dynamic effects should be included. Quasi static containment capability evaluations alone are not adequate to address all severe accident phenomena.	Both static and dynamic effects shall be included. Quasi static containment capability evaluations alone are not adequate to address all severe accident phenomena.	Both static and dynamic effects shall be included. Quasi static containment capability evaluations alone are not adequate to address all severe accident phenomena.
L2-16	• All postulated failure modes identified by IDCOR or NRC Staff in NUREG-1150 are considered (2), (3)	All postulated containment failure modes identified by IDCOR or NRC Staff in NUREG-1150 should be considered. The containment isolation failure assessment should be retained in the model. Applications involving ranking the isolation system or considering configurations that have altered reliability for containment isolations would be adversely impacted by the non-inclusion of containment isolation.	All postulated containment failure modes identified by IDCOR or NRC Staff in NUREG-1150 shall be considered. The containment isolation failure assessment should be retained in the model. Applications involving ranking the isolation system or considering configurations that have altered reliability for containment isolations would be adversely impacted by the non-inclusion of containment isolation.	All postulated containment failure modes identified by IDCOR or NRC Staff in NUREG-1150 shall be considered. The containment isolation failure assessment shall be retained in the model. Applications involving ranking the isolation system or considering configurations that have altered reliability for containment isolations would be adversely impacted by the non-inclusion of containment isolation.
L2-17	• For Ice Condenser and BWR Mark III containments only: Geometric details impacting the hydrogen related phenomena (i.e., heat sink distribution, circulation paths, ignition sources, water availability, and gravity drain paths) should be documented in a readily comprehensible form, together with representative combustible transients.	For Ice Condenser and BWR Mark III containments only: Geometric details impacting the hydrogen related phenomena (i.e., heat sink distribution, circulation paths, ignition sources, water availability, and gravity drain paths) should be documented in a readily comprehensible form, together with representative combustible transients.	For Ice Condenser and BWR Mark III containments only: Geometric details impacting the hydrogen related phenomena (i.e., heat sink distribution, circulation paths, ignition sources, water availability, and gravity drain paths) should be documented in a readily comprehensible form, together with representative combustible transients.	For Ice Condenser and BWR Mark III containments only: Geometric details impacting the hydrogen related phenomena (i.e., heat sink distribution, circulation paths, ignition sources, water availability, and gravity drain paths) shall be documented in a readily comprehensible form, together with representative combustible transients.
L2-18	• Both leakage and large failures are included in the analysis	Containment failure sizes of leak and rupture may be conservatively treated. The degree of conservatism may be difficult to ascertain because of competing effects related to the containment pressurization.	A best estimate representation of the containment failure sizes should be included in the model. This best estimate evaluation should be based on a plant specific structural analysis or a generic evaluation that has been adjusted to account for plant specific features.	A realistic representation of the containment failure sizes shall be in included in the model based on a plant specific structural evaluation. If the results differ significantly from similar plant evaluations, the technical basis for the differences shall be clearly identified.

Table D3-9

INDUSTRY PRA PEER REVIEW SUBTIER CRITERIA: LEVEL 2 / LERF EVALUATION

Designator	CRITERIA	SUBTIER CRITERIA		
		Risk Ranking Prioritization	Risk Informed Decision Making	Risk Based Decision Making
L2-19	• Containment failure modes are treated realistically in the analysis	A conservative assessment of possible containment failure modes may be included in the PRA.	Containment failure modes should be treated on a best estimate basis in the analysis.	Containment failure modes shall be treated realistically in the analysis.
L2-20	• The containment analysis is: - Conservative OR - Realistic	The containment analysis may be conservative.	The containment analysis should be a best estimate and account for plant specific features.	The containment analysis shall be realistic and plant specific.
L2-21	ENDSTATE DEFINITION • The Level 2 end states support the applications currently envisioned.	The Level 2 end states should support the applications currently envisioned. The release categories may be assigned to the end states of the Level 2 analysis using insights from previous PRA work and judgments regarding the effectiveness of various release pathway mitigation measures.	The Level 2 end states shall support the applications currently envisioned. The Level 2 release categories should have a deterministic code calculation to support the subtle differences in the sequence that can influence release.	The Level 2 end states shall support the applications currently envisioned. The Level 2 release categories shall have a deterministic code calculation to support the subtle differences in the sequence that can influence release.
L2-22	LERF DEFINITION • The LERF definition is consistent with the following guidance, and is documented: - Regulatory Guide 1.174 OR - PSA Applications Guide or other Owners Group-specific definitions [(5)]	• The LERF definition should be consistent with the following guidance, and is documented: - Regulatory Guide 1.174 OR - PSA Applications Guide or other Owners Group-specific definitions [(5)]	• The LERF definition shall be consistent with the following guidance, and is documented: - Regulatory Guide 1.174 OR - PSA Applications Guide or other Owners Group-specific definitions [(5)]	• The LERF definition shall be consistent with the following guidance, and is documented: - Regulatory Guide 1.174 OR - PSA Applications Guide or other Owners Group-specific definitions [(5)]
L2-23	• The LERF definitions use Emergency Action Levels (EAL) bases if required; and the EAL bases are documented.	The LERF definitions should use Emergency Action Levels (EAL) bases if required; and the EAL bases are documented.	The LERF definitions shall use Emergency Action Levels (EAL) bases if required; and the EAL bases are documented.	The LERF definitions shall use Emergency Action Levels (EAL) bases if required; and the EAL bases are documented.

Table D3-9

INDUSTRY PRA PEER REVIEW SUBTIER CRITERIA: LEVEL 2 / LERF EVALUATION

Designator	CRITERIA	SUBTIER CRITERIA		
		Risk Ranking Prioritization	Risk Informed Decision Making	Risk Based Decision Making
L2-24	CONTAINMENT EVENT TREES (CETs) • The CETs: - Include all the functional events required to meet a safe stable condition - Include the phenomena cited under phenomena	The methodology should provide a logical framework to probabilistically assess the accident sequences that can lead to LERF end states. The CETs: • Should include all the functional events required to meet a safe stable condition or a non-LERF state • Should include the phenomena cited under phenomena	The methodology shall provide a logical framework to probabilistically assess the accident sequences that can lead to LERF end states. The methodology should provide a best estimate LERF assessment. The CETs: • Shall include all the functional events required to meet a safe stable condition or a non-LERF state • Shall include the phenomena cited under phenomena	The methodology shall provide a logical framework to probabilistically assess the accident sequences that can lead to LERF end states. The methodology should provide a best estimate LERF assessment. The CETs: • Shall include all the functional events required to meet a safe stable condition or a non-LERF state • Shall include the phenomena cited under phenomena

Table D3-9

INDUSTRY PRA PEER REVIEW SUBTIER CRITERIA: LEVEL 2 / LERF EVALUATION

Designator	CRITERIA	SUBTIER CRITERIA		
		Risk Ranking Prioritization	Risk Informed Decision Making	Risk Based Decision Making
L2-25	• The CETs: - Include the systems and HEPs necessary - Are consistent with the EOPs - Include reasonable recovery actions	Truncation of Level 1 sequences to avoid transfer to Level 2 shall not be performed unless they meet the truncation limits in QU. The CETs should: • Include the systems and HEPs necessary • Are consistent with the EOPs • Include reasonable recovery actions While "conservative" modeling is typically judged sufficient for IPEs, the neglect of the in-vessel recovery is not realistic, and is not appropriate for accident management applications. That is, by assuming the vessel serves no purpose in altering the accident sequence trajectory, opportunities for risk reduction measures are lost. If the damaged core is retained in-vessel, questions of direct containment heating, core-concrete interaction, debris quench on the drywell floor, etc., become moot. Use of the vessel to partition the risk reduces the importance of modeling highly uncertain containment damage processes, reducing the overall analysis uncertainty as well. Recognizing that saving the core in the vessel (e.g., by use of AC power recovery, fire suppression water, etc.), results in risk reduction for certain accident management actions and provides a better estimate of the risk associated with severe accidents.	Truncation of Level 1 sequences to avoid transfer to Level 2 shall not be performed unless they meet the truncation limits in QU. The CETs shall: • Include the systems and HEPs necessary • Are consistent with the EOPs • Include reasonable recovery actions While "conservative" modeling is typically judged sufficient for IPEs, the neglect of the in-vessel recovery is not realistic, and is not appropriate for accident management applications. That is, by assuming the vessel serves no purpose in altering the accident sequence trajectory, opportunities for risk reduction measures are lost. If the damaged core is retained in-vessel, questions of direct containment heating, core-concrete interaction, debris quench on the drywell floor, etc., become moot. Use of the vessel to partition the risk reduces the importance of modeling highly uncertain containment damage processes, reducing the overall analysis uncertainty as well. Recognizing that saving the core in the vessel (e.g., by use of AC power recovery, fire suppression water, etc.), results in risk reduction for certain accident management actions and provides a better estimate of the risk associated with severe accidents.	Truncation of Level 1 sequences to avoid transfer to Level 2 shall not be performed unless they meet the truncation limits in QU. The CETs shall: • Include the systems and HEPs necessary • Are consistent with the EOPs • Include reasonable recovery actions While "conservative" modeling is typically judged sufficient for IPEs, the neglect of the in-vessel recovery is not realistic, and is not appropriate for accident management applications. That is, by assuming the vessel serves no purpose in altering the accident sequence trajectory, opportunities for risk reduction measures are lost. If the damaged core is retained in-vessel, questions of direct containment heating, core-concrete interaction, debris quench on the drywell floor, etc., become moot. Use of the vessel to partition the risk reduces the importance of modeling highly uncertain containment damage processes, reducing the overall analysis uncertainty as well. Recognizing that saving the core in the vessel (e.g., by use of AC power recovery, fire suppression water, etc.), results in risk reduction for certain accident management actions and provides a better estimate of the risk associated with severe accidents.
L2-26	DOCUMENTATION • Documentation reflects the process used	NA	Documentation should provide the basis for meeting each of the criteria L2-4 through L2-25. The documentation should describe the results consistent with the process.	Documentation shall provide the basis for meeting each of the criteria L2-4 through L2-25. The documentation shall describe the results consistent with the process.

Table D3-9

INDUSTRY PRA PEER REVIEW SUBTIER CRITERIA: LEVEL 2 / LERF EVALUATION

Designator	CRITERIA	SUBTIER CRITERIA		
		Risk Ranking Prioritization	Risk Informed Decision Making	Risk Based Decision Making
L2-27	• Includes an independent review for the documented results	Independent review may be performed and documented by knowledgeable personnel.	Independent review should be performed and documented by knowledgeable personnel.	Independent review shall be performed and documented by knowledgeable personnel.
L2-28	• Provides the basis of the containment performance analysis and the analysis is traceable to plant specific or generic analysis.	Documentation may provide the basis for quantification process.	Documentation should provide the basis for quantification process.	Documentation shall provide the basis for quantification process.