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

The NRC staff has reviewed the subject standard using criteria from Regulatory Guide 1.200 Revision 1, "An Approach for Determining the Technical Adequacy of Probabilistic Risk Assessment Results for Risk-Informed Activities," dated January, 2007. Our comments are directed towards clarifying and strengthening requirements. NRC's view of this standard is positive, as reflected in the cover letter of this enclosure. This enclosure contains a table of comments on the individual requirements of this standard.

The staff's comment is either in the form of a clarification or a qualification. For each comment, the staff's concern (issue) and the proposed resolution is provided. In the proposed staff resolution, the staff clarification or qualification to the requirement is indicated in either bolded text (i.e. **bold**) or strikeout text (i.e ~~strikeout~~); that is, the necessary additions or deletions to the requirement (as written in the ANS standard) to resolve the staff's concern are provided.

Enclosure

Table: NRC Staff Comments on the Fire PRA Methodology Standard

Index No.	Issue	Comment	Resolution
Section 1			
Last sentence, last paragraph, section 1.4	The discussion on conservatism is useful and needed but this sentence is confusing.	Clarification	Increasing the depth of the analysis in this case **will identify additional spurious operations that will increase risk and thus the lower capability category will yield a lower (less conservative) estimated risk. Realism, however, does increase with increasing a capability category.** ~~Cannot lead to a less conservative result so the higher level of conservatism will be associated with a higher capability category rather than a lower capability category.~~
Section 2			
Section 2.1	PORV definition is incorrect	Clarification	Replace “Pressure” with “Power”
Section 3 - No comments			
Section 4			
Section 4.4	1st paragraph: The citations of section 4.2 and Figure 4.2-1 of the ASME standard are incorrect. 2nd paragraph: The reference to “Table 1-1 of this standard” is incorrect (**Repeat comment**)	Clarification	(I.e., see ASME Section **1**.4~~.2~~ and ~~Figure 4.2-1~~ **Table 1.4-1**) The interpretation .... is stated in~~ Table 1-1 of this Standard~~ **Table 1.4-1 of ASME RA-Sb-2005.**

Index No.	Issue	Comment	Resolution
PP-B1	Spelling error on the word “anlayis” for CC II and III.	Clarification	Correct spelling error.
ES-A1	The meaning of the phrase “within the time that the effects of the fire may preclude a safe shutdown” is not clear. Also, the phrase, “including spurious operation (see ES-A3)” is confusing as ES-A3 refers to including equipment excluding spurious operation.	Clarification	While discussion 4 explains what is intended, the words in the requirement are not clear. They suggest that safe shutdown is not possible. Perhaps the word preclude should be replaced by “degrade the capability for.” Either delete (see ES-A3), or change the citation to ES-A4.
ES-A2	Current text seems open ended but it should apparently build on identifying the particular support equipment whose failure could cause the undesirable spurious operations identified in ES-A1.	Clarification	REVIEW power supply, interlock circuits, instrumentation and support system dependencies and IDENTIFY additional equipment **whose fire-induced failure, including spurious events, could cause or contribute to an initiating event.** ~~As required.~~

Index No.	Issue	Comment	Resolution
ES-A4	The discussion implies that what is being looked for here is a spurious actuation that in conjunction with another fire-induced failure, causes an initiating event. However, there is something wrong with the sentence, “INCLUDE additional equipment .... .”	Clarification	INCLUDE additional equipments based on the consideration of cases where any single spurious operation of equipment that could be caused by a fire **when combined with a non-spurious failure caused by the same fire causes** ~~cause~~ an initiating event ~~associated with the affected equipment~~ considering:
ES-A4 pp. 45-46	Why not consider a gradation across the CCs for one or two spurious operations, instead of precluding the identification of two *a priori?* While looking for three or more could be prohibitive, expecting pairs would seem reasonable for CC III. "Current state-of-the-art" and "associated practicalities" do not preclude identification of pairs of spurious operations. This SR seems inconsistent with subsequent SR ES-B2, especially where ES-B2 dictates pairs of spurious operations for CC II and triples for CC III (not to mention up through quadruples in ES-B4). Similarly, subsequent SR ES-C2 in CC III requires up through pairs of spurious operations for instrumentation.	Clarification	Create CC III for this SR, and include consideration of pairs of spurious actuations for an initiating event.

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ES-B1	CCII: what is risk-significant from an internal events perspective may not be for fire induced scenarios. Furthermore, if something is not significant in an internal events model, there is no guarantee that it will remain so for fire-initiated scenarios. **(Repeat** comment) There should be no difference between CCII and CCIII in this regard. Differences that arise because of differences in the internal events model will drive the distinction between CCII and CCIII. Discussion 7 states the intent, but the distinction created by the wording is misleading. Also why is this different from ES-C1 (which appears to be more correct) in its treatment of the categories?	Qualification	Make CCII and CCIII the same: ." **And INCLUDE ~~(CCII)risk significant , and (CCIII) all~~ the equipment from the ASME PRA Standard** ..." An alternative would be to rewrite CC II as: IDENTIFY .... in the Fire PRA **and** **INCLUDE equipment modeled in the Internal Events PRA sufficient to capture the risk-significant fire sequences.**
ES-B2	Reference to Section 4.9 in the Categories description is too general to be helpful. They should be further specified or deleted. The reference in the discussion, "Additional spurious operations may need to be included to meet HLR-PRM-C (see section 4.9)" provides the needed information.	Clarification	All capability categories: .... will contribute to failure to meet the success criteria in the FPRA ~~(see Section 4.9)~~.

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ES-B5	Current requirement seems open ended but it should apparently build on identifying the particular support equipment whose failure could cause the undesirable failure events identified in ES-B1 to ES-B4.	Clarification	REVIEW power supply, interlock circuits, instrumentation and support system dependencies and IDENTIFY additional equipment **whose fire-induced failure could cause any of the failure events identified in ES-B1 to ES-B4** ~~as required.~~
ES-C1, Discussion 1	Expression “reactor core isolation coolant” in second and third sentences is incorrect	Clarification	Replace “coolant” with “cooling” in both occurrences
ES-C2	The discussion in the “Exception” statement in this requirement runs across all capability categories. While it is written as an expectation, it reads more like it should be a requirement related to when the instrumentation does not have to be identified. It does not contain a statement to the fact that redundant or diverse instrumentation (which can easily compensate for failed instrumentation) be unaffected by the fire or initiating event. The question arises how the operators would know what redundant or diverse instrumentation can be relied upon. In the case of using backup instrumentation in the first condition of the exception, it is expected that this instrumentation be part of trained operating procedures.	Qualification	The Exception should be rewritten as a requirement: **JUSTIFY the screening of failed or spuriously indicating instrumentation on the basis that it** is ~~expected that where the failure or spurious operation of instrumentation can be justified as~~ easily compensated for by other redundant or diverse instrumentation **unaffected by the fire or the resulting initiating event**, or the affected instrumentation is explicitly identified..... in response to the fire. **The redundant or diverse instrumentation must be identified in plant procedures as a means of backup indication, and the operators must be trained in their use.**

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HLR-CS	There does not appear to be a requirement to identify the cable failure modes and scope of cables to include in the model. SRs HLR-CS-A5 through 10 are written as REVIEW and CONFIRM or INCLUDE. It is in these SRs that the different cable and circuit failure modes are identified. This could have been done more directly as suggested in the resolution column.	Clarification	Modify SRs HLR-CS-A5 through 10 appropriately. For example for CS-A5 "INCLUDE cable conductor-to-ground and conductor-to-conductor shorts (both intra-cable and inter-cable) as potential cable and circuit failure modes."
CS-A7	Discussion 2 states: Section 2.2 defines the term "high consequence event." However, there is no such definition. Is the phrase "that might lead to a high consequence event" even necessary?	Clarification	Either provide a definition, or modify the text in the SR and discussion.
CS-A7	The CONFIRM statement includes the phrase "and lead to a high consequence event" which is undefined.	Clarification	See above.
CS-A11	CS-A2 CC II requires consideration of hot shorts impacting up to two cables. However, for this particular SR, only in CC III is there a need to identify raceways. Shouldn't the same apply to CC II?	Clarification	Revise the guidance to CC II to match that of CC III.
PRM-B1 Discussion	The first clause of the discussion, "If an internal events PRA is unavailable," is inconsistent with Section 1.2 that states that "This Standard assumes as an entry point for the FPRA that an internal event PRA for initiators other than fire has been completed.....	Clarification	Delete the words "an internal events PRA is unavailable, or if"

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PRM-B2	Discussion: The sentence: “The process used for meeting the SRs of that (HLR-ES-A) HLR can also be used to meet this SR” is not strictly correct. The former is the identification of the SSC failures that could cause an initiating event. This relates to the definition of the initiating events. They are clearly interrelated but not interchangeable. In fact, these requirements exhibit circular logic: identify the equipment failures that can cause new initiating events (ES) and identify the new initiating event based on the equipment failures (PRM).	Clarification	This is a “how-to-do” and should be removed.

Index No.	Issue	Comment	Resolution
PRM-B3	The second bullet states “As a minimum, the initiating event assigned to each fire scenario is to be the most conservative...” and applies this to all three Capability Categories. This seems inconsistent with Table 1-1 which suggests increasing realism in going from CC I to CC III. In addition, the second bullet qualifies the requirement to state that, “as a minimum, the initiating event ... is to be the most conservative ... .” It is not immediately obvious why more than one initiating event would be identified for a fire scenario (as defined in Section 4.10) as this would include an identification of the damaged targets, which should determine what equipment has failed. An exception might be the consideration of spurious actuations, where, if the probability of spurious actuation is not small, both the damage assuming spurious actuation and that assuming none, would have to be considered. Even here, wouldn’t these be different fire scenarios?	Clarification	Modify the second bullet for Capability Category III to read: Include all initiating events corresponding to the selected fire scenarios, considering the possible fire-induced initiating events and the failure of other ....” Provide a discussion to explain what is meant by “the most conservative initiating event” in relation to a fire scenario.
PRM-B8, PRM-B14, FSS-D7, Section 4.14	The term ‘operability’ or ‘operable’ are used in these SRs whereas most of the rest of the standard use the term ‘operability/functionality.’ The term “operable” has a particular regulatory connotation.	Clarification	Replace all occurrences of ‘operability’ by ‘operability/functionality’ and ‘operable’ by ‘operable/functional’.

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PRM-B9 p. 80	Discussion [1]: This assumption of failure for all equipment excluded from Element ES is inappropriate, unless it is known that this equipment is susceptible to fire-induced failure. For example, one would not want to set check valves to failed just because they were excluded from ES since these are not fire-susceptible.	Clarification	Apply the assumption only to equipment potentially damaged by fire, or else the treatment is not "proper" as claimed in the Discussion.
HLR-PRM-C	This intent of this HLR is not clear. Since the number of spurious actuations to be taken into account is already determined in other SRs, and differentiated by capability category, this almost reads as if it's an attempt to convert a Category I analysis into a Category II analysis, and a II into a III. Furthermore, it seems to be more of a "how-to-do" rather than a "what-to-do." The requirements for ES and CS already define what is expected. If this is not considered sufficient, it should be addressed there.	Clarification	Clarify or delete.
PRM-C2	In CC I, the term vulnerability is used, but no definition is provided.	Clarification	Provide a definition of vulnerability.

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PRM-C3 p. 83	Why is this not included under HLR-PRM-B? Is it adequate to limit inclusion for ISLOCAs only to those greater than 1E-7/y LERF? Should not there be an OR at the end of the SR such that ISLOCAs greater than some fraction of total LERF also be included to cover situations where the total LERF is low enough that LERF values less than 1E-7/y could be significant contributors as well?	Clarification	Move to HLR-PRM-B. Consider using a more appropriate lower screening threshold.
FSS-A4	The parenthetic phrase (i.e., core damage or large early release) is not needed in this context. This requirement is related to the definition of fire damage state only - the potential for, and conditional probability of, core damage is treated in PRM.	Clarification	In both CC I/II, and CC III ... credible range of potential fire damage end states has ~~(i.e., core damage or large early release)~~ been represented.
FSS-A4	CC III: It does not seem necessary to identify ignition sources here, since that is addressed in FSS-A5. Shouldn't this read the same across all categories? Is this SR even needed since it seems to be partially redundant to FSS-A5?	Clarification	... target sets for each **physical analysis unit** ~~**ignition source (or group of ignition sources)**~~ such that

Index No.	Issue	Comment	Resolution
FSS-A5 pp. 89-90	Discussion 2, for CCII and CCIII, indicates that those physical analysis units that are significant fire risk contributors should be characterized by detailed quantification of fire scenarios for specific ignition sources and target sets. However, only CCIII for this particular SR indicates that the risk contributions should be correlated to specific ignition sources and	Clarification	Develop a CCII such that the requirements are the same as the existing CCIII.
FSS-C4	The inference is that there is no need for the severity factor to reflect the conditions and assumptions of the specific fire scenarios under analysis for CC I. This does not seem logical.	Clarification	Replace CC I with CC II, so that the requirements in CCII span both CCI and CCII
FSS-C5 p. 96	Some discussion is needed to clarify what is meant by "reflecting the performance limits . . . " in CC III. Does this imply some particular damage threshold?	Clarification	Clarify what is meant by “reflecting the performance limits . . . "
FSS-D7 (p. 100)	Category I is supposed to account for unique design or operational features of the plant	Clarification	under Category I, add the following bullet • the system has not experienced outlier behavior relative to system unavailability.
FSS-D7 and D8	FSS-D7 seems to unnecessarily address effectiveness (see Discussion 1) of fire detection and suppression systems, even though FSS-D8 was established to address effectiveness.	Clarification	Incorporate discussions of effectiveness into FSS-D8.

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FSS-G4	This discussion is under the evaluation of multi-compartment fire scenarios and, as such, it should only apply to "compartments." Including a discussion about passive features that may be used elsewhere but not partitioning compartment boundaries unnecessarily confuses the issue. If the stricken text is meant to ensure that all passive fire barrier elements should be reviewed for effectiveness, this should be placed under fire scenario analysis, not here under multi-compartment analysis.	Clarification	Discussion: Passive fire barrier features that may have been credited in Plant Partitioning include items such as walls, normally closed fire doors, penetration seals, and other similar features that require no action (manual or automatic) to perform their intended function. ~~Other passive fire barrier elements (e.g., raceway fire wraps) would not be credited in Plant Partitioning, but might still be credited in quantification of fire scenarios~~. This requirement would apply to all passive fire barrier elements **credited in Plant Partitioning.**
HLR-FSS-G and FSS-G6	The evaluation of the risk of fire scenarios is not performed until Fire Quantification. This HLR and SR should focus on the identification and characterization of the multi-compartment fire scenarios	Clarification	HLR-FSS-G: The FPRA shall ~~evaluate the risk contribution of~~ **identify and characterize** multi-compartment fire scenarios. SR FSS-G6 should be addressed in the quantification section
HLR-FSS-H	In the SRs supporting this HLR and elsewhere there seems to be a suggestion that analyses are performed for physical analysis units for CC I and II, and scenarios for CC III. However, in HLR-FSS-A , scenarios are chosen in CC I and II. (See also FSS-C1)	Clarification	Suggest only using the term fire scenarios.

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FSS-H4 p. 110	The differentiation between CC I-II and CC III, based on whether fire modeling was performed per physical analysis unit vs. fire scenario, should not be introduced here in the SR for HLR-FSS-H on documentation unless this differentiation corresponds to that used uniformly under the other SRs of the FSS element. This does not appear to be the case.	Clarification	Use the CC III words for all three categories.
FSS-H5 p. 111	As immediately above, there should be no differentiation among the three CCs based on whether physical analysis unit or fire scenario served as the basis for fire modeling. The only differentiation that would seem appropriate, especially here in the SR on documentation, would be based on the uncertainty analysis characteristics.	Clarification	CC I and CC II: Document fire modeling output results for each analyzed **fire scenario** ~~physical analysis unit~~ ... .
FSS-H6 p. 111	The CC distinctions should parallel those in FSS-E1, which allows plant-specific updates across all three CCs.	Clarification	Modify the last bullet in CCI to say "a technical basis for the applicability of statistical models applied in the analysis of the **fire scenario** being analyzed" Then add this modified bullet to CCII-III. Then apply the new CCII-III to CCI, such that no distinction exists across capability categories.

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Section 4.11 p. 113	The limitation which prohibits use of only plant-specific fire ignition frequency data (last paragraph) can be misleading. Some Bayesian updates will not justify convolution of generic and plant-specific data if such data are widely disparate statistically. In such cases, one data source (usually the plant-specific data) is the only appropriate source to use, not a Bayesian combination of the two.	Clarification	Add a footnote discussing this or remove the limitation.
IF-A4 (p.115)	Category I is supposed to account for unique design or operational features of the plant	Clarification	for Category I, replace the statement “No Requirement” with the following: **REVIEW plant-specific experience for fire event outlier experience and update fire frequencies if outliers are found.**

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IF-A4 p. 115	The Discussion appears to limit outliers only to situations where the plant-specific fire frequency would be higher than the generic (recognizing that, for "unique" fires, the generic would be zero, so the plant-specific would automatically be higher as well). Does this imply that it is never appropriate to use plant-specific fire frequencies that are lower than generic in lieu of the generic (vs. just using Bayesian updated values)? If so, this may be unnecessarily conservative and could actually skew a plant-specific fire risk profile if, e.g., a particular type of fire cannot conceivably occur at a particular plant but must still be assigned the generic frequency. {NOTE: This comment has a tie-in to the 2nd bullet in Section 6.3.7 on p. 155, stated below}	Clarification	If the intent is to assign the generic frequency, even though a particular type of fire cannot conceivably occur at a particular plant, state so.
IF-A10 p. 117	Since IF-A6 allows Bayesian updating across all three CCs, why does IF-A10 acknowledge its use only for CC III? Since IF-A10 only addresses use of uncertainty distributions, it seems more appropriate to delineate solely on point estimates vs. uncertainty distributions without mention of Bayesian updating.	Clarification	Combine CC II and III using only the current criterion from CC II.

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CF-A1 p. 126	CCII and CCIII appear to provide the same requirements. The only difference between CCs II and III appears to be the addition of the word CONFIRM in the 3rd bullet to what is essentially the same requirement for ASSIGN in the 2nd bullet ("the specific circuit configuration" in the 2nd bullet is essentially the same as "circuit-specific" in the 3rd). Is the intent that CONFIRM (in addition to ASSIGN) is sufficient to upgrade from CC II to III? If so, this distinction seems unnecessary since one would always confirm that the assignment was done.	Clarification	Delete the requirement in CCIII that the user CONFIRM that a circuit specific conditional failure probability is applied. If indeed this CONFIRM is the only difference in CCII and CCIII, make CCII and CCIII the same.
SF-A5 (p. 138)	This SR calls for a review and assessment based upon the impacts of a seismic effect. A review for the compromise of firefighting equipment and brigade access routes, as indicated in CCII and CCIII, is necessary to establish fire fighting capability. Fire fighting capability is important for extinguishing fires across the plant.	Clarification	Apply CCIII/II to CCI, such that the requirements for CCIII/II apply to CCI.

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FQ-A1	The SR uses the phrase “FPRA accident sequence model.” This is not a term that is defined in the standard and is a throwback to an earlier version of the standard. The correct term should be “plant response model.” When combined with FQ-A2, this defines the complete impact of the fire in terms of the initiating event and the SSCs failed	Clarification	..... plant damage state corresponding to the ~~FPRA accident sequence~~ **plant response** model including consideration ...
FQ-A2	The acronym ‘LOSP’ is used for loss of offsite power whereas Section 2.1 uses ‘LOOP’.	Clarification	Replace ‘LOSP’ by ‘LOOP.’
FQ-A2	This SR contains the same condition as in PRM-B2, that the most conservative initiating event be assigned for the fire scenario for all three Capability Categories. This seems inconsistent with Table 1-1 which suggests increasing realism in going from CC I to CC III. Since the assignment of the initiating events has already been made on PRM-B2, it seems unnecessary to repeat this here.	Clarification	Either, a) create a CCIII which retains the IDENTIFIED portion of CCI/II, and modifies the ENSURED portion of CCI/II in the following way: “ENSURE that the most ~~conservative~~ **appropriate** (i.e., challenge from..... . Or, b) delete the “and ENSURE that the . . . ”

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FQ-A3	Again the phrase “FPRA accident sequence model” is used.	Clarification	For each scenario ..... LERF, QUANTIFY the ~~FPRA accident sequence model~~ **contribution to CDF and/or LERF** reflecting the scenario .... (i.e., fire ...., and **the impact of** the plant damage state **on the plant response model** (per SR-FQ-A1) **and in determining the initiating event (per SR-FQ-A2))**.
UNC-A1	The second bullet states QU-E2 is to be met in reference to the FPRA model developed per Section 4.9. Section 4.9 refers to the Plant response model. Therefore this bullet should refer to the set of fire risk scenarios quantified per FQ-A3.	Clarification	• QU-E2 is to be met in reference to the **set of fire risk scenarios quantified per FQ-A3** ~~FPRA model developed per Section 4.9~~.
Section 5 - No comments			
Section 6			
Section 6.3.7 p. 155	The 2nd bullet may need to be modified to reflect the Comment above regarding IF-A4 (p. 115).	Clarification	Ensure consistency with resolution cited above.
Section 6.3.13 p. 156	The 2nd bullet cites a parenthetical reference to the CCs (in Section 4.17), but Section 4.17 has no delineation among the CCs for uncertainties.	Clarification	Unless implying a default to Table 1.1, remove the parenthetical inclusion in this bullet.
Section 7			

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Section 7	The definition for ASME 2005 does not capture all contributions to the standard	Clarification	Substitute this reference: ASME 2005: "Standard for Probabilistic Risk Assessment for Nuclear Power Plant Applications," American Society of Mechanical Engineers, ASME RA-S-2002, New York, NY, Apr. 5, 2002; (including Addenda A and B to ASME RA-S-2002, i.e., ASME RA-Sa-2003, dated Dec 5, 2003, and ASME-RA-Sb-2005, dated Dec 30, 2005**.**
Section 7	Among its uses in the Standard, NFPA 805 is used to refer to the NFPA 805 change analysis, and in reference to Maximum Expected Fire Scenarios and Limiting Fire Scenarios. NFPA 805, 2006 edition has not been endorsed by the NRC and is not recognized by 10 CFR 50.48c. The 2001 edition of NFPA 805 was endorsed for the rule and should be referenced.	Qualification	Revise reference: NFPA 805: "Performance-Based Standard for Fire Protection for Light Water Reactor Electric Generating Plants," National Fire Protection Association, NFPA Standard 805, ~~Brainerd~~**Quincy**, MA, 200~~6~~**1**.
Section 7	RG 1.189 has been updated and re-issued as Revision 1. The title of the RG has been changed to include all nuclear power plants.	Clarification	Revise reference: RG 1.189: "Fire Protection for ~~Operating~~ Nuclear Power Plants," U.S. NRC, Regulatory Guide 1.189, Washington, D.C., ~~April 2001~~**March 2007**.
Section 7	ANS External Event Standard has been updated and re-issued	Clarification	Revise reference to reflect that the proper date associated with this standard is March 2007.

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Section 7	R.G. 1.200 has been updated and re-issued.	Clarification	Substitute for reference: Regulatory Guide 1.200, Revision 1: An Approach for Determining the Technical Adequacy of Probabilistic Risk Assessment Results for Risk-Informed Activities, U.S. NRC, January 2007.
Section 7	Include RG 1.205 where NFPA 805 is referenced since the RG provides qualifications and clarifications for the NFPA standard in its application to operating nuclear power plants.	Clarification	**RG 1.205: "Risk-Informed, Performance-Based Fire Protection for Existing Light-Water Nuclear Power Plants," U.S. NRC, Regulatory Guide 1.205, Washington, D.C. May 2006.**