NRR-PMDAPEm Resource

From: Miller, Ed
Sent: Monday, July 28, 2014 2:52 PM
To: 'Bryant, Julius W (Julius.Bryant@duke-energy.com)'
Subject: Draft RAIs for McGuire NFPA-805 LAR (PRA)
Attachments: DRAFT 07-28-14 MCGUIRE NFPA 805 Draft PRA RAIs TAC Nos MF2934 and MF2935.docx

Julius,
The NRC staff's draft RAI for the subject relief request is attached to this e-mail. The draft RAI is not an official NRC staff request and is being provided to you to facilitate a subsequent conference call to determine: 1) If the questions clearly convey the NRC staff information needs; 2) Whether the regulatory basis for the questions is understood; 3) Whether the information is already available in existing, docketed, correspondence; and 4) To determine an appropriate response time-frame. After you've had a chance to review the draft information request, please contact me to schedule the conference call.

Ed Miller
(301) 415-2481

Hearing Identifier: NRR_PMDA
Email Number: 1456

Mail Envelope Properties (9C2386A0C0BC584684916F7A0482B6CA01016938D191)

Subject: Draft RAIs for McGuire NFPA-805 LAR (PRA)
Sent Date: 7/28/2014 2:52:07 PM
Received Date: 7/28/2014 2:52:00 PM
From: Miller, Ed

Created By: Ed.Miller@nrc.gov

Recipients:
"'Bryant, Julius W (Julius.Bryant@duke-energy.com)'" <Julius.Bryant@duke-energy.com>
Tracking Status: None

Post Office: HQCLSTR02.nrc.gov

Files	**Size**	**Date & Time**
MESSAGE	673	7/28/2014 2:52:00 PM
DRAFT 07-28-14 MCGUIRE NFPA 805 Draft PRA RAIs TAC Nos MF2934 and MF2935.docx	61721	

Options
Priority: Standard
Return Notification: No
Reply Requested: No
Sensitivity: Normal
Expiration Date:
Recipients Received:

DRAFT REQUEST FOR ADDITIONAL INFORMATION

LICENSE AMENDMENT REQUEST TO ADOPT

NATIONAL FIRE PROTECTION ASSOCIATION STANDARD 805

DUKE ENERGY CAROLINAS, LLC.

MCGUIRE NUCLEAR STATION, UNITS 1 AND 2

DOCKET NOS. 50-369 AND 50-370

Probabilistic Risk Assessment (PRA) RAI 01

Section 2.4.3.3 of NFPA 805 states that the probabilistic safety assessment (PSA) (PSA is also referred to as PRA) approach, methods, and data shall be acceptable to the authority having jurisdiction (AHJ), which is the U.S. Nuclear Regulatory Commission (NRC). Regulatory Guide (RG) 1.205 identifies NUREG/CR-6850 as documenting a methodology for conducting a Fire PRA and endorses, with exceptions and clarifications, Nuclear Energy Institute (NEI) 04-02, Revision 2, as providing methods acceptable to the staff for adopting a fire protection program consistent with NFPA-805. RG 1.200 describes a peer review process utilizing an associated ASME/ANS standard (currently ASME/ANS-RA-Sa-2009) as one acceptable approach for determining the technical adequacy of the PRA once acceptable consensus approaches or models have been established for evaluations that could influence the regulatory decision. The primary result of a peer review are the facts and observations (F&Os) recorded by the peer review and the subsequent resolution of these F&Os.

Clarify the following dispositions to fire F&Os and Supporting Requirement (SR) assessment identified in LAR Attachment V that have the potential to impact the Fire PRA (FPRA) results and do not appear to be fully resolved:

a) PP-B7-01 and PP-C3-01: The resolutions to these F&Os state that "a subsequent walkdown was conducted for plant partitioning and is documented in the Fire Scenario Report." The walkdown sheets provided in Appendix F of the Fire Scenario Report (MCC-1535-0158-003) are principally focused on identifying targets, do not appear to address plant partitioning features, and are all dated prior to the peer review held in Sept. 2009. Provide a description of the subsequent walkdown performed for plant partitioning, the results of this walkdown, and when the walkdown was performed.

b) FSS-C5-02: The resolution to this F&O identifies non-armored cable as primarily related to security and communication (phone, LAN, or fiber optic cables) and concludes that "the low concentration of non-qualified cables, which are not associated with credited circuits, is considered insufficient to impact the results." Identify the other functions that include non-armored cable employed at MNS to provide the basis for concluding that these do not impact the FPRA results, both total and delta risks.

c) HRA-E1-01: The resolution to F&O HRA-E1-01 explains that human error probability (HEP) values for IEPRA actions were increased by a specified factor

depending on action time and complexity for actions both inside and outside the control room. Table V-2 of the LAR justifies the peer reviewer assessment for SR HRA-C1 to be acceptable for the NFPA 805 application on the basis that this factor or multiplier methodology is a conservative approach. The methodology, which is essentially an HRA scoping approach, does not follow the NRC-accepted guidance in NUREG/CR-6850 or NUREG-1921. In light of these issues:

i. Provide further justification that explains how the multiplier methodology for developing HEPs accounts for the various factors discussed in Section 5 of NUREG-1921 for performing a scoping/screening fire HRA. Alternatively, provide updated risk results as part of the aggregate change-in-risk analysis requested in PRA RAI 03 applying HEP and JHEP values developed using NRC-accepted guidance such as NUREG-1921 or NUREG/CR-6850.

ii. Provide further explanation of how using conservative or scoping values for HEPs for significant human actions impacts the delta risk results reported in the fire risk evaluations. The response should specifically address each HFE determined to be significant in accordance with the PRA standard. Alternatively, provide updated risk results as part of the aggregate change-in-risk analysis requested in PRA RAI 03 applying HEP values for risk significant HFEs developed using detailed HRA.

iii. NUREG-1921 indicates, and NUREG-1792 (Table 2-1) states that joint HEP values should not be below 10-5. Electric Power Research Institute (EPRI) Table 4-3 provides a lower limiting value of 10-6 for sequences with a very low level of dependence. Alternatively, the NRC staff has accepted general use of a 10-5 floor value for fire specific joint HEPs and 10-6 floor value for joint HEPs from the internal events that are credited in the fire PRA without additional justification for individual HEPs.

1. Confirm that each HEP value used to support the LAR below 10-5 includes its own justification that demonstrates the inapplicability of the NUREG-1792 lower value guideline. Provide an estimate of the number of joint HEPs between 10-5 and 10-6 and at least two different examples of the justification.

2. Confirm that each HEP value below 10-6 further includes its own justification that demonstrates that all the individual actions are independent. Provide an estimate of the number of HEPs less than 10-6 and at least two different examples of the justification.

3. Clarify in the response to PRA RAI 3 how joint HEPs will be retained in the post transition PRA.

d) FSS-D7: The disposition to the peer review assessment for FSS-D7 (LAR Table V-2) does not specifically address how automatic suppression was credited other than in the MCA. Section 10.3 of the Fire Scenario Report identifies that the Halon suppression system was credited in the evaluation of turbine-driven auxiliary feedwater pump fire scenarios and that the generic unavailability for Halon systems from NUREG/CR-6850 was used in the evaluation of these scenarios. According the PRA standard, the intent for CC-II is to "require a review of plant records to determine if the generic unavailability credit is consistent with actual system unavailability." Provide justification that the generic estimates for credited automatic suppression systems bound actual system unavailability based on an evaluation of plant records and that outlier behavior has not been experienced at MNS. If necessary, provide updated risk results as part of the aggregate change-in-risk analysis requested in PRA RAI 03 that appropriately accounts for actual automatic suppression system reliability/availability experience at MNS.

e) HRA-B4: The disposition to the peer review assessment for SR HRA-B4 (LAR Table V-2) does not provide the basis for the conclusion that "this SR is now considered met at CC-II" nor was there a basis provided for how it was concluded that the treatment of instrumentation in the Fire PRA model does not impact delta risk. Provide justification for these conclusions, specifically addressing how errors of omission/commission were evaluated, the results of this evaluation, and how these results were incorporated in the Fire PRA model.

PRA RAI 02

Section 2.4.3.3 of NFPA 805 states that the PRA approach, methods, and data shall be acceptable to the NRC. RG 1.205 identifies NUREG/CR-6850 as documenting a methodology for conducting a Fire PRA and endorses, with exceptions and clarifications, NEI 04-02, Revision 2, as providing methods acceptable to the staff for adopting a fire protection program consistent with NFPA-805. RG 1.200 describes a peer review process utilizing an associated ASME/ANS standard (currently ASME/ANS-RA-Sa-2009) as one acceptable approach for determining the technical adequacy of the PRA once acceptable consensus approaches or models have been established. The primary results of a peer review are the F&Os recorded by the peer review and the subsequent resolution of these F&Os.

Clarify the following dispositions to Internal Events F&Os and SR assessment identified in LAR Attachment U that have the potential to impact the FPRA results and do not appear to be fully resolved:

a) The disposition to F&O IE-02 and IE-C14 concludes that any additional risk would be small and would not have a significant impact on the Fire PRA results or results for the NFPA 805 application. Define what is meant by small and non-significant impact. The response should address small and non-significant in the context of both the RG 1.174 risk guidelines for transition and the post-transition change evaluation criteria, which is two orders-of-magnitude less than the RG 1.174 risk guidelines for Region II.

b) AS-04: The peer review Finding is that seal injection cooling must be restored within 15 minutes or seal failure may occur, which apparently was not

accounted for in the PRA model at the time for scenarios in which control was transferred to the Safe Shutdown Facility (SSF). It is unclear how the disposition to the Finding, incorporating the updated WOG2000 seal leakage model and the performance of MAAP runs that determined that core uncovery time is less than 3 hours, addresses the Finding. Provide further explanation for how the PRA model was updated to address the peer review Finding.

c) TH-02: The disposition to this F&O concludes that difference in the time to core damage is not significant when using either 2000 Deg F or 4000 Deg F "because the exothermic nature of the zircaloy-water reaction rapidly increases the fuel temperature." Relatively small changes in "the time available for human recoveries or other nonrecovery events such as loss of offsite power recoveries" could change the likelihood of some events. Provide further clarification on the difference in the time available and what is meant by not significant and negligible impact. The response should address not significant and negligible in the context of both the RG 1.174 risk guidelines for transition and the post-transition change evaluation criteria, which is two orders-of-magnitude less than the RG 1.174 risk guidelines for Region II.

d) QU-02: The disposition to this F&O addresses the broader issue of lack of a systematic process for applying recovery rules, however, the specific example wherein one Unit 2 nuclear service water (RN) pump is always assumed to be available for cross-tie to Unit 1, even during Modes 5 and 6 at Unit 2, is not addressed. Clarify if unavailability of the Unit 2 RN pump is now appropriately accounted for in the modeling of the cross-tie to Unit 1, and vice-versa. If not , provide justification for the treatment of this cross-tie in the PRA model and the implications of this treatment on the risk and delta risk results reported in the LAR.

e) HR-01: The disposition to this F&O concludes that the absence of miscalibration errors in the PRA model is not significant to the Fire PRA results based on the results of a sensitivity study adding four miscalibration events to the PRA. Provide further justification for this conclusion, including discussing why modeling just the four miscalibration events in the sensitivity study is a reasonable representation of potential miscalibration errors at MNS. The response should characterize what is meant by not significant impact in the context in the context of both the RG 1.174 risk guidelines for transition and the post-transition change evaluation criteria, which is two orders-of-magnitude less than the RG 1.174 risk guidelines for Region II.

f) F&Os DE-04 and DA-05: Address the following regarding common cause failure (CCF) modeling in the PRA model:

    i. The disposition to SR DA-D5 indicates that a single CCF event is utilized that combines the various combinations of failures. It is not clear how this approach is implemented and if it impacts the Fire PRA for situations when a CCF and a fire failure may be combined in a fire scenario.. Provide justification that the CCF modeling methodology does not underestimate the fire risk.

ii. Clarify if the updated CCF modeling made in response to these F&Os was incorporated in the Fire PRA risk results reported in the LAR. If not, provide further justification for the conclusions for various SRs that there is no impact to the Fire PRA or NFPA 805 from the CCF modeling changes or that CCF is not a significant contributor to fire risk. The response should address not significant in the context of both the RG 1.174 risk guidelines for transition and the post-transition change evaluation criteria, which is two orders-of-magnitude less than the RG 1.174 risk guidelines for Region II.

g) SR HR-D6: The status of this SR is reported as "open" and the disposition states "the HRA values have been updated to mean values during the Fire PRA development." The disposition further states that "the suggested data refinement is not expected to have a significant impact on applications." Clarify what the "suggested data refinement" issue is from the 2008 self-assessment, and how the disposition resolves the issue, and why the issue is considered to be an "open" item. If further changes to the PRA are necessary to resolve the issue, discuss their potential impact to the Fire PRA and results reported in the LAR.

h) SR HR-G6: The 2013 self-assessment concludes that this SR is not met and the status of this SR is reported as "open." The disposition further states that a meeting will be conducted with the PRA model integrator, the HRA specialist and plant operators to perform a formal consistency check of the post-initiator human error probability quantifications. Clarify if this action has been completed and, if so, discuss the results of the review and if it resulted in any PRA model changes. If changes to the PRA were necessary to resolve the issue, discuss their potential impact to the Fire PRA and results reported in the LAR.

PRA RAI 03

Section 2.4.3.3 of NFPA 805 states that the PRA approach, methods, and data shall be acceptable to the NRC. Section 2.4.4.1 of NFPA-805 further states that the change in public health risk arising from transition from the current fire protection program to an NFPA-805 based program, and all future plant changes to the program, shall be acceptable to the NRC. RG 1.174 provides quantitative guidelines on core damage frequency (CDF), large early release frequency (LERF), and identifies acceptable changes to these frequencies that result from proposed changes to the plant's licensing basis and describes a general framework to determine the acceptability of risk-informed changes. The NRC staff review of the information in the LAR has identified additional information that is required to fully characterize the risk estimates.

The PRA methods currently under review in the LAR include:

- PRA RAI 01.c regarding the Fire PRA HRA
- PRA RAI 01.d regarding credit for automatic suppression
- PRA RAI 06 regarding application of SOKC
- PRA RAI 09 regarding deviations from NRC guidance
- PRA RAI 10 regarding reduced circuit failure probabilities

- PRA RAI 11 regarding ignition bins missing from the sensitivity study
- PRA RAI 12 regarding main control room (MCR) abandonment on loss of habitability
- PRA RAI 13 regarding treatment of recovery action
- PRA RAI 17 regarding sensitive electronics
- PRA RAI 18 regarding reduced heat release rate (HRR) for transients
- PRA RAI 20 regarding fire propagation from electrical cabinets
- PRA RAI 21 regarding the multi-compartment analysis (MCA)
- PRA RAI 22 regarding modeling of reactor coolant pump (RCP) oil fires
- PRA RAI 23 regarding modeling of multiple spurious operations (MSOs)
- PRA RAI 24 regarding modeling of junction boxes
- PRA RAI 25 regarding modeling of transient fires caused by welding and cutting (TFWC)
- FM RAI 02.a regarding treatment of armored cable

Provide the following:

a) Results of an aggregate analysis that provides the integrated impact on the fire risk (i.e., the total transition CDF, LERF, ΔCDF, ΔLERF) of replacing specific methods identified above with alternative methods which are acceptable to the NRC. In this aggregate analysis, for those cases where the individual issues have a synergistic impact on the results, a simultaneous analysis must be performed. For those cases where no synergy exists, a one-at-a-time analysis may be done. For those cases that have a negligible impact, a qualitative evaluation may be done. It should be noted that this list may expand depending on NRC's review of the responses to other RAIs in this document.

b) For each method (i.e., each bullet) above, explain how the issue will be addressed in 1) the final aggregate analysis results provided in support of the LAR, and 2) the PRA that will be used at the beginning of the self-approval of post-transition changes. In addition, provide a process to ensure that all changes will be made, that a focused-scope peer review will be performed on changes that are PRA upgrades as defined in the PRA standard, and that any findings will be resolved before self-approval of post-transition changes.

c) In the response, explain how the RG 1.205 risk acceptance guidelines are satisfied for the aggregate analysis. If applicable include a description of any new modifications or operator actions being credited to reduce delta risk as well as a discussion of the associated impacts to the fire protection program.

d) If any unacceptable methods or weaknesses will be retained in the PRA that will be used to estimate the change in risk of post-transition changes to support self-approval, explain how the quantification results for each future change will account for the use of these unacceptable methods or weaknesses.

PRA RAI 04

Section 2.4.3.3 of NFPA 805 states that the PRA approach, methods, and data shall be acceptable to the NRC. Section 2.4.4.1 of NFPA-805 further states that the change in public health risk arising from transition from the current fire protection program to an NFPA-805 based program, and all future plant changes to the program, shall be acceptable to the NRC. RG 1.174 provides quantitative guidelines on CDF, LERF, and identifies acceptable changes to

these frequencies that result from proposed changes to the plant's licensing basis and describes a general framework to determine the acceptability of risk-informed changes. The NRC staff review of the information in the LAR has identified additional information that is required to fully characterize the risk estimates.

LAR Section 4.5.1.3 has the following statement: "All F&Os that were defined as suggestions have been dispositioned and will be available for NRC review along with the dispositions related to the supplemental F&Os that were generated outside the consensus process." Discuss the process and basis for the development of these "supplemental" F&Os generated outside the consensus process. If they are peer review F&Os, provide the F&O and associated dispositions.

PRA RAI 05

Section 2.4.3.3 of NFPA 805 states that the PRA approach, methods, and data shall be acceptable to the NRC. Section 2.4.4.1 of NFPA-805 further states that the change in public health risk arising from transition from the current fire protection program to an NFPA-805 based program, and all future plant changes to the program, shall be acceptable to the NRC. RG 1.174 provides quantitative guidelines on CDF, LERF, and identifies acceptable changes to these frequencies that result from proposed changes to the plant's licensing basis and describes a general framework to determine the acceptability of risk-informed changes. The NRC staff review of the information in the LAR has identified additional information that is required to fully characterize the risk estimates.

LAR Section 4.5.2.2 provides a high-level description of how the impact of transition to NFPA 805 impacts defense-in-depth (DID) and safety margin was reviewed, including using the criteria from Section 5.3.5 of NEI 04-02 and from RG 1.205. However, no explanation is provided of how specifically the criteria in these documents were utilized and/or applied in these assessments.

a) Provide further explanation of the method(s) or criteria used to determine when a substantial imbalance between DID echelons existed in the Fire Risk Evaluations (FREs), and identify the types of plant improvements made in response to this assessment.

b) Also, provide further discussion of the approach in applying the NEI 04-02, "Guidance for Implementing a Risk-Informed, Performance-Based Fire Protection Program Under 10 CFR 50.48(c)", Revision 2, (ADAMS Accession No. ML081130188) criteria for assessing safety margin in the FREs.

PRA RAI 06

Section 2.4.3.3 of NFPA 805 states that the PRA approach, methods, and data shall be acceptable to the NRC. Section 2.4.4.1 of NFPA-805 further states that the change in public health risk arising from transition from the current fire protection program to an NFPA-805 based program, and all future plant changes to the program, shall be acceptable to the NRC. RG 1.174 provides quantitative guidelines on CDF, LERF, and identifies acceptable changes to these frequencies that result from proposed changes to the plant's licensing basis and describes a general framework to determine the acceptability of risk-informed changes. The NRC staff's review of the information in the LAR has identified additional information that is required to fully characterize the risk estimates.

LAR Section 4.7.3 explains that the sources of uncertainty in the Fire PRA were identified and specific parameters were analyzed for sensitivity in support of the NFPA 805 Fire Risk Evaluation process. It is further explained that during the Fire Risk Evaluation process, the uncertainty and sensitivity associated with specific Fire PRA parameters were considerations in the evaluation of the change in risk relative to the applicable acceptance thresholds. Based on these explanations it is apparent that the risk results presented in Attachment W of the LAR are point estimates and do not include parameter uncertainty. Explain how state-of-knowledge correlations (SOKCs) were taken into account in the Fire PRA quantification, including fire ignition frequencies, circuit failure likelihood and hot short duration, and non-suppression probabilities. If SOKC for these parameters were not accounted for in the Fire PRA quantification, then include the impact of the SOKC for these parameters in the integrated analysis performed in response to PRA RAI 3.

PRA RAI 07

Section 2.4.3.3 of NFPA 805 states that the PRA approach, methods, and data shall be acceptable to the NRC. Section 2.4.4.1 of NFPA-805 further states that the change in public health risk arising from transition from the current fire protection program to an NFPA-805 based program, and all future plant changes to the program, shall be acceptable to the NRC. RG 1.174 provides quantitative guidelines on CDF, LERF, and identifies acceptable changes to these frequencies that result from proposed changes to the plant's licensing basis and describes a general framework to determine the acceptability of risk-informed changes. The NRC staff review of the information in the LAR has identified additional information that is required to fully characterize the risk estimates.

LAR Attachment G identifies three categories of operator manual actions [OMA(s)] in post-fire procedures: (1) recovery actions (RAs) to reduce risk, (2) RAs required for defense-in-depth (DID), and (3) actions associated with VFDRs but are screened out due to no or very low risk and are not considered recovery actions. Provide the following regarding these screened actions:

a) Are the screened OMAs the same as the "pre-existing" OMAs discussed on Page 40 of the LAR? If not, explain the difference.

b) Describe the criteria for screening OMAs as RAs.

c) Discuss how the screened in OMAs are treated or modeled in the Fire PRA.

d) Explain how the screened out OMAs will be treated in the post-transition fire procedures. If they will be retained in the procedures, clarify that they have been evaluated for adverse impact on the PRA (e.g., the HRA/feasibility analysis of RAs considered these OMAs in development of timing, operator availability, etc.).

PRA RAI 08

Section 2.4.3.3 of NFPA 805 states that the PRA approach, methods, and data shall be acceptable to the NRC. Section 2.4.4.1 of NFPA-805 further states that the change in public health risk arising from transition from the current fire protection program to an NFPA-805 based program, and all future plant changes to the program, shall be acceptable to the NRC. RG 1.174 provides quantitative guidelines on CDF, LERF, and identifies acceptable changes to

these frequencies that result from proposed changes to the plant's licensing basis and describes a general framework to determine the acceptability of risk-informed changes. The NRC staff review of the information in the LAR has identified additional information that is required to fully characterize the risk estimates.

LAR Table S-3, Implementation Item #12 commits to updating the Fire PRA and re-evaluating the risk results after installation of the plant modifications identified in Table S-2 are completed. This implementation item does not address completion of the implementation items identified in Table S-3. Discuss your plans for re-evaluating the risk results following completion of the Table S-3 implementation items, guidelines for taking action based on the results, and actions that will be taken if the guidelines are exceeded.

PRA RAI 09

Section 2.4.3.3 of NFPA 805 states that the PRA approach, methods, and data shall be acceptable to the NRC. Section 2.4.4.1 of NFPA-805 further states that the change in public health risk arising from transition from the current fire protection program to an NFPA-805 based program, and all future plant changes to the program, shall be acceptable to the NRC. RG 1.174 provides quantitative guidelines on CDF, LERF, and identifies acceptable changes to these frequencies that result from proposed changes to the plant's licensing basis and describes a general framework to determine the acceptability of risk-informed changes. The NRC staff review of the information in the LAR has identified additional information that is required to fully characterize the risk estimates.

LAR Attachment V Section V.2.1 states that the "The MNS Fire PRA does not employ any unreviewed analysis methods as identified in NRC Letter dated June 21, 2012" (ADAMS Accession No. ML12171A583)). Indicate if any other methods were employed that deviate from guidance in NUREG/CR-6850 or other acceptable guidance (e.g., FAQs or interim guidance documents). If so, describe and justify any proposed method that deviates from NRC guidance, or replace the proposed method with an accepted method. Also, include the proposed method as a method "currently under review" as part of the integrated analysis in the response to PRA RAI 3.

PRA RAI 10

Section 2.4.3.3 of NFPA 805 states that the PRA approach, methods, and data shall be acceptable to the NRC. Section 2.4.4.1 of NFPA-805 further states that the change in public health risk arising from transition from the current fire protection program to an NFPA-805 based program, and all future plant changes to the program, shall be acceptable to the NRC. RG 1.174 provides quantitative guidelines on CDF, LERF, and identifies acceptable changes to these frequencies that result from proposed changes to the plant's licensing basis and describes a general framework to determine the acceptability of risk-informed changes. The NRC staff review of the information in the LAR has identified additional information that is required to fully characterize the risk estimates.

LAR Section V.2.2 states that reduced circuit failure probabilities for circuits with control power transformers (CPTs) was not credited in the Fire PRA. Recently, new guidance on using conditional probabilities of spurious operation for control circuits was issued by the NRC in Section 7 of NUREG/CR-7150, Volume 2. This guidance included: a) replacement of the conditional hot short probability tables in NUREG/CR-6850 for Option #1 with new circuit failure probabilities for single break and double break control circuits, b) Option #2 in NUREG/CR-6850

is not an adequate method and should not be used, c) replacement of the probability of spurious operation duration figure in FAQ 08-0051 for AC control circuits, d) aggregate values for circuit failure probabilities should be used unless it is demonstrated that a cable is only susceptible to a single failure mode, e) incorporation of the uncertainty values for the circuit failure probabilites and spurious operation duration in the state-of-knowledge correlation (SOKC) for developing the mean CDF/LERF, and f) recommendations on the hot short probabilities to use for other cable configurations, including panel wiring, trunk cables, and instrument cables. Provide an assessment of the assumptions used in the McGuire Fire PRA relative to the updated guidance in NUREG/CR-7150, Volume 2, specifically addressing each of these items. If the Fire PRA assumptions are not bounded by the new guidance provide a justification for each difference or, provide updated risk results as part of the aggregate change-in-risk analysis requested in PRA RAI 03, utilizing the guidance in NUREG/CR-7150.

PRA RAI 11

Section 2.4.3.3 of NFPA 805 states that the PRA approach, methods, and data shall be acceptable to the NRC. Section 2.4.4.1 of NFPA-805 further states that the change in public health risk arising from transition from the current fire protection program to an NFPA-805 based program, and all future plant changes to the program, shall be acceptable to the NRC. RG 1.174 provides quantitative guidelines on CDF, LERF, and identifies acceptable changes to these frequencies that result from proposed changes to the plant's licensing basis and describes a general framework to determine the acceptability of risk-informed changes. The NRC staff review of the information in the LAR has identified additional information that is required to fully characterize the risk estimates.

LAR Section V.2.6 indicates that only Bins 4 and 15 are applicable to the fire ignition frequency sensitivity analysis. For each of the other Bins having an alpha of less than or equal to 1, provide the basis for concluding that each does not impact the VFDR delta risk results.

PRA RAI 12

Section 2.4.3.3 of NFPA 805 states that the PRA approach, methods, and data shall be acceptable to the NRC. Section 2.4.4.1 of NFPA-805 further states that the change in public health risk arising from transition from the current fire protection program to an NFPA-805 based program, and all future plant changes to the program, shall be acceptable to the NRC. RG 1.174 provides quantitative guidelines on CDF, LERF, and identifies acceptable changes to these frequencies that result from proposed changes to the plant's licensing basis and describes a general framework to determine the acceptability of risk-informed changes. The NRC staff review of the information in the LAR has identified the following information that is required to fully characterize the risk estimates.

LAR Section V.2.7 describes two main control room (MCR) abandonment on loss-of-habitability scenarios, W1 and W2, where, in both cases, "failures were assumed which virtually eliminated all success paths other than the Standby Makeup Pump and the TD CA [turbine-driven auxiliary feedwater] pump from the SSF [Safe Shutdown Facility]." It is further explained that the conditional core damage probability (CCDP) for these scenarios is based on the highest CCDP for main control board (MCB) and non-MCB fires with additional failures as necessary to ensure no credit for functions that require continued presence in the MCR. Regarding this analysis, provide the following:

a) Summarize what “failures were assumed” and why they are assumed. Specifically, are they assumed because of general issues (e.g., unknown cable routing for functions always assumed failed) or are the assumptions only used for MCR abandonment scenarios?

b) An explanation of how the CCDPs account for the range of probabilities for properly shutting down the plant, and discussion of how they were applied in the scenario analysis. In doing so, provide examples over the full range of values utilized, a characterization of the scenarios to which these values are applied, and a summary of how each value is developed.

   This information should include explanations of how the following scenarios are addressed:

   i. Scenarios where the fire fails few functions aside from MCR habitability and successful shutdown is straightforward.

   ii. Scenarios where the fire could cause some recoverable functional failures or spurious operations that complicate the shutdown but successful shutdown is likely.

   iii. Scenarios where the fire induced failures cause great difficulty for shutdown by failing multiple functions and/or causing complex spurious operations that make successful shutdown unlikely.

c) Explanation of the timing considerations (i.e., total time available, time until cues are reached, manipulation time, and time for decisionmaking) made to characterize scenarios in Part (a). Include in the explanation the basis for any assumptions made about timing.

d) Discussion of how the probability associated with failure to transfer control to the SSF is taken into account in Part (a).

e) Description of how the feasibility of the operator actions supporting the alternate shutdown pathway was considered by the scenario characterization performed in Part (a).

PRA RAI 13

Section 2.4.3.3 of NFPA 805 states that the PRA approach, methods, and data shall be acceptable to the NRC. Section 2.4.4.1 of NFPA-805 further states that the change in public health risk arising from transition from the current fire protection program to an NFPA-805 based program, and all future plant changes to the program, shall be acceptable to the NRC. RG 1.174 provides quantitative guidelines on CDF, LERF, and identifies acceptable changes to these frequencies that result from proposed changes to the plant’s licensing basis and describes a general framework to determine the acceptability of risk-informed changes. The NRC staff review of the information in the LAR has identified additional information that is required to fully characterize the risk estimates.

LAR Section V.2.7 states "Control room abandonment is only considered for cases where the Control Room environment (temperature and smoke) reaches the criteria specified in

NUREG/CR 6850. For non-abandonment cases credit may be taken at the Primary Control Station (PCS) as needed to control functions impacted for a given Control Room panel fire." LAR Table G-1 identifies PCS actions for the following 10 fire areas in addition to the MCR (Fire Area 24): 01 (U1 and U2), 02, 03, 04 (U1 and U2), 13 (U1 and U2), 14 (U1 and U2), 19, 20, 21 (U1 and U2), 24 (LU1 and U2), and 25 (U1 and U2). If primary command and control is retained in the MCR (i.e, the MCR is not abandoned), then RG 1.205 states, "operation of dedicated or alternative shutdown controls while the main control room remains the command and control location would normally be considered a recovery action." In light of this, provide the following:

a) Clarify if primary command and control is retained in the MCR for fires in these 11 fire areas and explain how this conclusion is reached. Also clarify if the actions then taken at the primary control stations are treated as recovery actions and included in the additional risk of recovery action estimate.

b) If command and control is not retained in the MCR, the actions taken at the primary control station are not recovery actions, but then the MCR is essentially assumed to be abandoned on loss-of-control. If abandonment due to loss of control is credited provide an assessment of MCR abandonment through establishing a bounding scenario or a set of representative scenarios. Ensure the potential complexity of fire induced damage, including spurious operations, are incorporated into these scenarios. Evaluate the timing supported by thermal hydraulics for these scenarios and the effect on the HRA including the effect on cues. Provide a comparison of the results of this analysis with the values from the PRA supporting the LAR, and explain any potential differences.

c) Assess the implications of the above issues in the integrated analysis performed in response to PRA RAI 3.

PRA RAI 14

Section 2.4.3.3 of NFPA 805 states that the PRA approach, methods, and data shall be acceptable to the NRC. Section 2.4.4.1 of NFPA-805 further states that the change in public health risk arising from transition from the current fire protection program to an NFPA-805 based program, and all future plant changes to the program, shall be acceptable to the NRC. RG 1.174 provides quantitative guidelines on CDF, LERF, and identifies acceptable changes to these frequencies that result from proposed changes to the plant's licensing basis and describes a general framework to determine the acceptability of risk-informed changes. The NRC staff review of the information in the LAR has identified additional information that is required to fully characterize the risk estimates.

LAR Section W.2.1 describes only one method for estimating the delta risk, as follows: "The compliant case was created by manipulating the Fire PRA model to 'remove' the VFDR(s). Fire PRA manipulations involved 'toggling off' or excluding specific PRA basic events to remove the potential fire induced failure associated with the VFDRs." It does not address if there are any exceptions to this method, such as potentially with MCR abandonment scenarios or the use of bounding methods per FAQ 08-0054 (use of the bounding method seems to be implied by the delta risk results presented in Tables W-3 and W-4 for some fire areas). Provide further description of the methods used to determine the change in risk values reported in LAR Tables W-3 and W-4 and additional discussion of the results as requested below.

a) Please explain how the "Offset Risk (WL Mod) Δ LERF" column in Appendix W is calculated from the variant and/or the compliant case models. The explanation should clarify why the total LERF transition change in risk is not the "Fire Risk Eval Δ LERF" in Appendix W but, as implied under W.2.2, are the values in that column minus the "Offset Risk" column.

b) RG 1.174 states that combined change request (i.e., those that combine risk increases with risk decreases) should report the risk increase and risk decrease separately. Please explain how these values can be obtained from the tables in Appendix W or provide for the post-transition plant an estimate of the risk increase from the retained VFDRs and, separately, the risk decrease associated with modifications made only to reduce risk.

c) Were any methods other than the basic event toggling already described used to determine the fire area change in risk or delta risk reported in LAR Tables W-3 and W-4? If so, describe each method.

d) Describe how the change in risk was determined for MCR abandonment scenarios, including a summary of how the CCDP was determined for the complaint and the variant plants. Note that an overestimate of the compliant plant risk, unless offset with a similar overestimate in the variant plant risk, results in a non-conservative analysis of the delta risk. If the method described applies different assumptions to the variant and the complaint plant risk estimates, an indeterminate but non-conservative impact on the change-in-risk estimate may result.

PRA RAI 15

Section 2.4.3.3 of NFPA 805 states that the PRA approach, methods, and data shall be acceptable to the NRC. Section 2.4.4.1 of NFPA-805 further states that the change in public health risk arising from transition from the current fire protection program to an NFPA-805 based program, and all future plant changes to the program, shall be acceptable to the NRC. RG 1.174 provides quantitative guidelines on CDF, LERF, and identifies acceptable changes to these frequencies that result from proposed changes to the plant's licensing basis and describes a general framework to determine the acceptability of risk-informed changes. The NRC staff review of the information in the LAR has identified additional information that is required to fully characterize the risk estimates.

The risk results presented in Table W-1 for fire for both Units 1 and 2 and for CDF and LERF are substantially different from the corresponding values reported in Tables W-3 and W-4. Clarify this discrepancy and discuss any implications to the conclusions of the LAR.

PRA RAI 16

Section 2.4.3.3 of NFPA 805 states that the PRA approach, methods, and data shall be acceptable to the NRC. Section 2.4.4.1 of NFPA-805 further states that the change in public health risk arising from transition from the current fire protection program to an NFPA-805 based program, and all future plant changes to the program, shall be acceptable to the NRC. RG 1.174 provides quantitative guidelines on CDF, LERF, and identifies acceptable changes to these frequencies that result from proposed changes to the plant's licensing basis and describes a general framework to determine the acceptability of risk-informed changes. The

NRC staff review of the information in the LAR has identified additional information that is required to fully characterize the risk estimates.

LAR Tables W-3 and W-4 report results for total delta LERF of 1.06E-06 per year for Unit 1 and 9.32E-07 per year for Unit 2. These tables also report an "Offset Risk" from crediting a risk reduction modification to the Liquid Waste Recycle System (WL) that results in a substantial reduction in the reported total delta LERF values for both units, yielding a net reduction in delta LERF from the transition to NFPA 805. Given the importance of this modification to the transition, provide a description of how the risk reduction from this modification was calculated. The response should include a discussion of key assumptions and non-conservatisms, and the impact of any non-conservatisms on the reported "Offset Risk."

PRA RAI 17

Section 2.4.3.3 of NFPA 805 states that the PRA approach, methods, and data shall be acceptable to the NRC. RG 1.205 identifies NUREG/CR-6850 as documenting a methodology for conducting a Fire PRA and endorses, with exceptions and clarifications, NEI 04-02, Revision 2, as providing methods acceptable to the staff for adopting a fire protection program consistent with NFPA-805. Methods that have not been determined to be acceptable by the NRC staff or acceptable methods that appear to have been applied differently than described require additional justification to allow the NRC staff to complete its review of the proposed method.

In regard to modeling fire damage to sensitive electronics, neither Appendix H of the LAR or the licensee's procedures refer to use of FAQ 13-0004, "Clarifications on Treatment of Sensitive Electronics", dated December 3, 2013 (ADAMS Accession No. ML13322A085). Describe the treatment of sensitive electronics for the FPRA and explain whether it is consistent with the guidance in FAQ 13-0004, including the caveats about configurations that can invalidate the approach (i.e., sensitive electronic mounted on the surface of cabinets and the presence of louver or vents). If the approach is not consistent with FAQ 13-0004, justify the approach or replace the current approach with an acceptable approach in the integrated analysis performed in response to PRA RAI 3.

PRA RAI 18

Section 2.4.3.3 of NFPA 805 states that the PRA approach, methods, and data shall be acceptable to the NRC. RG 1.205 identifies NUREG/CR-6850 as documenting a methodology for conducting a Fire PRA and endorses, with exceptions and clarifications, NEI 04-02, Revision 2, as providing methods acceptable to the staff for adopting a fire protection program consistent with NFPA-805. Methods that have not been determined to be acceptable by the NRC staff or acceptable methods that appear to have been applied differently than described require additional justification to allow the NRC staff to complete its review of the proposed method.

The licensee's analysis indicates that the ZOI associated with a 142 kilo-watt (kW) heat release rate (HRR) (75th percentile) transient fire was used in almost all fires areas. Discuss the key factors used to justify the reduced rate below 317 kW per the guidance provided in the June 21, 2012, memo from Joseph Giitter to Biff Bradley ("Recent Fire PRA Methods review Panel Decisions and EPRI 1022993, 'Evaluation of Peak Heat Release Rates in Electrical Cabinets Fires'," ADAMS Accession No. ML12171A583). Include in this discussion:

a) Identification of all fire compartments/areas where a ZOI for a reduced HRR of 142 kW (75th percentile) was used. The guidance in the referenced June 21,2012,

memo indicates that a reduced HRR would be an exception supported by rigorous controls and restrictions. Please discuss how using a reduced HRR for almost all fire areas, if correct, is consistent with the guidance.

b) For each location (or group of similar locations) where a reduced HRR is credited, a description of the administrative controls that justify the reduced HRR including how location-specific attributes and considerations are addressed.

c) The results of a review of records related to violations of the transient combustible and hot work controls.

d) Confirm that 142 kW and 317 kW HRRs were the only transient fire sizes used in the FPRA.

PRA RAI 19

Section 2.4.3.3 of NFPA 805 states that the PRA approach, methods, and data shall be acceptable to the NRC. RG 1.205 identifies NUREG/CR-6850 as documenting a methodology for conducting a Fire PRA and endorses, with exceptions and clarifications, NEI 04-02, Revision 2, as providing methods acceptable to the staff for adopting a fire protection program consistent with NFPA-805. Methods that have not been determined to be acceptable by the NRC staff or acceptable methods that appear to have been applied differently than described require additional justification to allow the NRC staff to complete its review of the proposed method.

The Main Control Board (MCB) is described as having a horshoe arrangement that is fully enclosed and is effectively a sub-enclosure. The analysis of MCB fires treats the front and back panels of the horseshoe as an integral part of the MCB. Address the following with regard to MCB fire scenarios:

a) Provide justification for this treatment by describing the MCB sub-enclosure configuration, including addressing the following MCB configuration questions:

- Are the overall back and front sides of the horseshoe bolted together as a single piece? Does the MCB have its own ceiling, visible from walking down the corridor separating the front and back sides, separate from that of the MCR?

- Are there cables connecting the front and back sides of the MCB?

- Are the front and back sides of the MCB divided by panels?

b) Describe how MCB fire scenarios are postulated and evaluated, including how the fire ignition frequency is determined for each scenario, how NUREG/CR-6850 Appendix L is applied to individual scenarios, how partitions between panels/cabinets are treated if credited, and how propagation between the front and back sides of the MCB is evaluated including identification of and evaluation of damage to target sets.

PRA RAI 20

Section 2.4.3.3 of NFPA 805 states that the PRA approach, methods, and data shall be acceptable to the NRC. RG 1.205 identifies NUREG/CR-6850 as documenting a methodology

for conducting a Fire PRA and endorses, with exceptions and clarifications, NEI 04-02, Revision 2, as providing methods acceptable to the staff for adopting a fire protection program consistent with NFPA-805. Methods that have not been determined to be acceptable by the NRC staff or acceptable methods that appear to have been applied differently than described require additional justification to allow the NRC staff to complete its review of the proposed method.

The licensee's analysis appears to indicate that fires within some Bin 15 cabinets above 440V [e.g., motor control centers (MCCs)], are not assumed to propagate outside of the cabinet. In addition, it is indicated that the damage for some well-sealed MCC fires is limited through the application of a 0.20 severity factor. Guidance in Frequently Asked Question 08-0042 from Supplement 1 of NUREG/CR-6850 applies to electrical cabinets below 440 V. With respect to Bin 15 as discussed in Chapter 6, it clarifies the meaning of "robustly- or well-sealed" when used in conjunction with these lower voltage cabinets. For those cabinets of 440 V and higher, the original guidance in Chapter 6 remains: "Also note that panels that house circuit voltages of 440 V or greater are counted because an arcing fault could compromise panel integrity (an arcing fault could burn through the panel sides, but this should not be confused with the high energy arcing fault type fires)." Therefore, propagation of fire outside the ignition source panel must be evaluated for all Bin 15 panels that house circuits of 440 volts or greater.

a) Describe how fire propagation outside of well-sealed cabinets greater than 440 V is evaluated.

b) Clarify under what circumstances the 0.20 severity factor is used, how it is used, and what is the justification.

c) Clarify whether, contrary to the guidance in Chapter 6, well-sealed cabinets less than 440 V are included in the Bin 15 count thereby reducing the frequency assigned to the remaining cabinets.

PRA RAI 21

Section 2.4.3.3 of NFPA 805 states that the PRA approach, methods, and data shall be acceptable to the NRC. RG 1.205 identifies NUREG/CR-6850 as documenting a methodology for conducting a Fire PRA and endorses, with exceptions and clarifications, NEI 04-02, Revision 2, as providing methods acceptable to the staff for adopting a fire protection program consistent with NFPA-805. Methods that have not been determined to be acceptable by the NRC staff or acceptable methods that appear to have been applied differently than described require additional justification to allow the NRC staff to complete its review of the proposed method.

A severity factory of 0.20 is applied to all MCA scenarios "to account for the probability that only 1 in 5 fires are expected to challenge the zone boundary." This is an industry average-type factor that does not account for the design-specific considerations and potential for hot gas layer (HGL) formation at MNS. In addition, a barrier failure probability of 7.4E-03 is also applied to all MCA scenarios, which only accounts for the barrier having the highest probability of failure (e.g., non-rated barrier, door, damper, or wall)."

a) Is the 0.20 factor only applied when there is a rated fire barrier? If not provide further justification of the use of any factor.

b) Provide further justification for the use of the 0.2 severity factor and single barrier failure probability appropriately accounting for the MNS-specific design and potential

for HGL formation potential in the MCA, or provide updated risk results as part of the aggregate change-in-risk analysis requested in PRA RAI 03 without the severity factor and summing the barrier failure probabilities for each type of barrier present per NUREG/CR-6850.

PRA RAI 22

Section 2.4.3.3 of NFPA 805 states that the PRA approach, methods, and data shall be acceptable to the NRC. RG 1.205 identifies NUREG/CR-6850 as documenting a methodology for conducting a Fire PRA and endorses, with exceptions and clarifications, NEI 04-02, Revision 2, as providing methods acceptable to the staff for adopting a fire protection program consistent with NFPA-805. Methods that have not been determined to be acceptable by the NRC staff or acceptable methods that appear to have been applied differently than described require additional justification to allow the NRC staff to complete its review of the proposed method.

The RCP oil collection system is credited with limiting the amount of oil involved in postulated RCP pump oil fire scenarios. However, RCP oil collection systems are required by Appendix R (and Section 3.1 of NFPA 805) and so their function to contain RCP oil spills and, hence, associated fires is already accounted for in the fire events database. Furthermore, the treatment of oil fires involving 10% of the pump oil capacity should be based on an appropriate ZOI not just limited to damage to the pump itself (i.e., "B2" endstate). Provide justification for this treatment of RCP oil fires.

PRA RAI 23

Section 2.4.3.3 of NFPA 805 states that the PRA approach, methods, and data shall be acceptable to the NRC. RG 1.205 identifies NUREG/CR-6850 as documenting a methodology for conducting a Fire PRA and endorses, with exceptions and clarifications, NEI 04-02, Revision 2, as providing methods acceptable to the staff for adopting a fire protection program consistent with NFPA-805. Methods that have not been determined to be acceptable by the NRC staff or acceptable methods that appear to have been applied differently than described require additional justification to allow the NRC staff to complete its review of the proposed method.

The licensee's analysis dispositions how each MSO from the industry generic list was addressed in the FPRA model. This list is not consistent with the generic MSO list in Appendix G of NEI 00-01, Rev. 2 which, according to Attachment F of the LAR, may not have been the source of the generic MSO list used in the FPRA. Identify the MSOs in Appendix G of NEI 00-01, Rev. 2, that are not identified in Table A-1 of the Fire Model Development Report and describe how these are dispositioned in the FPRA model. Provide justification for any generic MSOs not identified in Table A-1 or provide updated risk results as part of the aggregate change-in-risk analysis requested in PRA RAI 03 that incorporates the additional MSOs in the FPRA model.

PRA RAI 24

Section 2.4.3.3 of NFPA 805 states that the PRA approach, methods, and data shall be acceptable to the NRC. RG 1.205 identifies NUREG/CR-6850 as documenting a methodology for conducting a Fire PRA and endorses, with exceptions and clarifications, NEI 04-02, Revision 2, as providing methods acceptable to the staff for adopting a fire protection program consistent with NFPA-805. Methods that have not been determined to be acceptable by the NRC staff or

acceptable methods that appear to have been applied differently than described require additional justification to allow the NRC staff to complete its review of the proposed method.

The MNS Fire PRA does not employ junction boxes based on scenario walk downs and due to utilization of armored cables, and therefore there were no Bin 18 fires assumed in the MNS Fire PRA. However, per FAQ 13-0006, it is noted that junction box frequencies should be included for both thermoplastic and thermoset cables as the fire event experience suggests that these fires start due to small arcs generated by bad connections, which is not influenced by the cable insulation or jacket type. Provide further justification for not including junction box fires in the fire PRA by specifically addressing the definition and characteristics of junction boxes in FAQ 13-0006. If the apportioning method used is not in conformance with the acceptable methods defined in NUREG/CR-6850 or FAQ 13-0006, provide a detailed justification for the alternate method that includes a discussion of conservatisms and non-conservatisms relative to the accepted methods and assesses the associated impacts on the fire total and delta risk results, or replace the current approach with an acceptable approach in the integrated analysis performed in response to PRA RAI 3.

PRA RAI 25

Section 2.4.3.3 of NFPA 805 states that the PRA approach, methods, and data shall be acceptable to the NRC. RG 1.205 identifies NUREG/CR-6850 as documenting a methodology for conducting a Fire PRA and endorses, with exceptions and clarifications, NEI 04-02, Revision 2, as providing methods acceptable to the staff for adopting a fire protection program consistent with NFPA-805. Methods that have not been determined to be acceptable by the NRC staff or acceptable methods that appear to have been applied differently than described require additional justification to allow the NRC staff to complete its review of the proposed method.

The fire ignition frequency (FIF) for transient fires caused by welding and cutting (TFWC) is apportioned based on the number of raceways in each compartment in lieu of cable loading per NUREG/CR-6850. Furthermore, the fire compartment FIF for TFWC is apportioned to multiple scenarios uniformly rather than with an NRC-accepted method such as FAQ 13-0005. Provide a detailed justification for these alternate methods that includes a discussion of conservatisms and non-conservatisms relative to the accepted methods and assesses the associated impacts on the fire total and delta risk results, or replace the current approach with an acceptable approach in the integrated analysis performed in response to PRA RAI 3.