UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

November 14, 2012

Mr. Brian J. O'Grady
Vice President-Nuclear and CNO
Nebraska Public Power District
72676 648A Avenue
Brownville, NE 68321

SUBJECT: COOPER NUCLEAR STATION – REQUEST FOR ADDITIONAL INFORMATION RE: LICENSE AMENDMENT REQUEST TO ADOPT NATIONAL FIRE PROTECTION AGENCY STANDARD NFPA 805 (TAC NO. ME8551)

Dear Mr. O'Grady:

By letter dated April 24, 2012 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML121220216), as supplemented by letter dated July 12, 2012 (ADAMS Accession No. ML12202A042), Nebraska Public Power District, (NPPD, the licensee), submitted a license amendment request to transition the fire protection licensing basis at the Cooper Nuclear Station, from paragraph 50.48(b) of Title 10 of the *Code of Federal Regulations* (10 CFR), to 10 CFR 50.48(c), National Fire Protection Association Standard NFPA 805.

The U.S. Nuclear Regulatory Commission (NRC) staff has reviewed the information provided in your application and determined that additional information is required in order to complete its review. A draft copy of the enclosed request for additional information (RAI) was provided to Mr. Edward McCutchen and Mr. William Victor of your staff via e-mail on October 9, 2012. A clarifying call was held on October 18, 2012. During this call, Mr. Victor indicated that the responses to the RAIs would be provided within 60 days of receipt of this letter except the following:

- Responses will be provided within 90 days for:
  - Fire Protection RAI 06;
  - Probabilistic Risk Assessment RAIs 06, 11, 13, 15, 16e, and 32;
  - Radioactive Release RAI 03;
  - Fire Modeling RAIs 01a, b, f, h, 02c, d, and e.
- Response provided within 90 days for Fire Modeling RAI 02b.

The NRC staff has no objections to the staggered response times.

If you have any questions, please contact me at 301-415-1377 or via e-mail at lynnea.wilkins@nrc.gov.

Sincerely,

Lynnea E. Wilkins, Project Manager
Plant Licensing Branch IV
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

Docket No. 50-298

Enclosure:
As stated

cc w/encl: Distribution via Listserv

REQUEST FOR ADDITIONAL INFORMATION

LICENSE AMENDMENT REQUEST TO ADOPT NATIONAL FIRE PROTECTION ASSOCIATION STANDARD 805, "PERFORMANCE-BASED STANDARD FOR FIRE PROTECTION FOR LIGHT WATER REACTOR GENERATING PLANTS," 2001 EDITION

NEBRASKA PUBLIC POWER DISTRICT

COOPER NUCLEAR STATION

DOCKET NO. 50-298

By letter dated April 24, 2012 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML121220216), as supplemented by letter dated July 12, 2012 (ADAMS Accession No. ML12202A042), Nebraska Public Power District, (NPPD, the licensee), submitted a license amendment request (LAR) to transition the fire protection licensing basis at the Cooper Nuclear Station, from paragraph 50.48(b) of Title 10 of the *Code of Federal Regulations* (10 CFR), to 10 CFR 50.48(c), National Fire Protection Association Standard NFPA 805, "Performance Based Standard for Fire Protection for Light Water Reactor Generating Plants."

The U.S. Nuclear Regulatory Commission (NRC) staff has reviewed the information provided in your application and determined that the following additional information is required in order to complete its review.

Safe Shutdown (SSD)

SSD RAI 01

By letter dated April 24, 2012, LAR Section 4.2.1.1 identifies that the nuclear safety capability assessment (NSCA) methodology review evaluated the existing post-fire safe shutdown analysis methodology against the guidance for transitioning to NFPA 805, provided in Nuclear Energy Institute (NEI) 00-01, Rev. 1, "Guidance for Post-Fire Safe Shutdown Circuit Analysis," and the subsequent performance of a gap analysis to identify impacts from NEI 00-01, Rev. 1 to Rev. 2. Please provide a summary of the technical issues from the gap analysis from NEI 00-01, Rev. 1 to Rev. 2., including the following:

a. NEI 00-01, Rev. 2, Section 3.2.1.2 describes that any post-fire operation of a manual rising-stem valve that has been exposed to fire conditions should be well justified. Please identify instances where it is necessary to manually operate valves post-fire that are located in the fire area of concern and may have been exposed to the fire.

b. NEI 00-01, Rev. 2, Section 3.5.1, requires consideration of proper-polarity hot shorts in certain direct current (DC) control circuits for non-high-low pressure

interface components. Please identify whether proper-polarity dc shorts in non-high-low pressure interfacing components are considered.

SSD RAI 02

LAR Section 4.2.1.2 describes actions necessary to achieve and maintain safe and stable conditions for the first 24 hours; however, no description is provided of the actions and resources required to maintain safe and stable conditions beyond the 24-hour coping period.

a. Please describe the specific capabilities that will be required to meet the performance criteria beyond 24 hours.

b. Please describe any system or component capacity limitations and time-limited actions needed replenish systems, make repairs, or otherwise maintain safe and stable conditions, (e.g. nitrogen supply for automatic depressurization system safety relief valves (ADS SRVs), DC battery power, etc.).

c. Please describe whether there are any actions to recover nuclear safety capability analysis (NSCA) equipment to sustain safe and stable conditions. Please describe the resource (staffing) requirements and timing of these actions.

d. Please describe how the feasibility of the actions in b and c above are evaluated or addressed.

e. Please provide a more detailed discussion of the risk of failure of the actions necessary to sustain safe and stable conditions beyond 24 hours.

f. LAR Section 4.2.1.2 states, "For the plant to be in a safe and stable condition, it may not be necessary to perform a transition to cold shutdown as currently required under 10 CFR 50, Appendix R. Therefore, the unit may remain at or below the temperature defined by a hot shutdown plant operating state for the event." Please confirm that the NSCA does not require the plant to achieve cold shutdown to be in a safe and stable condition or confirm that the NSCA has included cold shutdown equipment and procedures in the analysis. Also, please define the term "event" in the context of the statement in Section 4.2.1.2 as it applies to achieving and maintaining safe and stable conditions.

SSD RAI 03

LAR Attachment D describes the methods to identify and resolve pinch-points identified from the non-power operation (NPO) transition review. Please provide a response to the following:

a. Please provide a description of any actions being credited to minimize the impact of fire-induced spurious actuations on power operated valves (e.g., air-operated valves (AOVs) and motor operated valves (MOVs)) during NPO either as pre-fire configuring or as required during the fire response recovery (e.g., pre-fire rack-out and isolation of air supplies).

b. Please identify the locations where key safety functions (KSFs) are achieved solely by recovery actions (RAs) or for which instrumentation not already included in the at-power analysis is needed to support RAs required to maintain safe and stable conditions. Please identify those RAs and instrumentation relied upon in NPO and describe how RA feasibility is evaluated. Also, please include in the description whether these variables have been or will be factored into operator procedures supporting these actions.

SSD RAI 04

Attachment V of the LAR, provides discussion of an incipient detection system to be installed (Attachment S, Implementation Item S-2.4), based on insights from analyses for two panels (9-32 and 9-33) in the Auxiliary Relay Room (ARR) (part of fire area CB-D). This incipient detection system is to provide indication in the Control Room (CR) so that an operator/auxiliary operator can respond to the ARR confirm that the incipient detector for one of these panels has activated, and inform the CR. Please describe the necessary immediate actions by the CR operators to these incipient detection alarms and how these actions mitigate the circuit failures of concern. Also, please describe the longer term RAs remaining given confirmation of activation of detector.

SSD RAI 05

LAR Attachment G describes the method used to transition operator manual actions (OMAs) as RAs. Please provide additional discussion and details of the following RAs:

a. Fire Area CB-D – VFDR CBD-07: repair of the 125VDC and 250VDC train B battery charger cables.

b. Fire Areas CB-D and RBCF – VFDRs CBD-10 and RBCF-05: lifting leads to secure power to valves: RW-AOV-AO82, RW-AOV-AO94.

c. Fire Area CB-A - VFDR CBA-01 – please address why is there no RA for the repair of the fuel oil transfer pump, which is an existing action under Appendix R and included in the Fire Probabilistic Risk Assessment (FPRA) (Attachment V SR: SY-A24).

SSD RAI 06

LAR Attachment S, Implementation Item S-3.6 describes confirmatory walk downs of the feasibility of RAs following completion of procedure changes to incorporate NFPA 805 actions. Implementation Item S-3.6(2) addresses validation of execution times to physically perform the action. Please describe the extent to which the actions will be validated (e.g., opening of cabinets to access components and verifying the components can be operated as described). In addition, please describe whether there are procedures that address the performance and acceptance criteria for the procedure validations being performed during these confirmatory walk downs.

SSD RAI 07

LAR Attachment F, "Fire-Induced Multiple Spurious Operations Resolution," states (under Results of Step 2), "The analysis was updated in January 2011 without reconvening the expert panel." Please provide additional discussion of the January 2011 update of the multiple spurious operation (MSO) analysis and the process used for this update.

SSD RAI 08

LAR Attachment C describes a means of meeting ventilation cooling requirements for various components (e.g., VFDR CBD-05: EE-BAT-125-1B, EE-BAT-250-1B, EE-SWGR-125B, EE-SWGR-250B; VFDR CBA1-01: EE-SWGR-125B, EE-BAT-124B; VFDR CBB-01: EE-PNL-CDP1A, EE-MCC-LX) via open compartments. Please describe whether these compartments require actions to open doors or other features. If these actions are required, please describe whether feasibility has been reviewed and whether these actions should be included in LAR Attachment G as RAs. Also, please describe if any other heating ventilation and air conditioning (HVAC) RAs are credited.

SSD RAI 09

Numerous RAs identified in LAR Attachment G, document the removing of fuses and operation of MOVs using the motor starter. Use of the motor starter from the motor control center (MCC) bypasses the protective functions of the torque and limit switches. Application of stall thrust to MOVs may cause structural damage to the valve (stem, yoke, stem nut, etc.). Please describe the procedural guidance and training provided to the operators to assure that the valve will be positioned to the desired position. Also, please describe how the process prevents damage to the valve/actuator due to overtorque/overthrust.

Fire Protection Engineering (FPE)

FPE RAI 01

LAR Section 4.1.2.3 lists NFPA 805 Chapter 3 elements for which approval is requested via 10 CFR 50.48(c)(2)(vii) but does not include Element 3.3.3. Chapter 3, Element 3.3.3 is included in Attachment A as "Submit for NRC Approval," and also in Attachment L as Approval Request 2. Please confirm that NRC approval is requested for NFPA 805 Chapter 3, Element 3.3.3.

FPE RAI 02

LAR Attachment I identifies "Yard" as a Building /Structure in the Power Block. Please identify the structures and explicitly define the needed pieces of equipment included in the Yard in a more detailed list.

FPE RAI 03

Table 4-3, (Fire Areas CB-D and RB-M), Attachment C, and Attachment S (Modifications S-2.5, -2.6, and -2.7) identify existing and planned installations of radiant energy and flame impingement shields (e.g., Promat-H board) as features required for risk. For each of the existing or planned installations of radiant or flame impingement shields, please provide additional information and a description regarding the design of the shields, the installation configuration, and the protection function that is credited in the NFPA 805 analyses. Include descriptions of the fire exposure assumed in determining the acceptability of the shields to meet the protection function. Describe the additional fire protection systems, if any, provided in these areas

FPE RAI 04

LAR Attachment A, Section 3.2.3, states, "Complies with Required Action." Attachment S, Table S3, Item S-3.1 states that performance based surveillance frequencies will be established as described in Electric Power Research Institute (EPRI) Technical Report 1006756, "Fire Protection Surveillance Optimization and Maintenance Guide for Fire Protection Systems and Features." The use of performance-based methods to meet the requirements of NFPA 805, Chapter 3 requires NRC approval in accordance with 10 CFR 50.48(c)(2)(vii).

a. Please describe how the guidance in EPRI Technical Report 1006756 will be integrated into the NFPA 805 monitoring program.

b. Please discuss your plans for complying with 10 CFR 50.48(c)(2)(vii) regarding the use of EPRI Technical Report 1006756.

FPE RAI 05

LAR Attachment A, Section 3.3.5.1 and Attachment L, Approval Request 3, requests NRC approval for minor amounts of wiring located above suspended ceilings that does not meet

qualification criteria and is not installed in conduit. Please provide the following additional information:

a. Please describe the specific circuits associated with the unqualified wires or cables (e.g., type, voltage, communication, data, signal, etc.).

b. Please describe whether the areas above the suspended ceilings are provided with fire detection or suppression.

c. Please provide additional details describing the visual inspection for ignition sources above the suspended ceilings and indicate if the inspection was considered comprehensive.

d. Please state if the wires and cables that do not meet the qualification criteria of LAR Attachment A, Section 3.3.5.1, meet Institute of Electrical and Electronics Engineers (IEEE) 383, "Standard for Type Test of Class 1E Electric Cables, Field Splices, and Connections for Nuclear Power Generating Stations," or other qualification standards. If so, please indicate the other standards.

e. Please provide additional discussion of "minimal amount" as used in the "Acceptance Criteria Evaluation."

f. Please describe the pathway for smoke above the suspended ceiling. If the area is a plenum, describe the exhaust path and whether it is part of a smoke purge system.

g. Please provide discussion of the subject wiring installations relative to fire areas containing nuclear safety capability systems and equipment. Also, identify if any NSCA cables are routed in the areas above suspended ceilings where unqualified cables are located.

FPE RAI 06

LAR Attachment A, Section 3.6.1, and Attachment L, Approval Request 7, requests NRC approval of deviations from NFPA 14, "Standard for the Installation of Standpipe and Hose Systems," regarding the design and installation of standpipes and hose systems. The Attachment L Acceptance Criteria Evaluation for NFPA 14, Section 322, states that the subject fire zones can be reached with a maximum of 50 feet of hose in addition to the 100 feet required by the standard. Please confirm that the hydraulic calculations for the standpipe system demonstrates acceptable pressure and flow conditions at the nozzle with the head-loss associated with 150 feet of hose.

FPE RAI 07

LAR Attachment A, Element 3.5.6 Compliance Statement, states, "Submit for NRC Approval"; however, this element is not cited in the Approval Request. Please clarify that Attachment L, Approval Request 6 also applies to NFPA 805, Section 3.5.6.

FPE RAI 08

Attachment S, Table S-3, Implementation Item S-3.2 establishes "enhanced transient and combustible controlled zones" in high-risk Fire Zones 8A (cable spreading room (CSR)), 9A (Relay Room), 2C above the (traversing incore probe (TIP) Room, 3C, and 3D in the areas around instrument racks 25-5 and 25-6. Please describe the assumptions made for these "enhanced transient and combustible controlled zones" and the types of controls to be put in place relative to other combustible control zones.

Implementation Item S-3.25 identifies the designation of "enhanced transient and hot work controlled fire zones". Please define "enhanced transient and hot work controlled fire zones" and specify what controls will be put in place. Also, describe what it means to "restrict" hot work in the context of these enhanced zones.

FPE RAI 09

LAR Section 4.5.2.2 and Figure 4-7 summarizes the approach to evaluating defense-in-depth (DID) and safety margin in the resolution of variance from deterministic requirements (VFDRs). Under the heading, "Disposition of VFDR," the LAR indicates the results of the risk evaluation, DID, and safety margin are summarized in Attachment C. Attachment C does not include discussion or summary of DID and safety margin for the individual VFDRs or on a fire area basis. Please provide additional discussion of the methods and criteria for evaluating DID and safety margins and summarize the results as required by NFPA 805, Section 4.2.4.2.

FPE RAI 10

Attachment S, Item S-2.4, identifies a modification to install incipient detection in two panels in the ARR. Because of the various vendor types of "incipient detection systems," please provide a description of the incipient detection system that will be installed, including a discussion of the design, installation and testing criteria provided in frequently asked question (FAQ) 08-0046, "Incipient Fire Detection Systems" (ADAMS Accession No. ML093220426). Please describe the compensatory measures necessary in the period between post-transition and prior to completion of the modification, or during incipient detection outages, that will provide the necessary early detection and response as credited in the FPRA.

FPE RAI 11

LAR Section 4.2.2 describes the process and criteria used to evaluate Existing Engineering Equivalency Evaluations (EEEEs) to determine that a fire protection system or feature is "adequate for the hazard." None of the summaries of the EEEEs cited in LAR Table B-1 or described in LAR Table B-3 state that the basis of acceptability of remains valid. Please provide an explicit statement that the credited EEEEs were determined to meet the NEI 04-02, "Guidance for Implementing a Risk-Informed, Performance Based Fire Protection Program Under 10 CFR 50.48(c)," criteria and that the basis of acceptability of previous EEEEs remains valid.

FPE RAI 12

There appears to be inconsistencies between LAR Attachment A (Table B-1) and Attachment S. Examples include:

> Table B-1, Sections 3.3.1.2 Control of Combustibles, 3.3.1.3.1 Control of Ignition Sources, 3.4.2 Fire Pre-Plans, are affected by implementation items listed in Attachment S, but do not reflect the compliance category "complies with required action."
>
> Attachment S implementation Items S-3.2 and S-3.25 are associated with enhanced combustible and hot work controls, and Item S-3.20 is associated with pre-fire planning, but are not identified in the associated sections of Table B-1 described above.

a. Please clarify that these selected Table B-1 sections "comply with required action" as appropriate.

b. Please provide the results of an extent of condition review that identifies all situations where implementation items are identified and ensure that the appropriate compliance strategy ("complies with required action") is reflected as required in the transition report (B-1 Table).

FPE RAI 13

LAR Attachment L, Approval Request 5, requests NRC approval of the bulk hydrogen storage configuration. NFPA 805, Section 3.3.7.2 applies to outdoor storage of high-pressure flammable gas containers. The licensee describes the bulk hydrogen storage as being in a separate structure. Please describe how the configuration of the bulk storage of hydrogen gas is a deviation from the requirements of NFPA 805, Section 3.3.7.2.

FPE RAI 14

With regard to LAR Attachment L, Approval Request 6, please describe indications available to the CR operators in the event of electric fire pump failure to start while the diesel fire pump is locked out from starting. For example, please describe if there is an alarm or indication of low fire water system pressure.

FPE RAI 15

Please describe the post-transition NFPA 805 compliance basis for LAR Attachment A, Element 3.2.3, since the stated technical specification (TS) section cited in the compliance basis will be deleted during transition.

FPE RAI 16

Attachment L, Request 3 states that it is similar to the request made by Arkansas Nuclear One (ANO), Unit 2. However, that request contains an error, as stated below:

> Power and control cables at ANO are IEEE-383-1974 or equivalent. FAQ 06-0022 identified acceptable electrical cable construction tests. Plenum rated cable is tested to NFPA 262, "Standard Method of Test for Flame Travel and Smoke of Wires and Cables for Use in Air-Handling Spaces," and the FAQ concluded that the NFPA 262 test is equivalent to the IEEE-383-1974 test. Therefore, IEEE cable is inherently equivalent to plenum rated cable and acceptable to be routed above suspended ceilings. [emphasis added]

While FAQ 06-0022, "Electrical Cable Flame Propagation Tests" (ADAMS Accession No. ML091240278), documented the fact that NFPA 262 is a more stringent fire test than IEEE-383, the reverse is not true. Just because a cable passes the IEEE-383 flame test does not mean that it can pass NFPA 262.

Please describe whether the assumption of equivalence between the IEEE-383-1974 and NFPA 262 tests is relied upon. If the assumption is relied upon, please revise the request as needed (i.e., clarify that this is no longer the case).

FPE RAI 17

Please provide the NRC citations that establish the previous approval for LAR Attachment A, Elements 3.4.1(a) and 3.6.4.

FPE RAI 18

Please describe and justify why the dry well is not included in LAR Attachment C (B-3 Table) and Table 4-3. Alternatively, revise the tables to include this fire area.

Probabilistic Risk Assessment (PRA)

RAI-01 Internal Events PRA F&Os

Please clarify the following dispositions to Internal Events (IE) PRA Facts and Observations (F&Os) identified in Attachment U of the LAR that appear to have the potential to noticeably impact the FPRA results and do not seem fully resolved:

a. F&O against HR-G7: Dependencies between multiple human actions in the same cutset appear not to be evaluated in all cases. Please discuss in more detail the F&O examples. Include a discussion of the use of Human Error Probability (HEP) "floors" in the Human Reliability Analysis (HRA) dependency analysis.

b. F&O against HR-I3, DA-E3, IE-D3, IF-F3, and SC-C3: The requirement to document key assumptions and sources of uncertainty appears not to have been met for a number of PRA elements. Please describe how key assumptions and sources of uncertainty were identified and documented for the PRA elements cited in these F&Os. Include in this description, identification of criteria used to judge the importance of assumptions and whether any sensitivity studies were performed as a result.

c. F&O against QU-E3: Please discuss the F&O disposition and why the finding has no impact. Specifically, please clarify if a state-of-knowledge correlations (SOKC) of failure rates using plant specific data was performed. Please clarify that for component failures based on the same plant-specific data, SOKC was taken into account.

d. F&O against AS-A2: Please confirm that examination of thermo-hydraulic analysis demonstrates that event sequences modeled in the PRA reach a stable state.

e. F&O against SY-A4: It is not clear that since the individual plant evaluations (IPEs) if walkdowns and interviews with plant engineers and operators have been specifically performed to support the PRA. Please describe the system walkdowns and interviews that have been performed to confirm that the PRA system analysis reflects the as-built, as-operated plant.

f. F&O against QU-D4. Please describe the reasonableness review performed on the non-significant cutsets for the PRA results supporting the LAR.

g. F&O against QU-S5. Please describe the limitations that were identified for the quantification process and how they are addressed in the PRA.

PRA RAI-02 Fire PRA F&Os

Please clarify the following dispositions to FPRA F&Os and supporting requirement (SR) assessment identified in Attachment V of the LAR that appear to have the potential to noticeably impact the FPRA results and do not seem fully resolved:

a. F&O 4-1 against PP-B2: In response to this F&O, a review of the justification of partitioning between fire zones was performed for screened fire zones. Please describe the criteria used to determine whether a barrier is "substantial enough to preclude fire spread to adjacent fire zones within the fire compartment." Please clarify the difference, if any, between barriers defined for zones and those defined for fire compartments (i.e., the physical analysis units). Include in this clarification a discussion of how elements of partitioning were considered for fire zones. In particular, please discuss how ducting, spatial separation, and localized protection features were considered.

b. F&O 5-2 against CS-A7: The disposition to this F&O states that Kerite was treated as thermoset material with respect to flame spread and heat release rate (HRR) but treated as thermosplastic with respect to damaging heat flux. The FPRA peer review report provides the following reviewer's elaboration on this F&O:

> FAQ 08-0053 was generated by CNS to justify consideration of Kerite cable as thermoset. Recent testing conducted by NRC tends to indicate that Kerite cable should be treated as thermosplastic. However, a final determination has not been made as FAQ 08-0053 is still open.

FAQ 08-0053, "Kerite-FR Cable Failure Thresholds," has now been finalized and a closure memo dated June 6, 2012, issued by the NRC (ADAMS Accession No. ML121440155). The closure memo recommends, based on experimental evidence from NUREG/CR-7102, "Kerite Analysis in Thermal Environment of Fire (KATE-Fire); Test Results-Final Report," December 2012 (ADAMS Accession No. ML11333A033), "that a temperature of 477 °F (247 °C [degrees Celsius]) be assumed as the minimum threshold of electrical failure for Kerite-FR cables. Please discuss the following:

i. Please describe the use of Kerite, identify locations it is credited in the PRA, and explain how Kerite cables are treated in the FPRA. Specifically, please clarify what damaging heat flux values (e.g., 205 °C or 372 °C) and what HRR values (see Section 7.4 of NUREG/CR-7102) were used (e.g., 150 or 250 kiloWatt (kW) per square meter (m^2)) for the justification for these values.

ii. Please provide the results of a sensitivity analysis showing the impact on the PRA results (total and delta core damage frequency (CDF) / large early release frequency (LERF)) from evaluating Kerite-FR as

thermoplastic material using the recommended temperature from the FAQ 08-0053 closure memo.

c. F&O 4-10 against PRM-B11: The FPRA peer review report presents the reviewers' recommended resolution to this F&O: that instrument indication requirements be added directly the fault tree logic in an AND-gate with the corresponding operator actions. The disposition to this F&O explains that instruments (i.e., indication) required for diagnosis are addressed in the HRA, and if the cables for those indications have not been traced the failure of the corresponding HEP is set to 1.0. Please clarify how indications needed for diagnosis, and associated instrumentation, are identified and documented in the fire PRA, and explain how random failures of those instruments are addressed.

d. F&O 5-12 against FSS-F1: In response to this F&O an update to Calculation NEDC 09-090 (Exposed Structural Steel) was performed that addresses fire impact on the steel columns caused by oil cascading to a lower elevation. Please describe the update to the calculation, assumptions made about the size of the oil spill, and the basis for those assumptions.

e. F&O 6-2 against FSS-E4: This F&O indicates that the uncertainty and sensitivity report (Task 7.15 Uncertainty and Sensitivity Analysis) makes no mention of assumed cable routes, even though it states that cable routing could be the source of uncertainty. Please discuss the extent to which assumed cable routes are factors in the FPRA and, if the cable routes are assumed, describe the impact of these assumptions on risk estimates.

f. F&O 6-15 against FSS-H5: The disposition to this F&O cites NEDC 08-041 (Main Control Room Abandonment) as addressing the fire spread between Main Control Board (MCB) panels and electrical panels in the main control room (MCR). Please discuss the modeling of both MCB and electrical panels, including the following:

   i. Where it is assumed that fire does not propagate between open back cabinets, please confirm that there is no cable run between the exposing and exposed panels.

   ii. Neither NEDC 08-041 nor NEDC 10-001 discuss the treatment of sensitive electronics. Please explain the extent to which sensitive electronics are installed, both in the MCR and elsewhere in the plant, and how sensitive electronics were treated in the PRA. Please clarify if the treatment of sensitive electronics is in accordance with NUREG/CR-6850, "EPRI/NRC-RES Fire PRA Methodology for Nuclear Power Facilities," and discuss the sensitivity of the PRA results to the NUREG/CR-6850 treatment of sensitive electronics.

g. F&O 1-9 against HR-G1: This F&O indicates that there was a number of significant human failure events (HFEs) for which screening values were applied.

Please clarify what significant HFEs were assigned high failure probabilities and provide the bases for those values.

h. F&O 1-17 against QU-E3: The disposition for this F&O provides a detailed explanation of why quantitative uncertainty results are not provided as part of the FPRA results and appears to present an informal estimate of the risk uncertainty that concludes with the following statement: "a reasonable estimate of the uncertainty interval is minus 10 to plus 5 on the calculated mean value, where the mean is estimated to be on the order of a factor of 5 to10 lower than calculated." Attachment W of the LAR states that "calculated values are estimated to be conservative by a factor of 5 to 10..... Thus better estimates of CDF and LERF are <~1E-5/yr and <~2E-6/yr." This statement in Attachment W seems to indicate that parametric data uncertainty was propagated and that the risk estimates in Attachment W are a calculated mean based on propagation of parametric uncertainty referred to in the F&O disposition. Please clarify how parametric uncertainty was propagated and how the risk values in LAR Attachment W were determined.

i. Assessment against SY-A24: This SR assessment comes from the FPRA peer review SR Summary assessment table (i.e., Appendix B) against SY-A24. (Attachment V-2 of the LAR does not attribute an F&O to this SR assessment.) The disposition to the assessment of this SR acknowledges that the fire PRA includes repair of battery charters and diesel generator fuel oil transfer pumps which are supported by procedures, pre-staged equipment, and timing assessments. The requirement of SR SY-A24 is "DO NOT MODEL the repair of hardware faults, unless the probability of repair is justified through an adequate analysis or examination of data." Repairing equipment damaged by fire would appear to be difficult to proceduralize. Please describe the basis for the determination of the HEPs for these repairs. As part of this description, please discuss the procedure for performing these repairs and how it addresses the variability and uncertainty presumably associated with fire damage. Additionally, please discuss to what extent examination of data was performed to support determination of these HEPs.

j. Assessment against SY-A6: This SR assessment comes from the FPRA peer review SR Summary assessment table (i.e., Appendix B) assessment SY-A6 (Attachment V-2 of the LAR does not attribute an F&O to this SR.) This assessment indicates that instrumentation may need to be added to system boundary definitions for the FPRA. The disposition to this SR noncompliance explains that new components were added to system definitions for the FPRA. Please describe what components were added to the system boundary definitions, whether instruments were included, and the criteria for adding new components.

k. Assessment against PRM-B9: This SR assessment comes from the FPRA peer review SR Summary assessment table (i.e., Appendix B) assessment PRM-B9 (Attachment V-2 of the LAR does not attribute an F&O to this SR). Significant

changes were made to the Internal Events PRA (IEPRA) models to produce the FPRA models, but it is difficult to review and judge completeness of these models given that this information resides in various reports not parallel to the internal events systems analysis. As a result, it is difficult to determine that this SR and associated ones (e.g., SY-A2, SY-A3, SY-A4, SY-A6, SY-A12, and SY-A24) are met. Please discuss the extent of PRA model changes made since the peer review and whether these changes constitute a "PRA Upgrade" as defined in the American Society of Mechanical Engineers/American Nuclear Society (ASME/ANS) PRA standard and clarified in NRC Regulatory Guide (RG) 1.200, "An Approach For Determining the Technical Adequacy of Probabilistic Risk Assessment Results For Risk-Informed Activities."

l. F&O 4-5 against PRM-B9: If the failure mode "Fails to Remain Open/Closed" is not modeled in the IEPRA model, please discuss how it is assured that this failure mode is considered for the FPRA model.

m. F&O 1-30 against FSS-E3: Please provide detailed justification describing why only meeting Cat I, and not Cat II, is acceptable for this application.

n. F&O 4-22 against HRA-A4: The disposition appears to suggest that the focus of the interviews were on select dominant sequences rather than relevant actions identified in SR HRA-A1, HRA-A2, and HRA-A3. Please clarify how the interviews satisfy the requirements of HRA-A4 with regard to the cited SRs.

o. F&O 2-15 against HR-G7: Please discuss how the peer review observation was addressed that "The current quantification method does not use higher HEP values in quantification and does not apply recovery file that includes HEP combination events."

p. F&O 7-8 against QU-D6: The disposition mentions that the CDF and LERF cutsets were not merged. Please discuss how reasonableness reviews were performed for CDF and LERF cutsets.

q. F&O 8-6 against LE-G3: It is not clear how the disposition addresses the peer review finding on documenting LERF contributions. Please clarify how the contributions to LERF were documented.

r. F&O 7-8 against QU-D7: Please discuss what was reviewed, what results were reviewed, and the conclusions from the review.

s. F&Os 7-8 and 8-2 against QU-F3: Please explain how it is known if the significant basic events are reasonable.

PRA RAI-03 PRA Modeling of VEWFDS

LAR Attachment V, first paragraph of Section V.2, states that the very early warning fire detection system (VEWFDS) was modeled using FAQ 08-0046, with the exception that "rather

than modeling the increased potential for suppressing the fire, the analysis only modeled the early detection and then applied human reliability analyses to model operator response to the early detection." As indicated, the guidance in FAQ 08-0046 is meant for determining increased probability of fire suppression, not to determine the probability of shutdown from the MCR before forced abandonment. The discussion on page V-3 indicates that two operator actions are credited. A probability of 0.01 is assigned to the failure of operators to confirm the situation locally and report back to the MCR. A probability of 0.01 is also assigned to the failure of MCR operators to respond using procedures for these panels. Attachment S (see Item S-2.4) states that crediting these actions allows for shutdown from the CR with minimal field actions and a lower CCDP (i.e., 0.0127) than if the alternate shutdown room (ASD) is modeled (0.1). However, these operator actions are not the actions defined in the FAQ-08-0046 Event Tree. Accordingly, it is not clear a probability of 0.01 is an appropriate probability for these operator failures. No HRA is presented or referenced. In light of the significant risk reduction from VEWFDS (in combination with these HEPs), please provide the basis for these operator error probabilities. As part of this basis, please Include a complete description of the required operator actions and the basis for the HEPs. In addition, please clarify if the two cabinets where the VEWFDS is being installed are "sealed" cabinets per NUREG/CR-6850 and FAQ 08-0042, "Fire Propagation from Electrical Cabinets" (ADAMS Accession No. ML092110537), and, if not, please justify why the fire is not postulated to propagate to adjacent cabinets.

PRA RAI-04 Transient Fire Heat Release Rate

LAR Attachment V identifies that the Cable Spreading Room (CSR) and HRR have been designated enhanced transient and hot work controlled fire zones, and therefore a reduction (beyond NUREG/CR-6850 recommendations) from 317 kW to 69 kW is made for transient fires analyzed in these areas. Please provide additional justification for the use of 69 kW transient fires in these fire zones. Specifically, please address the specific attributes and considerations applicable to the location, plant administrative controls, the results of a review of records related to violations of the transient combustible controls, and any other key factors for this reduced fire size. If the HRR cannot be justified using the guidance criteria, please discuss the impact on the analysis.

PRA RAI-05 Flame and Radiant Heat Shields

Table 4-3 of the LAR identifies "flame impingement shields" and "radiant energy shields" as features of the Fire Protection Program (FPP). Although Table 4.3 indicates that these shields are credited as "Required for Risk Significance," it is not clear whether they are credited as part of the fire modeling supporting the FPRA. If they are credited, please define what is credited and provide justification of this credit. Include in the discussion identification of engineering evaluations used to support the assumptions made about the function of these shields.

PRA RAI-06 Non-suppression Probability

The non-suppression probability (P_{ns}) results reported in NEDC-08-041, Rev. 3 (i.e., Tables 11, 12, 13, 21, 22, and 23) used non-suppression probability values less than 0.001, contrary to NUREG/CR-6850 Attachment P. Please provide the results of a sensitivity analysis (CDF, LERF, delta (Δ) CDF, ΔLERF) using P_{ns} no lower than 1E-03.

PRA RAI-07 MCB Modeling

Attachment A of NEDC-10-001 shows a single fire scenario for MCB 9-4. Attachment D of NEDC-09-085 indicates that this scenario results in MCR abandonment. Please discuss the modeling of this panel and why there are no loss-of-control scenarios.

PRA RAI-08 Fixed Fire Ignition Frequencies

Attachment B of NEDC 08-032 identifies instances in which motors/pumps smaller than 5 horsepower (hp) are included in the count for Bins 21 and 26 (e.g., pages 44 and 45). There are also instances in which transformers rated less than 45 kilovolt-ampere (kVa) are included in the count for Bin 23b (e.g., page 55). Please clarify whether these components, and any other identified components, have been assessed appropriately and, if not, please provide an assessment of the impact on the PRA results (CDF, LERF, ΔCDF, ΔLERF) of not including these components in the ignition source weighting factors.

PRA RAI-09 Inclusion of Multiple Compartment Scenarios

LAR Attachment W, states that "The total calculated CDF and LERF (post NFPA 805), including multi-compartment scenarios, are 5.2E-5/yr and 1.2E-5/yr respectively." However, Table W-2 shows the fire CDF and LERF to be 5.07E-5/yr and 1.05E-5/yr, respectively. This suggests that Table W-2 does not include the contribution from the multi-compartment scenarios. Please clarify this discrepancy. If the ΔCDF and ΔLERF, and the additional risk of RAs shown in Table W-2 do not include the contribution of multi-compartment scenarios, then provide a recompilation of Table W-2 that includes risk from multi-compartment scenarios.

PRA RAI-10 Spread of Fire to Other Combustibles

Please describe how your evaluation includes the possible increase in HRR caused by the spread of a fire from the ignition source to other combustibles. Summarize how suppression is included in your evaluation

PRA RAI-11 Transient Fire Modeling at Pinch Points

Per Section 11.1.5.6 of NUREG/CR-6850, transient fires should at a minimum be placed in locations within the plant physical access units (PAUs) where critical targets are located, such as where CCDPs are highest for that PAU (i.e., at "pinch points"). Pinch points include locations of redundant trains or the vicinity of other potentially risk-relevant equipment, including the cabling associated with each. Transient fires should be placed at all appropriate locations in a PAU where they can threaten pinch points. Hot work should be assumed to occur in locations where hot work is a possibility, even if improbable (but not impossible), keeping in mind the same philosophy.

a. Please describe how transient and hot work fires are distributed within the PAUs. In particular, identify the criteria that determine where an ignition source is placed within the PAUs. Also, if there are areas within a PAU where no transient or hot

work fires are located since those areas are considered inaccessible, please describe the criteria used to define "inaccessible." Note that an inaccessible area is not the same as a location where fire is simply unlikely, even if highly improbable.

b. Relative to the MCR, please provide an assessment of the impact on the PRA results (CDF, LERF, ΔCDF, ΔLERF) of placing transients behind the open-back MCBs and back panels.

PRA RAI-12 Defense in Depth and Safety Margins

Please describe the methodology that was used to evaluate DID and that was used to evaluate safety margins. The description should include what was evaluated, how the evaluations were performed, and what, if any, actions or changes to the plant or procedures were taken to maintain the philosophy of DID or sufficient safety margins.

PRA RAI-13 Fire Ignition Frequencies from Supplement 1

Section 10 of NUREG/CR-6850, Supplement 1, states that a sensitivity analysis should be performed when using the fire ignition frequencies in the Supplement as the base case instead of the fire ignition frequencies provided in Table 6-1 of NUREG/CR-6850. Please provide the results of a sensitivity analysis of the impact of using the Table 6-1 frequencies instead of the Supplement frequencies on CDF, LERF, ΔCDF, and ΔLERF for all of those bins that are characterized by an alpha that is less than or equal to one. If the sensitivity analysis indicates that the change in risk acceptance guidelines would be exceeded using the values in Table 6-1, please justify not meeting the guidelines.

PRA RAI-14 Main Control Room Abandonment

Please describe how CDF and LERF are estimated in MCR abandonment scenarios. Please state if any fires outside of the MCR cause MCR abandonment because of loss of control and/or loss of control room habitability. State if "screening" values for post MCR abandonment are used (e.g., CCDP of failure to successfully switch control to the primary control station (PCS) and achieve safe shutdown of 0.1) or state if detailed human error analyses been completed for this activity. Also, please justify any screening value used. In the justification, please provide the results of the HFE quantification process, such as that described in Section 5 of NUREG-1921, "EPRI/NRC-RES Fire Human Reliability Analysis Guidelines," which would include the following, or an analogous method:

a. The results of the feasibility assessment of the operator action(s) associated with the HFEs, specifically addressing each of the criteria discussed in Section 4.3 of NUREG-1921.

b. The results of the process in Section 5.2.8 of NUREG-1921 for assigning scoping HEPs to actions associated with the use of alternate shutdown, specifically addressing the basis for the answers to each of the questions asked in the Figure 5-5 flowchart.

c. The results of a detailed HRA quantification, per Section 5.3 of NUREG-1921, if the screening CCDP is determined to not be bounding.

PRA RAI-15 Control Power Transformer Credit

It was recently stated at the industry fire forum that the Phenomena Identification and Ranking Table Panel (PIRT) being conducted for the circuit failure tests from the DESIREE-FIRE and CAROL-FIRE tests may be eliminating the credit for Control Power Transformers (CPTs) (about a factor 2 reduction) currently allowed by Tables 10-1 and 10-3 of NUREG/CR-6850, Vol. 2, as being invalid when estimating circuit failure probabilities. Please provide a sensitivity analysis that removes this CPT credit from the PRA and provide new results that show the impact of this potential change on CDF, LERF, ΔCDF, and ΔLERF. If the sensitivity analysis indicates that the change in risk acceptance guidelines would be exceeded after eliminating CPT credit, please justify not meeting the guidelines.

PRA RAI-16 Calculation of VFDR ΔCDF and ΔLERF

Attachment W of the LAR provides the ΔCDF and ΔLERF for the VFDRs for each of the fire areas, but the LAR does not describe either generically or specifically how ΔCDF and ΔLERF were calculated. Please describe the method(s) used to determine the changes in risk reported in the Tables in Appendix W. The description should include:

a. A summary of PRA model additions or modifications needed to determine the reported changes in risk. If any of these model additions used data or methods not included in the fire PRA Peer Review, please describe the additions.

b. Identification of new operator actions (not including post MCR abandonment which are addressed elsewhere) that have been credited in the change in risk estimates.. If such actions are credited, please explain how instrument failure is addressed in the HRA.

c. Please clarify why and how the VDFR risk estimates provided in the Fire Risk Evaluations (FRE) reports are different from the ΔCDF and ΔLERF values provided in Attachment W of the LAR for each Fire Area.

d. Please discuss how the FREs considered modifications, fire procedures, and RAs in the determination of risk evaluations.

e. LAR Table W-2 reports a negative delta risk for Fire Area RB-FN. During the audit, it was discussed that this reported Δ risk was likely in error. Please provide the revised Δ risk (CDF and LERF) for Fire Area RB-FN and any other identified corrections to Table W-2. Discuss the reason for the error in the results and whether the source of the error has potentially broader implications. If there is determined to be broader implications, please provide updated risk results where applicable.

PRA RAI-17 RG 1.200 Rev 2 Clarifications

Please clarify if the peer reviews for both the IEPRA and FPRA considered the clarifications and qualifications from RG 1.200, Revision 2, "An Approach for Determining the Technical Adequacy of Probabilistic Risk Assessment Results for Risk-Informed Activities," March 2009 (ADAMS Accession No. ML090410014), to the ASME/ANS PRA Standard. If not, please provide a self-assessment of the PRA model for the RG 1.200 clarifications and qualifications and indicate how any identified gaps were dispositioned.

PRA RAI-18 Wrapped or Embedded Cables

Please identify if any VFDRs in the LAR involved performance-based evaluations of wrapped or embedded cables. If applicable, please describe how wrapped or embedded cables were modeled in the Fire PRA including assumptions and insights on how the PRA modeling of these cables contributes to the VFDR delta-risk evaluations.

PRA RAI-19 Implementation Item Impact on Risk Estimates

Please identify any plant modifications (implementation items) in Attachment S of the LAR that have not been completed but which have been credited directly or indirectly in the change-in-risk estimates provided in Attachment W. When the affects of a plant modification has been included in the PRA before the modification has been completed, the models and values used in the PRA are necessarily estimates based on current plans. The as-built facility after the modification is completed may be different than the plans. Please add an implementation item that, upon completion of all PRA credited implementation items, verifies the validity of the reported change-in-risk. This item should include a plan of action should the as-built change-in-risk exceed the estimates reported in the LAR.

PRA RAI-20 Model Changes and Focused Scope Reviews Since Full Peer Review

Please identify any changes made to the IEPRA or FPRA since the last full-scope peer review of each of these PRA models that are consistent with the definition of a "PRA upgrade" in ASME/ANS-RA-Sa-2009, "Standard for Level 1/Large Early Release Frequency for Nuclear Power Plant Applications," as endorsed by RG 1.200. Also, please address the following:

a. If any changes are characterized as a PRA upgrade, please indicate if a focused-scope peer review was performed for these changes consistent with the guidance in ASME/ANS-RA-Sa-2009, as endorsed by RG 1.200, and describe any findings from that focused-scope peer review and the resolution of these findings.

b. If a focused-scope peer review has not been performed for changes characterized as a PRA upgrade, please describe what actions will be implemented to address this review deficiency.

PRA RAI-21 Fire Barriers

A number of dampers are blocked open and non-rated fire barriers exist.

a. Please state if these have been considered in the FPRA and FREs. In performing FREs, please state what assumptions are made for (1) non-rated fire barriers and (2) blocked open fire dampers.

b. Please state if all such dampers and fire barriers have been considered in the FPRA. Include a discussion on fire modeling and conclusions, as well as application of NUREG/CR-6850 guidance on multi-compartment analysis. Specifically, please discuss the following:

   i. Both RPS Rooms are connected by ventilation without fire-rated dampers and non-rated barriers according to EE 09-040. Please state if this is considered in the FPRA and FREs.

   ii. FA RB-J has non-rated fire barriers for critical switchgear rooms. Please state how this is considered in the FPRA and FREs.

PRA RAI-22 MSO Combinations

The LAR page F-4 states "For cases where the pre-transition MSO combinations did not meet the deterministic compliance, the MSO combinations were added to the scope of the RI-PB [risk-informed, performance-based] change evaluations." Please elaborate on this statement. Please discuss the risk significance of the MSOs identified, and the contributing reasons for the observed significance.

PRA RAI-23 SSC Modeling

Please describe any systems, structures, and components (SSC) boundaries, failure modes, or success criteria that have been changed from the IEPRA model for the FPRA model.

PRA RAI-24 Success Criteria

Please discuss if "windmilling" the residual heat removal system (RHR) service water (SW) pumps from the SW booster pumps is a new success criteria. If so, please provide the technical basis including this success criteria in the FPRA.

PRA RAI-25 Drywell De-inertion

Please discuss the risk significance of potential drywell de-inertion pathways for this application, and insights which are important to its significance.

PRA RAI-26 Containment Bypass

Please discuss how containment bypass pathways have been considered and which ones are modeled in the FPRA.

PRA RAI-27 Hardened Vent

Please discuss how the hardened wetwell vent is credited in the FPRA and how the potential fire impact on vent cables has been considered for the FPRA. Also, please discuss if fire areas with potential impact on hardened wetwell venting have been walked down.

PRA RAI-28 VFDR

VFDR ISA-03 is not specified as a separation issue. Please state what type of issue VFDR ISA-03 is.

PRA RAI-29 Human Reliability Analysis

a. According to the peer review report, for the HRA analysis many of the actions are based on timing from the internal events HRA (e.g., HR-G4, HR-G5). Please state if this applies to OMAs and, if so, discuss why the timing applies.

b. PCV-XHE-FO-AOV is a containment venting basic event. NEDC 09-083 does not contain an HRA worksheet for this basic event. Provide the worksheet or clarify. PC-XHE-FO-AOV is also an OMA in Fire Areas RB-J (3A), RB-K (3B), DGA (14A), DGB (14B), and DGA (14C). Please discuss why this basic event is associated with these fire areas.

c. PCV-XHE-FO-HPV is the basic event for when operators fail to operate the primary containment hard pipe vent system. Please discuss what the operator actions are and how fire impact was considered for these actions.

d. HEPs considered fire with minimal instrumentation as noted in NEDC 09-83. Please discuss what is meant by minimal instrumentation and clarify if required instrumentation is verified to be available where it is credited in the FPRA sequences. If less than minimal instrumentation is available, please discuss how HEPs are quantified.

e. Please identify which RAs involve operator actions at the ASD panel while maintaining an operator presence in the MCR. Provide justification for their HEPs, and discuss their significance for the application.

f. The detailed HEP worksheets show that for the case of minimal instrumentation available, the HEPs are insensitive to the parameter T_{SW}. For example, short times generally have HEPs of 0.15, while long times can be slightly greater. Please describe why the HEP does not increase for shorter T_{SW} times. Include a discussion on why the HEPs do not appear to vary between times when the fire

impacts could be significant and when fire impacts would not be expected to be significant.

g. Please discuss what time line is assumed for which the fire is assumed not to affect operator actions. Also, please discuss how this is worked into the fire HEPs.

h. Please discuss any floors used in the HEP and dependency analyses.

PRA RAI 30 Risk Importance

LAR Section 4.6 (Risk Monitoring) indicates that risk significance criteria such as specific Risk Achievement Worth (RAW) values will be used. Use of RAW values would require initiating and failure event-related information. Since risk significance based on the FPRA will be used in the Monitoring Program, please confirm that this information can and will be developed using the FPRA.

PRA RAI 31 Exclusion Analysis

NEDC 09-089 explains that the Feedwater and Condensate System (F&C) was significantly enhanced for support the FPRA and discusses an exclusionary analysis that was performed to credit the F&C in the FPRA for certain fire scenarios. Please discuss how this system and its supporting systems were modeled in the FPRA, including how random failures of components added to the enhanced model were treated. Furthermore, please discuss the results of the exclusionary analysis and how the results were used in the FPRA. Specifically, discuss additional circuit analysis performed to determine the location of both control and instrumentation and diagnostic cabling. In addition, please discuss how fire-induced impact to instrument air lines were modeled in the PRA, including how brazed instrument lines were modeled.

PRA RAI 32 Fire Area DW

NEDC 09-085 reports risk results (CDF/LERF) for Fire Area DW/Fire Zone Drywell. However, LAR Table W-2 does not have an entry for this fire area. Please explain this discrepancy. If the risk results for the drywell fire zone are not included in Table W-2, provide an updated table with the risk results for this fire zone/area. Please discuss whether there are any other missing fire zones/areas and, if so, provide the risk results for these areas.

PRA RAI 33 Torus Monitoring FRE

For the FRE performed for VFDR RBDI-05, please discuss the risk calculation. The variant case involves loss of all indication and operator actions at the ASD panel. The operator actions appear to apply only to scenarios when minimal instrumentation is available. If these actions are credited in the variant case, provide justification for their application. Also, if this scenario is a MCR abandonment scenario with control switched to the ASD panel, please provide justification for their application since such scenarios have been modeled differently in the MCR abandonment risk analysis. Further a FRE will typically model the impact of a fire. For this

scenario, it appears that the impact is not directly modeled. Please explain how the impact is modeled for the variant case.

PRA RAI 34 Recovery Actions

Please explain which of the RAs in Attachment G of the LAR are included in the FPRA model. Include the basic event description and probability, and note if it is a dependent probability. In addition, please clarify which RAs are new and which are previously approved.

Radioactive Release (RR)

RR RAI 01

Please provide information on the availability and use of spill control kits, temporary dikes, storm drain covers, retention ponds, settling ponds, etc. for containment of liquid effluents in areas where permanent engineering controls are not in place (e.g., tanks, sumps, concrete containment, etc.).

RR RAI 02

In areas where containment of gaseous and liquid effluents is not achieved and radiation monitoring is credited as a mitigating measure:

a. Please describe the actions to be taken or methods to be used to minimize radioactive effluent (e.g., closing of doors, shutting off smoke educators).

b. For these areas, please provide a qualitative or quantitative bounding analysis to ensure that the 10 CFR 20 annual dose limits for members of the public will be met.

RR RAI 03

Please explain the potential discrepancy between statements in the LAR, Section 4.4, Radioactive Release Performance Criteria, that the methodology used was based on guidance in NFPA 805 Task Force FAQ 09-0056 (related to meeting limitations for instantaneous release of radioactive effluents in a licensee's Technical Specifications) and the analyses and conclusions in calculation NEDC 10-062 and NEDC 11-148 which conclude that the offsite radioactive effluent releases will be limited to less than the annual dose limits of 10 CFR 20.

Monitoring Program

Monitoring Program RAI 01

Please describe the process that will be used to identify SSCs for inclusion in the NFPA 805 monitoring program. Include an explanation of how SSCs that are already within the scope of the Maintenance Rule program will be addressed with respect to the NFPA 805 monitoring program.

Monitoring Program RAI 02

Please describe the process that will be used to assign availability, reliability, and performance goals to SSCs within the scope of the NFPA 805 monitoring program including the approach to be applied to SSCs for which availability, reliability, and performance goals are not readily quantified. Please describe how SSCs that fail to meet assigned availability, reliability, or performance goals will be addressed.

Monitoring Program RAI 03

Please describe how the NFPA 805 monitoring program addresses programmatic elements that fail to meet performance goals (examples include discrepancies in programmatic areas such as combustible controls programs).

Monitoring Program RAI 04

Please describe how the NFPA 805 monitoring program addresses fundamental fire protection program elements.

Monitoring Program RAI 05

Please describe how periodic assessments of the monitoring program will be performed taking into account, where practical, industry wide operating experience, including whether this process will include both internal and external assessments and the frequency at which these assessments will be performed.

Programmatic

Programmatic RAI 01

Please describe the specific documents that will comprise the post transition design basis document in accordance with NFPA 805 Section 2.7.1.2.

Programmatic RAI 02

Please describe the changes that are anticipated to the configuration control program to incorporate the requirements of the NFPA 805 Section 2.7.2.

Programmatic RAI 03

Please describe the changes that are anticipated to the fire protection program manual as a part of the NFPA 805 transition process, including associated training and identification of the recipients of any such training necessary to support the program changes.

Programmatic RAI 04

Please describe where the requirements for periodic assessments (audits) of the fire protection program will reside in the NFPA 805 program documentation and how these requirements are anticipated to differ from the current requirements.

Programmatic RAI 05

Please describe how the NFPA 805 plant change evaluation process will be implemented post-transition. Include identification of specific documents that need to be developed or changed to support the process, a description of how these documents will implement the process presented in Section 4.7.2 of the LAR, and a description of the training program that will support the change evaluation process to include who will be trained and how the training will be implemented (e.g., classroom, computer-based, reading program).

Programmatic RAI 06

Please describe how the combustible loading program will be administered to ensure that FPRA assumptions regarding combustible loading are met.

Programmatic RAI 07

Please describe your commitment to conduct future NFPA 805 analyses in accordance with the requirements of NFPA 805 Section 2.7.3, Compliance with Quality Requirements.

Fire Modeling

Fire Modeling RAI 01

Section 4.5.1.2, "Fire PRA" of the Transition Report states that fire modeling was performed as part of the FPRA development (NFPA 805 Section 4.2.4.2). Reference is made to Attachment J, "Fire Modeling V&V [Verification and Validation]," for a discussion of the acceptability of the fire models that were used.

Regarding the acceptability of the PRA approach, methods, and data:

a. It appears that non-cable intervening combustibles were missed in some areas of the plant. An example is the combustible insulation of the heat exchangers in fire area RB-M. Please explain how non-cable secondary combustibles were accounted for in the fire modeling analyses. In addition, please describe the criteria that were used to determine when a secondary combustible could be ignored in the zone-of-influence (ZOI) calculations. Please identify where secondary combustibles were not and should have been considered, and assess the impact on the risk of including scenarios involving the intervening combustibles in the fire modeling analyses.

b. Please explain why the effect of the size of the ventilation opening was not evaluated in the temperature sensitive equipment hot gas layer (HGL) study, or revise the analysis to include the ventilation opening size.

c. In the structural steel analysis for beams in areas 13A and 20B, the flame height exceeds the elevation of the beams. Please explain why the gas temperature around the beams used in the analysis is lower than the flame temperature, or revise the analysis to reflect the flame temperature.

d. The fire resistance of the columns in area 13A is determined from an empirical method that is based on test data from American Society of Testing Materials (ASTM) Standard E119, "Standard Test Methods for Fire Tests of Building Construction and Materials," exposure. In the pool fire scenario that is considered in the structural steel analysis, the lower part of the columns are exposed to a more severe hydrocarbon fire. Please provide justification for using an empirical method that is based on ASTM E119 test data, or revise the analysis to reflect the more severe hydrocarbon fire.

e. Please explain how it is ensured that the model assumptions in terms of transient combustibles in a fire area or zone will not be violated during and post-transition.

f. Regarding the use of the algebraic models:

    i. Please explain how fire location corner and wall proximity effects are accounted for in the method of McCaffrey, Quintiere, and Harkleroad for

calculating HGL temperature; and in Alpert's method for calculating ceiling jet temperature.

ii. Please describe in detail how the time to sprinkler actuation and the time to heat and smoke detector actuation was calculated. In particular, please describe and justify any use of steady-state models to time-varying conditions.

iii. Please explain how the damage threshold for targets in a mixed convective/radiative environment was established. The response should also address FPRA F&O 3-9 under FSS-D1.

iv. Please explain how the elevation and dimensions of ignition source fires were determined. If the height and dimensions were not adjusted following ignition of secondary combustibles, justify why not.

g. Regarding the use of the Consolidated Model of Fire Growth and Smoke Transport (CFAST) in a multi-compartment analysis, please provide the input files in electronic format (*.in and *.o) for all CFAST runs that were conducted in support of this multi-compartment analysis.

h. Regarding the use of Fire Dynamics Simulator (FDS) in the MCR abandonment study:

i. Please provide the input files in electronic format (*.fds) for all FDS runs that were conducted in support of the MCR abandonment time study.

ii. Please provide justification for assuming an alarm set point of 8.2 percent per meter of smoke detector SD-1001 in the CSR.

iii. Please provide justification for using a response time index (RTI) of 132 $m^{1/2}s^{1/2}$ for the fusible link of the dampers between the MCR and the CSR.

Fire Modeling RAI 02

Section 4.5.1.2, "Fire PRA" of the Transition Report states that fire modeling was performed as part of the Fire PRA development (NFPA 805, Section 4.2.4.2). Reference is made to Attachment J, "Fire Modeling V&V," for a discussion of the verification and validation (V&V) of the fire models that were used. Furthermore, Section 4.7.3, "Compliance with Quality Requirements in Section 2.7.3 of NFPA 805," of the Transition Report states that "Calculational models and numerical methods used in support of compliance with10 CFR 50.48(c) were verified and validated as required by Section 2.7.3.2 of NFPA 805."

Regarding the V&V of fire models:

a. Attachment J of the Transition Report states that the algebraic models implemented in the FDTs and Fire Induced Vulnerability Evaluation (FIVE), Rev.1, were used to characterize flame radiation, flame height, plume temperature, ceiling jet temperature and HGL temperature. However, the FDTs and/or FIVE, Rev. 1 spreadsheets were not used to perform the calculations, but selected algebraic models from NUREG-1805, "Fire Dynamics Tools (FDT^s) Quantitative Fire Hazard Analysis Methods for the U.S. Nuclear Regulatory Commission Fire Protection Inspection Program," and FIVE, Rev. 1, were used in a new spreadsheet (or set of spreadsheets). Please describe how this new (set of) spreadsheet(s) was verified (i.e., how was it ensured that the empirical equations and correlations were coded correctly and that the solutions are identical to those that would be obtained with the corresponding chapters in NUREG-1805 or FIVE, Rev. 1).

b. For V&V of the aforementioned algebraic models, reference is made to NUREG-1824, "Verification and Validation of Selected Fire Models for Nuclear Power Plant Applications." Please provide technical details to demonstrate that the algebraic models have been applied within the validated range of input parameters, or to justify the application of the equations outside the validated range reported in NUREG-1824.

c. Please provide technical details to demonstrate that CFAST has been applied in the multi-compartment analysis for zones 7A and 8A and the sensitive equipment HGL study within the validated range of input parameters, or to justify the application of the model outside the validated range reported in NUREG-1824.

d. Please provide technical details to demonstrate that FDS has been applied in the MCR abandonment study and plume/HGL study within the validated range of input parameters, or to justify the application of the model outside the validated range reported in NUREG-1824.

e. Please provide the V&V basis for the method that models a smoke detector as a heat detector and uses a temperature increase of 10°C as the criterion for detector actuation. The response to this question should also address FPRA F&O 3-1 under FSS-D1.

f. Please provide the V&V basis for the plume temperature equation (3.2.9) in the book by Zalosh on Industrial Fire Protection Engineering that is used in the structural steel analysis for fire zones 13A and 20B.

Fire Modeling RAI 03

Section 4.7.3, "Compliance with Quality Requirements in Section 2.7.3 of NFPA 805," of the Transition Report states that "Engineering methods and numerical models used in support of

compliance with 10 CFR 50.48(c) were and are used with the same limitations and assumptions supported by the V&V for the methods as required by Section 2.7.3.3 of NFPA 805."

Regarding the limitations of use, FPRA F&O 3-12 under FSS-D1 states that there are no clear limits on the applicability of the ZOI parameters. Please identify uses, if any, of the fire modeling tools outside the limits of applicability of the method and, for those cases, explain how the use of the fire modeling approach was justified.

Fire Modeling RAI 04

Section 4.5.1.2, "Fire PRA" of the Transition Report states that fire modeling was performed as part of the FPRA development (NFPA 805, Section 4.2.4.2). This requires that qualified fire modeling and PRA personnel work together. Furthermore, Section 4.7.3, "Compliance with Quality Requirements in Section 2.7.3 of NFPA 805," of the Transition Report states that "For personnel performing fire modeling or Fire PRA development and evaluation, NPPD will develop and maintain qualification requirements for individuals assigned various tasks. Position Specific Guides will be developed to identify and document required training and mentoring to ensure individuals are appropriately qualified per the requirements of NFPA 805 Section 2.7.3.4 to perform assigned work."

Regarding qualifications of users of engineering analyses and numerical models (i.e., fire modeling techniques):

a. Please describe the process/procedures for qualifying engineers/personnel performing the fire analyses and modeling activities.

b. Please explain how the necessary communication and exchange of information between fire modeling analysts and FPRA personnel was accomplished and any direction/guidance provided by one group to the other was confirmed to be implemented correctly.

Fire Modeling RAI 05

Section 4.7.3, "Compliance with Quality Requirements in Section 2.7.3 of NFPA 805," of the Transition Report states that "Uncertainty analyses were performed as required by 2.7.3.5 of NFPA 805 and the results were considered in the context of the application. This is of particular interest in fire modeling and Fire PRA development used to support performance-based approach."

Regarding the uncertainty analysis for fire modeling:

a. Please describe how the uncertainty associated with the fire model input parameters (compartment geometry, radiative fraction, thermophysical properties, etc.) was addressed for this application and accounted for in the analyses.

b. Please describe how the "model" and "completeness" uncertainties were addressed for this application and accounted for in the analyses. NUREG-1934, "Nuclear Power Plant Fire Modeling Application Guide," provides guidance on quantifying model/completeness uncertainty.

If you have any questions, please contact me at 301-415-1377 or via e-mail at lynnea.wilkins@nrc.gov.

Sincerely,

/RA/

Lynnea E. Wilkins, Project Manager
Plant Licensing Branch IV
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

Docket No. 50-298

Enclosure:
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