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**Review of ASME/ANS Standard for Level 1/Large Early Release
Frequency Probabilistic Risk Assessment for Nuclear Power Plant
Applications**

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CONTENTS

| | |
|---|----|
| 1. Introduction..... | 5 |
| 2. Review Findings on Consistency, Understandability, Transparency, Clarity, and Defensibility of the ASME/ANS PRA Standard..... | 7 |
| 3. References..... | 23 |

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DRAFT

1. Introduction

ASME/ANS Standard for Level 1/Large Early Release Frequency Probabilistic Risk Assessment for Nuclear Power Plant Applications, hereafter referred to as ASME/ANS PRA Standard or the Level 1 PRA Standard or simply the Standard, was reviewed to address issues relating to consistency, understandability, transparency, clarity and defensibility of the Standard. For the review, Part 2, Requirements for Internal-Events at-Power PRA, was reviewed to identify issues of consistency, clarity, transparency, understandability, and defensibility. This review was followed by the review of the other parts addressing other hazard groups. Requirements in each of the parts were compared to delineate the issues relating to consistency, clarity, and understandability of the requirements. The review focused on the top-level issues and didn't attempt to address the details of the requirements.

The review findings are presented in the next section. The review findings are presented simply by identifying the issue and describing the issue with examples from the requirements as applicable. Some suggestions were made as parts of the findings, as considered applicable, to further explain the review finding.

Review findings relating to requirements in Part 2 are presented first. These findings generally apply to other parts also. Review findings on consistency among different parts of the Standard are presented next. No specific significance is attached to the order in which the findings are presented.

Developing Standards for conducting PRA for nuclear power plant applications is a significant and challenging effort. The review finds that the Standard is a significant accomplishment and is of great benefit to the nuclear PRA community. The review findings are intended to help achieve better consistency and clarity in the Standard among the extensive requirements that are used to develop PRA for nuclear power plants. They are not intended as any criticism.

Review findings are presented in the next section and the references are noted in the following section.

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2. Review Findings on Consistency, Understandability, Transparency, Clarity, and Defensibility of the ASME/ANS PRA Standard

The review findings of the ASME/ANS PRA Standard Parts 1 through 10 are as follows:

1. *Defining requirements for Capability Categories I and II and ensuring that the requirements for these categories are different, to the extent possible*

Two different levels of Capability Categories (CC) are being defined for the PRA Standards, replacing the three different levels of CCs. Considering the bases for the PRA CCs defined in Chapter 1, the requirements should be succinctly defined so that for each of the high level requirement (HLR) a distinction is achieved between CC I and II. Each of the supporting requirements does not need to be different, but, overall, sufficient difference should be noted making CC I PRA different from a CC II PRA.

When CC III is removed, it is conceivable that in some cases the supporting requirements for CC I and II will appear to be the same. A review of the requirements should be undertaken to define them so that the requirements are clear and different, to the extent feasible. It is understood that in some cases, the requirements may still remain the same. For example, in Part 2, supporting requirements for HLR-SY-A include 24 items, SY-A1 to SY-A24. Of the 24, only 2 have different CC I and CC II requirements. Additionally, the resources to be spent for CC I vs CC II do not appear to be very different. Similarly, supporting requirements for HLR-IE-C includes 15 items, IE-C1 to IE-C15. Only 3 of them are different.

The differences between CC I and CC II in other parts are even less distinct. In Part 5, Seismic PRA, for the technical element, Probabilistic Seismic Hazard Analysis, there are 10 HLRs and 32 associated SRs. There are no differences in requirements between CC I and CC II. For Seismic Fragility Analysis, there are 6 HLRs and 21 associated SRs. One SR (SFR-E3) makes a distinction between CC I and CC II. In Seismic Plant Response Analysis, there are 6 HLRs and 30 associated SRs. In 3 cases (SPR-D4, SPR-D6, and SPR-E5), requirements for CC I and CC II are different. In this technical element, for some SRs, some additional differences may be implicit because of references to Part 2 requirements.

In summary, the differences between CC I and CC II should be:

- (a) more clear and distinct, and
- (b) consistent across different parts for the same issues.

2. *Order of the SRs for a particular HLR*

In presenting the SRs, some ordering of the requirements should be followed. It is expected that requirements relating to a specific issue or a specific aspect will be presented together. Also, the "INCLUDE" requirements should be discussed prior to "DO

NOT INCLUDE” requirements for a particular aspect or issue. In other words, it is useful to know what needs to be done before the restrictions are defined.

In SRs for HLR-SY-A, there are requirements related to systems modeling and also related to component modeling within the system model. The requirements for the system should be discussed first followed by the requirements for component modeling. For example, SY-A21 and SY-A23 related to system modeling and can be placed before component modeling requirements are discussed. SY-A12 is a “DO NOT INCLUDE” requirement and can be placed following the “INCLUDE” requirements for system model. Such ordering of requirements may make it easier for the user to follow the standards defined.

3. *Action verbs should be denoted in caps and included in all SRs*

This is consistently done. One exception was noted. SY-A15 does not have an action verb in caps.

4. *Inclusion of criteria within an SR*

Some SRs include one or more criteria relating to other SRs. When criteria are defined, criteria relating to a particular SR should be included in one SR. In other words, criteria for multiple requirements should not be included in one SR. Multiple criteria relating to one SR can and should preferably be included in the same SR.

In SY-A14, criteria for meeting requirements for SY-A11 and SY-A14 are provided. SY-A11 relates to inclusion of components in a system model and SY-A14 relates to inclusion of component failure modes for a component. Instead of including both these criteria in a single SR, separate SR should be defined for each since they relate to separate SRs or issues.

5. *Relating criteria to the respective requirements*

Criteria are sometimes defined for a requirement in the standard. When criteria are defined for a requirement, both the requirement for which criteria are defined and the requirement where the criteria are defined should refer to each other. In that way, the user of the standard will have clear understanding when and where to expect and find the requirements and associated criteria.

Requirement SY-A15 contains criteria for SY-A11 and SY-A14. SY-A15 refers to SY-A11 and SY-A14. However, SY-A11 and SY-A14 do not refer to SY-A15. While reading SY-A11 and SY-A14, the user is not aware that there are criteria associated with these requirements.

6. *Non-Applicability or restricted use of a criteria*

In some cases, the use of a criterion may be restricted or reversed in another requirement. The requirements relating to the restriction of a criterion or where the

application of a criterion may be reversed should be noted when the criterion is first presented.

SY-B13 asks to “INCLUDE components that, using the criteria in Requirement SY-A15, may be screened out from each system model individually, if their failure affects more than one system (e.g., a common suction pipe feeding two separate systems),” but there is no mention of Requirement SY-B13 in Requirement SY-A15. The user may not realize that the components being excluded may be included back as part of another HLR. Referring to SY-B13 in SY-A15 will be appropriate.

7. *Clearer guidance for “DO NOT USE” Requirements*

Some requirements are presented as “DO NOT USE,” e.g., SY-B12 which states that “DO NOT USE proceduralized recovery actions as the sole basis for eliminating a support system from the model; INCLUDE these recovery actions in the model quantification.” Clearer guidance should be provided.

In the case of SY-B12, the question arises as to when a support system can be eliminated from the model since proceduralized recovery action cannot be the sole basis. This requirement should also refer to the requirement(s) which provide the guidance. If the relevant guidance is included, it is not clear where the guidance for including the support systems resides or how it should be derived from the existing guidance.

8. *Provide explanation and/or references when an SR relates to another HLR and its associated SRs*

When an SR in a particular HLR relates to another HLR, then brief mention should be made of the related HLR and associated SRs. If additional or different requirements are being defined, then a brief explanation may be appropriate.

SY-B15 states “INCLUDE operator interface dependencies across systems or trains, where applicable.” Human reliability analysis includes requirements relating to operator interface dependencies. Connection or lack of to these requirements should be mentioned here for the user to clearly understand what is being required and in case, it is different from or additional to the related requirements in another HLR.

9. *Eliminating phrases like “reasonably complete identification” or “reasonably complete set” in defining objectives or requirements*

The standard at times has used phrases meaning reasonably complete analysis to be performed in defining the objectives of an element or in defining specific requirements. However, it is noted that in the revised version being worked on attempts are being made to replace these phrases. However, few instances remain. For example, in Table 2.2.1-1, HLR-IE-A includes the phrase “provide a reasonably complete identification of initiating events.” Section 2-2.4-1, Objectives, of System Analysis, item (a) states “A reasonably complete set of system failure and unavailability models for each system is

presented.” However, the phrase “reasonably complete treatment” is being replaced from HLR-SY-A and HLR-SY-B.

Although such phrasing is allowed in objectives and in HLRs, it is probably better to eliminate these phrases from the few remaining instances. It can be done with simple wording changes.

10. *Provide reference when an approach which is not commonly used is included as part of the discussion in the requirements*

In defining a requirement, the standard sometimes mentions different approaches that may be adequate to satisfy the requirement. This is useful because it provides the user with specific approaches that can be used and it makes the requirement clear. However, if the approach being discussed is not commonly used or is not a standard practice, then the usefulness is limited. If a reference is cited which demonstrates how the approach can be used to satisfy the requirement, then inclusion of such approaches is appropriate.

For example, in requirement IE-B2, heat balance fault tree is mentioned along with master logic diagram and failure modes and effects analysis. A reference for heat balance fault tree would be appropriate.

It will also support the peer review defined in Section 1-6.3, Review of PRA Elements to Confirm the Methodology. The peer review team is expected to determine if the methodology and the implementation of the methodology for each PRA element meet the requirements of this Standard. Reference to the methodologies included in the SRs will ensure that the peer reviews are consistent.

11. *Consistently defining PRA Scope*

Each part defines the “PRA SCOPE” as the first section. This PRA scope should be defined consistently with consistent wording. In general, it is done consistently. However, one exception was noted.

Each part defines it succinctly in a sentence. For example, Part 3 for Internal Flood at-power PRA states “This Part establishes the technical requirements for a Level 1 and large early release frequency (LERF) analysis of the internal hazard group at-power.” However, Part 5 for Seismic PRA Requirements at Power uses a slightly different wording. It states “This part establishes technical requirements for a Level 1 *core damage frequency (CDF)* and a *Level 2* large early release frequency (LERF) analysis of seismic events while at power.” (Italics are added to show the differences in wording)

Since the same level of analysis is being conducted in different Parts, same wording is desirable. If different wording is desired to convey any different type of analysis being performed, then an explanation should be provided so that the users have a clear understanding of the different requirements as far as scope is concerned for the Part. In other words, if different wording is intentional with specific meaning, it should be clarified and justified.

12. *Consistent discussion in section titled “Coordination with other parts of this Standard”*

Each part has the second section titled “Coordination with other parts of this standard” which discusses how the part is intended to be used with other parts of the Standard. However, the discussions in this section among the different parts are different. Consistent discussions in different parts are desirable.

Part 2 defines that the technical requirements in Part 2 are fundamental requirements and provide the foundation for modeling the impacts of various hazards described in other parts. The discussion in other parts should be consistent with that theme in similar wording.

Similarly, all parts should address the same issues. Currently, Part 4 for Fires at-Power PRA discusses low-power/shutdown PRA Standard. If the interface with low-power/shutdown PRA should be discussed in this section, then it should be done in all parts.

Part 4 also presents some discussions related to fire-induced accident sequences clarifying when requirements of Part 2 vs Part 4 are applicable. These discussions are useful and provide some clarifications to the user. However, similar discussions may be applicable in some other parts.

Additionally, Parts 7-9 uses the wording “assessing the conditional core damage probability and conditional large early release probability.” This wording is not used in Part 2, 3, 4, and 5. It will be highly desirable to use consistent terminology for clarity and not to leave any source of confusion to the user.

13. *Treatment of peer review exceptions and deficiencies*

The requirements in Part 2 are fundamental requirements for other parts and are therefore referred to by other parts. Requirements in other parts also address the need to address the peer review exceptions and deficiencies identified for Part 2, internal-events PRA. Two specific requirements, PRM-B2 in Part 4, internal fire PRA, and SPR-B2 in seismic PRA, are noted within specific HLRs. For example, PRM-B2 stated:

ENSURE that the peer review exceptions and deficiencies for the internal-events PRA are dispositioned, and that the disposition does not adversely affect the development of the fire PRA plant response model.

The requirements to address peer review comments in Part 2 for its use for the other parts are expected to be more generic and should consistently be addressed for all the parts. One approach may be to discuss this requirement in some manner in the section titled “Coordination with other parts of this Standard.”

14. *Scope of the PRA for the Individual Parts*

Each part contains a section addressing the scope for that part. For example, Part 2 contains Section 2.1-3, Internal-Events Scope. However, the discussion, level of detail, and the issues addressed are different among the parts. It will be desirable to bring consistency in the discussion of the scope among the parts.

Part 2, Internal-Events Scope, has a brief discussion of the scope. It basically defines internal events and discusses the relation to other parts. Part 3, Internal Flood Events Scope, includes the overall objectives of the internal flood PRA. Part 4, Fire PRA Scope, contains a more detailed discussion that includes two subsection 4-1.3.1, Scope: The LERF Endpoint and 4-1-3.2, Scope: Other Types of Nuclear Power Reactor. The discussions in other parts are brief.

Consistent discussion and addressing the same issues consistently will be beneficial for the user. For example, if the use of the Standard for the other types of nuclear reactors should be discussed, it should be discussed in all cases. It is understandable that some parts may have additional unique issues to be discussed and they should be presented. The writing will make it clear to the reader why it is included.

15. *Additional Subsections in Section 4-1 for Fires at-Power PRA*

Additional subsections are included in Section 4-1 for Fires at-power PRA. These subsections probably are not necessary considering that other parts do not include similar discussions.

16. *Introduction to Technical Elements and Requirements in Different Parts*

Introduction to the Technical Elements and Requirements in different parts are differently written addressing related, but different issues. It is desirable, to the extent feasible, to address the same issues in the introduction to the Technical Elements and Requirements in different parts.

Some observations on the differences are as follows:

- (a) Title for Parts 2 and 3 are Technical Elements and Requirements whereas the titles in other parts are Technical Requirements.
- (b) Part 2, Internal-Events PRA, lists the technical elements and gives a road map for the user. It gives examples to benefit the user. Part 3, Internal Flood PRA, discusses a number of issues in the introduction. It discusses screening and uniformity of the level of detail. Part 3 also includes a brief description of each of the elements in the internal flood PRA. Part 5, Seismic PRA at-Power, discusses seismic PRA team members and their understanding of the interaction between different elements.
- (c) It can be argued that the many of the issues addressed in different parts apply to all the parts and they should be consistently discussed in all parts.

It is recognized that there may be some unique aspects or emphasis to a particular issue for a particular part. The writing should make that clear so that the user can place the appropriate emphasis. For example, close interactions among specialists from different fields may require emphasis in the seismic PRA. If it is so desired, introducing this discussion with introductory sentence(s) will provide the perspective and emphasis for the user.

17. Objectives of Individual Technical Elements

The technical elements in different parts are presented defining the objectives followed by tables for HLRs and SRs. This is fairly consistently done and is useful. Some inconsistencies are noted and preferably should be avoided.

- (a) Fire PRA has at places additional discussions. These discussions may not be necessary or they may be added as a Note.
- (b) Part 5, Section 5-2.3 includes assumptions. This should preferably be discussed elsewhere.

In general, clearly defined objectives which can be related to the HLRs should be aimed.

18. Treatment of Multi-Unit Sites

SRs for multi-unit sites are defined for some HLRs and in some parts. Part 2 and 3 provide requirements for some HLRs. The remaining parts do not discuss multi-unit sites.

Multi-unit sites should be consistently discussed across the different parts to provide clear guidance to the user for all the hazards. Also, to the extent feasible, clear guidance should be provided to the users who are developing PRAs for multi-unit sites. The requirements for multi-unit sites should be followed through the document, i.e., for all elements.

19. Data Analysis Requirements in Different Parts

Data analysis is a technical element in Part 2, Internal-Events PRA, and HLRs and SRs are defined. In other parts it is embedded in different requirements. It will be useful for the users if data analysis is defined as a technical element in each part and the appropriate requirements are pulled together under this technical element.

20. Use of Generic vs Plant-specific Data

Use of generic or plant-specific data or expert judgments is noted in different requirements in different parts. In general, use of more generic data is acceptable in CC I vs CC II. However, different wordings are used and it is not clear if a consistent approach is being used among different parts.

In many cases, same wording for use of generic and plants-specific data is used for CC I and CC II whereas in some other cases, there are differences between CC I and CC II requirements. Also, although there is some general consistency, specific requirements across different parts are not consistent. In one or two instances, guidance is given for combining generic and plant-specific data, i.e., use of Bayesian update process was recommended.

If a clear guidance can be developed for use of generic vs plant-specific data between CC I and CC II for different parts, then the user can significantly benefit in defining the level of data analysis that may be employed. There may be exceptions in some aspects. But, in general, CC I and CC II requirements with respect to generic and plant-specific data are expected to be different. To the extent feasible, if similar wordings can be used across different parts in describing these requirements, then the user will have a clear understanding.

In regards to using generic vs plant-specific data, consistency in the following aspects are desirable:

- (a) consistency across different parts for similar issues of data analysis,
- (b) clearly defining the differences in requirements between CC I and CC II and consistently addressing the differences across different parts, and
- (c) consistently providing guidance for combining generic and plants-specific data, whenever applicable.

21. Expert Judgments

In some cases, expert judgments are allowed. When expert judgments are noted as part of the requirements, then guidance should be given for using expert judgments. In few instances, reference to Section 1-4.3 where use of expert judgment is discussed is provided. For example, SR IGN-A3 states to use expert judgment consistent with Section 1-4.3 of this Standard. But, this is not consistently done.

Guidance for using expert judgments can be standard across different elements and parts. When deviations are allowed, then they should be so noted. The process of using expert judgment can be different for CC I and CC II, and possibly, should be different allowing use of less resources for CC I compared to CC II. Current discussion in Section 1-4.3 provides flexibility in defining different types of expert judgment process. If guidance is provided once, then it can be referred to for later cases providing consistency.

22. Screening Criteria

Different screening criteria are used in different part of the Standard. Examples of these different screening criteria are as follows:

- (a) Internal Flood at-Power PRA allows screening out of accident sequences at 10^{-8} /reactor-yr. (IFQUA-A3)
- (b) Another requirement in Internal Flood at-Power PRA states that “using qualitative or quantitative assessment, ENSURE the cumulative impacts from screened out flood-induced accident sequences do not affect the insights for the total flood-induced CDF.” (IFQU-A4, IFQU-A5)
- (c) Internal Fire at-Power PRA asks to SPECIFY the criteria used and ENSURE that (FQ-A1):
 - the quantitative screening process does not screen out physical analysis units with a high CDF contribution (e.g., any physical units that have a fire-induced CDF within an order of magnitude of physical unit with highest fire-induced CDF contribution) and
 - the sum of the CDF contribution for all screened out fire scenarios is <5% of the estimated total CDF for fire events
- (d) Seismic PRA allows screening out of seismically-induced accident sequences at less than 1% of the seismic related CDF.

Consistency in the use of screening criteria across different parts is desired. If different screening criteria are to be used, then justification should be provided, and preferably, their consistency with or validity with respect to the screening criteria in other parts should be presented.

23. *Consistent consideration of dependency in human reliability analysis (HRA) across different parts*

HRA is carried out in different parts and it is presented as a separate technical element or high level requirement (HLR). Consistency across different parts is addressed by referring to the HRA requirements in part 2. For example, Part 3, Internal Flood PRA, requirements address this consistency by referring to the applicable Part 2 HRA requirements to be addressed with its requirements. This approach assures the consistency and makes the process being used for HRA in different parts clear.

The treatment of human error dependency is explicitly is noted and defined as requirements in Part 2. Human error dependency in other parts, e.g., in internal flood PRA, seismic PRA, can play a significant role affecting multiple actions. However, no separate requirement or mention of dependency is noted in the other parts. It can be argued that by general reference to Part 2 requirements, which includes dependency considerations, human error dependency is also addressed. Mention of dependency considerations as applicable in different parts will provide clarity and will be meaningful for the user.

24. Use of terminology and phrases

At times, different terminology or phrases are used to define the requirements. It is not clear whether they imply specific meanings or not. In some cases, some definition or clarifications are provided in the appendix or in notes. Minimizing use of such terminologies and using simpler descriptions to present the requirements, to the extent feasible, can be useful for the user. Examples are presented from Part 4, Internal Fire PRA, below:

- (a) In FSS-C1, requirement for CC I uses the phrase “risk-contributing.” It states “ASSIGN characteristics to the ignition sources that bound potentially risk-contributing fire events in the context of both fire intensity and duration given the nature of the fire ignition sources present. Requirement for CC II addresses “risk-significant ignition sources”. It states “For risk-significant ignition sources and where supported by the current state of practice PROVIDE a probabilistic representation that reflects:.....” Stating the requirements without using these phrases can be helpful.
- (b) HLR-PP-A and SR PP-A1 use the phrases “global boundaries of the analysis” and “global analysis boundary.” Dropping “global” will probably not affect the intent of the requirements.
- (c) Requirement ES-A3 uses the phrase “structured systematic process.” Defining the process in the requirement, as is done, is probably adequate.
- (d) Requirement IGN-A7 uses the phrase “plant-wide consistent methodology” and the methodology is defined in the Appendix. However, avoiding the phrase and describing or summarizing the methodology, as is done in the requirement, is probably adequate.

25. Selection within a requirement and justification that screened out elements do not affect the analyses and insights

Some requirements involve selections among components or accident sequences. In some situations requirements ask to ensure that the impact of screening out is not detrimental. In many cases, no clear guidance is provided as regards to how these requirements should be implemented.

For example, SR FSS-B2 states “SELECT a sufficient number of fire scenarios, ether in the MCR or elsewhere, leading to a transfer of primary command and control outside main control room so that fire risk contribution of MCR abandonment can be characterized.

SR IFQU-A4 states “Using qualitative or quantitative assessment, ENSURE the cumulative impacts from screened out flood-induced sequences do not affect the insights for the total flood-induced CDF.”

In principle when some kind of selection is required or a justification is needed as regards to impacts on the analysis or on the insights to be derived due to or as affected by the selection, then some guidance should be provided.

26. Quantification Requirements in Different Parts

Quantification requirements are defined in each of the parts. Details of specific requirements are defined in Part 2 and other parts refer to these requirements to achieve consistency. Changes are being made in the revisions to achieve consistencies across different parts. Nevertheless, some issues relating to consistency across different parts remain. Because of the strong similarities in the quantification requirements, better consistency should be aimed. Issues relating to consistency are as follows:

- (a) Quantification is treated as a separate technical element in some parts while not in others. It is a separate technical element in internal-event, flood, and fire, but not in seismic. It is also applicable for parts 7 thru 10. Given the significance of this aspect and the associated requirements, making quantification a separate element for all parts should be considered.
- (b) The objectives and high level requirements may also apply in all parts. Some additional high level requirements may be applicable in some parts and can be added. With these considerations, objectives and high level requirements can be consistently defined across the parts.
- (c) Requirements in Part 2 are referred to other parts, but are done differently from one part to another. There are no references to Part 2 for Parts 7 thru 10. A consistent approach of reference to the requirements in Part 2 will be desirable and will provide clarity to the users.
- (d) Requirements in Parts other than Part 2 should be presented in a manner and in the order as they are presented in Part 2. Additional requirements can be added and should be justified. Similarly, requirements can be deleted or changed whose reasoning should be clear.
- (e) Differences in requirements between CC I and CC II categories in Part 2, if intended to be maintained, should also be maintained and clear in other parts. If such differences are no longer applicable, then they can be combined and can be noted. For example, in Part 2, point estimate of CDF is required for CC I in Part 2, whereas propagation on uncertainty and calculation of mean CDF is required in CC II. To maintain this distinction, requirements for CC I and CC II should include corresponding wording and the requirements should be separately written. A requirement referring to requirements in Part 2 for both CC I and CCII may not be clear and may be misinterpreted.

27. Specifying the basis of nonapplicability of requirements

Some SRs in PRAs for a hazard refer to the requirements in the corresponding HLR for Part 2. These requirements also ask to SPECIFY the basis for nonapplicability of any of the requirements under HLR requirement in Part 2. This is consistently done in Part 3, Flood PRA, and Part4, Internal Fire PRA, but not in Part 5, Seismic PRA.

28. Significant Contributors to CDF and LERF

Identification of significant contributors to CDF and LERF such as initiating events, accident sequences, and basic events (equipment unavailability and human failure events) is defined as an objective and is a high level requirement in Part 2. However, this aspect is not clear in other parts and should be specifically addressed.

This requirement should be specifically noted in all parts and the requirements should be specific to identify the significant contributors for each hazard category and for the total CDF combining all the hazard category, if feasible.

29. Plant Walkdown Requirements

Part 3, Internal Flood PRA, requires plant walkdown to confirm the accuracy of information collected from plant information sources. Specifically, SR IFQU-A11 states:

CONDUCT walkdown(s) to confirm the accuracy of information collected from plant information sources and to collect or confirm inputs to the following quantification of flood-induced accident sequences:

- (a) Engineering analyses
- (b) Human reliability analyses
- (c) Spray or other applicable impact assessments
- (d) Screening decisions.

Similar requirements for plant walkdown were not noted in other parts for accident sequences. (In seismic PRA, Walkdown is referred in one SR. SR SFR-D6 states that “if prior walkdown is relied on, VALIDATE that it is consistent withseismic interaction considerations.”) Such a requirement may be applicable for other parts also and should be considered. Plant walkdown is also needed in some other instances, but a consistent approach could not be delineated.

When defining plant walkdown requirement, specific items to be confirmed are expected to be different from one Part to another and can be noted as is done in the Flood PRA requirement.

In addition, plant walkdown requirement for CC I and CC II may be different and can be defined accordingly.

In general, a consistent approach for a confirmation of the models and analyses through plant walkdown should be considered. It can be argued that for hazard groups where

generic industry data is relied upon and plant-specific information is scarce, plant walkdown should be used as part of validation of the analyses conducted. Plant walkdown can then be required consistently for such situations throughout different elements and HLRs.

30. *Review Considerations*

Review of quantification results is defined as part of high level requirements and specific SRs in Part 2. Specific requirements are defined addressing review of a sample of significant and non-significant accident sequences and cutsets. They include review of results for modeling and operational consistency, comparison of results to those from similar and to ensure consistency with expected results. However, such review requirements are not included in other parts. Addition of review requirements to other parts should be considered.

The following considerations may apply in defining the review requirements:

- (a) Review requirement for each part may be different focusing on the specific attributes of that part and should be consistent and coordinated with the review requirements of other parts,
- (b) Review requirements for CC I can be different from CC II where the resources to be expended in CC I should be less than that for CC II, and
- (c) Some guidance should be provided considering the review findings and documentation for review findings.

31. *Separate HLR for review considerations*

Review requirements are combined along with identification of significant contributors to CDF in Part 2. As mentioned, review requirements are not specifically mentioned in parts.

A separate HLR for review requirements with associated SRs may be appropriate for each part. In that way, both review needs and identification of contributors to CDF would receive adequate emphasis.

32. *Use of “risk-significance” in SRs*

In Part 5, Seismic PRA, in few cases, SRs use the terminology “risk-significant” or “significant.” For example, SFR-D5 states “IDENTIFY potential risk-significant seismic interactions including proximity impacts,...and EVALUATE the consequences of such interactions on equipment contained in the systems model.” SPR-A1 states “INCLUDE in the plant response analysis the initiating events that cause significant accident sequences and/or significant accident progression sequences.”

It is not clear how the analyst will identify or assess risk-significance at this stage. Clear guidance should be provided for following the requirement.

33. *Use of Industry Experience Data*

Industry experience is referred to in some SRs. Terminologies such as generic information or data, generic industry data are also used in the SRs. The use of same terminology will be appropriate along with use of Notes to define the terminology.

In general, it appears that CC I allows use of more generic information or data whereas CC II requires use of more plant-specific data. However, a consistent application was not clear. Part 2 SRs attempts to delineate the use plant-specific vs generic information between CC I and CC II. However, such distinctions are not necessarily maintained in other parts. Clarity and specific guidance in these regard when generic or industry experience is being used will be beneficial. It is recognized that in some cases, due to the paucity of data, requirements for CC I and CC II may be very similar or even the same.

34. *Consistency in Requirements for Documentation*

The requirements for documentation are reasonably consistent across different parts of the Standard. It is also noted that changes are being made to make the requirements for documentation more consistent. This consistency will be useful in assuring the required documentation of the PRAs. The following comments are provided to help ensure consistent requirements for documentation across different parts:

- (a) Documentation requirements for Part 4, Fire PRA, are somewhat different compared to other Parts. Other parts are more similar.
- (b) In Fire PRA Table 4.2.10-8, remove references to 4.2-13 which has been deleted.
- (c) Wording relating to sources of uncertainty, assumption and bases (e.g., choice of model), and their justification vary from one part to another. Clarity may be improved through use consistent or same wording.
- (d) Only in IGN-B2 in Part 4, references are required to be documented. Standard practice for documenting the references may be defined and included in all parts as part of documentation. If references are not publicly available, then those references should be maintained and available for future use.

35. *Documentation Requirement and relation to other requirements*

The documentation requirement in many cases include an SR which states "DOCUMENT and JUSTIFY the assumptions (e.g., choice of model) made in response to a source of model uncertainty associatedanalysis." for such a documentation

requirement, there should be one or more corresponding requirements that ask to identify the source of model uncertainty and the assumptions made to address the model uncertainty. Without some specificity (all) appropriate aspects may not be documented. Such specific requirements are not always included as part of the SRs for the technical element.

36. *Documentation Requirements for CCI and CCII*

Documentation requirements usually are the same for both Capability Categories I and II, with some exceptions. It is probably expected that the differences in analyses requirements will account for the differences in documentation. However, it can be argued that the documentation requirements for CC I should be considerably lower compared to CC II. At the same time, for CC I, adequate documentation must be kept so that upgrading to CC II at a later time is not affected due to lack of proper documentation.

With that perspective, delineating specific guidance for documentation between CC I and CC II can be useful. Typically, the second SR in the documentation provides a list of the items that are included in the documentation. Separate requirements for CC I and CC II for this item may be considered. Once it is defined for Part 2, other parts can refer to Part 2 and maintain consistency, as applicable.

37. *Peer Review*

Peer reviews are structurally defined consistently for different parts. However, additional consistency in the details of the peer review may be useful. Examples of such consistency that may apply are as follows:

- (a) In some parts, the requirements note use of selected portions for peer review. It is considered adequate. In some other parts, no mention is made for selecting portions of the analysis for peer review.
- (b) Internal flood PRA recommends selected review by walkdown to confirm the accuracy of the information used. Other parts do not include walkdown in the peer review.
- (c) In Parts 7 thru 10, under Quantification Method, it states that “The peer review team shall evaluate whether the quantification method used in the PRA is appropriate and provides all of the results and insights needed for risk-informed decisions.”

This guidance for the peer review team is not used in any other parts. It is also not specific or clear. Specific guidance should be provided to clarify such statements.

- (d) Peer review can benefit from focusing on the risk significant aspects. This, however, is not noted in any of the peer reviews. It can be part of the selection process discussed in item (a) above.

38. General editorial consistency

Different parts of the Standards should be carefully edited to ensure consistency given that significant changes are being made to different parts simultaneously. This is probably planned to be done, but is being noted because there are significant cross-references among different parts and this review findings may lead to additional cross-references among the parts. Examples of specific areas for ensuring editorial consistencies are as follows:

- (a) Changes are being made to the requirements where phrases or wording are being revised. Introduction to the requirements should also be edited to ensure that the wording, phrases, and the intents remain consistent.
- (b) Changes to the requirements are resulting in renumbering and in elimination of some subsections. When references are being made among different parts, careful review should be made that corresponding changes are addressed.
- (c) When changes are being made in requirements, ensure consistency in requirements and in associated wording for similar issues across different parts. When requirements are intended to be different, clarifications should be included for the reader to understand.

3. References

1. ASME/ANS RA-Sb-2013, Addenda to ASME/ANS RA-S-2008 Standard Level 1/Large Early Release Frequency Probabilistic Risk Assessment for Nuclear Power Plant Applications.
2. Revisions to ASME/ANS RA-Sb-2013 for Parts 2, 3, 4, and 5, 2014.

DRAFT