[7590-01-P]

NUCLEAR REGULATORY COMMISSION

[NRC-2019-0118]

Refining and Characterizing Heat Release Rates from Electrical Enclosures during Fire

AGENCY: Nuclear Regulatory Commission.

ACTION: Draft NUREG; request for comment.

SUMMARY: The U.S. Nuclear Regulatory Commission (NRC) is issuing for public comment a draft NUREG entitled, "Refining and Characterizing Heat Release Rates from Electrical Enclosures during Fire – Volume 2: Fire Modeling Guidance for Electrical Cabinets, Electric Motors, Indoor Dry Transformers, and the Main Control Board" (NUREG-2178 Volume 2/EPRI 3002016052). This report is a joint product of the NRC and the Electric Power Research Institute (EPRI) collaborating under a memorandum of understanding for fire research. This report describes improved methods that can increase the realism in the modeling of selected ignition sources. The areas further investigated include the treatment of flame radiation and obstructed radiation, fire propagation between adjacent electrical cabinets, heat release rates (HRRs) for electric motors and dry transformers, fire location factor, non-suppression probability floor values, and the modeling of the main control board.

DATES: Submit comments by [INSERT DATE 60 DAYS FROM DATE OF PUBLICATION IN THE *FEDERAL REGISTER*]. Comments received after this date will be considered if it is practical to do so, but the Commission is able to ensure consideration only for comments received before this date.

ADDRESSES: You may submit comments by any of the following methods:

- **Federal Rulemaking Web Site:** Go to https://www.regulations.gov/ and search for Docket ID **NRC-2019-0118**. Address questions about docket IDs in Regulations.gov to Jennifer Borges; telephone: 301-287-9127; e-mail: Jennifer.Borges@nrc.gov. For technical questions, contact the individuals listed in the **FOR FURTHER INFORMATION CONTACT** section of this document.

- **Mail comments to:** Office of Administration, Mail Stop: TWFN-7-A60M, U.S. Nuclear Regulatory Commission, Washington, DC 20555-0001, ATTN: Program Management, Announcements and Editing Staff. For additional direction on obtaining information and submitting comments, see "Obtaining Information and Submitting Comments" in the **SUPPLEMENTARY INFORMATION** section of this document.

FOR FURTHER INFORMATION CONTACT: David W. Stroup, Office of Nuclear Regulatory Research, telephone: 301-415-1649, e-mail: David.Stroup@nrc.gov; or Nicholas.Melly, Office of Nuclear Regulatory Research, telephone: 301-415-2392, e-mail: Nicholas.Melly@nrc.gov. Both are staff of the U.S. Nuclear Regulatory Commission, Washington, DC 20555-0001.

SUPPLEMENTARY INFORMATION:

I. Obtaining Information and Submitting Comments

A. Obtaining Information

Please refer to Docket ID **NRC-2019-0118** when contacting the NRC about the availability of information for this action. You may obtain publicly-available information related to this action by any of the following methods:

- **Federal Rulemaking Web Site:** Go to https://www.regulations.gov/ and search for Docket ID **NRC-2019-0118**.

- **NRC's Agencywide Documents Access and Management System (ADAMS):** You may obtain publicly-available documents online in the ADAMS Public

Documents collection at https://www.nrc.gov/reading-rm/adams.html. To begin the search, select "Begin Web-based ADAMS Search." For problems with ADAMS, please contact the NRC's Public Document Room (PDR) reference staff at 1-800-397-4209, 301-415-4737, or by e-mail to pdr.resource@nrc.gov. The draft NUREG entitled "Refining and Characterizing Heat Release Rates from Electrical Enclosures during Fire – Volume 2: Fire Modeling Guidance for Electrical Cabinets, Electric Motors, Indoor Dry Transformers, and the Main Control Board" is available in ADAMS under Accession No. ML19162A406.

- **NRC's PDR:** You may examine and purchase copies of public documents at the NRC's PDR, Room O1-F21, One White Flint North, 11555 Rockville Pike, Rockville, Maryland 20852.

B. Submitting Comments

Please include Docket ID **NRC-2019-0118** in your comment submission.

The NRC cautions you not to include identifying or contact information that you do not want to be publicly disclosed in your comment submission. The NRC will post all comment submissions at https://www.regulations.gov/ as well as enter the comment submissions into ADAMS. The NRC does not routinely edit comment submissions to remove identifying or contact information.

If you are requesting or aggregating comments from other persons for submission to the NRC, then you should inform those persons not to include identifying or contact information that they do not want to be publicly disclosed in their comment submission. Your request should state that the NRC does not routinely edit comment submissions to remove such information before making the comment submissions available to the public or entering the comment into ADAMS.

II. Discussion

In 2005, the EPRI and the NRC's Office of Nuclear Regulatory Research issued a joint technical report NUREG/CR-6850 (EPRI 1011989), *EPRI/NRC-RES Fire PRA Methodology for Nuclear Power Facilities*. This publication documented state-of-the-art methods, tools, and data for conducting a fire probabilistic risk assessment (PRA) for a commercial nuclear power plant application. Following this publication, many utilities developed Fire PRAs using the guidance in NUREG/CR-6850 (EPRI 1011989) to support risk informed applications, including the transition to National Fire Protection Association Standard 805 among others. The results obtained from the Fire PRA models have suggested specific elements in the fire scenario analysis where improved methods and/or guidance can reduce conservatism and increase realism in the risk estimates. Consequently, over the past fifteen years, fire PRA research covering the areas of fire ignition frequencies (e.g., NUREG-2169 (EPRI 3002002936)), fire modeling (e.g., NUREG-2178 (EPRI 3002005578)), human reliability analysis (NUREG-1921 (EPRI 1023001)), and spurious operations (e.g., NUREG/CR-7150) have been published and made available to the industry.

The first volume of NUREG-2178 (EPRI 3002005578) was published in April of 2016. This document included methods focused on refining the modeling of fires in electrical cabinets, including updated HRR probability distributions and an obstructed fire plume model. During drafting of NUREG-2178 volume 1 (EPRI 3002005578), the joint NRC/EPRI working group authoring the document identified additional methods to further refine the modeling of selected ignition sources within the fire PRA for inclusion in a second volume. As in the case of Volume 1 of NUREG-2178, this second volume would provide improved methods for achieving realism by reducing some of the conservatisms present in the NUREG/CR-6850 (EPRI 1011989) methods. As such, the

guidance and methods described in these documents would not replace or invalidate existing methods or guidance, but rather, provide more realistic (usually less conservative) alternative approaches.

This second volume of NUREG-2178 (EPRI 3002016052) includes the following methods that can be used for refining the modeling of selected ignition sources:

- Flame radiation and obstructed radiation: The document describes and reviews existing methods for calculating flame radiation. From that discussion, a modified approach for computing flame radiation is developed and a detailed method for determining the thermal radiation impact from fires inside electrical cabinets is presented. This approach extends the research documented in NUREG-2178 Volume 1 (EPRI 3002005578) associated with modeling plume temperatures generated by fires inside electrical cabinets (i.e., the obstructed plume temperature model) by developing guidance on predicting thermal radiation that may be obstructed by vented or unvented cabinet walls.
- Fire propagation between adjacent electrical cabinets: A detailed approach for modeling fire propagation between vertical sections in a bank of electrical cabinets is described in the report. This method expands upon the guidance provided in Appendix S of NUREG/CR-6850 (EPRI 1011989) which referred to this scenario as "enclosure-to-enclosure fire spread."
- HRRs for electric motors and dry transformers: Appendix G of NUREG/CR-6850 (EPRI 1011989) recommended bounding/conservative values for HRRs associated with electric motors and dry transformers based on the values used for electrical cabinet fires. However, electric motors and dry transformers are different in terms of ignition sources, modes of ignition, and combustible configuration in comparison to electrical cabinets. Consequently, revised HRRs for electric motors (including those motors associated with pumps) and dry transformers based on the size (horsepower or voltage respectively) of the equipment were developed.

- Fire location factor: Existing guidance suggests that fires adjacent to walls or in corners of a room may generate elevated plume temperatures when compared to fires away from these surfaces (sometimes referred to as the wall/corner plume correction factors). Based on recent fire experiments, this document discusses new guidance for estimating plume temperatures from fires along walls or in corners. The guidance is applicable to both fixed and transient ignition sources.
- Non-suppression floor value: Appendix P of NUREG/CR-6850 (EPRI 1011989) recommends that the non-suppression probability versus time curves be used subject to a floor (minimum) value of 0.001 for all cases. This assumption means that, in effect, 1 fire in 1000 is never suppressed which clearly contradicts the available data. This document discusses the basis and development of a lower non-suppression probability floor value.
- Main control board fire scenarios: Appendix L of NUREG/CR-6850 (EPRI 1011989) described a simplified model for determining the severity factor and non-suppression probability for fire scenarios associated with the main control board based on a predefined zone of influence (i.e., a defined set of damage target components). Although easy to apply, this model limits the ability to integrate the main control board scenarios with other elements associated with the PRA quantification of fire scenarios inside the main control room. This document describes a comprehensive event-tree based approach for characterizing the fire scenario progression following ignition of a component in the main control board.

Dated at Rockville, Maryland, this 25th day of June 2019.

For the Nuclear Regulatory Commission.

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