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Methodology for Modeling Fire Growth and Suppression for Electrical Cabinet Fires in Nuclear Power Plants

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General Comment

Comment letter attached

Attachments

07-31-19_NRC_NEI Comments NUREG 2230

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Office of Administration
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U.S. Nuclear Regulatory Commission
Washington, DC 20555–0001

Subject: Industry Comments on Draft NUREG-2230, "Methodology for Modeling Fire Growth and Suppression Response for Electrical Cabinet Fires in Nuclear Power Plants;" 84 FRN 31354-31355; Docket ID NRC-2019-0119

Project Number: 689

Dear Ms. Jennifer Borges:

The Nuclear Energy Institute (NEI)[1], on behalf of its members, submits the following comments on the draft NUREG-2230, "Methodology for Modeling Fire Growth and Suppression Response for Electrical Cabinet Fires in Nuclear Power Plants". The technical work documented in this draft NUREG represents an important advancement in making Fire Probabilistic Risk Assessment (PRA) models more realistic. Current models of electrical cabinet fires represent a substantial portion of the known conservatism in Fire PRAs. Integration of this new technical work will enable licensees to significantly improve the realism in their models and ultimately allow them to use these models in making operational decisions. NEI urges the Nuclear Regulatory Commission (NRC) to incorporate the comments received on this draft NUREG as soon as practical to support near-term finalization of this important work.

[1] The Nuclear Energy Institute (NEI) is responsible for establishing unified policy on behalf of its members relating to matters affecting the nuclear energy industry, including the regulatory aspects of generic operational and technical issues. NEI's members include entities licensed to operate commercial nuclear power plants in the United States, nuclear plant designers, major architect and engineering firms, fuel cycle facilities, nuclear materials licensees, and other organizations involved in the nuclear energy industry.

We trust that NRC staff will find these comments useful and informative, while continuing to give priority to finalization of the document. Please contact me at vka@nei.org or (202) 739-8101 with any questions or comments about the content of this letter or the attached comments.

Sincerely,

Victoria K. Anderson

Attachment

c: Mr. Mark H. Salley, RES, NRC
Mr. David Stroup, RES, NRC

Attachment: Detailed Comments on Draft NUREG-2230: Methodology for Modeling Fire Growth and Suppression Response for Electrical Cabinet Fires in Nuclear Power Plants

Page	Statement from Report	Comment
viii	*Key Findings: The typical HRR profile for interruptible fires is a pre-growth period with a negligible HRR for up to 8 minutes, 12-minute time to peak, 8 minutes at steady state, and a 19-minute decay period (see Section 4.1.1).*	The growth profile for interruptible fires discussed in Section 4.1.1 is pre-growth for 8 minutes, 7 minutes time to peak, 5 minutes steady state, and 13 minutes decay. If both curves are acceptable for use, then both should be listed as key findings.
3-2	*Equipment trouble alarms in the main control room (MCR) due to fire will occur in the early stages of the fire development.*	Suggest clarification if other notification to the MCR is acceptable other than trouble alarms.
3-9 & 3-10	*Table 3-2 and Table 3-3*	It may be worth reiterating that the data used for Table 3-2 is the 2000-2014 data because the next page shows Table 3-3 which uses the 1990-2014 data for the non-suppression curve, and the number of interruptible vs growing fires is not equivalent between the tables.
3-12	*3.5.2 NSP Floor for the MCR*	This data is presented in both NUREG-2230 and NUREG 2178 Vol. 2. Suggest removal from one of the NUREGs replacing it with a simple reference to the other.
3-14 & 3-15	*MCR will use the interruptible and growing suppression rates presented in Section 3.5 for fire durations in excess of 18 minutes.*	Additional clarification could be provided to explain that this crossover occurs at the time on the interruptible or growth curve where NSP=1.00E-3
3-14	*For example, a fire in a cabinet located within the MCR will use the interruptible and growing suppression rates presented in Section 3.5 for fire durations in excess of 18 minutes.*	Add a parenthetical at the end of the sentence to provide more direction of the applicability of the approach. "... bin specific suppression rate (Interruptible, Growth, transient, etc.)."
Chapter 4	*Figures 4-3 and 4-4*	The modeling does not match the summary description key finding on page 12.

Section 4.1.1	*A period of up to 8 minutes with no measurable HRR may be included prior to the period of fire growth. If included, this pre-growth phase must be reflected in any calculations of the time to damage, time to detection, and time to suppression.*	Here, an interruptible fire is said to have a growth period up to 8 minutes. Later in in Section 4.2, 4 minutes is recommended. As no criteria are provided to determine what value to use, this introduces unclear and ambiguous guidance. The pre-growth period should be defined and used like the growth, steady-state, and decay periods. A single recommended value should appear in all sections and examples within the NUREG.
4-7	*The growth profile described in NUREG/CR-6850 is recommended for modeling growing fires.*	If the use of the NUREG/CR-6850 curve is recommended, then it may be clearer to identify this in section 4.1.2 with the full explanation as is in section 4.2. As it reads right now it appears the NUREG is suggesting this as a new curve, only to say it is not recommended later.
Chapter 5	*Throughout*	The fire events database (EPRI 3002005302) that is referred to in NUREG-2230 indicates that: A distinction is now made between fires that were capable of damaging a PRA important component and those that were not capable but, in the absence of automatic or manual suppression, might have become capable. However, this distinction appears to simply remove fires that are outside of the protected area. The screening criteria do not properly characterize whether or not a fire has any possibility of becoming an initiator that affects FPRA components. For example: 1. The fire could affect components that are in the PRA but never be expected to become an initiator, in which case it would simply become another type of unavailability. 2. On the other hand, the fire could be an initiator, but would never be expected to affect FPRA components, and there are examples of this in the FPRA database.
5-19	*Very low: 0.5 – Compartment is subject to controls and procedures that result in a factor less than a low rating level*	The stated value of 0.5 for very low is incorrect. Per the FAQ 12-0064 closure memo, this value is 0.3.

5-19	*These modifications are the only exceptions that may be made and are done so for the purposes of estimating personnel detection.*	Clarification should be provided whether this only impacts NUREG-2230 event tree calculations or also alters existing FAQ 12-0064 transient analysis using 0.3 and 3 for very low and medium.
5-21	*For occupancy, the rating level associated with medium was revised from 3 to 5.*	This discussion should also include the change from 0.3 to 0.5 for very low. This applies to the maintenance factor as well.
5-22	*Line 4: Recalling Figure 2-2, almost 50% of the fires that have occurred in electrical cabinets have been detected by plant personnel*	Figure 2-2 shows that 55% of the fires that have occurred in electrical cabinets have been detected by plant personnel.
Chapter 6	*Section 6.1: First Interruptible: 8.41E-02*	Treatment of automatic smoke detection failure in Section 6.1 is inconsistent with Figure 6-1 and Appendix C, Tables C-2 through C-17 equations. Smoke detection ineffectiveness and unreliability are mutually exclusive so these values should be added together when calculating the first interruptible detection failure probability. This impacts all examples through Chapter 6 and Appendix D
Chapter 6	*Section 6.1: Second Growing: 3.64E-01*	Treatment of automatic smoke detection failure in Figure 6-2 is inconsistent with Figure 6-1 and Appendix C, Tables C-22 through C-25 equations. Smoke detection ineffectiveness and unreliability are mutually exclusive so these values should be added together for the second growing detection failure probability. This impacts all examples through Chapter 6 and Appendix D
6-8	*Figure 6-6: 0.72 & 0.28*	Replace 0.72 and 0.28 with 0.723 and 0.277 respectively to be consistent with Table 3-2
6-8	*Figure 6-6: 0.0324581*	Update 0.0324581 to 3.25E-02 to be consistent with other similar values.
6-9	*Table 6-1: Note: No additional credit is given for the higher maintenance rating. Additionally, no credit may be taken for an adjacent occupancy with a lower rating.*	In the current calculation examples, credit is actually given for the higher maintenance rating of the adjacent compartment. Suggest revising the note or calculation accordingly.

6-9	*Table 6-1: (5+0/2)/10+(5+**5/2**)/50 = 0.0575*	The second half of the equation appears to be missing that subtracts the adjacent compartment's higher maintenance rating (Equation 5-2). It also appears the final value should be updated to 0.575 with the equation: (5+0/2)/10+(5+**5/2**)/50 − (5+0/2)/10 × (5+**5/2**)/50 = **0.575**
6-10 & 6-11	*Table 6-2*	Add "*Pns* =" in front of the Pns value in the Automatic Smoke Detection Failure Probability and Pns column. Similarly the detection failure probability should be denoted as well to avoid misinterpretation.
7-1	*For the purposes of fire modeling, the NUREG/CR-6850 growth profile may be used with a suggested consideration for interruptible fires.*	This statement appears to suggest that the Figure 4-3 interruptible curve cannot or should not be used as opposed to the old 6850 curve with a delay. Clarification may be warranted.
7-1	*For interruptible fires, a period of up to 8 minutes with no measurable heat release rate (HRR) may be included prior to the period of fire growth.*	Suggest adding a statement that use of 4 minutes is recommended for the pre-growth period with reference to section 4.2.
7-3	*7.5 NSP Estimation Update*	There is no mention of the revised NSP floor for the MCR in the summary. If this was primarily developed by NUREG-2178 V2, this should be noted since the results are still presented in this NUREG as well.
Table 7-3	*NUREG-2169 | All Fires | 457 | 6691*	"All Fires" number of events and total duration do not match NUREG-2169, Table 5-1. If this has been updated by NUREG-2230 or NUREG-2178 V2, the reference should be updated.
Table 7-3	*All Fires | 457 | 6691*	In previous versions of this chart, such as NUREG-2169 Table 5-1 and NUREG/CR-6850 Supp1 Table 14-2, the "All Fires" curve is the sum of all the previous line items for events and duration. This does not appear to be the case for NUREG-2230. If a differing methodology was used, explanation or disclaimer should be provided.
8-1	*REFERENCES*	If NUREG-2178 V2 is referenced in the document, it should be provided as a reference as well.