

EPRI / NRC Methods Review Panel Treatment of Well-Sealed MCC Greater than 440 Volts April 16, 2015

A methods review panel was assembled to review the Fire Probabilistic Risk Assessment (FPRA) FAQ 14-009 regarding the treatment of fire propagation from well-sealed motor control centers operating at 440 volts or greater. The panel membership, summary of technical discussion, and the panel decision will be discussed further below.

Panel Membership

To reach timely resolution and to finalize technical details, FAQ 14-009 (and an event review of MCC fire experience) entered the EPRI / NRC methods review process. The purpose of the methods panel was to a.) Review and agree upon the classification of breach events, b.) Amend the FAQ due to technical discussions.

Consistent with the new makeup of the methods panel, the membership contains equal industry and NRC participation. Consensus is reached when four of six members agree. The panel membership includes:

JS Hyslop
US NRC, Office of Nuclear Reactor Regulation

Nicholas Melly
US NRC, Office of Nuclear Regulatory Research

Harold Stiles
Duke Energy

Jeff Stone
Exelon

Gabe Taylor
US NRC, Office of Nuclear Regulatory Research

Kiang Zee
ERIN Engineering and Research, Inc.

The methods panel discussions were moderated by Ashley Lindeman of EPRI.

Summary of Technical Discussion

Development of Breach Factor

To develop the breach factor, a review of the MCC fire event experience from 1990-2009 was performed and classified to determine a.) Fire type and b.) For arc fault induced fires, did breach of the enclosure occur?

Twenty-five fire events were reviewed for fire type and classified as either thermal, arcing or unknown. Events classified as unknown were not used in calculating the split fraction of arcing versus thermal fires. Events were weighted based on fire frequency weight. A count of 1 is assigned for fire events with the following fire severity classifications; challenging, challenging/potentially challenging and potentially

challenging. A count of 0.5 is used for undetermined events in terms of fire severity. The review found that 40% of MCC fires are arcing and 60% are thermal.

For the arcing MCC fire events, the panel reviewed the event narratives and supporting information to determine if the cabinet enclosure was breached. Definitive cabinet breaches were counted as 1 and possible or uncertain breaches were counted as 0.5. The panel concluded the following with regard to arc fault induced fire events leading to an enclosure breach:

- Fire ID 144 – Count of 0.5
- Fire ID 152 – Count of 1.0
- Fire ID 209 – Count of 1.0
- Fire ID 10338 – Count of 0.5
- Fire ID 20357 – Count of 0.5

The total number of breach events totals 3.5. The panel confirmed 2 definitive breaches and 3 events that were counted as half events. The resulting breach factor is calculated by multiplying the fraction of fires that are arcing by the conditional probability of breach.

Arcing Split Fraction	Conditional Probability of Breach	MCC fires energetic enough to breach well-sealed MCC (F_E)
6/15 (0.40)	3.5/6 (0.58)	0.23

Fire PRA Treatment of Breach Events

The FAQ recommends two options to treat the potential damage from a breached motor control center; a simplified model that does not consider fire growth and manual suppression or a detailed treatment using the available methods for modeling thermal fires.

The simplified model uses the heat release rate distribution to calculate the critical HRR to damage for each of the four cubicles in the vertical stack (F_D). This number is combined with the breach fraction (F_E) to come up with a treatment factor for a variety of configurations (non-qualified in MCC with TS or TP targets and qualified cable in MCC with TP and TS targets). The simplified model assumes targets are within six inches of the top of the cabinet.

If a more detailed and plant specific analysis is warranted, the analyst may use acceptable fire modeling methods to take advantage of actual target spacing. A more detailed analysis considering growth time, manual suppression, and thermal response (Appendix H of NUREG/CR-6850 EPRI 1011989 or THIEF) can also be considered.

Panel Decision

The methods panel approves the breach factor and subsequent fire treatment as amended. There are no dissenting views.

Attachments

Attachment 1: Revised FAQ 14-009 with Attachment 1: Probability of Breaching Well-Sealed MCCs of 440V or Greater.docx