July 6, 2006

MEMORANDUM TO: Ho K. Nieh, Acting Director
Division of Policy and Rulemaking
Office of Nuclear Reactor Regulation

FROM: James E. Lyons, Director ***/RA/***
Division of Risk Assessment
Office of Nuclear Reactor Regulation

SUBJECT: COMMENTS ON AMERICAN NUCLEAR SOCIETY FIRE PROBABILISTIC RISK ASSESSMENT STANDARD

The enclosure provides the comments complied by the Division of Risk Assessment (DRA) on the draft Fire Probabilistic Risk Assessment Methodology Standard, BSR/ANS 58.23, Version of April 3, 2006. The enclosure provides general comments, and a number of specific comments that are included in tabular form.

While there is a large number of comments, this does not reflect the opinion of the DRA staff that the Standard is significantly flawed. The comments are provided in the spirit of making the Standard more understandable and useful. The DRA staff believes that these comments should be addressed before the Standard is issued for use.

Enclosure:
As Stated

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As Stated

Accession Number: NRR-106

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COMMENTS ON DRAFT FIRE PROBABILISTIC RISK ASSESSMENT METHODOLOGY STANDARD, BOARD OF STANDARDS/AMERICAN NUCLEAR SOCIETY 58.23, VERSION OF APRIL 3, 2006

GENERAL COMMENTS

1. The Fire Probabilistic Risk Assessment (FPRA) Standard developers' stated intent is that it can be used as a stand-alone Standard insofar as a completed internal events probabilistic risk assessment (PRA) done in accordance with the American Society of Mechanical Engineers (ASME) PRA Standard is not necessary as a starting point to successfully perform a FPRA according to this Standard. While we appreciate this intent, it complicates both the development and the use of the Standard and is insufficiently emphasized in this draft as evidenced by the initial confusion among the Office of Nuclear Reactor Regulation (NRR) reviewers who assumed that the starting point was a completed internal events PRA. At the very least, the fire Standard should clearly state the Standard does not assume that a completed internal events PRA was used as a starting point. NRR's comments include proposals for additional text throughout the Standard to ensure that users of the FPRA Standard are aware of the additional analysis demands placed on the analysts and the reviewers of FPRAs that have not been developed from internal events PRA. It is possible that other additions to the draft standard may be required that have not been noticed by the NRR commenters.

2. Experience with the performance of FPRA is not as extensive as that for internal events PRA. Therefore, it would be helpful to include, in Section 1.5.1, a brief discussion of the elements of the FPRA and how they are interrelated, perhaps using a flow diagram similar to that in Figure 1 of the Preface to Volume 2 of NUREG/CR-6850 as a basis. The figure from the NUREG may need to be modified, however, as the NUREG assumes that a FPRA is developed based on a completed internal events PRA while the Standard's intent is that it include the process that does not rely upon a completed internal events PRA. In particular, the NUREG figure should be modified to indicate that there will be feedback between Task 5: Developing the Fire-Induced Risk Model and Task 2: Fire Component Selection if the FPRA is being developed as a stand-alone analysis.

3. The Standard in its current form does not facilitate the integration with the American Society of Mechanical Engineers (ASME) PRA Standard (ASME RA-S-2002, ASME RA-Sa-2003, and ASME RA-Sb-2005), which is one of the goals of both American Nuclear Society and ASME. The major problem is with the requirements for the evaluation of the conditional core damage probability (CCDP) and conditional large early release probability (CLERP). In performing a FPRA, these probabilities are evaluated using what is essentially a PRA model evaluated for the plant damage state created by each fire scenario. This PRA model should be constructed to the requirements of the ASME Standard. While this is the intent of the FPRA Standard, as is evidenced by the fact that the ASME requirements are indeed referenced in the Accident Sequence Model (ASM) and FPRA Quantification (FQ) sections of the Standard, the way this is accomplished is not clearly defined. Part of the problem is in the language used. For example, in the ASME PRA Standard, the term accident sequence is essentially synonymous with an event tree sequence, whether it be a

functional or systemic, or a large event tree sequence. Using a parallel interpretation, a FPRA accident sequence model should be the result of combining a fire initiating event with a specific fire scenario resulting from that initiating event, and with a path through a plant response model (see below) to produce a fire induced accident sequence that when quantified provides the fire induced core damage frequency (CDF) and large early release frequency (LERF). The FPRA ASM using the definition and interpretation discussed above, is to a large extent addressed in Section 4.15, Fire Risk Quantification.

Even after the terminology problem has been addressed, the intent that the FPRA Standard stand independently from any existing internal events PRA model is not successful. In particular, Section 4.5, Equipment Selection and Location, can not be successful until Section 4.8, FPRA Accident Sequence Model, is completed because equipment selection is targeted toward equipment whose failure can cause an initiating event or relied upon to mitigate the initiating event. In practice, selection of equipment to include in the FPRA relies heavily on the availability of an internal events PRA. For example, both ES-A1 and ES-B1 refer directly to using an internal events PRA model to identify relevant initiating events and mitigating equipment respectively.

What appears to be intended in Section 4.8, FPRA ASM, however, is the construction of the model that enables the response of the plant to a specific plant damage state caused by a fire to be quantified, such that a CCDP or CLERP can be evaluated. To avoid confusion with the definition in the ASME Standard, it would help to replace the term FPRA ASM in Section 4.8 by a new term such as plant response model. As stated above, a crucial requirement is that this plant response model shall be constructed in accordance with the requirements of the ASME Standard. This could even be a high level requirement. It should be noted that not all the requirements for the internal events PRA model are needed. For example, there is no need to evaluate initiating event frequencies; in the FPRA model they arise from the frequency of the plant damage state associated with each fire scenario, and to derive the CCDP, the initiating event frequencies in the plant response model are set to one. Similarly, the set of initiating events is not the complete set in the internal events PRA (e.g., there is no need to address loss-of-coolant accidents or steam generator test rigs for example.)
The following suggestions are intended to provide greater clarity with respect to invoking the requirements of the ASME Standard. This can be achieved by addressing the development of the logic model in Section 4.8, and addressing the compilation of the various elements of the FPRA, namely, fire ignition frequencies, fire damage state probabilities and CCDP and CLERP, in Section 4.15, FQ. For example, the supporting requirements for DA (ASME) and the estimation of human error probabilities (HEPs) (HLR-G in ASME) could be addressed in Section 4.15, FQ.

With this motivation the suggestion is in Section 4.8, FPRA plant response model, to define the objectives of the FPRA plant response model element as:

- To depict the logical relationships between .... given a fire.

- To provide the basis for the quantification of the CCDP and CLERP for each fire scenario that survives screening.

A comment should be made here to the point that typically the starting point would be the internal event PRA model. The second paragraph in the introduction can be deleted, as it more properly belongs in QU, which is where the elements of the quantification (i.e., fire scenario frequency and CCDP or CLERP) are combined.

Define the HLR-ASM-A as: The FPRA plant response model shall be constructed to depict the logical relationships etc. (as in the objective statement), and shall be capable of providing the CCDP and CLERP for all the fire scenarios identified in accordance with the requirements of Sections XXX.

The supporting requirements of HLP-PRM-A should include things like:

A1: The plant response model logic structure should be developed in accordance with the requirements of IE, AS, SC, SY, HR of ASME as appropriate (clarification pertaining to the fact that not all initiating events will be required, that there is no need to estimate the initiating event frequencies, the important requirements of the HR are those pertaining to identification of the human factors engineering (HFEs), etc., could be provided in a note). One of the issues is that while the logic model can be constructed at this stage, not all the probabilities associated with the events can be determined, This is particularly true for the HFEs, because they will be fire scenario dependent.

A2: Identify initiating events caused by fires.

A3: Include failures caused by spurious actuations etc., in accordance with ES and CS.

In Section 4.15, for FQ-A1, include a clarification as follows: For each fire scenario selected .... into a plant damage state ~~corresponding to the FPRA accident sequence model~~, **i.e., initiating event and equipment failed** including consideration of insights from the circuit failure (CF) analysis (see the CF requirements), **to provide the boundary conditions for the evaluation of the CCDP using the appropriate ASM.** (Bold to show changes only)

Expand the FQ section to include a SR: “Use the plant response model developed per Section 4.8 to evaluate the CCDP and CLERP for each fire scenario,” another that addresses parameter estimation in accordance with the ASME DA requirements and another to address the HEPs. (Referencing Section 4.13).

In FQ-A2 replace CDF and LERF by CCDP and CLERP.

FQ-A3 should be more explicit about what gets multiplied together. The calculation performed is to multiply the frequency of the initiating event by the conditional probability of the fire scenario (if that is what is referred to as the conditional damage probability

factor) and by the CCDP or CLERP. The circuit failure likelihoods should either be in the probability of the plant damage state or in the CCDP, and don't need to be called out specifically. If it is felt to be necessary to make it clear, then another SR could be added that addresses circuit failure likelihoods.

The attached table provides specific comments on the various sections of the Standard.

Index No.	Issue	Position	Resolution
Section 1			
Section 1		No Objection (except for the typos below)	
Section 1.3.3	The acronym "SSC" is not defined the same as in ASME 2005 or the Acronyms list of Section 2.1.	Clarification	. . . to which must be added a number of ~~Systems,~~ Structures, **Systems,** and Components (SSCs) and human actions ...
Section 1.3.5	Typo	Clarification	. . . and applications for~~e~~ evaluating . . .
Table 1-1	Typo	Clarification	Capability Category ~~i~~ **II** Capability Category ~~ii~~ **III**
Section 2			
Section 2.1	Hyphenate defense-in-depth for consistency with other sections (see page 15.	Clarification	DID - Defense**-**In**-**Depth
Section 2.2	In the definition of Electrical overcurrent protective device, generally passive items do not change state during operation, see definition of passive fire barriers later. Therefore, both fuses and breakers would be considered active.	Clarification	An active ~~or passive~~ device designed . . .
Section 2.2	Definitions of fire-induced initiating event, uses an inconsistent term for the FRRS. Replace NUREG/CR-6850 with FRRS.	Clarification	. . . (adapted from ~~NUREG/CR-6850, EPRI RT 1011989~~ **FRRS**).

ATTACHMENT

Section 2.2	Discussion 2: Volume 2, Chapter 1 of the FRRS (NUREG/CR-6850, EPRI TR-1011989) discusses criteria that can be applied in justifying decisions related to non-rated partitioning features. +	Clarification	Define *Fire location:* The smallest spatial unit in which a particular fire is assumed based on the available fire sources and from which a fire scenario developed. Replace: All other terms used that refer to this spatial unit. For example ***Fire scenario:*** A set of elements that describes a fire event. The elements usually include a **fire location** ~~room~~, fire, detection and suppression, targets, and intervening combustibles.
Section 2.2	Definition of fire suppression feature, should include manual hose stations as an example, otherwise they may be confused and considered a fire suppression system.	Qualification	For example, the manual fire brigade**,** ~~and~~ portable fire extinguishers**, and manual hose stations** are considered fire suppression features.
Section 2.2	Definition of Risk, capitalize first word in sentence.	typo	Risk: ~~p~~**P**robability and . . .
Section 2.1	SSC acronym should have defined by pluralized elements.	Clarification	SSC - Structure**s**, System**s**, and Components
Section 2.2	"Definition of Terms" needs to be supplemented with definitions of the following terms mentioned in the Standard: Ignition Frequency, Combustion Loading, Secondary Combustibles, Damage Criteria, Damage Threshold, and Limiting failure Threshold.	Clarification	Include terms in the "Definition of Terms" list.

Section 2.2	Definition of Walkdown. Suggested additional text to emphasize the importance of walkdowns in FPRAs.	Clarification	**Add the text:** Because of the high spatial dependence of fire damage, walkdowns are a useful way to gather information during all phases of a FRPRA and should have been used extensively, although formal documentation is not always required.
Section 3			
Section 3		No objection with the exception of the typo below	
Section 3.3.1	Typo	Clarification	This standard adopts this aspect of the overall process description as provided in Section 3.~~2~~ **3**.1 of ASME 2005 . . .
Section 4.1		No objection	
Section 4.2		No objection	
Section 4.3			
Section 4.3	Reference to Table 1-1 is incorrect. The correct reference is to Table 1.4-1 of ASME 2005.	Clarification	. . . The interpretation of a Supporting Requirement whose action spans multiple categories is stated in Table 1**.4**-1 **of ASME 2005 . . .**

Section 4.4 Plant Partitioning			
PP-A1	The distinction between categories is based on the potential scope of the analysis, where applications for which CC I and II apply may analyze a limited number of fire areas rather than the whole plant, whereas a CC III application would address the complete plant. This is an inappropriate distinction, since even for a fire PRA done to CC III, the application may only address a limited number of fire areas. A CCI or CCII PRA should have the potential to address the complete plant.	Qualification	Use the CC III words for all categories.
PP-A3	The intent of this SR, and the distinction between the Categories is not clear. A fire in a sister plant area might cause an unavailability of shared equipment, but if it does not lead to an initiating event at the plant of interest, would the fire be included in the fire PRA? Furthermore, the discussion states that for CC I and II only equipment relied upon for safe-shutdown should be addressed. This is inconsistent with SR ES-B1.	Qualification	Clarification required.

PP-B2	CC II and III suggest consistency with regulatory guidance is useful. Partitioning should be based on barriers or physical features, not regulatory guidance which is different for each plant and each plant may claim since they are licensed they are automatically consistent with regulatory guidance and therefore CC III. Use words from GL 86-10, which defines fire area. Furthermore, if the condition in the SR for CC II/III is met, there is no distinction between the categories. In this case, are SRs PP-B3 and PP-B4 bypassed?	Qualification	. . . been defined ~~consistent with existing regulatory guidance~~ **as bounded to withstand the hazards associated with the area.** Clarify the SR for CC II/III. Should there be no requirement for CC II/II because it is expected that this condition is not met?
PP-B2, Discussion 1	Similar justification as above for removal of discussion of regulatory requirement compliance discussion.	Qualification	. . . so long as those areas ~~comply with existing regulatory requirement~~ **are bounded to withstand the hazards associated with the area.**
PP-B3, Discussion 1	Similar justification as above for PP-B2 for removal of discussion about regulatory requirement compliance.	Qualification	. . . fire areas that should be bounded ~~by rated fire barrier elements consistent with existing regulatory requirements~~ **to withstand the hazards associated with the area.**
PP-B6	CC I should not credit active fire barriers, this would be consistent with PP-B3 and PP-B4. Add new CC I to not allow credit for unanalyzed active barrier elements.	Qualification	**DO NOT CREDIT active fire barrier elements as a partitioning feature.**

PP-B8	All CC should be enhanced to require periodic, complete barrier inspection by licensees. As written, there may be holes in barriers that will not be identified by the walkdown, yet the barrier may be fully credited.	Qualification	. . . partitioning elements. **Also verify that the licensee has a procedure that maintains and periodically inspects the credited partitioning elements.**
Table 4.4-3 for PP-C	Two tables are labeled 4.4-3. The PP-C table should be 4.4-4.	Clarification	4.4-~~3~~ **4**
Section 4.5 Equipment Selection and Location			
Notes on ES-A1 and ES-B1	This section does not make specific mention or give consideration to items such as microprocessors, digital instrumentation, and fiberglass cables, for which information about fire and combustion products (smoke) induced malfunction is quite sparse. These items may exist in some operating plants, and are planned for ALWRs as well as other advanced designs.	Clarification	Include a Discussion 3 that states that consideration should be given to items such as microprocessors, digital instrumentation, and fiberglass cables.
ES-A1	This section refers to identifying equipment associated with internal events PRA initiators effectively assuming that a completed internal events PRA is available.	Clarification	Add an asterisk to “Internal Events PRA initiator” with the associated note. ***Note: If an internal events PRA is not available, an evaluation of initiating events that shall be considered should be done in accordance with ASME Section 4.5.1 Initiating Event Analysis (IE).**

ES-B1	The fire PRA accident sequence model is based on the internal events PRA model, modified, for each FS retained for analysis, to reflect the damage state characteristic of the FS. Therefore it should be clearly stated that the internal events PRA is the starting point for equipment identification. This is clearly stated in NUREG/CR-6850, Chapter 2. If the fire PRA standard is to be applied when an internal events PRA is not available, a note should be added indicating that an analysis comparable to the accident sequence model development in the ASME standard should be performed for all fire induced initiating events identified in ES-A1. For CC I, the requirement is to only take credit for the equipment on the fire safe shutdown/Appendix R list. By contrast for CC II the requirement is to include “risk significant internal events PRA equipment.” What is risk significant for fire scenarios may be different from what is significant for internal events. The fire PRA should include those SSCs that are taken credit for in the internal events PRA for event mitigation, whether they be risk significant or not. There should be no distinction between CC II and CC III.	Qualification	For CC II: Identify Fire Safe Shutdown/Appendix R equipment **as well as ~~the risk significant internal events PRA equipment~~ other internal events PRA equipment that is credited for preventing core damage**, as modified ... For CC II: Identify Fire Safe Shutdown/Appendix R equipment **as well as ~~all~~ other internal events PRA equipment that is credited for preventing core damage**, as modified. * Note: If an internal events PRA is not available, each initiating event that could be caused by fire that is identified in ES-A1 should be fully developed with an internal events model according to the ASME standard. The FPRA development should then be continued using these models.

ES-B2	The stated objective of this SR is " to select the plant equipment that will be included/credited in the FPRA accident sequence model." To meet this objective, it is difficult to see how to specify the number of spurious actuations that should be taken into account. It is clear how this can be done in the case of a series system of potential spurious actuations. However, the HLR is phrased as "adversely affect credited functions," which includes affecting a single train of a multi-train system. If each train is affected by a potential spurious actuation, wouldn't it be necessary to include that in each train? Should this SLR focus on identifying those SSCs whose spurious actuation could negatively impact one of the credited functions? It is not clear why the phrase "for a given fire" is relevant here. Won't this be the result of the analysis to follow? In order to determine whether this requirement has been met, it would be necessary to identify each fire scenario and its impact. The number of different spurious actuations included in the model should be addressed in the requirements for the translation of the damage from each fire scenario into an impact statement for the evaluation of the CCDP (e.g., in FSS or in FQ). However, it might be useful to include an additional SR that addresses the screening of series multiple spurious actuations. . .	Qualification	Fire induced failures of equipment including ~~(bolded statement for each of the CCs) of equipment for a given fire~~ **spurious actuation**. Include a requirement to include in the estimation of the CDF conditional on each modeled FS, for CC I only one spurious actuation, for CC II up to two, and for CC III more than two.

ES-B3	This requirement looks more like a result of an analysis than a search for the SSCs and their failure modes that should be included in the model.	Qualification	Delete requirement.
ES-C1	See comment on ES-B1		
ES-C2	See comment on ES-B2		
ES-C3, Discussion	As defined in Section 2.2, equipment excludes electrical cable. The problem of identifying cable routing information in FPRAs is well-known. However, it is peculiar that the Standard would endorse the notion ". . . that practicality may limit the completeness of equipment location information." Note that ES-A3 and ES-B5 are similar SRs, but do not contain the discussion below ES-C3.	Qualification	Delete the discussion.
ES-D1	The last bullet refers to ". . . equipment considered but screened out of the FPRA." It appears that the only explicit reference to screening process within the entire ES element is contained within ES-C2.	Clarification	Either indicate which SRs provide input to the last bullet, or delete the last bullet.

Section 4.6			
CS-A3	CC I, discusses hot shorts in one cable, both intra and inter-cable shorts. One cable cannot experience an inter-cable short. Delete inter-cable from CC I.	Clarification	. . . (including ~~both~~ intra-cable ~~and inter-cable~~ hot shorts) . . .
CS-A3	CC II and CC III. Is it the intent of the additional condition, that those instances where hot shorts on up to two cables (CC II) or more than two cables (CC III) are necessary to create the adverse effect on a single piece of equipment? Or is it the intent that the model should include up to two hot short related spurious actuations per modeled FS? If the latter, this is the wrong place for this requirement.	Clarification	Clarify the intent in the light of the comments on Section 4.5 above.
CS-A4	The discussion permits CC I, II and III to use exclusionary cable routing. This should not be allowed for CC III, since the quality of the FPRA will be limited if this analysis assumption is used.	Qualification	. . . The routing of cables on an exclusionary basis is acceptable **for Capability Categories I and II.**
CS-A4	Discussion 1The FPRA should strive for completeness in its cable routing information. .... fire area/compartment/scenario being analyzed.	Clarification	Discussion 1: The FPRA should strive for completeness in its cable routing information. . . . fire area/compartment/~~scenario~~**location** being analyzed.

CS-A4	The second bullet under Discussion 1 appears to state a requirement. If this is the intent, it should be elevated to SR status.	Qualification	
Section 4.8 FPRA Accident Sequence Model			
Section 4.8	To be consistent with the ASME Standard, this section should address the development of the event trees (or equivalent), and the objectives should be the same as in Section 4.5.2.1 or ASME-RA-Sb-2005, modified to indicate that the concern is with fire-induced scenarios.	Qualification	
ASM-B2	There should be a reference to the grouping requirements of ASME-RZ-Sb-2005.	Clarification	(a) consistent with ~~other Internal Events PRA initiator groupings~~ **the requirements for internal events initiating event grouping (Table 4.5.1-2(b) of ASME RA-Sb-2005)**
ASM-B3	To parallel the ASME Standard, this should refer only to those equipment failures that appear directly in the accident sequence modelthe modifications to the fault trees should be addressed elsewhere.		
ASM-B5, B6, and B7	These do not support the HR, which is concerned with the delineation of the event sequences, not its quantification. These should be dealt with under technical elements SY, DA, etc., that parallel those in the ASME Standard.		

Section 4.8 Qualitative Screening			
QLS-A1	DEFINE qualitative screening criteria that provide reasonable assurance that fire areas/compartments that are screened out are insignificant contributors to fire risk consistent, at a minimum, with SRs QLS-A2 and QLS-A3. (See note 1)	Qualification	**This element should be removed to prevent confusion and misuse**. This element is an unnecessary and extraneous element because QLS-A2, and QLS-A3 say that you can not qualitatively screen out any area that contains equipment that is credited in FPRA analysis or even could cause a TS shut down. Doesn't seem to be any room for any additional qualitative criteria.

Section 4.9 Fire Scenario Selection and Analysis			
General Comment	The fire scenarios define the fire damage states that will be used to quantify the fire risk. As such, there should be a HLR to characterize the plant damage caused by the FS in terms of the initiating event assumed and the equipment failed. This would be a good place to incorporate the distinction between CCs I, II, and II, with respect to the number of spurious actuations taken into account.	Qualification	Introduce a new HLE, and supporting SRs.
Text on Page 55	The objectives of the Fire Scenario Selection and Analysis (FSS) element are: • To select a set of fire scenarios for each unscreened fire area/compartment upon which fire risk estimates will be based,	Clarification	The objectives of the Fire Scenario Selection and Analysis (FSS) element are: • To select a set of fire scenarios for each unscreened fire area/compartment**/location** upon which fire risk estimates will be based,
FSS-A2	As written with the “and/or” statement, CC I could claim to be Cat II/III, since fire area level analysis is necessary and sufficient (and/or may equal or). CC II and III should be revised to avoid this problem.	Qualification	. . . unscreened fire area ~~and/~~or compartment, **when compartments subdivisions are used,** within the global analysis boundary.

FSS-A4	Subdivide this SR, such that a CC I uses the revised CC I for general class of damage thresholds, and add a new CC for CC II and III. Damage thresholds can and should be target specific when available.	Qualification	CC I: For each target set identified per FSS-A3, SPECIFY the **general class of** damage threshold**s**. CC II and CC III: For each target set identified per FSS-A3, SPECIFY the **appropriate plant specific** damage threshold.
FSS-A4	Add a discussion to CC I as created in the above comment, to warn analysts of targets that can not appropriately apply the general class of damage thresholds.	Qualification	Discussion: Some target sets, specifically cable types, may be subject to low damage thresholds, lower than the general cable damage threshold for that cable type. When known, the lower thresholds must be used. (Kerite FR is a thermoset cable type that should be considered no better than thermoplastic cables.)
FSS-A5	As written “and/or” CC I could claim to be Cat II/III, since fire area level analysis is necessary and sufficient (and/or may equal or). CC II and III should be revised to avoid this problem.	Qualification	CC II/III. . . unscreened fire area ~~and/~~or compartment, **when compartments subdivisions are used,** within the global analysis boundary.
FSS-A5	Scenario should not be plural on first line of CC I.	Typo	Select at least one fire scenario~~s~~ of each . . .
FSS-A5, Discussion 1	The discussion incorrectly implies that an overall Capability Category is assigned to a FPRA. Also, use of the term “risk importance” is not in keeping with RG 1.200.	Qualification	. . . quantified at a level of detailed commensurate with ~~both~~ the risk ~~importance~~ **significance** of the scenario ~~and the overall Capability Category of the FPRA~~.

FSS-A5, Discussion 2	Using the phrase “dominant fire risk contributors” is not in keeping with RG 1.200.	Clarification	. . . that are identified as the ~~dominant~~ **significant** fire risk contributors. . .
FSS-A6	Discussion: One aspect of confirmation by walkdown is the verification of information obtained from engineering drawings or other plant documentation. However, the objectives of walkdowns also include the confirmation of configuration specific factors that influence fire growth and damage behaviors to ensure that these factors have been properly accounted for in the fire growth and damage analyses (i.e., in the fire modeling efforts).	Clarification	**Add the following Discussion** 2. Because of the high spatial dependence of fire damage, walkdowns are a useful way to gather information during all phases of a FRPRA and should have been used extensively, although formal documentation is not always required. Inclusion of walkdowns as a specific element here is intended to ensure that walkdowns performed at this step have been systematic and formally documented.
FSS-A7	A new CC II and III should be added that includes the procedural requirements for control room abandonment.	Qualification	CCII/III Define the condition that ~~are assumed to cause~~ **procedures require** control room abandonment.
FSS-B1	In CC I, add “selected” as third word similar to CC II and III. The missing word implies a different meaning which is probably not intended.	Typo	For each **selected** fire scenario.
FSS-B2	In CC II and III, clarify the fire growth profile.	Clarification	. . . fire growth profile **to a maximum heat release rate and then decay, not requiring active suppression in every case** (i.e., a time-dependent. . .

FSS-B2	Add Discussion 2, to describe types of fires that always need active suppression.	Qualification	Discussion 2: Active suppression will generally be needed in cable tray fires and other fire scenario's with extensive combustibles (such as, transformer, lube oil fires or hydrogen fire where the fuel source is not isolated).
FSS-B3	There are two FSS-B3s. Renumber accordingly.	Typo	FSS-B3~~-~~**4, and so forth.**
FSS-B6/B7 (old B6 new B7)	Establish a CC III which evaluates flame impingement and mechanical damage. The way this is written, no credit can be given when detailed analysis is performed. CC III should be added which allows credit when such analysis is performed.	Qualification	New CC III If raceway wraps are credited, establish a technical basis for their fire endurance rating and **ANALYZE the protection provided by the wrap from either mechanical damage or direct flame impingement from a high-hazard source.**
FSS-C1, Discussion	Using the phrase "risk importance" is not in keeping with RG 1.200.	Clarification	For example, the ~~relative~~ risk ~~importance~~ significance of a fire scenario. . .
FSS-C1, Discussion	Extraneous indefinite article was used.	Typo	. . . more sophisticated tools such as ~~a~~ compartment fire models.
FSS-C1, Discussion	Same issue identified in FSS-A5, Discussion 1 concerning the overall Capability Category of a FPRA.	Qualification	Delete the sentence "The capability category that the FPRA is aiming to achieve would also influence the selection of the modeling tools and approaches."
FSS-C2, Discussion	Using the phrase "risk importance" is not in keeping with RG 1.200.	Clarification	. . . a fire compartment's risk ~~importance~~ **significance**. . .

FSS-C4	This SR may be unworkable; how would a user of the Standard demonstrate that the "individual responsible..possesses the expertise necessary..?" The Internal Events PRA Standard (ASME 2005) does not contain any similar requirements.	Qualification	Delete this SR.
FSS-C5	This SR may be unworkable since it cannot be achieved without the cooperation of the AHJ. **To date, the NRC has not formally endorsed any industry-sponsored fire modeling tools by issuing a Safety Evaluation.**	Qualification	Delete this SR.
FSS-C6 and FSS-C8	Both of these CCs relate to estimating fire behavior. FSS-C6 and FSS-C8 should be merged, such that CC I includes FSS-C8, and CC II and III includes the discussion of FSS-C6. The considerations in a full fire model vs. an empirical correlation should qualify the full fire model as a higher capability category.	Qualification	Delete CC-8, and make CC-8 a new CC I for CC-6.

FS-C11	The wording of the CC II and III SRs implies that plant-specific data should be assessed, but not actually used in the FPRA. The wording does not meet the intent expressed in the discussion. The terms reliability/availability factors are not in common usage. CC III reads INCLUDE a plant-specific assessment of system availability and USE generic estimates of reliability. Is this intentional or should both read reliability?	Qualification	Compare with SR DA-D1 of the ASME Standard which addresses this problem. Is what is meant reliability and availability estimates?
FSS-C12	Explain "- -" This notation is not explained. If it means that there is no requirement for CC I, then state this plainly.	Clarification	**CCI There is no requirement**
FSS-C13, Discussion	Using the term "importance" is not in keeping with RG 1.200.	Clarification	. . . will be commensurate with both the risk ~~importance~~ **significance** of the fire areas . . . In the case of a detailed analysis of ~~an importance~~ **a significant** fire scenario . . .

FSS-C13	CONDUCT WALKDOWNS to verify that the factors influencing the timing	Clarification	**Add the following Discussion** 2. Because of the high spatial dependence of fire damage, walkdowns are a useful way to gather information during all phases of a FRPRA and should have been used extensively, although formal documentation is not always required. Inclusion of walkdowns as a specific element here is intended to ensure that walkdowns performed at this step have been systematic and formally documented.
FSS-D1	The vulnerability of exposed structural steel to the effects of a fire should be a concern for areas housing high-hazard sources even for CC I and II. The SR as written limits this consideration to the turbine building. If there is a rationale for this, clarify in a Discussion note.	Qualification	Combine the SR across all three Capability Categories, and use the current wording for CC III, or provide a discussion on why this is not a concern for CC I and II.
FSS-D1	There is no Discussion “1" only Discussion “2". Renumber the discussion.	Typo	Discussion ~~2~~ **1**: . . .
FSS-E1	APPLY requirements listed for fire modeling of single fire compartments to modeling multi-compartment fire scenarios.		**Listed Where?**
FSS-F8	Using the phrase “risk importance” is not in keeping with RG 1.200.	Clarification	. . . fire scenarios identified as potentially risk ~~important~~ **significant**; . . .

Section 4.10 Ignition Frequency			
IF-A2	The discussion beginning, “when performing plant-specific fire frequency updates” only applies to CC III, since only CC III involves “plant-specific updates.” This discussion should be moved to be only under CC III.	Typo	Move discussion as described.
IF-A4	The phrase “self-consistent methodology” is not defined in Section 2, nor explained elsewhere.	Qualification	Provide attributes or criteria to enable a user to ascertain if a given methodology for apportioning high-level fire frequencies is “self-consistent.”
IF-B4	Add new SR for IF, to ensure that the methodology for updating IF is documented.	Qualification	New SR, **document the updating methodology, weighting methods, and assumptions used in this analysis that facilitates FPRA applications, upgrades and peer reviews.**

Section 4.11 Quantitative Screening			
QNS-A1	This requirement requires the screening criteria to meet the quantitative goals set in SR-QNS-B3. Why not specify the criteria here? In addition, since the FPRA may be used for a number of applications, there should be a requirement that the screening criteria be structured so that fire areas are retained when equipment (that is taken credit for in the CCDP calculation) that is taken out of service leads to a significant change in CDF.	Qualification	Include the criteria from QNS-B3 here, but note comment below.

QNS-B3	The CCI requirement to "VERIFY that the Quantitative Screening Process does not screen the highest risk fire areas" is not very useful, and could allow the sum of the quantitatively screened areas to be a significant risk contributor. There are several options to address this.	Qualification	Option 1: Add discussion to CC I: **Discussion: The highest risk fire areas are any areas that have a fire risk within an order of magnitude of the highest risk fire area. For example, if the highest risk area has a CDF of 1E-5/year, any area with a CDF of 1E-5 to 1E-6/year, is considered a "highest risk fire area."** Option 2: Make Capability Category II also apply to Capability Category I; Verify that ~~the Quantitative Screening Process does not screen the highest risk fire areas.~~**:** C **The sum of the CDF contributors for all screened fire compartments is less than 10% of the estimated total CDF for internal events,** **and** C **The sum of the LERF contributors for all screened fire compartments is less than 10% of the estimated internal events LERF.** Option 3: Require that the sum of the quantitatively screened contribution be included in the FPRA risk results: Verify that the Quantitative Screening Process does not screen the highest risk fire areas~~.~~**,** **and** **The sum of all screened fire compartments is included in the FPRA results and identified as a source of uncertainty.**

Section 4.12 Circuit Failures			
CF-A1, 2, 4, 5, 6	These SRs do not support the HR, which is to identify cable and circuit failure modes. These SRs are all stated as REVIEW and/or CONFIRM.	Clarification	
CF-A3	This SR is inconsistent with ES-B3, which identifies two (CC I and CC II) or three (CC III) spurious actuations.	Clarification	
CF-B1	This SR is written as REVIEW and CONFIRM the assigned conditional failure probabilities for fire-induced failure probabilities. There should be a reference to the SR which requires the estimation of the failure probabilities.	Qualification	Provide a cross-reference to the SR(s) that address quantification of the failure probabilities, OR write this requirement to address that issue directly.
Section 4.13 Human Reliability Analysis			
General	There is a lack of parallelism with the ASME Standard structure, which will make the integration of the standards difficult.		

HLR-HRA-A	This HR addresses identifying human actions relevant to the credited functions and including them in the PRA model. This is a combination of HLR-HR-E of ASME Standard, which is the identification of operator responses, and HLR-HR-F, which is the definition of HFEs. The SRs only support the second of these since they relate only to HFEs. HFEs are not only included in the accident sequence models (see comment on section 4.8) but also in the fault tree models.	Qualification	Requirements are needed to address the identification of responses, in parallel to HLR-HR-E of the ASME standard. The FPRA shall identify . . . and shall include the **corresponding human failure events** ~~failures of these actions~~ in the FPRA ~~accident sequence~~ model **as appropriate**.
HRA-B2 and B3	These can be deleted, since they are addressed in HRA-B1 which requires the HEPs be calculated consistent with the requirements of HR-G of ASME 2005.	Clarification	Delete HRA-B2 and HRA-B3.
Section 4.14 Seismic Fire			
SF-A4	CC I: There is no requirement other than to review the plant response procedures.	Clarification	Add a requirement to assess the significance of the results of the review.

Section 4.15 Fire Risk Quantification			
General comment on HLR FQ-A	The fire scenarios define the fire damage states in terms of the initiating event assumed and the equipment failed that will be used to quantify the fire risk. This would be a good place to incorporate the distinction between CCs I, II, and II, with respect to the number of spurious actuations taken into account.	Qualification	Add a new SR to address the differences between capability categories with respect to single versus spurious actuations.
FQ-A1	The plant damage state is not well defined.	Qualification	For each fire scenario selected . . . Into a plant damage state ~~corresponding to the FPRA accident sequence model~~, **i.e., initiating event and equipment failed** including consideration of insights from the Circuit Failure analysis (see the CF requirements), **to provide the boundary conditions for the evaluation of the conditional core damage probability using the appropriate accident sequence model.**
FQ-A3	The plant damage state is not a quantification factor.	Qualification	For each fire scenario . . . circuit failure likelihoods (per the CF requirements), and **the conditional core damage probability corresponding to** the plant damage sate (per SR FQ-A1).

FQ-A3	The evaluation of uncertainty in this SR duplicates HLR UNC-B.	Qualification	. . . and the plant damage state (per SR FQ-A1). ~~and~~ ~~INCLUDE uncertainty evaluations consistent with:~~ • ~~the other technical elements in the Standard and their requirements; and~~ • ~~the Internal Events PRA QU and LE requirements (ASME 2005).~~
FQ-A3	There is no requirement to establish an appropriate accident sequence truncation frequency.	Qualification	Provide a requirement to establish an appropriate accident sequence truncation frequency.
HLR FQ-B	There is no requirement to review the results of the FPRA quantification, as is done by SRs QU-D1, QU-D3, and QU-D4 in the Internal Events PRA Standard (ASME 2005).	Qualification	Provide requirements to review the results of the FPRA quantification.
Section 5 FPRA Configuration Control — No objection			
Section 6 FPRA Peer Review			
Section 6.2.1	The requirement is for documented evidence of familiarity with EPRI TR1011989/NUREG/CR-6850.	Clarification	Absent a certificate of attendance at the workshops, what would constitute documented evidence?

Section 6.4	A section on the peer review of expert judgment is not provided.	Qualification	**6.4 Expert Judgment** **This standard adopts in whole the provisions for peer review of expert judgment as set forth in Section 6.4 of ASME 2005, as modified by the following:** C **Whenever ASME makes reference to the ASME standard, it should be interpreted as a reference to the equivalent section of the FPRA standard.**
Section 6.5	A section corresponding to the section on peer review of the PRA Configuration Control in the ASME Standard is not provided.	Qualification	**6.5 FPRA Configuration Control** **This standard adopts in whole the provisions for peer review of the FPRA Configuration Control as set forth in Section 6.5 of ASME 2005, as modified by the following:** C **Whenever ASME makes reference to "PRA", "FPRA" is substituted.** C **Whenever ASME makes reference to the ASME standard, it should be interpreted as a reference to the equivalent section of the FPRA standard.**

Section 6.6	A section corresponding to the section on documentation of the peer review in the ASME Standard is not provided.	Qualification	**6.6 Documentation** **This standard adopts in whole the provisions for documentation of the peer review of the FPRA as set forth in Section 6.6 of ASME 2005, as modified by the following:** C **Whenever ASME makes reference to "PRA", "FPRA" is substituted.** C **Whenever ASME makes reference to the ASME standard, it should be interpreted as a reference to the FPRA standard.** C **Address the clarification in RG 1.200, Table a-1, index No. 6.6.1.**
Appendix A	The staff has not reviewed this non-mandatory Appendix and has no position on it at this time.		
Appendix B	The staff has not reviewed this non-mandatory Appendix and has no position on it at this time.		