May 28, 2009

MEMORANDUM TO: AFPB File

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

SUBJECT: PUBLIC RELEASE OF DRAFT INTERIM POSITION REGARDING NATIONAL FIRE PROTECTION ASSOCIATION 805 FREQUENTLY ASKED QUESTION 08-0042 FIRE PROPAGATION FROM ELECTRICAL CABINETS

The purpose of this memorandum is to release for comment the enclosed draft interim position regarding National Fire Protection Association (NFPA) Standard 805 Frequently Asked Question (FAQ) 08-0042 to the public and the Nuclear Energy Institute NFPA 805 Task Force. Comments on the enclosed draft interim position are due by July 2, 2009. Comments should be sent to one of the contacts below.

The enclosed draft interim 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. No comments were received on the enclosed position, and it represents a consensus position on this FAQ between RES, EPRI, and the NRC's Office of Nuclear Reactor Regulation.

Enclosure:
As Stated

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FAQ 08-0042: Fire Propagation from Electrical Cabinets

Clarification of NUREG/CR-6850 (EPRI 1011989) Guidance for Screening of Electrical Cabinets from the Overall Set of Ignition Sources, Supporting NFPA-805 Fire PRA Application

Background:

Text in Appendix G (Section G.3.3.) of NUREG/CR-6850 (EPRI 1011989) indicates that a fire in an un-vented electrical cabinet does not propagate beyond the cabinet. More comprehensive language in Chapter 11 (Section 11.5.1.7.3) provides additional requirements on cabinet construction for those cabinets which do not propagate fires. In particular, Chapter 11 also requires that electrical cabinets have fire-sealed penetrations and be robustly secured for no propagation to occur beyond the cabinet. The bin 15 discussion in Chapter 6 provides information on definition of "robustly secured" as well. This clarification is not related to electrical cabinets for the purposes of high energy arcing faults, as those faults counted in Appendix M for purposes of developing fire frequency are all assumed to breach the cabinet.

The guidance provided in Appendix G for the screening of fire propagation from "un-vented" electrical cabinets appears to conflict with the guidance provided in Chapters 6 and 11 of the main body. Clarification is needed. Portions of the text in Appendix G, Section G.3.3, were an unintended carryover from the original *Fire PRA Implementation Guide* (EPRI TR 105928) and were not modified to reflect the EPRI/RES team's consensus. The alternate discussion provided in Chapter 11 represents the consensus positions.

Appendix G (Section G.3.3) provides a general discussion of the effects of venting on fire development and fire propagation for electrical cabinets. In most regards, the discussions are correct. In particular, cabinet venting is important to the development of fires in an electrical cabinet. The point where the discussion deviates from the team consensus developed as a part of the methodology is where it discusses the potential for fire propagation outside the cabinet for a cabinet that is not vented.

In order to achieve closure of this FAQ in a timely manner, the NRC developed a draft interim staff position, as discussed below. This position was developed using currently existing information, databases, and experimental results, and should not be seen as prejudicing the NRC's view of future developments in this area.

Discussion:

The wording provided in Appendix G relative to the potential for fire spread beyond the boundaries of an un-vented cabinet should be disregarded. The wording provided in Chapter 11 relative to fire propagation from electrical cabinets is the intended and correct guidance. (Specific citations are provided below.) Specifically, those portions of the second paragraph in Section G.3.3 that read as follows should be disregarded:

> "Electrical cabinets that are not vented do not propagate a fire. … It is assumed that in the absence of other ventilation *(other than those listed in Table G.3)*, penetrations will not allow sufficient air exchange to replace oxygen consumed by the fire, and an incipient fire will self-extinguish when there is no longer enough oxygen to support combustion." (Italics added for clarity.)

Also, the final sentence of the third paragraph in Section G.3.3., which reads as follows, requires some clarification:

> "… Therefore, air exchange through the top penetrations for typical NPP cabinet configurations listed above is not expected to be sufficient to support combustion."

This latter discussion is correct but incomplete. The fundamental factor not addressed by the wording in both of these citations is that once a fire starts inside an electrical cabinet, uneven heating of the cabinet side/top panels and door(s) will take place. This uneven heating can cause these elements to warp unless they are "robustly secured" as discussed in Chapters 6 (under Bin 15 discussion) and 11. Warping will in turn create new openings for the passage of air into and out of the cabinet. The observation of this behavior and its impact on fire growth behavior was a major finding of the Mangs/Keski-Rahkonan (VTT Finland) tests which are also discussed (and cited) in Appendix G.

In lieu of the wording from Appendix G, analysts should screen electrical cabinets for fire propagation potential based on the following guidance from Chapter 11 (Section 11.5.1.7.3, Step 7.a.3):

> "In the case of electrical panels, the panel ventilation configuration and the latching configuration of the doors are important. If the panel contains open vents, either at the top or bottom of the pane, or if penetrations into the top or sides of the panel are not fire-sealed, fires can be assumed to be capable of spreading out of the panel to secondary combustibles. However, for un-vented cabinets, fire spread may be less likely. Fire spread out of the panel may still occur, unless the panel doors are attached and anchored at multiple points. Simple twist-handle style top-and-bottom door latches are not sufficient to contain a fire within a panel. Substantial warping of the door face may occur due to the heat of the fire. This can allow gaps to open in an otherwise un-vented panel. In contrast, fire spread is not considered likely given a weather-tight or waterproof cabinet construction where multiple mechanical fasteners secure panel access plates and where all penetrations into the panel are sealed."

As a point of clarification, it should be noted that in the above description on penetrations, the term "fire-sealed" was not intended to imply "fire-rated." Rather the intent was that penetrations into a cabinet would be sealed such that they would not readily allow for the passage of air.

This clarification has the potential to impact the preliminary fire modeling and screening analysis for fire propagation from electrical cabinets (fire ignition source Bin 15). If the potential for fire propagation outside any given cabinet was dismissed based on the guidance provided in Appendix G, then the screening results for these cabinets, and these cabinets only, should be reconsidered based on the guidance provided in Chapter 11.

This clarification should not require any reconsideration of the original fire ignition source counting results, provided the guidance in Chapter 6 was followed.

References:

1. Revision 0 to FAQ 08-0042, January 9, 2008, Accession No. ML080230438

2. 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

3. 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)

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

5. 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

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