March 18, 2008

MEMORANDUM TO: J. E. Dyer, Director
Office of Nuclear Reactor Regulation

FROM: Mark A. Cunningham, Director ***/RA/***
Division of Risk Assessment
Office of Nuclear Reactor Regulation

SUBJECT: NUCLEAR REGULATORY COMMISSION STAFF POSITION ON THE FIRE PROBABILISTIC RISK ASSESSMENT STANDARD (TAC NO. MC5664)

The purpose of this memorandum is to document the position of the Offices of Nuclear Reactor Regulation (NRR) and Nuclear Regulatory Research (RES) on the fire probabilistic risk assessment (PRA) standard. This standard was developed by the American Nuclear Society (ANS) as "Fire PRA Methodology, an American National Standard," ANSI/ANS-58.23-2007, and published on November 20, 2007. It is our understanding that this ANS standard has been incorporated without changes into ASME/ANS RA-S-2008, "Standard for Level 1/Large Early Release Frequency Probabilistic Risk Assessment for Nuclear Power Plant Applications," a consensus publication by both the American Society of Mechanical Engineers (ASME) and ANS. The staff plans to endorse this combined standard in Revision 2 to Regulatory Guide (RG) 1.200, "An Approach for Determining the Technical Adequacy of Probabilistic Risk Assessment Results for Risk-Informed Activities," as discussed below. Further, the staff review of ASME/ANS RA-S-2008 has been initiated (see letter from C. Lui, "Request for Comment on [1] ASME/ANS Standard for Probabilistic Risk Assessment for Nuclear Power Plant Applications and [2] NEI Documents," dated February 12, 2008, ADAMS Accession No. ML080240476). Part 3 of ASME/ANS RA-S-2008 contains the internal fire at-power PRA requirements. The staff from both NRR and RES have reviewed and agreed with the comments in the Enclosure.

This memorandum provides an early, publicly available, indication of the expected staff position on Part 3 of ASME/ANS RA-S-2008 for the benefit of those licensees transitioning to the performance-based fire protection program licensing basis via Title 10 of the *Code of Federal Regulations,* Part 50 (10CFR50.48(c)). We intend to inform stakeholders of its availability

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using a number of mechanisms, including the NFPA-805 Frequently Asked Questions process. It does not request or require any action on your part.

Conditional upon the items listed in the attached table, the staff encourages these licensees to meet the requirements of ASME/ANS RA-S-2008, Part 3 (and the general requirements in Part 1), in full when developing, updating and maintaining fire PRAs in support of fire protection program licensing bases under 10 CFR50.48(c).

However, it should be noted that the staff position, as documented in the Enclosure, and as will be documented in Revision 2 to RG 1.200, is in the context of the use of the standard in developing a fire PRA, independent of an application. When using the fire PRA to support the transition to, and implementation of, NFPA 805, it is the licensee's responsibility to determine which supporting requirements of the standard are needed to support its license amendment request(s), at which capability category, and for which physical analysis units. Consequently, some of the positions provided in the attached table may not be applicable to all licensees.

This memorandum does not, of course, constitute a formal endorsement of Part 3 of ASME/ANS RA-S-2008. Endorsement of a fire PRA methodology standard is expected at a later time through issuance of Revision 2 to RG 1.200.

ENCLOSURE:
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STAFF POSITION ON PART 3 OF ASME/ANS RA-S-2008

| SECTION/ REQUIREMENT[a] | COMMENTS |
|---|---|
| 3-1.2 *[1.2]* | The statement in the last paragraph that *"accident sequences that are not associated with fires within the plant ..."* should be interpreted as if reading *"accident sequences that are <u>associated with fires external to (or not within)</u> the plant ..."* |
| 3-1.7.1-2(b) *[4.5-3]* /PP-B1 | The requirement for Capability Category I is one of the options for Capability Category II/III; therefore, the requirement could be the same for all Capability Categories. The statement about meeting the other requirements is unnecessary. This SR makes a distinction between the use of the fire protection program fire areas and a subdivision of those areas. Deleting this condition, together with the suggested changes to PP-B2, B3, and B5 below, is adequate to characterize the plant partitioning. In effect, use the same words for all three categories, or delete the first option in CC II/III so that it reads as follows: "DEFINE Fire PRA physical analysis units *<u>by using</u>* a combination of fire areas and physical analysis units where each physical analysis unit represents a subdivision of a fire area." Remove the additional requirement following (and including) the "and." |
| 3-1.7.1-2(b) *[4.5-3]* /PP-B2, B3 and B5 | Requirements PP-B2 through PP-B7 apply only to Capability Categories II and III. For each entry under Capability Category I in PP-B2, B3 and B5, delete the existing statement and replace with "*<u>No Requirement</u>*." |
| 3-1.7.2-2(a) *[4.6-2]* /ES-A4 | In all three Capability Categories, the requirement should be interpreted as if the qualifying phrase *"... associated with the affected equipment ..."* was not there. |
| 3-1.7.2-2(b) *[4.6-3]* /ES-B1 | With respect to Capability Category II, the notes state that this requirement is a starting point for selection of mitigating equipment, and that an iterative process will provide the completeness with respect to Table 1-1.3-1, which specifies that the significant contributors be included in the model. The requirement should represent the end result, not the beginning point. To accomplish this, the requirement for Capability Category II should read as follows: "... and INCLUDE *<u>fire</u>* risk-significant equipment" (removing reference to the Internal Events PRA). |
| 3-1.7.5-2(c) *[4.9-4]* /PRM-C1 | In Discussion 3, the phrase *"if a combination of three spurious operations could lead to the same sequence, and if this could result in new significant contributing sequences ..."* should be interpreted as if reading *"if a combination of three spurious operations could lead to the same sequence, and if this could result in <u>new contributions to CDF or LERF</u> ..."* |

[a] *[Italics]* indicate corresponding sections in ANSI/ANS-58.23-2007.

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| 3-1.7.6-2(c) *[4.10-4]* /FSS-C4 | Capability Category I has no requirement that the severity factor reflect the conditions and assumptions of the specific fire scenarios, as in Capability Categories II and III. Either Capability Category I should be adjusted to indicate that bounding estimates for the severity factor should be used, or Capability Category I should be changed to match Capability Category II, i.e., also indicate that *"the severity factor reflects the conditions and assumptions of the specific fire scenarios under analysis".* |
| 3-1.7.7-2(a) *[4.11-2]* /IGN-A1 | In the Discussion, item (e) should be interpreted as if it read *"... (e) if being used as a supplement to, rather than in lieu of, nuclear data, that the fire frequencies calculated are consistent with those derived from nuclear experience ..."* (i.e., with the addition of the qualifying phrase as underlined). |
| 3-1.7.13 *[4.17]* | The first bullet should be interpreted as if the word "key" as not there. The third bullet should be interpreted as assessing the "potential" impact. In the subsequent paragraph, corresponding changes should be assumed to imply (i.e., "uncertainties," not "key uncertainties;" and "potential impacts," not just "impacts"). |
| 3-1.7.13-1 *[4.17-1]* /UNC-A | The high-level requirement should be interpreted as if it read *"the Fire PRA shall identify sources of CDF and LERF uncertainties and related assumptions and modeling approximations. These uncertainties shall be characterized such that their potential impacts on the results are understood."* |
| 3-1.7.13-2(a) *[4.17-2]* /UNC-A2 | IGN-A10 is the relevant SR for uncertainty, as apposed to IGN-A8 |
| 3-1.7.13-2(a*) [4.17-2]* /UNC-A3 | This supporting requirement should be ignored since an evaluation of the sensitivity of the results to sources of uncertainty is not needed for the base Fire PRA, only when needed to support a subsequent application. |
| The reasoning behind the following is given in NOTE 1 | |
| 3-1.7.2-2(c) *[4.6-4]* /NOTE ES-C1 | In the last paragraph, the term "significant contributor" should be interpreted consistent with the definitions in Section 1-2. |
| 3-1.7.5-2(c) *[4.9-4]* /NOTE PRM-C1 | In the first paragraph, the term "significant contributor" should be interpreted consistent with the definitions in Section 1-2. |
| 3-1.7.6-2(c) *[4.10-4]* /FSS-C2 | For Capability Category II/III, the requirement should be interpreted as "For those scenarios that represent significant contributors to ~~a physical analysis unit's~~ fire risk, CHARACTERIZE …" This would be consistent with the explanation in the NOTE. |
| 3-1.7.8-2(c) *[4.12-4]* /QNS-C1 | The screening criteria in Capability Categories II and III should relate to the total CDF and LERF for the fire risk, not the internal events risk. |
| 3-1.7.7-2(a) *[4.13-2]* /CF-A1 | The term "significant contributor" should be interpreted consistent with the definitions in Section 1-2. |
| 3-1.7.12-2(e) *[4.16-1]* /FQ-E | The term "significant contributor" should be interpreted consistent with the definitions in Section 1-2. |
| 3-1.7.12-2(e) *[4.16-6]* /FQ-E1 | The term "significant contributor" should be interpreted consistent with the definitions in Section 1-2. |
| 3-1.7.12-2(f) *[4.16-7]* /FQ-F1 | The term "significant contributor" should be interpreted consistent with the definitions in Section 1-2. |

NOTE 1: The staff notes inconsistencies in the way in which the term “significant’ has been used in Part 3 of ASME/ANS-RA-S-2007. In some cases, the requirements state clearly that the significance is measured with respect to fire risk (e.g., PRM-A3, Note on FSS-C2, FSS-D3). However, in other cases, it is ambiguous as to whether the reference is to the total CDF, the internal events CDF, or the fire CDF (e.g., Note on ES-C1, HLR-FQ-E, FQ-E1 and FQ-F1).

In order to avoid ambiguity, it is necessary to have a definition of the term “significant.” The terms “significant accident sequence,” “significant accident progression sequence,” “significant basic event,” “significant cutset,” and “significant contributor” are defined in ASME/ANS-RA-S-2007 within the context of the hazard group, so that in Part 3, they should be interpreted as being measured with respect to the fire risk.

The rationale for this choice of defining significance is included in the following, extracted from the rationale presented by the ASME Cross-Cutting Issues Project Team:

> *The requirements for developing a PRA model in Parts 3 and 4 refer back to the requirements of Part 2. The requirements of Part 2 should be applied to the extent needed given the context of the modeling of each hazard group. In each Part, many of the requirements that differentiate between Capability Categories, either directly, or by incorporating the requirements of Part 2, do so on the basis of the treatment of significant contributors and significant accident sequences/cutsets for the hazard group being addressed. Because, as discussed above, there are differences in the way the PRA models for each specific hazard group are developed, the requirements are best treated as being self-contained for each hazard group separately when determining significant contributors and significant accident sequences/cutsets. In other words, these are identified with respect to the CDF and LERF for each hazard group separately. While there is a need in some applications to assess the significance with respect to the total CDF or LERF, this assessment has to be done with a full understanding of the differences in conservatism and level of detail introduced by the modeling approaches for the different hazard groups, as well as within each hazard group.*
>
> *In order to determine the category at which the [Supporting Requirements] SRs have been met, it is necessary to have a definition of the term significant. Consequently, the term "significant" is used in various definitions in this Standard and is thereby explicitly incorporated into specific SRs. Generally, the philosophy used in Capability Category II ensures a higher level of realism for "significant" contributors. This manifests itself in SRs related to the scope of plant-specific data, detailed HRA (versus screening values), CCF treatment, documentation, and others.*
>
> *The only consequence of not meeting the Standard definition of "significant" for a specific SR is that the PRA would not meet Capability Category II for that SR. Thus, in the context of an application, if a hazard group is a small contributor, it should be acceptable to meet Capability Category I by using screening HEPs, not using plant-specific data for equipment reliability, etc. The applicable portion of the PRA will simply be considered as meeting Capability Category I for that specific SR for that hazard group.*
>
> *Additionally, from a practical standpoint, PRA models are generally developed on a hazard group basis (i.e., a fire PRA, a seismic PRA, a high wind PRA, etc.). While they may be integrated into a single model with multiple hazards, the development is done on a hazard*

*group basis. In Capability Category II, this Standard strives to ensure that the more "significant" contributors to each hazard group are understood and treated with an equivalent level of realism, so as to not skew the results for that hazard group. The definitions also acknowledge that there may be cases where the proposed quantitative definition is inappropriate (e.g., the hazard group risk is very low or bounding methods are used).*

*To summarize, the definitions that use the term "significant" simply help to define how much realism is necessary to meet Capability Category II of some SRs. They are NOT intended to be definitions of what is "significant" in a particular application. Indeed, in the context of a specific application, they may be either too loose or too restrictive, depending on what is being evaluated. In the context of this Standard, the decisions on applying these definitions and/or defining what is significant to a decision would be addressed in the Risk Assessment Application Process (see Section 1-3).*

In addition to the above, the material in non-mandatory Appendix A, "Fire PRA Methodology," is viewed as only "for information." NRR and RES take no position on this material.