September 1, 2009

MEMORANDUM TO: AFPB File

FROM: Alexander R. Klein, Chief **/RA by Daniel Frumkin for/**
Fire Protection Branch
Division of Risk Assessment
Office of Nuclear Reactor Regulation

SUBJECT: CLOSURE OF NATIONAL FIRE PROTECTION ASSOCIATION 805 FREQUENTLY ASKED QUESTION 08-0048 REVISED FIRE IGNITION FREQUENCIES

The purpose of this memorandum is to close National Fire Protection Association (NFPA) Standard 805 Frequently Asked Question (FAQ) 08-0048. The enclosed position was previously sent for comment under the joint U. S. Nuclear Regulatory Commission's (NRC) Office of Nuclear Regulatory Research (RES) / Electric Power Research Institute (EPRI) Memorandum of Understanding process. It was later sent to the Nuclear Energy Institute's NFPA 805 Task Force for industry and other stakeholder comment. RES and the NRC's Office of Nuclear Reactor Regulation (NRR) collaborated on resolving the comments that were received. The resolution of the comments is documented in ADAMS at accession number ML092180383. The enclosed position represents a joint resolution of this FAQ between RES and NRR.

Enclosure:
As stated

CONTACT: Charles Moulton, NRR/DRA
(301) 415-2751

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ADAMS Accession No.: ML092190457 * via e-mail

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FAQ 08-0048: NUREG/CR-6850 Revised Fire Ignition Frequencies

Guidance for the Use of Revised Fire Ignition Frequencies in NUREG/CR-6850

Background:

FAQ 08-0048 was proposed by the Nuclear Energy Institute (NEI), through its NFPA 805 Task Force, to clarify the guidance from NEI 04-02, "Guidance for Implementing a Risk-Informed, Performance-Based Fire Protection Program under Title 10 of the *Code of Federal Regulations* Part 50 (10 CFR 50.48(c))," which cited the fire ignition frequencies as provided in NUREG/CR-6850 (EPRI 1011989), "EPRI/NRC-RES Fire PRA Methodology for Nuclear Power Facilities," as appropriate for use in developing Fire Probabilistic Risk Assessments (PRAs). NEI believed that the fire events data cited in NUREG/CR-6850 could be reinterpreted as supporting reduced frequencies, on the most part, for various fire bin ignition categories subsequent approximately to 1990. Initial analyses were performed under the Memorandum of Understanding (MOU) between the Electric Power Research Institute (EPRI) and Office of Nuclear Regulatory Research (RES), but were not concluded prior to EPRI publication of EPRI 1016735, "Fire PRA Methods Enhancements: Additions, Clarifications, and Refinements to EPRI 1011989," in December 2008.

EPRI 1016735 included the analysis completed to date for FAQ 08-0048, which was considered by the NRC to be necessary but not sufficient to formally close-out this FAQ. The NRC incorporated the EPRI 1016735 analysis into the interim position discussed below in order to achieve closure of this FAQ in a timely manner. This interim position should not be seen as prejudicing the NRC's view of future developments in this area. RES and EPRI, under the MOU, are updating the fire events database from NUREG/CR-6850 to be inclusive through year 2008, and establishing a process for subsequent periodic updating. Final endorsement of this position will be addressed through the next revision of either Regulatory Guide 1.205 or NUREG/CR-6850.

Therefore, RES and EPRI will be in a position to complete confirmatory analysis for the new fire bin ignition frequencies in EPRI 1016735. Upon successful completion, RES and EPRI should jointly revise NUREG/CR-6850 and EPRI should revise EPRI 1016735, to establish new frequencies for the fire bin ignition categories.

Discussion:

Chapter 2, "Fire Ignition Frequency," and Appendices A and B, "Statistical Methods" and "Fire Ignition Data and Results Details," of EPRI 1016735, "Fire PRA Methods Enhancements: Additions, Clarifications, and Refinements to EPRI 1011989," document the analysis performed by EPRI to revise, for the most part, the fire bin ignition frequencies cited in NUREG/CR-6850 (EPRI 1011989), "EPRI/NRC-RES Fire PRA Methodology for Nuclear Power Facilities," for subsequent use in performing Fire PRAs for NFPA-805 transitions, as per guidance in NEI 04-02, "Guidance for Implementing a Risk-Informed, Performance-Based Fire Protection Program under 10 CFR 50.48(c)." At the time of publication of EPRI 1016735 (December 2008), RES, through the MOU with EPRI, was awaiting confirmatory analysis by EPRI that the revised fire bin ignition frequencies cited in EPRI 1016735 using the existing fire events data

through year 2000 from NUREG/CR-6850 could be considered applicable today. This confirmation would consist of analysis of more recent fire events data (i.e., subsequent to year 2000) to statistically verify that the revised frequencies subsequent to approximately 1990 could still be considered valid once data beyond year 2000 were incorporated. Since EPRI 1016735 was published prior to completion of this confirmatory analysis, the NRC was unable to reach closure of this FAQ through the normal process (see RIS 2007-19, "Process for Communicating Clarifications of Staff Positions Provided in Regulatory Guide 1.205 Concerning Issues Identified During The Pilot Application of National Fire Protection Association Standard 805").

Nonetheless, to achieve closure of this FAQ in a timely manner, the NRC establishes the following interim position with regard to the use of the new fire bin ignition frequencies in EPRI 1016735, Chapter 2, Table 2-2, "Updated Bin Frequencies and Statistical Parameters (Individual Bins)." The NRC accepts use of these revised fire bin ignition frequencies for Fire PRAs conducted for NFPA 805 transition for best-/point-estimate calculations of fire risk (core damage frequency (CDF) and large early release frequency (LERF)), including delta-risk values from plant change evaluations, with the following provision. The fire PRA, including plant change evaluations, must also evaluate the sensitivity of the risk and delta-risk results to evaluations performed using the current fire bin ignition frequencies[1] in NUREG/CR-6850, Chapter 6, "Fire Ignition Frequencies," Table 6-1, "Fire Frequency Bins and Generic Frequencies," and Appendix C, "Determination of Generic Fire Frequencies," Table C-3, "Generic Fire Ignition Frequency Model for U.S. Nuclear Power Plants."[2] For those cases where the results from this sensitivity analysis indicate a change in the potential risk significance associated with elements of the Fire PRA or plant change evaluations which affects the decisions[3] being made (e.g., what is acceptable with the new frequencies from EPRI 1016735

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[1] The sensitivity analyses should be performed for a fire ignition frequency bin using the mean of the fire ignition frequency bins contained in NUREG/CR-6850. Furthermore, sensitivity analyses only need to be performed for those bins characterized by an alpha from the EPRI 1016735 analysis which is less than or equal to 1. Note that an alpha value less than or equal to 1 is characteristic of a reverse-J shaped probability density function, i.e., the same shape as the non-informative prior distributions used in EPRI 1016735. This reverse-J shape is indicative of the large uncertainty in the bin fire frequency due to the sparsity of data for that bin and, therefore, the potential for significant changes should the post-2000 fire event data differ significantly from the 1991-2000 data. The required sensitivity analysis is, for the purpose of this interim solution, judged to provide an adequate indication of the effects on risk and delta-risk in such a case. Note also that a sensitivity analysis need not be performed for Bin 9 (Air Compressors); the alpha value in Table 2-2 of EPRI 1016735 appears to be in error.

[2] As modified to address any FAQs related to fire ignition frequencies that were closed out prior to issuance of EPRI 1016735, (e.g., FAQ 06-0017, "Guidance for Counting High Energy Arcing Faults (HEAFs)" (ADAMS Accession No. ML072500300)), and any similarly-related FAQs which may subsequently be closed out ((e.g., FAQ 07-0035, "Bus Duct Counting Guidance for High Energy Arcing Faults" (ADAMS Accession No. ML091620572)).

[3] The portion of the Fire PRA supporting the decisions may be very focused for analyses associated with many fire protection features and systems. For example, a fire barrier may be subject to failure by a single type of fire ignition source or a fixed suppression system may be protecting a single type of ignition source. As a result, sensitivity analyses of all relevant ignition source bins may only require examination of a single (or few) ignition source bin(s) for a particular decision.

might not be acceptable with the current applicable set from NUREG/CR-6850), the licensee must address this situation by considering fire protection, or related, measures that can be taken to provide additional defense-in-depth.[4]

Under the MOU, RES and EPRI are updating the fire events database from NUREG/CR-6850 to be inclusive through year 2008, as well as establishing a process for subsequent periodic updating. Therefore, RES and EPRI will be in a position to complete the confirmatory analysis for the new fire bin ignition frequencies in EPRI 1016735. Upon successful completion, RES and EPRI should jointly revise NUREG/CR-6850 and EPRI should revise EPRI 1016735, to establish new frequencies for the fire bin ignition categories, eliminating the need for the specific sensitivity analysis cited here.

References:

1. Revision 0 to FAQ 08-0048, March 31, 2008, Accession No. ML081200291

2. NRC Draft Interim Position on FAQ 08-0048, Accession No. ML091590457

3. Resolution of stakeholder comments on the NRC Draft Interim Position, Accession No. ML092180383

4. EPRI 1016735, December 2008, Accession No. ML090290195

5. NUREG/CR-6850 (EPRI 1011989), Accession Nos. ML050940183 (Vol. 1) and ML050940189 (Vol. 2)

6. NEI 04-02, Guidance for Implementing a Risk-Informed, Performance-Based Fire Protection Program Under 10 CFR 50.48(c), Revision 1, Accession No. ML052590476

7. NFPA 805, Performance-Based Standard for Fire Protection for Light Water Reactor Electric Generating Plants, 2001 Edition (available through the Public Document Room or NFPA)

8. Regulatory Guide 1.205, Risk-Informed, Performance-Based Fire Protection for Existing Light-Water Nuclear Power Plants, Accession No. ML061100174

9. NRC Regulatory Information Summary 2007-19, Process for Communicating Clarifications of Staff Positions Provided in Regulatory Guide 1.205 Concerning Issues Identified During The Pilot Application of National Fire Protection Association Standard 805, Accession No. ML071590227

[4] It is recognized that there is some degree of subjectivity in this determination, which may require consensus between the licensee and NRC on a plant-specific basis. Such a change need not necessarily result in a risk increase; a change in the risk profile (e.g., dominant fire scenarios, etc.) could also affect the decisions being made. Also, defense-in-depth measures should be commensurate with any potential increase in risk significance (e.g., as per RIS 2005-07, "Compensatory Measures to Satisfy the Fire Protection Program Requirements" (ADAMS Accession No. ML042360547)).