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10 CFR 50.90

July 6, 2015

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

Calvert Cliffs Nuclear Power Plant, Unit Nos. 1 and 2
Renewed Facility Operating License Nos. DPR-53 and DPR-69
NRC Docket Nos. 50-317 and 50-318

Subject: Request for Additional Information Regarding the National Fire Protection Association Standard 805 License Amendment Request

Reference:
1. Letter from G. H. Gellrich (CCNPP) to Document Control Desk (NRC), dated September 24, 2013, License Amendment Request re: Transition to 10 CFR 50.48(c) - NFPA 805 Performance Based Standard for Fire Protection
2. Letter from A. N. Chereskin (NRR) to G. H. Gellrich (Exelon), dated June 3, 2015, Calvert Cliffs Nuclear Power Plant, Unit Nos. 1 and 2 - Request For Additional Information Regarding The National Fire Protection Association Standard 805 License Amendment Request (TAC Nos. MF2993 and MF2994)

In Reference 1, Calvert Cliffs Nuclear Power Plant, LLC submitted a license amendment request to transition to 10 CFR 50.48(c) – NFPA 805 Performance Based Standard for Fire Protection. In Reference 2 the NRC staff requested additional information regarding this amendment request. Attachment (1) and the Enclosure provide the response to the request for additional information. Enclosure 1 contains markups of the original license amendment package pages and supersedes the previously provided pages.

This additional information does not change the No Significant Hazards Determination provided in Reference 1. No regulatory commitments are contained in this letter.

Should you have questions regarding this matter, please contact Mr. Larry D. Smith at (410) 495-5219.

A006
LRR

I declare under penalty of perjury that the foregoing is true and correct. Executed on July 6, 2015.

Respectfully,

George H. Gellrich
Site Vice President

GHG/PSF/bjm

Attachments: (1) Request For Additional Information Regarding The National Fire Protection Association Standard 805 License Amendment Request
Enclosure 1 Updated pages

cc: NRC Project Manager, Calvert Cliffs
NRC Regional Administrator, Region I
NRC Resident Inspector, Calvert Cliffs
S. Gray, MD-DNR

ATTACHMENT (1)

REQUEST FOR ADDITIONAL INFORMATION REGARDING THE NATIONAL FIRE PROTECTION ASSOCIATION STANDARD 805 LICENSE AMENDMENT REQUEST

Calvert Cliffs Nuclear Power Plant
July 6, 2015

ATTACHMENT (1)

REQUEST FOR ADDITIONAL INFORMATION REGARDING THE NATIONAL FIRE PROTECTION ASSOCIATION STANDARD 805 LICENSE AMENDMENT REQUEST

By letter dated September 24, 2013 (Agencywide Documents Access and Management System (ADAMS) Accession Nos. ML13301A673 and ML13301A674), Calvert Cliffs Nuclear Power Plant, LLC (the licensee), submitted a license amendment request (LAR) for Calvert Cliffs Nuclear Power Plant, Unit Nos. 1 and 2 (Calvert Cliffs), to transition its fire protection licensing basis from Title 10 of the *Code of Federal Regulations* (10 CFR) Section 50.48(b) to 10 CFR 50.48(c), National Fire Protection Association Standard (NFPA) 805, "Performance-Based Standard for Fire Protection for Light Water Reactor Electric Generating Plants," 2001 Edition. The licensee submitted request for additional information (RAI) responses by letters dated February 9, 2015 (ADAMS Accession No. ML15043A249), and March 11, 2015 (ADAMS Accession No. ML15075A110). Based on its review of the RAI responses, the U.S. Nuclear Regulatory Commission (NRC) staff requests the following additional information to complete its safety evaluation of the LAR:

Probabilistic Risk Assessment (PRA) RAI 02.b.i.01:

The PRA RAI 02.b.i requested an explanation about how Human Reliability Analysis (HRA) methods for developing Human Error Probability (HEP) and joint HEP values are consistent with or conservatively bound NRG-accepted guidance in NUREG/CR-6850 or NUREG-1921. The response dated February 9, 2015, indicates that a small fraction of HEPs were found to have included a "T_{delay} of zero that might not be appropriate." The response subsequently states that the overall impact on the Fire Probabilistic Risk Assessment (FPRA) results would likely be negligible because the number of affected HEPs is small compared to the total number of HEPs. The NRC staff has determined that this justification is insufficient. Even a very few HEPs in dominate sequences could have a large impact on risk results.

a) *Provide justification for the conclusion that the HEPs based on a "T_{delay} of zero that might not be appropriate" have a negligible impact on the transition risk results (i.e., Core Damage Frequency (CDF), Large Early Release Frequency (LERF), delta (Δ) CDF and ΔLERF) based on the collective contribution to risk and not on the fraction of HEPs affected.*

b) *Provide justification for the conclusion that the HEPs based on a "T_{delay} of zero that might not be appropriate" have a negligible impact on the post-transition self-approval risk results (i.e., CDF, LERF, ΔCDF and ΔLERF) based on the collective contribution to risk and not on the fraction of HEPs affected.*

c) *If it is not possible to demonstrate that the HEPs based on a "T_{delay} of zero that might not be appropriate" have a negligible impact on both the transition and post-transition self-approval risk results, then provide updated risk results as part of the change-in-risk analysis requested in PRA RAI 03, using appropriate timing.*

CCNPP Response to RAI 02.b.i.01:

a) A review of the HEPs with a T_{delay} of zero will be conducted to confirm adequate justification is available in the PRA documentation. Adequate justification or an adequate T_{delay} will be provided for all HEPs that have a T_{delay} of zero. The HEPs will be revised and incorporated in FPRA to determine the impact and collective contribution on the transition risk results (i.e., CDF, LERF, Δ CDF and Δ LERF).

b) A review of the HEPs with a T_{delay} of zero will be conducted to confirm adequate justification is available in the PRA documentation. Adequate justification or an

adequate T_{delay} will be provided for all HEPs that have a T_{delay} of zero. The HEPs will be revised and incorporated in FPRA to determine the impact and collective contribution to risk on the post-transition self-approval risk results (i.e., CDF, LERF, ΔCDF and ΔLERF).

c) The quantification results that will be provided in PRA RAI 03 will reflect the resolution of the RAIs including appropriate T_{delays}. The updated risk results for both the transition and post-transition risk results will be included as part of the change-in-risk analysis requested in PRA RAI 03.

PRA RAI 02.b.ii.01:

The response to PRA RAI 02.b.ii (in the letter dated February 9, 2015) requesting justification for each joint HEP less than 10^{-5} states, in part, that 2,259 of the 2,700 joint HEP values are below 10^{-5} and that, "[t]he documentation provided in the EPRI HRA Calculator justifies each unique HEP value, including the unique values used for all joint HEPs." The NRC staff disagrees that simply using the Electric Power Research Institute (EPRI) HRA Calculator tool is sufficient justification for any value. In NUREG-1792 the process for performing an HRA that is applicable to all methods is addressed (including the HRA Calculator) and concludes that joint HEP values are to not be below 10^{-5} because "it is typically hard to defend that other dependent failure modes that are not usually treated ... cannot occur." Consistent with "hard to defend," the NRC staff does not reject all values less than 10^{-5} but does expect a robust investigation and documentation for each such value. Without agreeing or disagreeing with the discussion provided in the response for the two sample joint HEPs, the NRC staff finds that the written discussion that follows the lists of actions in each joint HEP to be the type of evaluation and justification required for each value less than 10^{-5}. Confirm that a justification, such as these discussions, exist for each joint HEP less than 10^{-5}, or if such discussions do not currently exist:

a) Provide a justification for each HEP value less than 10^{-5} that will be retained, confirm that a justification for each such HEP value has been developed, provide further examples of justifications developed, and provide the number of such HEP values that will be retained.

b) For all other joint HEPs, apply a lower bound value of 10^{-5} in the FPRA that will be used to support post-transition evaluations, and provide updated risk results as part of the aggregate change-in-risk analysis requested in PRA RAI 03.

CCNPP Response to RAI 02.b.ii.01:

a) The FPRA re-quantification in support of Calvert Cliffs' response to RAI PRA-03 will incorporate a joint HEP floor value of 1.00E-05. A review of the results will identify any joint HEPs which are of high importance and an evaluation of the previously documented bases for use of a lower HEP will be provided. Where a lower HEP can be justified, the HRA documentation will be updated to provide that justification. The justifications used in the re-quantification will be available when Calvert Cliffs' response to RAI PRA-03 is submitted.

b) As noted above, a floor value of 1.00E-05 will be used for all joint HEPs with the exception of those justified by specific evaluations. The results of this change to the FPRA quantification will be incorporated into the re-quantification to be provided in conjunction with Calvert Cliffs' response to RAI PRA-03.

PRA RAI 07.01:

The response to PRA RAI 07 (in the letter dated March 11, 2015) appears to indicate that for a given Plant Area Unit (PAU), the fire ignition frequencies for self-ignited cable fires and cable fires due to welding and cutting are combined with the transient fire ignition frequency and then apportioned to transient scenarios within that PAU. It is unclear whether this approach is consistent with or bounds accepted methods given that: (1) potentially risk-significant cable trays that could serve as ignition sources for cable fire scenarios may be located outside of the zone of influence (ZOI) of postulated transient fire scenarios (e.g., cable trays located at a height greater than the vertical component of the transient ZOI, cable trays located near or above permanent fixtures that occupy the available space such that the storage or placement of transient materials would be physically impossible, etc.); and (2) accepted methods used to apportion fire ignition frequency to individual transient fire scenarios (e.g., number of scenarios, floor area, etc.) would appear to be inconsistent with the accepted methods for apportioning fire ignition frequency to individual cable fire scenarios in Frequently Asked Question (FAQ) 13-0005 (ADAMS Accession No. ML13319B181) and NUREG/CR-6850 (i.e., cable loading, surface area, or volume, as applicable).

To resolve this issue, modify the FPRA's treatment of self-ignited cable fires and cable fires due to welding and cutting to be consistent with accepted methods (i.e., NUREG/CR-6850 and FAQ 13-0005), and provide updated risk results as part of the aggregate change-in-risk analysis requested in PRA RAI 03.

CCNPP Response to PRA RAI 07.01:

The FPRA will be revised to incorporate the methodology specified in FAQ 13-0005 and the results will be incorporated in the integrated analysis that will be submitted as part of Calvert Cliffs' response to RAI PRA-03.

PRA RAI 08.01:

The response to PRA RAI 08, dated March 11, 2015, appears to indicate that for a given PAU, the fire ignition frequency for junction boxes is combined with the transient fire ignition frequency and then apportioned to transient scenarios within that PAU. However, this approach, while proposed during the development of FAQ 13-0006 (ADAMS Accession No. ML13149A527), has been rejected by the NRC staff. It is unclear whether this approach is consistent with (or bounds) accepted methods given that: (1) potentially risk-significant junction boxes that could serve as ignition sources for junction box fire scenarios may be located outside of the ZOI of postulated transient fire scenarios (e.g., junction boxes located near or amongst permanent fixtures that occupy the available space such that the storage or placement of transient materials would be physically impossible); and (2) accepted methods used to apportion fire ignition frequency to individual transient fire scenarios (e.g., number of scenarios, floor area, etc.) would appear to be inconsistent with the accepted methods for apportioning fire ignition frequency to individual junction box fire scenarios in FAQ 13-0006 (ADAMS Accession No. ML13331B213) and NUREG/CR-6850 (e.g., number of junction boxes, number of cables entering junction boxes, etc.).

To resolve this issue, modify the FPRA's treatment of junction box fires to be consistent with accepted methods (i.e., NUREG/CR-6850 and FAQ 13-0006), and provide updated risk results as part of the aggregate change-in-risk analysis requested in PRA RAI 03.

CCNPP Response to PRA RAI 08.01:

The FPRA will be revised to incorporate the methodology specified in FAQ 13-0006 and the results will be incorporated in the integrated analysis referenced in Calvert Cliffs' response to RAI PRA-03.

PRA RAI 11.d.01:

The response to PRA RAI 11.d, dated March 11, 2015, states that for well-sealed and robustly secured cabinets that house circuits of 440V or greater, propagation of fire outside the ignition source will be evaluated using the guidance in draft FAQ 14-0009 and the "NRC Position on Probability of Breaching Well-Sealed MCCs [Motor Control Centers] of 440V or Greater" (ADAMS Accession No. ML15023A064), dated January 23, 2015. However, the staff has determined that this guidance only applies to MCCs. Confirm whether fire propagation outside of well-sealed and robustly secured cabinets that are not MCCs, but do house circuits greater than 440V, is evaluated consistent with guidance in NUREG/CR-6850. If it is not, then provide updated risk results as part of the aggregate change-in-risk analysis as requested in PRA RAI 03. The updated risk results for evaluating propagation of these cabinets should be consistent with NRG-accepted guidance.

CCNPP Response to PRA RAI 11.d.01:

Well-sealed and robustly secured electrical cabinets that are not MCCs, but do house circuits of 440V or greater, are evaluated for fire propagation beyond the ignition source consistent with the guidance in NUREG/CR-6850. Calvert Cliffs has not and will not use FAQ 14-0009 for electrical cabinets other than MCCs.

Fire Modeling (FM) RAI 05.01:

Section 4.5.1.2 of the LAR states that fire modeling was performed as part of the FPRA development (NFPA 805, Section 4.2.4.2). Section 2.7.3.4 of NFPA 805 states, in part, that the personnel who use and apply engineering analysis and numerical models (e.g., fire modeling techniques) shall be competent in that field and experienced in the application of these methods.

In their responses to FM RAIs 05.a and 05.b, (ADAMS Accession Nos. ML15043A249 and ML15075A104), the licensee did not describe the qualifications of the fire modeling users in relation to the requirements of the standard (that is Section 2.7.3.4 of NFPA 805).

Describe how the qualifications of personnel performing fire modeling calculations met or will meet the requirements of NFPA 805, Section 2.7.3.4, during the development of the application, before transition, during the transition period, and after transition.

CCNPP Response to FM RAI 05.01:

Section 2.7.3.4 of NFPA 805 says that cognizant personnel who use and apply engineering analysis and numerical models (e.g., fire modeling techniques) shall be competent in that field and experienced in the application of these methods as they relate to nuclear power plants, nuclear power plant fire protection, and power plant operations.

The Calvert Cliffs response to FM-5a (ADAMS accession number ML15043A249) described how fire modeling calculations were performed by engineers who were determined to have met

the qualification requirements of Section 2.7.3.4 of NFPA 805. This determination included formal review of their qualifications by the CENG PRA Engineering Supervisor per the CENG procedures that were in effect at that time, and formal documentation of their qualifications was in the CENG training database.

The Calvert Cliffs response to FM-5b (ADAMS accession number ML15075A104) described how, during and following the transition to Exelon procedures, the personnel assigned to the Calvert Cliffs FPRA project continue to be knowledgeable in fire modeling techniques, including interpreting and maintaining the fire modeling database; and, if new fire modeling personnel are needed in the future, their credentials will be reviewed and approved by Exelon PRA Engineering Management.

Since the submission of the Calvert Cliffs reply to FM-05b, three new Exelon qualification guides specific to fire modeling have been implemented.

All personnel assigned to tasks involving fire modeling are required to be evaluated against the requirements of the three new fire modeling qualification guides when their work falls into one of the areas covered by the Exelon guides. The implementation of the three Exelon fire modeling qualification guides therefore ensures that the requirements of Section 2.7.3.4 of NFPA 805 are presently met and continue to be met during the development of the application before, during and after transition.

Fire Protection Engineering (FPE) RAI 01.01:

Section 3.3.4 of NFPA 805 requires that thermal insulation materials, radiation shielding materials, ventilation duct materials, and soundproofing materials be noncombustible or limited combustible. In LAR Attachment A, the licensee stated that it "Complies with Clarification" with Section 3.3.4 of NFPA 805. The NRC issued FPE RAI 01 to request additional information related to the compliance bases for Section 3.3.4. In the 90-day RAI response letter dated March 11, 2015, the licensee stated that thermal insulation materials, radiation shielding materials, ventilation duct materials, and soundproofing materials that are either permanently or temporarily installed in the plant are noncombustible or limited combustible with some exceptions. The licensee stated that the above materials, which cannot be classified as noncombustible or limited combustible, are treated the same as any other combustible materials located within the plant and are administratively controlled. The licensee further stated that these materials are tracked by the site combustible loading database and evaluated and approved by the site fire protection engineer. Site fire protection engineering ensures that the installed materials will not impact the ability of the plant to achieve and maintain the nuclear safety and radioactive release performance criteria.

Appendix B of Nuclear Energy Institute (NEI) 04-02, "Guidance for Implementing a Risk-Informed, Performance-Based Fire Protection Program Under 10 CFR 50.48(c)," Revision 2, which is endorsed by the NRC in Regulatory Guide 1.205, "Risk-Informed, Performance-Based Fire Protection for Existing Light-Water Nuclear Power Plants," states that "Complies with Clarification" are items that meet the requirements in NFPA 805 with clarification of an administrative or editorial nature (e.g., NFPA 805 specifies that a piece of information is documented in the pre-fire plans, but the licensee has it in the fire response procedure). Based on the above, the NRC staff does not agree that the licensee's current plant configuration meets the criteria for classifying "Complies with Clarification" to Section 3.3.4 of NFPA 805. Provide the following to address the subject compliance issue:

a. *Revise the compliance statement for Section 3.3.4 of NFPA 805 using one or more of the compliance strategies described in NEI 04-02 Appendix B, such as evaluating the condition in an existing engineering equivalency evaluation or submitting a performance-based evaluation approval request in accordance with 10 CFR 50.48(c)(2)(vii).*

b. *Provide additional information characterizing the installed conditions that do not meet the NFPA 805, Section 3.3.4, requirement (i.e., types, quantity, permanent or temporary installation, locations, installation details, etc.).*

c. *Describe the administrative controls and the criteria for evaluating the acceptability of future uses of materials that do not meet the requirements of NFPA 805, Section 3.3.4.*

CCNPP Response to FPE RAI 01.01:

a. Attachment A of the License Amendment Request has been revised to include the following compliance statements: "Complies," "Complies by Previous NRC Approval," "Submit for NRC Approval," and "Complies, with Required Action." All materials that meet the requirements of Section 3.3.4 of NFPA 805 are included in the "Complies" statement. Materials that do not meet the requirements of Section 3.3.4 but are the subject of a previous NRC approval are included in the "Complies by NRC Previous NRC Approval." Attachment L, Approval Request 9, has been developed for all materials that do not meet the requirements of Section 3.3.4 and are not part of a previous NRC approval. These materials are discussed in the "Submit for NRC Approval" compliance statement.

b. Attachment L, Approval Request 9, has been developed for all materials that do not meet the requirements of Section 3.3.4 and are not part of a previous NRC approval. There are two parts to the approval request.
    1. Part A requests approval for the use of radiation shielding materials at Calvert Cliffs that have not been specifically tested to the standards for classification as "noncombustible" or "limited combustible". These materials however, have been classified as Class A materials in accordance with NFPA 101 and/or have passed NFPA 701, Standard Methods of Fire Tests for Flame Propagation of Textiles and Films. The materials are used, as necessary, for temporary radiation shielding in the Auxiliary Building, Turbine Building, and Containment Buildings. The amount of material will be limited to that required to limit dose to plant personnel to levels that are as low as reasonably achievable (ALARA).
    2. Part B requests approval for approximately 32 linear feet of 4 foot high, 1 inch thick, 5% borated, high density polyethylene neutron shielding installed around the north and west portion of the spent fuel pool cask wash pit on the 69' elevation of the Auxiliary Building.
    The Attachment L request concludes that the level of risk encountered by maintaining the current radiation shielding materials at Calvert Cliffs is acceptable, because it:
        - satisfies the performance goals, performance objectives, and performance criteria specified in NFPA 805 related to nuclear safety and radiological release;
        - maintains safety margins; and
        - maintains fire protection defense-in-depth (fire prevention, fire detection, fire suppression, mitigation, and post-fire nuclear safety capability).

c. Administrative procedures ensure that the future use of materials subject to the requirements of NFPA 805, Section 3.3.4 will either comply or, in the case of radiation shielding materials, will meet the criteria for acceptability requested in Part A of Attachment L, Approval Request 9 (i.e., classified as Class A materials in accordance with NFPA 101, "Life Safety Code" and/or have passed NFPA 701, "Standard Methods of Fire Tests for Flame Propagation of Textiles and Films").

ENCLOSURE 1

UPDATED PAGES

NFPA 805 Ch. 3 Ref.	Requirements/Guidance	Compliance Statement	Compliance Basis	Reference Document	
3.3.4 Insulation Materials.	Thermal insulation materials, radiation shielding materials, ventilation duct materials, and soundproofing materials shall be noncombustible or limited combustible.	Complies ~~with Clarification~~	~~The referenced procedures, specifications, and the Combustible Loading Analysis Database control and account for the use of thermal insulation materials, radiation shielding materials, ventilation duct materials, and soundproofing materials.~~ Except as identified below, CCNPP complies with the requirements of Section 3.3.4.	~~Calculation CA02243, Combustible Loading Analysis Database Update, Rev. 0002 / All~~ ~~Procedure CNG-FES-007, Preparation of Design Inputs and Change Impact Screen, Rev. 00017 / Section 5.4.16.A.14~~ ~~Procedure CNG-FES-015, Design Engineering and Configuration Management Forms, Rev. 00006 / Form 17 - Item A~~ ~~Procedure SA-1-100, Fire Prevention, Rev. 01800 / Sections 4.9 and Attachment 1: Section I to PCR-13-02460~~ Specification C-0056, Specification for Furnishing, Detailing, Fabricating, and Delivery of Structural Steel for Neutron Shielding, Rev. 0003 / Section 9.1 Specification M-0196, Specification for Heating, Ventilating and Air Conditioning Ducts, Rev. 0004 / Section 5.2 Specification M-0196A, Specification for Heating, Ventilating, and Air Conditioning Ducts, Rev. 0002 / Section 5.2 ~~Specification M-0198, Specification for Insulation of HVAC Systems, Rev. 0000 / Section 7.3~~ ~~Specification M-0336, Specification for Reactor Coolant System and Steam Generators Insulation (Except Reactor Cavity), Rev. 0003 / Section 7.9.c~~	FPE RAI 01.01 FPE RAI 01.01

NFPA 805 Ch. 3 Ref.	Requirements/Guidance	Compliance Statement	Compliance Basis	Reference Document	
				~~Specification M-0338, Specification for Plant Insulation - Except Reactor Cavity Insulation, Reactor Coolant System and Steam Generators Insulation, Rev. 0008 / Section 8.1.a~~	FPE RAI 01.01
				~~Specification M-0338C, Specification for Plant Insulation, Unit 2 - Except Reactor Cavity Insulation, Reactor Coolant System and Steam Generators Insulation, Rev. 0003 / Section 5.1.a~~	
				Specification M-0339, Specification for Reactor Cavity Insulation, Rev. 0002 / Section 5.3	
				Specification SP-0590, Intake Structure Exhaust Vents, Rev. 0 / Section 2.5.2	
				Specification SP-0742-NSR, Technical Specification SP-742-NSR for Diesel Generator Project Gypsum Wallboard, Rev. 0002 / Section 2.3	
				Specification SP-0747, Design Specification NO. SP-747 for SR HVAC Ductwork, Rev. 0003 / Section 5.1.3	
				Specification SP-0748, Design Specification for Diesel Generator Project NSR HVAC Systems Installation SP-748, Rev. 0004 / Section 5.1.3	
				~~Specification SP-0770, Design Specification NO. SP-770 for Diesel Generator Project Non-Metallic Thermal Insulation, Rev. 0004 / Section 5.10~~	FPE RAI 01.01

NFPA 805 Ch. 3 Ref.	Requirements/Guidance	Compliance Statement	Compliance Basis	Reference Document
				Specification SP-0782, Design Specification for Diesel Generator Project SBO HVAC Installation, Rev. 0002 / Section 5.1.3
				~~Specification SP-0869, Unit 1 and 2 Replacement Steam Generator Insulation, Rev. 1 / Section 6.2.7~~ FPE RAI 01.01
				Specification SP-0918, Post LOCI Control Room Charcoal Filter Units, Rev. 0001 / Section 8.0 of Appendix 6
				Procedure CC-AA-209, Fire Protection Program Configuration Change Review, Rev. 5 / Section 4.5.5 and Attachment 1 FPE RAI 01.01

NFPA 805 Ch. 3 Ref. Requirements/Guidance	Compliance Statement	Compliance Basis	Reference Document	
	Complies by Previous NRC Approval	In the response to Appendix A to Branch Technical Position APCSB 9.5-1 for Units No. 1 and 2, dated March 15, 1977, item D.1.(d) BG&E stated: "Thermal insulation used throughout the plant is either hydrous-calcium-silicate or fiberglass, which have a flame spread index of zero and 25, respectively. Mineral wool thermal insulation, used in Unit 1 only, has successfully withstood ASTM E-119 "Fire Tests of Building Construction Materials." Armstrong Armaflex and Johns-Manville Aerotube antisweat insulation are used throughout the plant and have a flame spread index of 25 and 45, respectively. Most radiation shielding is of concrete. In addition RTV 627 silicone rubber (General Electric) is used for radiation shielding in various areas throughout the plant. This type of radiation shielding has been tested with the ASTM E-119 "Fire Tests of Building Construction Materials," surface burning test and successfully withstood exposure for 6 hours." The NRC Safety Evaluation Report dated September 14, 1979 stated: "We find that, subject to implementation of quality assurance provisions for fire protection and the development of adequate fire fighting strategies, the fire protection program [including radiation shielding materials] satisfies the objectives identified in Section 2.2 of this report and is, therefore, acceptable." Supplement 2 to the NRC Safety Evaluation Report dated March 18, 1982 stated: "We have completed our review of the Quality Assurance Fire Protection Program Description. This information was included in the BG&E response to our letter dated December 31, 1979. Based on the evaluation of the above information, we conclude this response meets the guidelines contained in the Branch Technical Position ASB 9.5-1, and, therefore, is acceptable."	Letter from Clark (NRC) to Lundvall, Jr. (BG&E), dated March 18, 1982 / Enclosure 1, Second Supplement to Safety Evaluation Report, Section 3.3.7 Letter from Lundvall, Jr. (BG&E) to Reid (NRC), dated December 31, 1979 / All Letter from Reid (NRC) to Lundvall, Jr. (BG&E), dated September 14, 1979 / Enclosure 3, Safety Evaluation Report, Section 5.18 and Section 6.0 Letter from Lundvall, Jr. (BG&E) to Stello, Jr. (NRC), dated March 15, 1977 / Enclosure, Fire Protection Program Evaluation, Item D.1.(d) and Table D-3 Report R2215-021-001, NFPA 805 Chapter 3 Fundamental Fire Protection Program and Design Elements Review, Rev. 1 / Section 3.4.2 Specification M-0198, Specification for Insulation of HVAC Systems, Rev. 0000 / Section 7.3 Specification M-0336, Specification for Reactor Coolant System and Steam Generators Insulation (Except Reactor Cavity), Rev. 0003 / Section 7.9.c Specification M-0338, Specification for Plant Insulation - Except Reactor Cavity Insulation, Reactor Coolant System and Steam Generators Insulation, Rev. 0008 / Section 8.1.a	FPE RAI 01.01 FPE RAI 01.01

NFPA 805 Ch. 3 Ref. Requirements/Guidance	Compliance Statement	Compliance Basis	Reference Document
		The basis for approval has been reviewed. There have been no plant modifications or other changes that would invalidate the basis for approval.	Specification M-0338C, Specification for Plant Insulation, Unit 2 - Except Reactor Cavity Insulation, Reactor Coolant System and Steam Generators Insulation, Rev. 0003 / Section 5.1.a Specification SP-0770, Design Specification NO. SP-770 for Diesel Generator Project Non-Metallic Thermal Insulation, Rev. 0004 / Section 5.10 Specification SP-0869, Unit 1 and 2 Replacement Steam Generator Insulation, Rev. 1 / Section 6.2.7
	Submit for NRC Approval	Approval is requested in Attachment L to allow the use of radiation shielding materials at CCNPP that have not been specifically tested to the standards for classification as "limited combustible". These materials however, have been successfully tested to NFPA 101 Class A flame spread (ASTM E84) and/or NFPA 701, Standard Methods of Fire Tests for Flame Propagation of Textiles and Films. Approval is requested in Attachment L to allow the use of 5% borated high density polyethyle plastic radiation (neutron) shielding materials along the north and west boundary of the spent fuel pool cask wash pit.	None

FPE RAI 01.01

Approval Request 9

NFPA 805 Section 3.3.4 states:

Thermal insulation materials, radiation shielding materials, ventilation duct materials, and soundproofing materials shall be noncombustible or limited combustible.

Radiation shielding materials that are practical for certain plant applications and that meet the requirements of noncombustible or limited combustible are not always readily available.

Part A:
This request is for NRC approval to allow the use of radiation shielding materials at CCNPP that have not been specifically tested to the standards for classification as "noncombustible" or "limited combustible". These materials however, have been classified as Class A materials in accordance with NFPA 101, "Life Safety Code" and/or have passed NFPA 701, "Standard Methods of Fire Tests for Flame Propagation of Textiles and Films."

Part B:
This request is for NRC approval to allow the use of a 32 foot long, 4 foot high, 1 inch thick, 5% borated high density polyethylene (HDPE) neutron shielding at CCNPP along the north and west railings of the spent fuel cask wash pit, located in Room 530, "Spent Fuel Pool/Cask Handling Area." This radiation shielding material does not meet the definition of noncombustible or limited combustible as required by Section 3.3.4 of NFPA 805.

Basis for Request:

FPE 01.01

Part A:
The majority of insulation and radiation shielding materials in use in the plant is in compliance with NFPA 805 Section 3.3.4 or has received previous NRC approval based on flame spread criteria. Some radiation shielding materials in use in the plant, primarily for temporary purposes, have successfully passed fire tests using methods that measure flame spread or propagation of flame and the ability to self-extinguish when removed from flames. These test methods do not specifically confirm whether the material qualifies as a "noncombustible" or "limited combustible" material, as required by Section 3.3.4 of NFPA 805. These materials are hypalon-coated Kevlar, fiberglass fabric impregnated with specially formulated silicone rubber, lead shielding covered with proprietary fire retardant heavy duty fabric, and a shield that contains a mix of silicone and proprietary radiation shielding materials. The materials are used, as necessary, for temporary radiation shielding in the Auxiliary Building, Turbine Building, and Containment Buildings. The amount of material will be limited to only that which is required to limit dose to plant personnel to levels that are as low as reasonably achievable (ALARA).

The NFPA 805 definition of limited combustible is as follows:

Material that, in the form in which it is used, has a potential heat value not exceeding 3500 Btu/lb (8141 kJ/kg) and either has a structural base of noncombustible material with a surfacing not exceeding a thickness of 1/8 in. (3.2 mm) that has flame spread rating not greater than 50, or has another material having neither a flame spread rating greater than 25 nor evidence of continued progressive combustion, even on surfaces exposed by cutting through the material on any plane. (See NFPA 220, Standard on Types of Building Construction.)

NFPA 220 states that limited combustible material has a potential heat value not exceeding 3,500 Btu/lb (8141 kJ/kg) where tested in accordance with NFPA 259, "Standard Test Method

for Potential Heat of Building Materials." This standard requires an oxygen bomb calorimeter test where the sample material is pulverized, pressed into a 1g pellet and tested in a high-temperature calorimeter. This standard also requires an electric muffle test procedure in which the sample is cut or formed into a small scale rectangular prism (formed by layering if the material is thin) and tested in a high temperature furnace. NFPA 259 states that nonhomogeneous test material greater than 3 inches in thickness shall not be tested in accordance with this method. Limited combustible materials will contribute a minor amount to fire (i.e., up to 3,500 Btu/lb); however, the materials have low flame propagation properties or do not exhibit self-sustained combustion and are not expected to be significant contributors to fire growth.

NFPA 805, Section 3.3.3 requires that interior wall or ceiling finish be classified as Class A materials in accordance with NFPA 101, "Life Safety Code." NFPA 101 defines a Class A material as one that has a flame spread rating of 0-25 and smoke developed index of 0-450 when tested in accordance with NFPA 255, "Standard Method of Test of Surface Burning Characteristics of Building Materials." ASTM E84, "Standard Test Method for Surface Burning Characteristics of Building Materials," is an equivalent test method to NFPA 255. The test method measures flame growth on the underside of a horizontal test specimen, using the Steiner tunnel test. The result is derivation of a Flame Spread Index which is a non-dimensional number placed on a relative scale in which asbestos-cement board has a value of 0, and red oak wood has 100. Similarly to limited combustible materials, Class A materials have low flame propagation properties or do not exhibit self-sustained combustion and are not expected to be significant contributors to fire growth.

Section 3.3.1.2 of NFPA 805 states that plastic sheeting materials used in the power block shall be fire-retardant types that have passed NFPA 701, "Standard Methods of Fire Tests for Flame Propagation of Textiles and Films," large-scale tests, or equivalent. NFPA 701 is a test method in which a textile, fabric, or film is subjected to direct flame impingement. The sample passes the test if flame does not self-propagate or drip after the pilot flame is removed. Similarly to limited combustible and Class A materials, materials passing the NFPA 701 test have low flame propagation properties or do not exhibit self-sustained combustion and are not expected to be significant contributors to fire growth. FPE 01.01

The materials for which approval is requested either meet NFPA 101, Class A, and/or have passed the NFPA 701 test. These materials meet the testing standards that are required by NFPA 805 for interior finish and/or plastic sheeting. NFPA 805 allows Class A interior wall and ceiling finish materials and plastic sheeting materials that have passed NFPA 701. In many instances, the combustible portion of the radiation shielding is similar to plastic sheeting (e.g., heavy duty fabric with lead core). Radiation shielding is no more prevalent in the plant than plastic sheeting; therefore, radiation shielding that meets NFPA 805 requirements for plastic sheeting and/or interior finish meets the level of safety intended by NFPA 805, Chapter 3. Additionally, previous NRC approval has been granted for insulation materials at CCNPP that have a flame spread of 25 or less (i.e., Class A).

This request is to allow use of radiation shielding materials that are classified as Class A per NFPA 101, and/or have passed the NFPA 701 test standard. Administrative procedures ensure that the future use of radiation shielding materials will either comply with the requirements of NFPA 805, Section 3.3.4, or will meet the criteria for acceptability requested in Part A of this request.

Part B:
HDPE radiation shielding is utilized at CCNPP to attenuate neutrons during independent spent fuel storage installation (ISFSI) campaigns. Due to ALARA concerns, the shielding remains in

place as a permanent installation. Use of water for neutron attenuation is a noncombustible alternative to the borated HDPE shielding; however, to obtain similar boron attenuation properties, extremely large quantities of water would be required. Therefore, CCNPP requests that the NRC approve of the current configuration of the HDPE shielding: 32 foot long, 4 foot high, 1 inch thick, 5% borated HDPE neutron shielding along the north and west railings of the spent fuel cask wash pit, located in Room 530. Future installation and use of radiation shielding is governed by administrative procedures to ensure compliance with the requirements of section 3.3.4 of NFPA 805, except as requested in Part A of this request.

Room 530, "Spent Fuel Pool/Cask Handling Area," is part of Fire Area 11, "Auxiliary Building (All Elevations) General and Miscellaneous Areas," and is located on the 69 foot elevation of the Auxiliary Building. Room 530 is a large open area surrounding the upper level of the spent fuel pools. The room has a ceiling height of approximately 50 feet.

Although the HDPE insulation is expected to contribute to a fire if subjected to an unmitigated exposure fire, this scenario is unlikely to occur based on several factors:

- The likelihood of a fire involving the HDPE is minimal as there are no fixed ignition sources located within 20 feet of the material, except for the Unit 1 new fuel elevator drive assemblies, which are located approximately 7 feet from the shielding; however, this is not considered a credible fixed ignition source because the equipment is infrequently operated and is continually-manned when in operation.
- The likelihood of a fire involving transient combustibles/ignition sources is minimized due to administrative controls on ignition sources, hot work, and transient combustibles throughout the plant. FPE 01.01
- The 1-inch thick, high density boards are expected to behave as a thermally-thick material and a significant exposure fire is therefore necessary to ignite the material. The NFPA Handbook of Fire Protection Engineering defines a thermally-thick material is one in which a temperature rise will not be perceived on the unexposed surface when the material is heated.
- There are no fixed intervening combustibles located adjacent to the HDPE shielding.
- There are smoke and flame detectors located directly above of the HDPE shielding that will provide early warning of an exposure fire in the vicinity of the HDPE. The fire is expected to be detected prior to significant involvement of the HDPE board materials.
- The smoke and flame detectors will initiate an alarm signal in the continually-manned control room. CCNPP maintains an on-site fire brigade which will be dispatched to quickly extinguish any fire that could occur. There is significant open floor space around the HDPE and spent fuel cask wash pit that provide excellent fire brigade access. Fire hose stations and extinguishers are provided in the vicinity of the cask washing pit.

In the unlikely event of an uncontrolled fire involving the radiation shielding materials, the fire is not expected to spread to adjacent rooms due to the lack of intervening combustibles in the vicinity of the radiation shielding materials. A hot gas layer is not expected to form due to the very large volume of the room, which has a ceiling height of approximately 50 feet. The control room will be notified of flame and/or smoke detector activation in this area which will facilitate a rapid emergency response.

Acceptance Criteria Evaluation:

Nuclear Safety and Radiological Release Performance Criteria:

Part A:
NFPA 805 Section 3.3.1.2 allows the use of plastic sheeting that has been tested to NFPA 701 and Section 3.3.3 allows for interior finish materials that are Class A materials. The limited use of radiation shielding materials that meet the above described standards therefore meet the level of fire safety intended by NFPA 805. Therefore, there is no adverse impact to Nuclear Safety Performance Criteria.

The presence of radiation shielding which is not noncombustible or limited combustible, but has passed NFPA 701 or is classified as Class A has no impact on the radiological release performance criteria. The radiological release performance criteria are satisfied based on the determination of limiting radioactive release (Attachment E), which is not affected by the shielding that does not comply with the requirements specified in section 3.3.4 of NFPA 805.

Part B:
As discussed in Part B above, there are no credible fixed ignition sources located in the area of the HDPE shielding and transient ignition sources are controlled by administrative procedures. In the unlikely event of a fire involving the thermally-thick HDPE, the fire will not spread to adjacent rooms due to the lack of intervening combustibles and the presence of automatic flame and ionization detection in the area of the shielding. Room 530 (room containing the HDPE shielding) is part of Fire Area 11. Fire Area 11 has been evaluated in accordance with NFPA 805, Section 4.2.4.2, "Performance based approach – fire risk evaluation with simplifying deterministic assumptions," and the risk has been found to be acceptable. Fire modeling was not performed in this room; therefore, the current NSCA and FPRA analyses assume whole room damage, which bounds all potential fire scenarios involving the HDPE shielding. Therefore, there is no impact on the nuclear safety performance criteria. FPE 01.01

The presence of the HDPE shielding has no impact on the radiological release performance criteria. The radiological release performance criteria are satisfied based on the determination of limiting radioactive release (Attachment E), which is not affected by the HDPE shielding.

Safety Margin and Defense-in-Depth:

Part A:
Radiation shielding materials that are classified as Class A materials in accordance with NFPA 101 and/or have passed NFPA 701, are difficult to ignite and, as tested, will not sustain combustion when removed from test fire/furnace exposure. The limited use and quantity of radiation shielding used throughout the plant is not expected to contribute significantly to any postulated fires in the plant.

NFPA 805 allows Class A interior wall and ceiling finish materials and plastic sheeting materials that have passed NFPA 701. The limited quantity of the shielding materials in question (only as needed for radiation protection on a case-by-case basis) therefore meets the level of fire safety intended by Chapter 3 of NFPA 805. The use of radiation shielding materials that have passed NFPA 701 and/or are classified as Class A materials in accordance with NFPA 101 provides reasonable assurance that the design capabilities of the fire protection systems in the plant will not be exceeded and that a fire involving radiation shielding materials will not impact nuclear safety or radioactive release performance criteria. Therefore, the safety margin inherent in the analysis for the fire event has been preserved.

The three echelons of defense-in-depth are:

(1) To prevent fires from starting (combustible/hot work controls)

(2) Rapidly detect, control and extinguish fires that do occur, thereby limiting damage (fire detection systems, automatic fire suppression, manual fire suppression, pre-fire plans)

(3) Provide adequate level of fire protection for systems and structures so that a fire will not prevent essential safety functions from being performed (fire barriers, fire rated cable, success path remains free of fire damage, recovery actions)

Per NFPA 805 Section 1.2, defense-in-depth is achieved when an adequate balance of each of these elements are provided.

Radioactive shielding materials that are Class A per NFPA 101 and/or pass NFPA 701 are not considered ignition sources. Echelon 1 is achieved by controls on ignition sources, hot work and combustibles throughout the plant. Radiation shielding meeting the tests discussed in this request provide reasonable assurance that the materials are neither easily ignited, nor will facilitate significant flame spread when subject to an exposure fire. Echelon 2 is achieved by the presence of automatic detection and suppression systems located in areas of the plant where fire risk, fire hazards, or regulatory commitments require their installations. The materials have low flame propagation properties or do not exhibit self-sustaining combustion and are within the design capabilities of the fire protection systems in the plant. These detection systems alarm in the continually-manned control room and will ensure rapid detection of a fire, should one occur. The manual fire brigade will respond to a fire in all plant areas. The presence of the radiation shielding materials does not impact Echelon 2. Echelon 3 is achieved by the presence of fire rated barriers between fire areas throughout the plants. Administrative procedures ensure that fire area separation be maintained. The NSCA and Fire PRA analyses are not impacted by the presence of radiation shielding materials as described in this request. Since a balance of the elements is provided, defense-in-depth is achieved. FPE 01.01

Part B:
The HDPE shielding is located in a large room with a high ceiling and there are no credible fixed ignition sources in the area of the shielding. Room 530 is part of Fire Area 11. Fire Area 11 has been evaluated in accordance with NFPA 805, Section 4.2.4.2, "Performance based approach – fire risk evaluation with simplifying deterministic assumptions," and the risk has been found to be acceptable. Fire modeling was not performed in this room; therefore, the current NSCA and FPRA analysis assume whole room damage, which bounds all potential fire scenarios involving the HDPE shielding and the safety margin inherent in the analysis has been preserved.

The three echelons of defense-in-depth are:

(1) To prevent fires from starting (combustible/hot work controls)

(2) Rapidly detect, control and extinguish fires that do occur, thereby limiting damage (fire detection systems, automatic fire suppression, manual fire suppression, pre-fire plans)

(3) Provide adequate level of fire protection for systems and structures so that a fire will not prevent essential safety functions from being performed (fire barriers, fire rated cable, success path remains free of fire damage, recovery actions)

Per NFPA 805 Section 1.2, defense-in-depth is achieved when an adequate balance of each of these elements are provided.

The HDPE shieling is not an ignition source. It is thermally-thick and will not easily ignite unless subjected to a significant exposure fire. Therefore, the presence of the HDPE shielding has

minimal impact on Echelon 1. Echelon 1 is achieved through the lack of fixed ignition sources in the vicinity of the HDPE shielding and administrative controls on ignition sources, hot work, and combustibles. Echelon 2 is achieved due to the presence of automatic smoke and flame detection systems in the area of the HDPE shielding. These detection systems alarm in the continually-manned control room and will ensure rapid detection of a fire, should one occur, and rapid fire brigade response who will initiate suppression activities. Echelon 3 is achieved by the presence of fire rated barriers between fire areas and the risk of VFDRs in Fire Area 11 being deemed acceptable in accordance with NFPA 805, Section 4.2.4.2. Since a balance of the elements is provided, defense-in-depth is achieved.

Conclusion:

Part A:
NRC approval is requested for the ability to use radiation shielding materials that have not been tested to NFPA 259 and thereby do not meet the definition of limited combustible material in compliance with Section 3.3.4 of NFPA 805, but have been alternatively passed NFPA 701 testing or are classified as Class A materials in accordance with NFPA 101. The limited use of these shielding materials meets the level of fire safety intended by NFPA 805.

Based on the analysis above, the level of risk encountered by maintaining this current practice is acceptable, and the approach is considered acceptable because it:

(A) Satisfies the performance goals, performance objectives, and performance criteria specified in NFPA 805 related to nuclear safety and radiological release; FPE 01.01

(B) Maintains safety margins; and

(C) Maintains fire protection defense-in-depth (fire prevention, fire detection, fire suppression, mitigation, and post-fire nuclear safety capability).

Part B:

NRC approval is requested for the presence of HDPE shielding materials located along the cask wash pit in Room 530 at CCNPP. Based on the assessment above, the level of risk encountered by this configuration is acceptable. As described above, this approach is considered acceptable because it:

(A) Satisfies the performance goals, performance objectives, and performance criteria specified in NFPA 805 related to nuclear safety and radiological release;

(B) Maintains safety margins; and

(C) Maintains fire protection defense-in-depth (fire prevention, fire detection, fire suppression, mitigation, and post-fire nuclear safety capability).