Entergy

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Anthony J Vitale
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PNP 2014-050

May 7, 2014

U. S. Nuclear Regulatory Commission
ATTN: Document Control Desk
Washington, DC 20555-0001

SUBJECT: Response to Request for Additional Information – License Amendment Request to Adopt NFPA 805 Performance-Based Standard for Fire Protection for Light Water Reactors

Palisades Nuclear Plant
Docket 50-255
License No. DPR-20

References:

1. ENO letter, PNP 2012-106, "License Amendment Request to Adopt NFPA 805 Performance-Based Standard for Fire Protection for Light Water Reactors," dated December 12, 2012 (ADAMS Accession Number ML12348A455)

2. ENO letter, PNP 2013-013, "Response to Clarification Request — License Amendment Request to Adopt NFPA 805 Performance-Based Standard for Fire Protection for Light Water Reactors," dated February 21, 2013 (ADAMS Accession Number ML13079A090)

3. NRC electronic mail of August 8, 2013, "Palisades - Requests for Additional Information Regarding Transition to the Fire Protection Program to NFPA Standard 805 (TAC No. MF0382)" (ADAMS Accession Number ML13220B131)

4. ENO letter, PNP 2013-075, "Response to Request for Additional Information – License Amendment Request to Adopt NFPA 805 Performance-Based Standard for Fire Protection for Light Water Reactors", dated September 30, 2013 (ADAMS Accession Number ML13273A469)

5. ENO letter, PNP 2013-079, "Response to Request for Additional Information – License Amendment Request to Adopt NFPA 805 Performance-Based Standard for Fire Protection for Light Water Reactors", dated October 24, 2013 (ADAMS Accession Number ML13298A044)

6. ENO letter, PNP 2013-083, "Response to Request for Additional Information – License Amendment Request to Adopt NFPA 805 Performance-Based Standard for Fire Protection for Light Water Reactors", dated December 2, 2013 (ADAMS Accession Number ML13336A649)

7. ENO letter, PNP 2014-035, "Revised Response to Request for Additional Information – License Amendment Request to Adopt NFPA 805 Performance-Based Standard for Fire Protection for Light Water Reactors", dated April 2, 2014

8. NRC electronic mail of March 11, 2014, "Requests for Additional Information – Palisades – NFPA 805 Project LAR - MF0382"

Dear Sir or Madam:

In Reference 1, Entergy Nuclear Operations, Inc. (ENO) submitted a license amendment request to adopt the NFPA 805 performance-based standard for fire protection for light water reactors. In Reference 2, ENO responded to a clarification request. In Reference 3, ENO received electronic mail Request for Additional Information (RAIs). In Reference 4, ENO submitted the 60-day RAI responses. In Reference 5, ENO submitted the revised 90-day RAI responses. In Reference 6, ENO submitted the 120-day RAI responses. In Reference 7, ENO submitted the revised response to RAI SSA 07. In Reference 8, ENO received electronic mail RAIs on Fire Modeling.

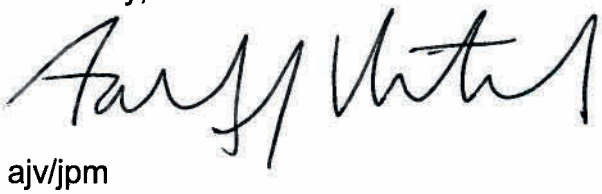
In Attachment 1, ENO is providing a response to the RAIs submitted in Reference 8.

A copy of this response has been provided to the designated representative of the State of Michigan.

This letter contains no new commitments and no revisions to existing commitments.

I declare under penalty of perjury that the foregoing is true and correct. Executed on May 7, 2014.

Sincerely,



ajv/jpm

Attachment:

1. Response to Request for Additional Information Regarding License Amendment Request to Adopt NFPA 805 Performance-Based Standard for Fire Protection for Light Water Reactors

cc: Administrator, Region III, USNRC
Project Manager, Palisades, USNRC
Resident Inspector, Palisades, USNRC
State of Michigan

ATTACHMENT 1
RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION REGARDING LICENSE AMENDMENT REQUEST TO ADOPT NFPA 805 PERFORMANCE-BASED STANDARD FOR FIRE PROTECTION FOR LIGHT WATER REACTORS

NRC REQUEST

FIRE MODELING (FM) REQUEST FOR ADDITIONAL INFORMATION (RAI) 01.01

In a letter dated December 2, 2013 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML13336A649), the licensee responded to PRA RAI 01.q and stated that, "... because sound engineering judgment has been provided regarding this assumption, additional technical justification for not having to consider structural collapse of the compartment as a result of the failure of one structural steel column is not required."

The staff noted that the licensees "evidence" consisted of statements made by a civil engineer about general building construction and structural engineering principles that were not specific enough for the staff to complete its review. Provide a summary of the actual analysis that was conducted that provides information in sufficient detail regarding your conclusion that consideration of structural collapse of the compartment as a result of the failure of one structural steel column is not required.

ENO RESPONSE

A detailed structural analysis of PNP's turbine building will not be provided. Instead, the RAI Response Fire PRA model is being updated to assume structural collapse of the compartment given the failure of one structural steel column for the applicable fire scenarios. The updated fire scenarios will be incorporated in the base case results of the RAI Response Fire PRA Model. Preliminary analysis with an in-progress RAI Response Fire PRA model that assumes structural collapse when a single structural steel column is failed by a fire does not result in a significant risk increase.

FM RAI 07

In the main control room (MCR) abandonment analysis, the licensee assumed that fire spreads to adjacent cabinets in 15 minutes rather than in 10 minutes, as recommended in Appendix S of NUREG/CR-6850, "EPRI/NRC-RES Fire PRA Methodology for Nuclear Power Facilities," for the case when cables in the adjacent cabinet are in direct contact with the separating wall.

Provide a technical justification for this assumption.

ENO RESPONSE

The propagation time between adjacent panels in the Main Control Room (MCR) abandonment analysis was updated to 10 minutes. Reference Figures 5-10 and 5-11 of Hughes Associates Report 0021-0019-000-001. Given that the 10 minute assumption of fire propagation is being used, additional technical justification for assuming 15 minutes for fire propagation is not required.

References:

[1] Hughes Associates, "Evaluation of Control Room Abandonment Times at the Palisades Nuclear Station," 1SPH02902.066, Revision 0, September 29, 2009

[2] Hughes Associates, "Evaluation of Control Room Abandonment Times at the Palisades Nuclear Station," 0021-0019-000-001, Revision 0, October 23, 2013

FM RAI 08

NFPA 805, Section 2.4.3.3, on acceptability states: "The PSA approach, methods, and data shall be acceptable to the AHJ." The staff has noted that the licensee has utilized a number of accepted tools and methods in its analyses for transition such as the Consolidated Model of Fire and Smoke Transport (CFAST) and NUREG-1805, "Fire Dynamic Tools (FDTs) - Empirical Correlations and Algebraic Models."

a. *Identify any fire modeling tools and methods that have been used in the development of the NFPA 805 LAR that are not already documented in the LAR and where their use or application is documented. Examples might include a methodology (empirical correlations and algebraic models) used to convert damage times for targets in Appendix H of NUREG/CR-6850 to percent damage as a function of heat flux and time or Supplements to the Generic Fire Modeling Treatments (GFMTs) - Empirical Correlations and Algebraic Models.*

b. *For any tool or method identified in a) above, provide the Verification and Validation (V&V) basis if not already explicitly provided in the LAR (for example in LAR Attachment J).*

ENO RESPONSE

a. The methodology to convert damage times for targets in Appendix H of NUREG/CR-6850 to percent damage as a function of heat flux and time is no longer being applied in the RAI Response Fire PRA Model, as

discussed in the response to PRA RAI 01 q. All other fire modeling tools or methods that have been used either have a documented V&V basis in LAR Attachment J, or are provided in the fire modeling reports developed to support RAI responses.

b. Verification and Validation basis for fire modeling tools and methods have been provided as discussed in the response to a) above.

FM RAI 09

Explain how high energy arcing fault (HEAF) initiated fires were addressed in the Hot Gas Layer (HGL) and Multi Compartment Analysis (MCA) and provide a technical justification for the approach that was used to calculate HGL development timing. More specifically, confirm whether the guidance provided in NUREG/CR-6850; page 11-19, fourth bullet regarding the fire growth, and the guidance provided on page M-13, sixth bullet regarding delay to cable tray ignition was followed. Also, considering the energetic nature of the HEAF event, provide a technical justification for the heat release rate (HRR) used in the HGL calculations for electrical cabinet fires following a HEAF.

ENO RESPONSE

The Fire PRA model analyzes High Energy Arcing Fault (HEAF) initiated fires using both the Fire Dynamic Simulator (FDS) and methods consistent with the Generic Fire Modeling Treatments, depending on the location of the HEAF initiated fire scenario.

The HEAF initiated fires involving the switchgear located in PAUs 03 and 04 are analyzed using FDS as described in Hughes Reports 0021-0019-000-005 and 0021-0019-000-006. In the HEAF scenarios, the switchgear panel experiencing the HEAF is assumed to be immediately at its peak heat release rate (HRR) (modeled to reach peak at 10 seconds for FDS model stability), consistent with the guidance on page 11-19 of NUREG/CR 6850. With regard to cable tray ignition, the first cable tray and other cable trays located in the HEAF Zone of Influence (ZOI) are ignited with no time delay. This represents a more conservative approach to cable tray ignition compared to that described on page M-13 of NUREG/CR-6850. Subsequent cable tray ignition and fire spread are modeled to occur when the cable is predicted to fail as described in the FDS model reports identified above. This was used instead of the generic guidance for subsequent cable tray ignition as it better represents the specific configurations analyzed. HEAF initiated fires outside of PAUs 03 and 04 were not analyzed using FDS and are currently being updated to use the techniques described in the Generic Fire Modeling Treatments. In the Generic Fire Modeling Treatments, CFAST (Consolidated Model of Fire and Smoke Transport) is used to obtain HGL development times. In this analysis, the HRR of the ignition source is again

assumed to be at its peak immediately (modeled as a ten second growth rate for model stability). With regard to cable tray ignition, the guidance described on page M-13 of NUREG/CR-6850 is being followed. The first cable tray in a cable tray stack is assumed to be in the HEAF ZOI and is ignited with no time delay. Additional cable trays in the stack are ignited following the time delay scheme described in Appendix R of NUREG/CR-6850.

The peak HRR used for the HEAF analyses, in both the FDS and CFAST models referenced above, is equal to the NUREG/CR-6850, Appendix E, 98th percentile HRR for the electrical fire of the ignition source. General room heat up due to the energetic nature of the HEAF event itself would not be a significant contributor to the HGL formation. This is based on the volumes of the spaces containing ignition sources capable of HEAFs and the short duration of the HEAF event. The energetic nature of the HEAF event is therefore considered to be a negligible contributor to room heat-up per the guidance provided in NUREG/CR-6850 section M.4.1.

References

[1] Hughes Associates, "Fire Model Analysis of Safe Shutdown Credited Raceways in the 1-D Switchgear Room at the Palisades Nuclear Station", 0021-0019-000-005, Revision 0, January 3, 2014.

[2] Hughes Associates, "Fire Model Analysis of Safe Shutdown Credited Raceways in the 1-C Switchgear Room at the Palisades Nuclear Station", 0021-0019-000-006, Revision 0, January 2, 2014.

[3] NUREG/CR-6850 (EPRI 1011989),) "EPRI/NRC–RES Fire PRA Methodology for Nuclear Power Facilities" Volume 2 Detailed Methodology, Electric Power Research Institute (EPRI) 1011989 Final Report, Nuclear Regulatory Commission (NRC), Rockville, MD, September, 2005.

ADDITIONAL INFORMATION - LICENSEE IDENTIFIED ISSUES

1. In response to the 120-DAY RAI, PRA RAI 17 d), the time cited for fire propagation to an adjacent cabinet for MCR abandonment scenarios referenced the propagation time (15 minutes) from the MCR abandonment calculation that supported the LAR (Hughes Associates Report 1SPH02902.066) instead of the propagation time (10 minutes) from the MCR abandonment calculation prepared to support the initial set of RAIs (Hughes Associates Report 0021-0019-000-001, Revision 0). Therefore, based on the FM RAI 07 response above, the last sentence of PRA RAI 17 d) response is revised to: "Fire propagation in the MCB for abandonment scenarios was modeled consistent with the guidance provided in NUREG/CR-6850 Appendix S (i.e., fire spread was modeled at 10 minutes)."

2. A review of the input files and the supporting heat release rate (HRR) calculations indicated that the summation of the HRR for the second group of panels was not included during a 90 second window starting at 10 minutes. This resulted in a maximum 5 percent under-estimate of the HRR from what was intended during this time interval. The main control room (MCR) abandonment calculation has been updated (Hughes Associates Report 0021-0019-000-001, Revision 1) to correct the summation of the HRR during this time interval. The overall effect on the baseline abandonment times was 0.1 minute or less. The effect on the sensitivity analysis cases was also 0.1 minute or less, with the exception of a single group of cases associated with the sub-enclosures which had abandonment times that were predicted within the 90 second time interval where the HRR for the second group of panels were not correctly added.

References:

[1] Hughes Associates, "Evaluation of Control Room Abandonment Times at the Palisades Nuclear Station," 1SPH02902.066, Revision 0, September 29, 2009

[2] Hughes Associates, "Evaluation of Control Room Abandonment Times at the Palisades Nuclear Station," 0021-0019-000-001, Revision 1, April 4, 2014