

March 20, 2018

MEMORANDUM TO: APLB Files

FROM: Greg A. Casto, Chief */RA/*  
PRA Licensing Branch B  
Division of Risk Assessment  
Office of Nuclear Reactor Regulation

SUBJECT: CLOSE-OUT OF FIRE PROBABILISTIC RISK ASSESSMENT  
FREQUENTLY ASKED QUESTION 17-0013 ON HIGH ENERGY  
ARCING FAULT NON-SUPPRESSION PROBABILITY

Background:

During industry peer reviews and Nuclear Regulatory Commission (NRC) staff review of Fire Probabilistic Risk Assessments (FPRAs) related to license amendment requests (LARs) to implement National Fire Protection Association "Performance-Based Standard for Fire Protection for Light-Water Reactor Electric Generating Plants" (NFPA 805, 10 CFR 50.48(c)), methods and approaches different from the accepted methods were encountered. NRC staff, the Nuclear Energy Institute, and representatives from the nuclear industry worked to identify these methods, approaches, and factors in current LARs (including but not limited to NFPA 805 LARs), and to address them through a frequently asked question (FAQ) process. This FAQ process is only one NRC process whereby a new FPRA method can be reviewed or developed.

FPRA FAQ 17-0013, "High Energy Arcing Fault (HEAF) Non-Suppression Probability (NSP)" provides an update to the NSP for HEAF fires based on a further review of existing HEAF fire events, as well as a review of three additional events. The NSP for HEAF fires provided in NUREG/CR-6850, Supplement 1, "Fire Probabilistic Risk Assessment Methods Enhancement (Agencywide Documents Access and Management System (ADAMS) Accession No. ML103090242) and NUREG 2169, "Nuclear Power Plant Fire Ignition Frequency and Non-Suppression Probability Estimation Using the Updated Fire Events Database" (ADAMS Accession No. ML15016A069) are considered overly conservative based on durations that extended past the control point in several fire events. As a result, the risk associated with HEAFs in critical fire areas may be artificially high.

Discussion and Conclusion:

The NRC staff and nuclear industry held a series of public meetings to discuss the resolution of FPRA FAQ 17-003.

To develop the lambda mean value for HEAFs for NUREG/CR-6850, Supplement 1 (FAQ 08-0050, "Manual Non-Suppression Probability" (ADAMS Accession No. ML092190555)), three fire

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events were used to develop a total of 276 minutes. In NUREG-2169, eight fire events were reviewed with a total duration of 602 minutes. With this expanded review, the change in the lambda mean was nominal (0.011 vs. 0.013).

The probability of non-suppression is related to the average time to suppression within a specific fire suppression bin. The times reported and utilized in NUREG-2169 for HEAF are excessive in some cases since the fire in these instances is controlled before the duration of the fire which may correspond to extinguishment. Control of fires before the event durations from NUREG-2169 is possible since fire brigade response is expected to occur quickly after the initial HEAF because many HEAF sources are located in accessible areas provided with automatic detection and the failures due to the HEAF often initiate a signal to the control room early in the event. Arresting the fire spread and propagation eliminates additional target damage and effectively controls the fire, and may not necessarily correspond with a fire being extinguished.

The resolution of this FAQ relied upon an investigation of Licensee Event Reports and related documentation (where available) beyond the data from NUREG-2169 for several of the HEAF fires in order to assess whether the fire was in fact under control earlier in the scenario than the event duration implies.

Based on the documentation review and considering the expanded data set, the mean suppression rates for HEAF proposed in NUREG/CR-6850, Supplement 1, and NUREG-2169 are overly conservative. It is proposed that the mean suppression rate should be increased by approximately a factor of two (from 0.011/0.013 to 0.029) to reflect the revised average fire duration for HEAFs originating in high energy equipment in the United States.

This guidance in FPRA FAQ 17-0013 is acceptable for use by licensees.

Enclosure:

FPRA FAQ 17-0013, "High Energy Arcing Fault (HEAF) Non-Suppression Probability (NSP)"

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ADAMS Package Accession No. **ML18075A086**

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