



## D. C. Cook Nuclear Plant Fire Safety Analysis (FSA)

Revision: 4

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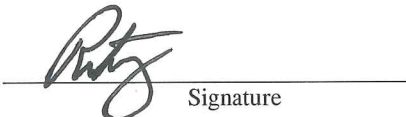
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## Executive Summary

A Fire Safety Analysis (FSA) for each Fire Area at D. C. Cook Nuclear Plant (CNP) was performed to support transition to 10 CFR 50.48(c), NFPA 805. Each FSA was previously an individual report, R1900-007-AAXX (where AA"XX" is the numerical fire area designation). This document supersedes all existing R1900-007- AAXX FSAs and consolidates them into a single document. This document is a key part of compliance with Section 2.7.1.2 Fire Protection Program Design Basis Document of NFPA 805.

## Scope of Revisions:

### Revision 1

FPPR-2014-0022 for EC54046 affecting fire analysis areas AA46 and AA47 for removing the acoustical panels.

FPPR-2015-0003 approved changes to fire analysis area AA2 to include Fire Zones 124 and 128 that had been previously removed in error.

FPPR-2015-0014 evaluated the addition of the Turbine Craft Facility (TCF) with updates to FSA. Impacts are limited to Fire Zone 130 interface with the TCF. The FSA Section AA2 element 3.1.1, element 3.1.2 and element 3.1.3 for Fire Zone 130 were updated to describe the interface between the buildings.

FPPR-2015-0027 for EC-0000054448 affecting fire analysis areas AA2 and AA15 for modification of the block wall for the Unit 1 AB EDG.

FPPR-2015-0069 for EC-0000053240 affecting fire analysis area AA2, Fire Zones 79-82 and 90-93 for sprinkler head replacement.

FPPR-2015-0077 approved changes to AA3 to correct a typographical error on page AA3-11 to correctly show that floor drains are not in Fire Zone 31 vice Fire Zone 32 and to correct the amount of oil in Fire Zone 69 page AA3-14 per EC-0000051302 (reference AR 2015-11518-1 and AR 2015-11518-2).

FPPR-2016-0008 evaluated and updated the FSA for editorial correction that demonstrated no more than minimal risk impact to the program.

FPCE-2016-0012, Update FSA to Revision 1.

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### Revision 2

FPCE-2017-0010 updated AA40 section 3.9 to reflect automatic CO2 suppression.

FPCE-2017-0017A updated the FSA for fire analysis area AA46-1 Section 3.2

FPPR-2015-0067 evaluated a change to the FSA fire analysis area AA2 Section 3.1.1 for Fire Zone 130 to install a two story Digital Control Staging Area.

FPCE-2017-0009 evaluated the following updates to the FSA:

Include minor editorial corrections for fire analysis area AA2 for fire zone 79 Section 3.1.1, Construction to shows that Fire Zone 15 is in AA14 instead of AA15. Updates to AA3 Section 3.1.6 to show that Fire Zoen 106 does not have floor drains, but they are available in adjacent Fire Zone 52. Additionally, three fire analysis areas (AA7, AA8 and AA35) that were previously modeled deterministically have been change to performance based as a result of AR 2016-9854.

79 new VFDRs, were added to 24 of the performance based analysis areas (AA3, AA7, AA8, AA9, AA10, AA11, AA27, AA29, AA31, AA33, AA34, AA35, AA36/42, AA37, AA38, AA40, AA43, AA46, AA48, AA50, AA51, AA52, AA56, AA58) with updates to Sections 3.3 and 3.3.1. Section 3.3.2 and Table 3-3 has been updated to show the new defense in depth recovery actions for each VFDR. Sections 3.7, 3.8 and 4.0 have been updated for AA7, AA8 and AA35 to show that the area changed from deterministic to performance based. Additionally, Attachment 2 of each affected analysis area has been updated as appropriate for the defense in depth recovery actions.

Global changes were made to incorporate the Fire Risk Evaluation calculations (PRA-FIRE-17663-701-AAXX series) for performance based fire areas into a single calculation (PRA-FIRE-NB-CRE, Fire PRA Cumulative Risk Evaluations – Rev. 0). This change impacts the FSA Sections 3.6 Probabilistic Risk Assessment-Summary of Results, 5.0 References and Attachment 2 Sections A2.1, Introduction, the analysis area references and is considered an editorial change because none of the numerical values have not changed between the current fire risk evaluations and PRA-FIRE-NB-CRE, this change only puts them in a single document to improve the ability to edit the calculation.

Added references to Technical Evaluation 12.1 and Technical Evaluation 12.1 Supplement 1 to Attachment 1 for each Analysis Area under “Fire Suppression Effects on Nuclear Safety Performance Criteria”.

Updated the following to reflect revisions made to EEE-11-44:  
 Fire Area AA3 – Attachment 1 - Table B-3 - Fire Area Transition  
 Fire Area AA34 section 3.1.1 "Construction"  
 Fire Area AA34 section 3.1.2 "Doors and Access Openings"  
 Fire Area AA34 – Attachment 1 - Table B-3 - Fire Area Transition  
 Fire Area AA35 – Attachment 1 - Table B-3 - Fire Area Transition

Updated Fire Area 3 section 3.1.1 to reflect changes made in Fire Zone 31 by EC-52984. Updated Fire Area 3 section 3.1.2 to reflect changes made in Fire Zones 31 and 32 by EC-52984.

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#### Revision 3

Updated to include references to EEE-11-69 Rev. 0, “Engineering Equivalency Evaluation for NFPA 80 1970 Ed. Code Deviation Electromagnetic Fire/Security Door Locks”. A statement was added to section 3.1.2 for each impacted Analysis Area indicating non-UL/FM approved electromagnetic door locks have been provided in class A doors. Attachment 1 for each impacted Analysis Area was also updated to include a reference to EEE-11-69. Affected Analysis Areas are: AA2 (Fire Zones 82, 86, 97, 129, 130, and 142), AA46 (Fire Zone 53), AA47 (Fire Zone 54), and AAYD.

Updated Analysis Areas AA14, AA15, AA23 and AA24 for EEE-11-17. This EEE was revised to evaluate the acceptability of fire seals grouted to an unknown depth. (Ref. AR 2017-11328-1)

Updated Analysis Area AA2 section 3.1.3 for Fire Zone 28 removing the statement referring to EEE-11-31 (Ref. AR 2017-11284-1).

Updated Analysis Area AA27 section 3.1.3 to correctly state that an exemption was granted for Fire Zone 22, not Fire Zone 12 (Ref. AR 2017-11708-1).

Updated fire analysis area AA3 Section 3.1.5 to show the allowance for use of 286F sprinkler heads in Fire Zone 32 (Ref. FPCE-2017-0030).

Updated combustible loading classification for Fire Zone 75 from LOW to MODERATE (Ref. FPCE-2018-0009).

Updated AA2 section 3.1.6 as follows: Removed 89 and 94 as not having extinguishers, added 124, and 128 as not having extinguishers. Added 108, 109, 110, 111, 124, 126, 128, and 141 to not having hose stations. Removed 30 from not having floor drain and added 94, 124, 128, 140, and 141. Added Fire Zones 83, 88, and 100 as a system having a low pressure CO2 system. Added that 28 floor drain has been sealed and is not available.

Updated AA2C section 3.1.6 to remove discussion of hose reel in Fire Zone 112.

Updated AA3 section 3.1.6 as follows: Added fire zones 35, 48, 106, and 107 as not having fire extinguishers. Added discussion of adjacent areas where extinguishers are located. Consolidated hose reel discussion. Removed discussion of sump drain in Fire Zone 31.

Updated AA5/6 section 3.1.6 as follows: Consolidated fire extinguisher available. Added hose reel available in Fire Zone 6S, and consolidated with discussion for Fire Zone 5 and Fire Zone 6N. Removed breathing apparatus discussion from Fire Zone 6M.

Updated AA12 section 3.1.6 to indicate fire extinguishers are available in Fire Area AA12.

Updated AA13 section 3.1.6 to indicate floor drains are available in this area.

Updated AA29 section 3.1.6 to remove discussion of hose reels in Fire Zones 23 and 24.

Updated AA32 section 3.1.6 to discuss floor drains for Fire Zones 29A and 29B, and drainage for Fire Zones 29E and 29G.

Updated AA33 section 3.1.6 to include the following: Floor drains are provided for Fire Zone 29C and 29D. Floor drains are not provided for Fire Zone 29F. Drainage for Fire Zone 29F is via the room entrance into the Screen House, Fire Zone 142, at the 591ft elevation.

Updated AA34 section 3.1.6 to remove discussion of breathing apparatus from Fire Zone 33A. Also added discussion of floor drains and area drainage.

Updated AA35 section 3.1.6 to remove discussion of breathing apparatus from Fire Zone 34A. Also added discussion of floor drains and area drainage.

Updated AA37 section 3.1.6 to indicate floor drains are available in this area.

Updated AA38 section 3.1.6 to indicate floor drains are available in this area.

Updated AA36/42 section 3.1.6 to remove discussion of a water hose reel from Fire Zone 43.

Updated AA40 section 3.1.6 to indicate that water hose reels are available in adjacent fire zones, but not available in Fire Zone 41.

Updated AA41 section 3.1.6 to remove discussion of water hose reel available in this area.

Updated AA44 section 3.1.6 to include fire extinguisher in adjacent Fire Zone 97.

Updated AA46 section 3.1.6 to indicate fire extinguishers are available in adjacent Fire Zones 54 and 129, and removed discussion of breathing apparatus from fire zone 129.

Updated AA47 section 3.1.6 to indicate fire extinguishers are available in adjacent Fire Zones 53 and 130, and removed discussion of breathing apparatus from fire zone 129.

Updated AA50 section 3.1.6 to remove discussions of hose reels in Fire Zones 57 and 144 and to add breathing apparatus available in Fire Zones 53 and 44N.

Updated AA51 section 3.1.6 to remove discussions of hose reels in Fire Zones 58 and 145 and to add breathing apparatus available in Fire Zone 54.

Updated AA56 section 3.1.4 to include line type detectors in zones 120 and 122. Updated section 3.1.6, deleted discussion of Fire Zone 122 not having floor drains, added discussion that Fire Zones 67 and 134 do not have floor drains.

Updated AA58 section 3.1.4 to include line type detectors in zones 121 and 123.

Updated fire analysis area YARD section 3.1.6 to support removal of the fire hose cabinets per FPCE-2017-0017. This changed the wording from "Outside manual hose installations", to "Outside manual hose applications".

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Revision 4 – Issued under FPCE 2019-0021

Updated B-3 Table for AA41 per AR 2018-8640, correcting the Performance Goal for Vital Auxiliaries with use of Unit 1 Green (CD) Off-site Power instead of Emergency Diesel Generator. This is an editorial change to match section 3.3 NSCA Compliance Summary in the FSA for AA41 as well as the failure report generated in R1900-0024-003, Nuclear Safety Capability Assessment Safe Reports.

FPCE-2019-0001 updated the title of EEE-11-18 referenced in the B-3 table for AA3, AA5/6, and AA35. FPCE-2019-0001 also updated Section 3.1.2 of AA3 removing the discussion of 1 ½ hour rated roll up door that was replaced in the late 1990s and discussing the 3 hour rated fire door installed in its place, 2-DR-AUX383. Discussion of EEE-11-18 was also added in relation to the unrated door Fire Zone 35 boundary.

Per AR 2017-8242 made generic updates to all analysis areas, section 3.6 and section 5.0 for PRA document number changes. “PRA-FIRE-17663-14-LAR” changed to “PRA-NB-FIRE-FQ” and “PRA-FIRE-17663-011A-LAR” changed to “PRA-NB-FIRE-FSS”. This is an editorial change only.

Updated AA2 Table 3-1 and 3-2 per FPCE-2018-0011 to remove the Risk Significance of the Fire Zone 129 and Fire Zone 130 thermal detection and manual suppression systems.

Updated AA2 Section 3.1.4 Detection to remove discussion of TSC charcoal filter unit thermistor string per EC-52275 (Approved under FPPR-2015-0060).

Added VFDR AA38-010 and VFDR AA36/42.42-037 for new control room action to place valve RU-9 controllers in MANUAL. This is due to EC-52454 and approved under FPPR-2015-0045.

Table 3-3 on page AA41-10 was updated to reflect a change in required recovery actions to "None" for AA41-001. This is consistent with Section 3.3.1.1 AA41-001 description (AR 2018-10933-2) and is an editorial correction only.

FPCE-2019-0013 updated the title and summary of EEE-11-19 Rev. 1, discussed under AA2 and YARD.

FPCE-2019-0012 updated The Fire Hazards Identification section for many of the Analysis Areas, documenting the exterior fire hazards impacting those Analysis Areas and the fire barrier requirements for exterior walls if necessary. Section 3.1.3, Penetrations, has been updated for Fire Zones 40A, 40B, 47A, 47B, 55, and 60 to remove the statement “Note: Statements regarding fire resistance rating of penetration seals are not applicable to seals in barriers to Analysis Area YD.” Section 3.1.3, Penetrations, has also been updated for Fire Zone 69 to remove the requirement for fire seals in the north wall of the fire zone.

FPCE-2019-0016 made editorial corrections to sections 3.1.1 and 3.1.2 for AA2, Fire Zones 77 and 78. Construction of Fire Zone 77 (Weld Shop) was updated to discuss metal frame and drywall enclosure with two unrated man doors and an unrated roll-up door. Fire Zone 78 was updated to remove discussion of the demolished backup heating boiler and abandoned in place fuel oil pumps and fuel oil pump enclosure associated with the backup heating boiler.

Section 3.6, PRA Results Summary was changed for every Fire Analysis Area referencing PRA-NB-FIRE-FQ for documentation of potentially risk significant fire scenarios as well as the overall risk for each fire analysis area. Where detailed fire modeling was used, reference to the associated fire modeling report was included as reference for any credited fire protection features. Table 3-4 containing the risk numbers for potentially risk significant fire scenarios and the overall fire analysis area CDF and LERF contribution have been removed. This is an editorial change only.

Section 3.1.8, Other Features, was updated for AA2 identifying ERFBS for raceways 80009PR-1 and 80046PR-1 in Fire Zone 79 and for AA5/6 identifying ERFBS for raceway 8154G-2 in Fire Zone 6M as identified in Attachment 6 of the NFPPM. This is an editorial change only.

AA11 and AA27 sections 3.2 and Attachment 2 sections A2.2 through A2.4.1 and A2.7 were updated to remove discussion of whole room burn analysis, discussing fixed ignition sources are in the area as well as pointing to the detailed fire modeling reports R1900-0411-AA11 and R1900-0411-AA27 used in PRA-NB-FIRE-FSS. This change is editorial. The conclusions from the Fire PRA and chosen fire modeling did not change.

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AA22	Unit 2 East Motor Driven Auxiliary Feedwater Pump Room (El. 591 ft.)	AA22-1
AA23	Unit 2 CD Diesel Generator Room (El. 587 ft.)	AA23-1
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## D. C. Cook Nuclear Plant Fire Safety Analysis

## Fire Area: AA1

Unit 1 and Unit 2 Residual Heat Removal and Containment Spray Pump  
Area (El. 573 ft.)

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## Attachments

Fire Area AA1 – Attachment 1 - Table B-3 - Fire Area Transition

## 1.0 PURPOSE

This report documents the Fire Safety Analysis (FSA) for Cook Nuclear Plant (CNP) Fire Area AA1, Unit 1 and Unit 2 Residual Heat Removal and Containment Spray Pump Area (El. 573 ft.) which comprises fire zone(s) 1, 1A, 1B, 1C, 1D, 1E, 1F, 1G, 1H, 136, 137, 138A, 138B, 138C. The purpose of this analysis is to demonstrate the achievement of the nuclear safety and radioactive release performance criteria of NFPA 805 as required by 10 CFR 50.48(c). The Fire Safety Analysis is a key part of compliance with Section 2.7.1.2 Fire Protection Program Design Basis Document of NFPA 805.

## 2.0 ANALYSIS METHODOLOGY

The FSA is the design basis document as described in NFPA 805 Section 2.7.1.2. The following steps are performed to develop the FSA on a fire area basis:

- Identify significant fire hazards in the fire area. This is based on NFPA 805 approach to analyze the plant from an ignition source and fuel package perspective.
- Summarize Nuclear Safety Capability Analysis (NSCA) compliance strategies. This is the result of the NEI 04-02 B-3 Table review of the Safe Shutdown Analysis.
- Summarize Non-Power Operations Modes compliance strategies.
- Summarize Radioactive Release compliance strategies. The transition review process required per NEI 04-02 is used to develop these results.
- Provide Fire Probabilistic Risk Assessment summary of results. This is based on the results from the plant Fire PRA.
- Perform risk informed, performance based evaluations if needed for the performance based approach.
- Summarize Defense-in-Depth strategy for each fire area.
- Determine key analysis assumptions which are candidates to be included in the NFPA 805 monitoring program.
- Provide conclusions relative to NFPA 805 compliance.

### 3.0 ANALYSIS

#### 3.1 Classical Fire Protection

##### 3.1.1 Construction

For Fire Zone 1, walls, floors and ceilings to adjacent fire areas and fire zones are all reinforced concrete in excess of 3-hour rating. High density concrete block shield walls are provided at the entrances to the Containment Spray and Residual Heat Removal Pump Rooms (Fire Zones 1A through 1H) . The removable block wall section provides a means for pump maintenance. The elevator shaft is constructed of reinforced concrete in excess of a 3-hour rating.

For Fire Zones 1A through 1H, walls, floors and ceilings to adjacent fire areas and fire zones are all reinforced concrete in excess of a 3-hour rating. High density concrete block shield walls are provided at the entrances to the Containment Spray and Residual Heat Removal Pump Rooms. The removable block wall section provides a means for pump maintenance.

For Fire Zones 136 and 137, walls, floors and ceilings to adjacent fire areas and fire zones are reinforced concrete in excess of a 3-hour rating.

For Fire Zones 138A, 138B and 138C, walls, floors and ceilings to adjacent fire areas and fire zones are reinforced concrete in excess of a 3-hour rating.

Applicable Engineering Equivalency Evaluations are documented in Attachment 1.

##### 3.1.2 Doors and Access Openings

In Fire Zone 1, there are no door openings to adjacent fire areas. Elevator doors are 1 1/2-hour rated. Wire mesh screen gates are provided at the entrances to adjacent Fire Zones 1A through 1H and 138A through 138C for ventilation purposes. Removable high density concrete block is provided for access from this fire zone into Fire Zones 136 and 137. An open stairway protected by a water curtain connects the basement area with the 587 ft. elevation of the Auxiliary Building, Fire Area AA5/6 - Fire Zone 5. A fire area boundary evaluation was performed for the rated and unrated fire barriers of the stairwells and elevators located in the Turbine and Auxiliary Buildings (Engineering Equivalency Evaluation 11-12).

For Fire Zones 1A and 1B, there are no door openings to adjacent fire areas. A wire mesh screen gate is provided at the entrance to adjacent Fire Zone 1 for ventilation purposes.

For Fire Zones 1C and 1D, there are no door openings to adjacent fire areas. A locked wire mesh screen gate is provided at the entrance to adjacent Fire Zone 1 for ventilation purposes.

For Fire Zones 1E and 1F, there are no door openings to adjacent fire areas. A wire mesh screen gate is provided at the entrance to adjacent Fire Zone 1 for ventilation purposes.

For Fire Zones 1G and 1H, there are no door openings to adjacent fire areas. A locked wire mesh screen gate is provided at the entrance to adjacent Fire Zone 1 for ventilation purposes.

In Fire Zone 136, there are no door openings to adjacent fire areas. Removable high-density concrete block is provided for access into this fire zone from Fire Zone 1.

In Fire Zone 137, there are no door openings to adjacent fire areas. Removable high-density concrete block is provided for access into this fire zone from Fire Zone 1.

In Fire Zone 138A, 138B and 138C, there are no door openings to adjacent fire areas. A wire mesh gate is provided for access into this fire zone from Fire Zone 1 and for ventilation purposes.

### 3.1.3 Penetrations

For Fire Zone 1, penetrations in fire barriers between this fire zone and adjacent fire areas and the elevator shaft are provided with fire seals. Penetrations in the "T-shaped" portion of the shield wall separating adjacent RHR pump cubicles are also sealed. However, barriers between this fire zone and adjacent fire zones are not fire sealed.

For Fire Zone 1A, penetrations in fire barriers between this fire zone and adjacent fire areas are provided with fire seals except as noted below. However, barriers between this fire zone and adjacent fire zones are not fire sealed. A fire area boundary evaluation was performed for an open penetration shaft to Fire Area AA54 - Fire Zone 62A and Fire Area AA36/42 - Fire Zone 44A (Engineering Equivalency Evaluation 9-31).

For Fire Zone 1B, penetrations in fire barriers between this fire zone and adjacent fire areas are provided with fire seals except as noted below. However, barriers between this fire zone and adjacent fire zones are not fire sealed. A fire area boundary evaluation was performed for an open penetration shaft to Fire Area AA54 - Fire Zone 62B and Fire Area AA36/42 - Fire Zone 44B (Engineering Equivalency Evaluation 9-31).

For Fire Zone 1C, penetrations in fire barriers between this fire zone and adjacent fire areas are provided with fire seals except as noted below. Additionally, penetrations in the "T-shaped" fire barrier between this fire zone and the adjacent RHR pump cubicle are also sealed. However, barriers between this fire zone and adjacent fire zones are not fire sealed. A fire area boundary evaluation was performed for an open penetration shaft to Fire Area AA54 - Fire Zone 62B and Fire Area AA36/42 - Fire Zone 44C (Engineering Equivalency Evaluation 9-31).

For Fire Zone 1D, penetrations in fire barriers between this fire zone and adjacent fire areas are provided with fire seals except as noted below. Additionally, penetrations in the "T-shaped" fire barrier between this fire zone and the adjacent RHR pump cubicle are also sealed. However, barriers between this fire zone and adjacent fire zones are not fire sealed. A fire area boundary evaluation was performed for an open penetration shaft to Fire Area AA54 - Fire Zone 62C and Fire Area AA36/42 - Fire Zone 44D (Engineering Equivalency Evaluation 9-31).

For Fire Zone 1E, penetrations in fire barriers between this fire zone and adjacent fire areas are provided with fire seals except as noted below. However, barriers between this fire zone and adjacent fire zones are not fire sealed. A fire area boundary evaluation was performed for an open penetration shaft to Fire Area AA55 - Fire Zone 63A and Fire Area AA36/42 - Fire Zone 44E (Engineering Equivalency Evaluation 9-32).

For Fire Zone 1F, penetrations in fire barriers between this fire zone and adjacent fire areas are provided with fire seals except as noted below. However, barriers between this fire zone and adjacent fire zones are not fire sealed. A fire area boundary evaluation was performed for an open penetration shaft to Fire Area AA55 - Fire Zone 63B and Fire Area AA36/42 - Fire Zone 44F (Engineering Equivalency Evaluation 9-32).

For Fire Zone 1G, penetrations in fire barriers between this fire zone and adjacent fire areas are provided with fire seals except as noted below. Additionally, penetrations in the "T-shaped" fire barrier between this fire zone and the adjacent RHR pump cubicle are also sealed. However, barriers between this fire zone and adjacent fire zones are not fire sealed. A fire area boundary evaluation was performed to an open penetration shaft to Fire Area AA55 - Fire Zone 63B and Fire Area AA36/42 - Fire Zone 44G (Engineering Equivalency Evaluation 9-32).

For Fire Zone 1H, penetrations in fire barriers between this fire zone and adjacent Fire Areas are provided with fire seals except as noted below. Additionally, penetrations in the "T" shaped fire barrier between this fire zone and the adjacent RHR pump cubicle are also sealed. However, barriers between this fire zone and adjacent fire zones are not fire sealed. A fire area boundary evaluation was performed for an open penetration to Fire Area AA55 - Fire Zone 63C and Fire Area AA36/42- Fire Zone 44G (Engineering Equivalency Evaluation 9-32).

For Fire Zone 136, 137, 138A and 138C, penetrations in fire barriers between this fire zone and adjacent fire areas are provided with fire seals. However, barriers between this fire zone and adjacent fire zones are not fire sealed.

For Fire Zone 138B, penetrations in fire barriers between this fire zone and adjacent fire areas are provided with fire seals except as noted below. However, barriers between this fire zone and adjacent fire zones are not fire sealed. A fire area boundary evaluation was performed for open penetrations to Fire Area AA5/6 - Fire Zone 6A (Engineering Equivalency Evaluation 9-33).



### 3.1.4 Detection

The table below outlines the fire detection system(s) provided in the Fire Area:

Table 3-1, Fire Area AA1 Detection Systems								
Fire Zone	Type of System	Local (L) / Remote (R)	Detection Actuates Suppression?	Required System?				
				S	L	E	R	D
1	Ionization	L/R	N	N	N	Y	N	N
1A	Ionization	L/R	N	N	N	Y	N	N
1B	Ionization	L/R	N	N	N	Y	N	N
1C	Ionization	L/R	N	N	N	Y	N	N
1D	Ionization	L/R	N	N	N	Y	N	N
1E	Ionization	L/R	N	N	N	Y	N	N
1F	Ionization	L/R	N	N	N	Y	N	N
1G	Ionization	L/R	N	N	N	Y	N	N
1H	Ionization	L/R	N	N	N	Y	N	N
136	None	N/A	N/A	N/A	N/A	N/A	N/A	N/A
137	None	N/A	N/A	N/A	N/A	N/A	N/A	N/A
138A	None	N/A	N/A	N/A	N/A	N/A	N/A	N/A
138B	None	N/A	N/A	N/A	N/A	N/A	N/A	N/A
138C	None	N/A	N/A	N/A	N/A	N/A	N/A	N/A

**Table 3-1 Legend:**

Table Field: "Required System?"	
S	- Required for Chapter 4 Separation Criteria
L	- Required for NRC Approved Licensing Action
E	- Required for Engineering Equivalency Evaluation
R	- Required for Risk Significance
D	- Required to maintain adequate balance of Defense-in-Depth in a Change Evaluation or Fire Risk Evaluation

For Fire Zone 1, there are 7 ionization detectors which alarm in Unit 1 Control Room. These detectors are part of a larger detection circuit that includes the RHR and CTS pump cubicles (Fire Zones 1A through 1H).

For Fire Zones 1A through 1H, there are 2 ionization detectors which alarm in the Unit 1 Control Room. The detectors are part of the detection circuit protecting Fire Zone 1 and the other RHR and CTS pump cubicles, Fire Zones 1A through 1H.

Fire Zones 136, 137, 138A, 138B and 138C are not provided with an automatic fire detection system.

### 3.1.5 Fixed Suppression

The table below outlines the fixed fire suppression system(s) provided in the Fire Area:

Table 3-2, Fire Area AA1 Suppression Systems								
Fire Zone	Type of System	Full (F) / Partial (P)	Required System?					
			S	L	E	R	D	
1	Water Curtain	P	Y	N	Y	Y	N	
1A	None	N/A	N/A	N/A	N/A	N/A	N/A	
1B	None	N/A	N/A	N/A	N/A	N/A	N/A	
1C	None	N/A	N/A	N/A	N/A	N/A	N/A	
1D	None	N/A	N/A	N/A	N/A	N/A	N/A	
1E	None	N/A	N/A	N/A	N/A	N/A	N/A	
1F	None	N/A	N/A	N/A	N/A	N/A	N/A	
1G	None	N/A	N/A	N/A	N/A	N/A	N/A	
1H	None	N/A	N/A	N/A	N/A	N/A	N/A	
136	None	N/A	N/A	N/A	N/A	N/A	N/A	
137	None	N/A	N/A	N/A	N/A	N/A	N/A	
138A	None	N/A	N/A	N/A	N/A	N/A	N/A	
138B	None	N/A	N/A	N/A	N/A	N/A	N/A	
138C	None	N/A	N/A	N/A	N/A	N/A	N/A	

**Table 3-2 Legend:**

Table Field: "Required System?"	
S	- Required for Chapter 4 Separation Criteria
L	- Required for NRC Approved Licensing Action
E	- Required for Engineering Equivalency Evaluation
R	- Required for Risk Significance
D	- Required to maintain adequate balance of Defense-in-Depth in a Change Evaluation or Fire Risk Evaluation

For Fire Zone 1, dry pilot preaction sprinklers at the ceiling provide a water curtain around the perimeter of the open stairway in order to provide a separation between fire areas. These sprinklers are part of the 587 ft. elevation dry pilot preaction system. Pilot sprinklers are rated at 175°F and water sprinklers rated at 250°F. Manual release capability is provided on the 587 ft. elevation.

For Fire Zones 1A and 1B, no area suppression is provided. A high temperature sprinkler and pilot line detector are installed in the open penetration shaft at approximately the same elevation as the charging pump cubicle ceiling. This sprinkler is fed from the dry pilot preaction sprinkler system inside the Charging Pump Room above this fire zone.

For Fire Zones 1C and 1D, no area suppression is provided. A high temperature sprinkler and pilot line detector are installed in the open penetration shaft at approximately the same elevation as the charging pump cubicle ceiling. This sprinkler is fed from the dry pilot preaction sprinkler system inside the Charging Pump Room above this fire zone.

For Fire Zones 1E and 1F, no area suppression is provided. A high temperature sprinkler and pilot

line detector are installed in the open penetration shaft at approximately the same elevation as the charging pump cubicle ceiling. This sprinkler is fed from the dry pilot preaction sprinkler system inside the Charging Pump Room above this fire zone.

For Fire Zones 1G and 1H, No Area suppression is provided. A high temperature sprinkler and pilot line detector are installed in the open penetration shaft at approximately the same elevation as the charging pump cubicle ceiling. This sprinkler is fed from the dry pilot preaction sprinkler system inside the Charging Pump Room above this fire zone.

Fire Zones 136, 137, 138A, 138B and 138C, fixed fire suppression is not provided.

### **3.1.6 Manual Suppression / Response Strategy**

For fire zones within AA1 equipped with automatic detection systems, a postulated fire will be identified by early detection using ionization type smoke detection, heat detection or by plant personnel using plant communication system to notify the control room. The automatic detection systems alarm in the control room. For fire zones within AA1 which are not equipped with automatic detection systems, a postulated fire will be identified by plant personnel using plant communication system to notify the control room. The Control Room operator will dispatch the fire brigade for initiation of manual fire fighting. A fire in this fire area will be contained by the construction features discussed in Section 3.1.1. Manual suppression is provided by the CNP Fire Brigade.

Fire extinguishers, water hose reels and a breathing apparatus are provided in Fire Zone 1. Other fire zones within this area are not provided with this fire fighting equipment but are in close proximity to Fire Zone 1.

Floor drains are provided in Fire Zones 1, 136 and 137. For Fire Zones 1A through 1H, floor drains are not available. A sump in each of these rooms drain to the Auxiliary Building sump.

For Fire Zone 138A, 138B and 138C, floor drains are available which drain to the Auxiliary Building sump system.

### **3.1.7 Ventilation**

A fire in this area will be contained by the fire barriers. Smoke can be removed by portable fans and flexible ducting to other areas of the Auxiliary Building and outdoors if not contaminated. Contaminated smoke can be removed by portable fans and flexible ducting to other areas of the Auxiliary Building per the Fire Pre-Plans. The normal building ventilating systems in the Auxiliary Building will then exhaust the smoke via filtered monitored pathways.

For Fire Zone 1, fire damper evaluation for undampered ventilation ducts to Fire Area AA5/6 - Fire Zones 6N and 6S (Engineering Equivalency Evaluation 11-45). There are undampered duct penetrations to Fire Zones 136, 137, 138A and 138C.

For Fire Zones 1A and 1B, a fire area boundary evaluation was performed for an undampered ventilation duct to Fire Area AA11 - Fire Zone 12 (Engineering Equivalency Evaluation 9-4).

For Fire Zones 1C and 1D, Fire dampers having a 3-hour rating are provided to adjacent Fire Area AA11 - Fire Zone 12.

For Fire Zones 1E and 1F, a fire area boundary evaluation was performed for an undampened ventilation duct to Fire Area AA27 - Fire Zone 22 (Engineering Equivalency Evaluation 9-4).

For Fire Zones 1G and 1H, fire dampers having a 3-hour rating are provided to adjacent Fire Area AA27 - Fire Zone 22.

For Fire Zones 136 and 137, there are no ventilation penetrations to adjacent fire areas. There is an undampened ventilation penetration to Fire Zone 1.

For Fire Zone 138A, there are no ventilation penetrations to adjacent fire areas. There is an undampened duct penetration to Fire Zone 1.

For Fire Zone 138B, there are no ventilation penetrations to adjacent fire areas. There is an undampened duct penetration to Fire Zone 138C.

For Fire Zone 138C, there are no ventilation penetrations to adjacent fire areas. There are undampened duct penetrations to Fire Zones 1 and 138B.

### 3.1.8 Other Features

For Fire Zone 1, six-inch curbs are provided at the entrance to the Containment Spray and Residual Heat Removal Pump Rooms, Reactor Coolant Drain Tank Pump Rooms and CVCS hold up tank areas.

For Fire Zones 1A through 1H, a 6-inch curb is provided at the entrance to the fire zone.

Fire Zones 138A, 138B and 138C are high radiation fire zones.

## 3.2 Fire Hazards Identification

The fire area contains both ignition sources and combustible fire hazards. The ignition sources consist of redundant safety related Containment Spray Pumps and RHR pumps, as well as primary water pumps, evaporation coil drain tank pumps and various electrical cabinets. The redundant CTS and RHR pumps are physically separated from each other by reinforced concrete walls and high density concrete block shield walls in Fire Zones 1A through 1H. The cables associated with each pump pass through Fire Zone 1 and consist of two independent trains located in separate cable trays which are physically separated from each other.

Combustibles present in the Fire Area include cable insulation, cellulose, rubber, plastics, thermolag and lube oil contained within the RHR pumps, primary water pumps, and evaporation coil drain tank pumps.

All fire zones within this fire area have a combustible loading classification of low.

## 3.3 NSCA Compliance Summary

Fire Area AA1, U1 & U2 RHR & CTS Pump Area (EL. 573'), contains Unit 1 and Unit 2 Red and Green Train cables, conduits and raceways as well as Unit 1 and 2 Containment Spray and RHR equipment.

Compliance with the nuclear safety performance criteria is achieved using the deterministic approach in accordance with NFPA 805, Section 4.2.3.2.

Safe and stable condition of Unit 1 will be accomplished using Steam Generators 2 and 3 via Unit 1 East Motor Driven Auxiliary Feedwater Pump or Unit 1 Turbine Driven Auxiliary Feedwater Pump or Steam Generators 1 and 4 via the Unit 1 West Motor Driven Auxiliary Feedwater Pump, Control Room process monitoring, Unit 1 Charging via the West or East pump, Unit 1 Component Cooling Water via the East or West Pump, Unit 1 ESW via the East or West Pump. The ESW system remains available to support the Red and Green Train EDG. Electrical power is supplied to either Red or Green Trains via offsite power with the Emergency Diesels also available.

Safe and stable condition of Unit 2 will be accomplished using Steam Generators 2 and 3 via Unit 2 East Motor Driven Auxiliary Feedwater Pump or Unit 2 Turbine Driven Auxiliary Feedwater Pump or Steam Generators 1 and 4 via the Unit 2 West Motor Driven Auxiliary Feedwater Pump, Control Room process monitoring, Unit 2 Charging via the Unit 2 East or West Pump, Unit 2 Component Cooling Water via the East or West Pump, Unit 2 ESW via the East or West ESW pump and power from offsite with the Emergency Generators also available.

The Nuclear Safety Performance Criteria compliance strategy for AA1 is documented within the NSCA Report.

### **3.3.1 Variances**

There are no variances for this fire area.

### **3.3.2 Recovery Actions Credited**

There are no recovery actions for this fire area.

## **3.4 Non-Power Operational Modes Compliance Summary**

A review of CNP for the potential effects of a fire in this Fire Area while in non-power modes of operation (NPO) was conducted. This review was conducted using the guidance provided in NEI 04-02 and FAQ 07-0040, "Non-Power Operations Clarifications".

The review determined that there are potential failures that affect certain Key Safety Functions (KSF) as a result of the fire in this area, and the fire could result in the loss of one or more KSF paths. Compensatory measures are required during high risk evolution periods to provide reasonable assurance a fire will not adversely affect key safety functions and the NFPA 805 performance goal for NPO is therefore satisfied. The results of the NPO analysis are contained within Technical Evaluation R1900-005-001, Non-Power Operation Modes Transition Review Report.

## **3.5 Radioactive Release Compliance Summary**

The NFPA 805 radiological release goal is to provide reasonable assurance that a fire will not result in a radiological release that adversely affects the public, plant personnel or the environment. The NFPA 805 requirement is to ensure a radiation release to any unrestricted area due to the direct effects of fire suppression activities (but not involving fuel damage) shall be as low as reasonably achievable and shall not exceed applicable plant Technical Specification limits.

AA1 is within the Radiological Controlled Area (RCA) and has been identified as a potential fire area for radioactive release due to fire fighting activities. In accordance with NFPA 805 FAQ 09-0056, this potential has been reviewed to ensure that engineering controls, fire pre-plans, and fire

brigade training materials are provided for containment and monitoring of gaseous and liquid effluents associated with fire suppression agents and products of combustion.

The review concludes that the steps to limit radiation release to other areas due to the direct effects of fire suppression activities, in addition to compliance with NFPA 805, Chapter 4, ensure that any radioactive release will be as low as reasonably achievable and will not exceed limits designated in the CNP Technical Specifications.

The review of this fire area, with respect to radioactive release, is documented in the NFPPM.

### **3.6 Probabilistic Risk Assessment-Summary of Results**

A Fire PRA (FPRA) quantification of Fire Area AA1 was performed and is documented in PRA-NB-FIRE-FQ, Fire PRA Model Quantification Notebook. The fire risk quantification for Fire Area AA1 is analyzed using detailed fire modeling to consider risk of fire scenarios of ignition sources. PRA-NB-FIRE-FQ includes a summary of all potentially risk-significant fire scenarios (i.e., CDF > 1.0E-7 or LERF > 1.0E-8). Bounding CDF / LERF per calendar year values are reported that are based on the risk values documented in PRA-NB-FIRE-FSS, Fire PRA Fire Scenario Selection.

Fire Protection features credited in the Fire PRA are documented in R1900-0411-AA1, Detailed Fire Modeling Report: Fire Compartment: AA1 Unit 1 & Unit 2 RHR & CTS Pump Area (EL. 573). PRA-NB-FIRE-FSS documents the revision level of the fire modeling reports used in the most recent Fire PRA quantification.

### **3.7 Risk-Informed, Performance-Based Evaluations**

There are no VFDRs for this fire area, and therefore, no Fire Risk Evaluations have been performed.

#### **3.7.1 Transition Risk-Informed, Performance-Based Evaluations**

There are no VFDRs for this fire area, and therefore this section is not applicable to Fire Area AA1.

### 3.8 Defense-in-Depth

Per NFPA 805, section 2.4.4.2, “Defense-in-Depth”: The deterministic approach for meeting the performance criteria shall be deemed to satisfy this defense-in-depth requirement.

### 3.9 Monitoring Program Input

A Monitoring Program will be developed in accordance with FAQ 10-0059, Rev. 1. Methods to monitor availability, reliability, and performance of fire protection program structures, systems, and components (SSCs), as well as programmatic elements will be provided. Additionally, effectiveness measures are established to review program related performance and trends. For AA1 the following systems and features are candidates for inclusion in the CNP Fire Protection Monitoring Program:

- Fire Area boundary barriers discussed in Section 3.1
- Fire Detection (Ionization)

## 4.0 CONCLUSION

The nuclear safety and radioactive release performance criteria of NFPA 805 are met for a fire in Fire Area AA1. This Fire Safety Analysis has demonstrated that for Fire Area AA1 a success path remains free of fire damage using the deterministic approach per Section 4.2.3 of NFPA 805.

## 5.0 REFERENCES

- 5.1 CNP Fire Pre-Plans, Volumes I, II, and III, Revisions 17, 14, and 18 respectively
- 5.2 Fire Hazards Analysis
- 5.3 NFPA 805, Performance-Based Standard for Fire Protection for Light Water Reactor Electric Generating Plants
- 5.4 NFPPM, NFPA 805 Fire Protection Program Manual (NFPPM)
- 5.5 Nuclear Energy Institute (NEI) 04-02, Guidance for Implementing a Risk-Informed, Performance-Based Fire Protection Program under 10 CFR 50.48(c), Rev. 2
- 5.6 Nuclear Safety Capability Assessment Report
- 5.7 PRA-NB-FIRE-FQ, Fire PRA Model Quantification Notebook
- 5.8 PRA-NB-FIRE-FSS, Fire PRA Fire Scenario Selection
- 5.9 R1900-0411-AA1, AA1 - Detailed Fire Modeling Report
- 5.10 Technical Evaluation R1900-005-001, Non-Power Operation Modes Transition Review

**Fire Area AA1 – Attachment 1 - Table B-3 - Fire Area Transition**

<b><u>Unit</u></b>	<b><u>Fire Area</u></b>	<b><u>Description</u></b>
1, 2	AA1	Unit 1 and Unit 2 Residual Heat Removal and Containment Spray Pump Area (El. 573 ft.)

<b><u>Fire Zone</u></b>	<b><u>Description</u></b>
1	Auxiliary Building - El. 573 ft. 0 in. - Both Units
1A	Containment Spray Pump East, Auxiliary Building - El. 573 ft. 0 in. - Unit 1
1B	Containment Spray Pump West, Auxiliary Building - El. 573 ft. 0 in. - Unit 1
1C	Residual Heat Removal Pump East, Auxiliary Building - El. 573 ft. 0 in. - Unit 1
1D	Residual Heat Removal Pump West, Auxiliary Building - El. 573 ft. 0 in. - Unit 1
1E	Containment Spray Pump East, Auxiliary Building - El. 573 ft. 0 in. - Unit 2
1F	Containment Spray Pump West, Auxiliary Building - El. 573 ft. 0 in. - Unit 2
1G	Residual Heat Removal East, Auxiliary Building - El. 573 ft. 0 in. - Unit 2
1H	Residual Heat Removal West, Auxiliary Building - El. 573 ft. 0 in. - Unit 2
136	Unit 1 Pipe Tunnel - El. 573 ft. 0 in.
137	Unit 2 Pipe Tunnel - El. 573 ft. 0 in.
138A	CVCS Hold-up Tank Area North - El. 562 ft. 0 in.
138B	CVCS Hold-up Tank Area Middle - El. 562 ft. 0 in.
138C	CVCS Hold-up Tank Area South - El. 562 ft. 0 in.

**Regulatory Basis**

4.2.3.2 - Deterministic Approach

<b>Performance Goal</b>	<b>Method of Accomplishment</b>	<b>Comments</b>
Reactivity Control	Unit 1 - Trip the reactor from the Control Room. Borate using Unit 1 East or West Charging Pump from the RWST. Use source range monitoring for indication.  Unit 2 - Trip the reactor from the Control Room. Borate using Unit 2 East or West Charging Pump supplied from the RWST. Use source range monitoring for indication.	None
Inventory and Pressure Control	Unit 1 - Control inventory using Unit 1 East or West Charging Pump. Control pressure using Unit 1 Pressurizer Safety Relief Valves.	None



**Fire Area AA1 – Attachment 1 - Table B-3 - Fire Area Transition**

<u>Unit</u>	<u>Fire Area</u>	<u>Description</u>
1, 2	AA1	Unit 1 and Unit 2 Residual Heat Removal and Containment Spray Pump Area (El. 573 ft.)
Decay Heat Removal		<p>Unit 2 - Control inventory using Unit 2 East or West Charging Pump. Control pressure using Unit 2 Pressurizer Safety Relief Valves.</p> <p>Unit 1 - Feed SGs 2 &amp; 3 with the Unit 1 East MDAFW Pump or Unit 1 TDAFW Pump or feed SGs 1 &amp; 4 with the Unit 1 West MDAFW Pump. The DHR function also requires MS isolation with a steam release path through the Safety Relief Valves.</p> <p>Unit 2 - Feed SGs 2 &amp; 3 with the Unit 2 East MDAFW Pump or Unit 2 TDAFW Pump or feed SGs 1 &amp; 4 with the Unit 2 West MDAFW Pump. The DHR function also requires MS isolation with a steam release path through the Safety Relief Valves.</p>
Process Monitoring		<p>Unit 1 Process Monitoring - Use Unit 1 process monitoring in the Control Room for the following: Pressurizer level, RCS pressure and temperature, and S/G level and Pressure.</p> <p>Unit 1 Source Range Monitoring - Use Unit 1 source range monitoring in the Control Room.</p> <p>Unit 2 Process Monitoring - Use Unit 2 process monitoring in the Control Room for the following: Pressurizer level, RCS pressure and temperature, and S/G level and Pressure.</p> <p>Unit 2 Source Range Monitoring - Use Unit 2 source range monitoring in the Control Room.</p>
Vital Auxiliaries		<p>Unit 1 Electrical - Control Unit 1 Red (AB) Train Electrical Distribution with Unit 1 Red (AB) Train Offsite Power or Unit 1 Red (AB) DG. Control Unit 1 Green (CD) Train Electrical Distribution with Unit 1 Green (CD) Train Offsite Power or Unit 1 Green (CD) DG.</p> <p>Unit 1 ESW - Operate Unit 1 East or West ESW.</p> <p>Unit 1 CCW - Operate Unit 1 East or West CCW.</p> <p>Unit 1 HVAC - Operate Unit 1 Control Room HVAC. Operate Unit 1 Auxiliary Building HVAC. Operate Unit 1 Red (AB) and Green (CD) DG HVAC. Operate Unit 1 Switchgear HVAC. Operate Unit 1 AFW Pump Room HVAC systems. Operate the Unit 1 East and West ESW Pump HVAC systems.</p> <p>Unit 2 Electrical - Control Unit 2 Red (AB) Train Distribution with Unit 2 Red</p>

**Fire Area AA1 – Attachment 1 - Table B-3 - Fire Area Transition**

<u>Unit</u>	<u>Fire Area</u>	<u>Description</u>
1, 2	AA1	Unit 1 and Unit 2 Residual Heat Removal and Containment Spray Pump Area (El. 573 ft.)
		(AB) Train Offsite Power or Unit 2 Red (AB) DG. Control Unit 2 Green (CD) Train Electrical Distribution with Unit 2 Green (CD) Train Offsite Power or Unit 2 Green (CD) DG. Unit 2 ESW - Operate Unit 2 East or West ESW. Unit 2 CCW - Operate Unit 2 East or West CCW. Unit 2 HVAC - Operate Unit 2 Control Room HVAC. Operate Unit 2 Auxiliary Building HVAC. Operate Unit 2 Red (AB) and Green (CD) DG HVAC. Operate Unit 2 Switchgear HVAC. Operate Unit 2 AFW Pump Room HVAC systems. Operate the Unit 2 East and West ESW Pump HVAC systems.

**Reference Documents**

Genesis Solution Suite, EDISON / SAFE-PB, DC Cook V 3.4.0

Nuclear Safety Capability Assessment Report

**Licensing Actions**

None

**Existing Engineering Equivalency Evaluations (EEEE)**

**EEEE Title** Engineering Equivalency Evaluation 9-4 - Auxiliary Building Vertical Air Shafts Evaluation: Fire Zones 12 (Fire Area AA11) and 22 (Fire Area AA27)

**Summary** The purpose of this engineering equivalency evaluation is to document the acceptability of two vertical air shafts, located in the Auxiliary Building (Fire Areas AA11 and AA27), that extend from the 573 ft. elevation to just below the 650 ft. elevation with dampered and undampered ventilation openings.

Reasonable assurance is provided that a fire in any of the adjoining fire areas to the Auxiliary Building air shafts with undampered or unrated duct penetrations or a fire in either air shaft will not adversely impact on safe shutdown capabilities of CNP. In addition, this engineering equivalency evaluation does not adversely impact other engineering equivalency evaluations.

The air shafts were evaluated and found to be acceptable based on the fire hazards, fire protection systems and construction features within the evaluated areas.

**Fire Area AA1 – Attachment 1 - Table B-3 - Fire Area Transition**

<b><u>Unit</u></b>	<b><u>Fire Area</u></b>	<b><u>Description</u></b>
1, 2	AA1	Unit 1 and Unit 2 Residual Heat Removal and Containment Spray Pump Area (El. 573 ft.)
<hr/>		
<b><u>EEEE Title</u></b>	<b>Engineering Equivalency Evaluation 9-31 - Fire Zones 62A, 62B and 62C (Fire Area AA54) Boundary Evaluation</b>	
<b><u>Summary</u></b>	<p>The purpose of this engineering equivalency evaluation is to document the acceptability of steel plate covered access openings to vertical chases/leakage detection boxes in Fire Zones 62A, 62B, and 62C (all from Fire Area AA54) that connect the RHR and containment spray pumps below with their heat exchangers above.</p> <p>Reasonable assurance is provided that a fire in the vicinity of the vertical chases/leakage detection boxes passing through Fire Zones 62A, 62B and 62C would not impair safe shutdown capabilities of CNP. This engineering equivalency evaluation does not adversely impact other engineering equivalency evaluations.</p> <p>The openings were evaluated and found to be acceptable based on the fire hazards, fire protection systems and construction features within the evaluated areas.</p>	
<b><u>EEEE Title</u></b>	<b>Engineering Equivalency Evaluation 9-32 - Fire Zones 63A, 63B and 63C (Fire Area AA56) Boundary Evaluations</b>	
<b><u>Summary</u></b>	<p>The purpose of this engineering equivalency evaluation is to document the acceptability of steel plate covered access openings to vertical chases/leakage detection boxes in Fire Zones 63A, 63B and 63C (all in Fire Area AA56) that connect the RHR and containment spray pumps below with their heat exchangers above.</p> <p>Reasonable assurance is provided that a fire in the vicinity of the vertical chases/leakage detection boxes passing through Fire Zones 63A, 63B and 63C would not impair safe shutdown capabilities of CNP or impact on the full area suppression exemption request for the 573 ft. elevation of the Auxiliary Building. This engineering equivalency evaluation does not adversely impact other engineering equivalency evaluations.</p> <p>The unprotected access opening steel plate covers were evaluated and found to be acceptable based on the fire hazards, fire protection systems and construction features within the evaluated areas.</p>	

**Fire Area AA1 – Attachment 1 - Table B-3 - Fire Area Transition**

<u>Unit</u>	<u>Fire Area</u>	<u>Description</u>
1, 2	AA1	Unit 1 and Unit 2 Residual Heat Removal and Containment Spray Pump Area (El. 573 ft.)

<b><u>EEEE Title</u></b>	<b>Engineering Equivalency Evaluation 9-33 - Fire Zone 6A (Fire Area AA5/6) to 138B (Fire Area AA1) Boundary Evaluations</b>
<b><u>Summary</u></b>	<p>The purpose of this engineering equivalency evaluation is to document the acceptability of a vertical shaft connecting the 601 ft. Pipe Tunnel in Fire Zone 6A (Fire Area AA5/6) and the CVCS Hold Up Tank Room B in Fire Zone 138B (Fire Area AA1).</p> <p>Reasonable assurance is provided that a fire on the 573 or 562 ft. elevations of the Auxiliary Building will not spread up the shaft in Fire Zone 138B to Fire Zone 6A and spread from there so as to impair redundant safe shutdown capabilities. This engineering equivalency evaluation does not impact other engineering equivalency evaluations.</p> <p>The undampered vertical shaft connecting Fire Zone 6A and Fire Zone 138B was evaluated and found to be acceptable based on the fire hazards and fire protection systems within the evaluated areas. Also, one of the fire zones being evaluated does not contain</p>
<b><u>EEEE Title</u></b>	<b>Engineering Equivalency Evaluation 11-9 - Turbine, Auxiliary and Containment Buildings Boundary Evaluation</b>
<b><u>Summary</u></b>	<p>The purpose of this engineering equivalency evaluation is to describe in general, the approach and existence of evaluations performed to determine and reconcile fire area boundaries having components or designs with less than a 3-hr fire rating on preventing the spread of fire. This engineering equivalency evaluation also specifically evaluates the impact of unrated door assemblies on the spread of fire.</p> <p>Reasonable assurance is provided that the fire area boundaries having components or design less than a 3-hr fire rating will not increase the spread of fire or impair the safe shutdown capabilities of Units 1 or 2. In addition, this engineering equivalency evaluation does not adversely impact on other engineering equivalency evaluations or exemption requests.</p> <p>This evaluation supports additional evaluations credited in this fire area.</p>

**Fire Area AA1 – Attachment 1 - Table B-3 - Fire Area Transition**

<u>Unit</u>	<u>Fire Area</u>	<u>Description</u>
1, 2	AA1	Unit 1 and Unit 2 Residual Heat Removal and Containment Spray Pump Area (El. 573 ft.)
<hr/>		
<b><u>EEEE Title</u></b>	<b>Engineering Equivalency Evaluation 11-12 - Stairwells and Elevator Construction and Boundary Evaluation (Fire Analysis Areas AA 1, AA2, AA3, AA5/6, AA3 6 and AA42)</b>	
<b><u>Summary</u></b>	<p>The purpose of this engineering equivalency evaluation is to document the acceptability of the rated and unrated fire barriers of the stairwells and elevators located in the Turbine and Auxiliary Buildings for their impact on preventing the spread of fire in Fire Areas AA1, AA2, AA3, AA5/6, and AA36/42.</p> <p>Reasonable assurance is provided that the open stairwells and elevators of the Turbine and Auxiliary Buildings will not result in an increased potential for the spread of fire or potential impairment of the safe shutdown capabilities of Unit 1 or Unit 2. This engineering equivalency evaluation does not impact other engineering equivalency evaluations.</p> <p>The stairwells and elevator boundaries were evaluated and found to be acceptable based on the fire hazards, fire protection systems and construction features within the areas.</p>	
<b><u>EEEE Title</u></b>	<b>Engineering Equivalency Evaluation 11-45 - Auxiliary Building HVAC Duct Penetrations Boundary Evaluation Fire Analysis Areas AA1, AA3, AA5/6 and AA36/42</b>	
<b><u>Summary</u></b>	<p>The purpose of this engineering equivalency evaluation is to document the acceptability of not installing fire dampers in the ventilation system duct penetrations that communicate between fire areas vertically from elevation to elevation in Fire Areas AA1, AA3, AA5/6, and AA36/42. The ventilation ducts associated with the 22 penetrations were located on HVAC drawings showing the entire flow path of each duct. Penetrations into fire zones/areas equipped with rated fire dampers were eliminated and what remained is discussed in this engineering equivalency evaluation.</p> <p>This analysis verifies that the safe shutdown system requirements relative to the guidelines of NFPA 805 are being met, and the exclusion of fire dampers in the ventilation ducts is justified.</p> <p>The ventilation ducts were evaluated and found to be acceptable based on the fire hazards, fire protection systems and construction features within the evaluated areas.</p>	

**Fire Area AA1 – Attachment 1 - Table B-3 - Fire Area Transition**

<u>Unit</u>	<u>Fire Area</u>	<u>Description</u>
1, 2	AA1	Unit 1 and Unit 2 Residual Heat Removal and Containment Spray Pump Area (El. 573 ft.)

**Fire Suppression Effects on Nuclear Safety Performance Criteria**

The CNP fire brigade is trained to discharge water in a judicious manner and instructed to direct hose streams and portable extinguishers at the base of the fire to limit the amount of overspray beyond the immediate fire zone. For this reason, fire brigade activities are not expected to fail components which are not immediately involved in the fire scenario. It has been concluded that water impingement on cables is not a concern. Electrical cabinets are provided with a seal at the conduit interface to prevent water intrusion. Per visual inspection any side vents for this equipment are pointed downward to prevent water intrusion. Therefore, in the event of discharge, the pre-action system will not adversely effect the other equipment operating within the fire zone. The drainage features of the fire area mitigate the potential for flooding damage due to fire suppression, such that the standing water would not affect credited equipment.

Since it is shown that suppression effects will not impact the nuclear safety performance criteria, the fire area configuration is deemed acceptable.

**References:**

Technical Evaluation 12.1, "Fire Suppression Effects Study"

Technical Evaluation 12.1, "Supplemental Information to Fire Suppression Effects Study – Supplement 1"

**Fire Area Comments**

None

D. C. Cook Nuclear Plant  
Fire Safety Analysis

Fire Area: AA2

Unit 1 and Unit 2 Turbine Building, Main Steam Enclosures and Pipe  
Tunnels

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Attachments

    Fire Area AA2 – Attachment 1 - Table B-3 - Fire Area Transition

    Fire Area AA2 – Attachment 2 - Fire Risk Evaluation Results Summary

## 1.0 PURPOSE

This report documents the Fire Safety Analysis (FSA) for Cook Nuclear Plant (CNP) Fire Area AA2, Unit 1 and Unit 2 Turbine Building, Main Steam Enclosures and Pipe Tunnels which comprises fire zone(s) 2N, 2S, 28, 30, 77, 78, 79, 80, 81, 82, 83, 84, 85, 86, 87, 88, 89, 90, 91, 92, 93, 94, 95, 96, 97, 98, 99, 100, 108, 109, 110, 111, 124, 126, 127, 128, 129, 130, 131A, 139, 140, 141, 142. The purpose of this analysis is to demonstrate the achievement of the nuclear safety and radioactive release performance criteria of NFPA 805 as required by 10 CFR 50.48(c). The Fire Safety Analysis is a key part of compliance with Section 2.7.1.2 Fire Protection Program Design Basis Document of NFPA 805. This analysis also documents results of risk-informed, performance-based Fire Risk Evaluations (FREs). These evaluations are associated with Variances from Deterministic Requirements (VFDRs) of NFPA 805 Chapter 4.

## 2.0 ANALYSIS METHODOLOGY

The FSA is the design basis document as described in NFPA 805 Section 2.7.1.2. The following steps are performed to develop the FSA on a fire area basis:

- Identify significant fire hazards in the fire area. This is based on NFPA 805 approach to analyze the plant from an ignition source and fuel package perspective.
- Summarize Nuclear Safety Capability Analysis (NSCA) compliance strategies. This is the result of the NEI 04-02 B-3 Table review of the Safe Shutdown Analysis.
- Summarize Non-Power Operations Modes compliance strategies.
- Summarize Radioactive Release compliance strategies. The transition review process required per NEI 04-02 is used to develop these results.
- Provide Fire Probabilistic Risk Assessment summary of results. This is based on the results from the plant Fire PRA.
- Perform risk informed, performance based evaluations if needed for the performance based approach.
- Summarize Defense-in-Depth strategy for each fire area.
- Determine key analysis assumptions which are candidates to be included in the NFPA 805 monitoring program.
- Provide conclusions relative to NFPA 805 compliance.



### 3.0 ANALYSIS

#### 3.1 Classical Fire Protection

##### 3.1.1 Construction

Fire Zone 28: There are no walls, floors, or ceilings to adjacent fire areas. Walls, to adjacent fire zones are 8-inch concrete block having a 4-hour rating. The floor is reinforced concrete in excess of a 3-hour rating. The ceiling is a 4-inch concrete slab on metal decking supported by unprotected steel framing.

Fire Zone 30: There are no walls, floors, or ceilings to adjacent fire areas. Walls to adjacent fire zones are 8-inch concrete block having a 4-hour rating. The floor is reinforced concrete in excess of a 3-hour rating. The ceiling is a 4-inch concrete slab on metal decking supported by unprotected steel framing. The diesel fuel oil day tank is located within the room and enclosed by a concrete dike and buried in sand.

Fire Zone 77: There are no walls, floors, or ceilings to adjacent fire areas. The east wall and floor to the adjacent yard are reinforced concrete in excess of a 3-hour rating. The north wall to the Service Building is constructed of 12-inch concrete block with a 4-hour rating. The ceiling to adjacent fire zones are reinforced concrete on unprotected steel framing. The west and south walls of the weld shop are constructed of metal frame and drywall.

Fire Zone 78: There are no walls, floors or ceilings to adjacent fire areas. Walls to adjacent fire zones and the Service Building are constructed of concrete block having a 4-hour rating. All exposed structural steel beams and columns are enclosed by 4-hour construction. The fuel oil pump for the auxiliary heating boiler is enclosed within its own room with its own ceiling. The west wall to the exterior is constructed of unrated metal siding. The floor slab is constructed of reinforced concrete with a 3-hour rating.

Fire Zone 79: Walls to adjacent fire areas are reinforced concrete in excess of a 3-hour rating with two exceptions to Fire Area AA14 -Fire Zone 15 and Fire Area AA15 - Fire Zone 16. These exceptions are the 3-hour 8-inch concrete block used to reduce the wall opening size for the installation of a single leaf door and the 4-hour, 8-inch concrete block used in the east wall for equipment removal.

The ceiling to adjacent Auxiliary Building fire areas is reinforced concrete in excess of a 3-hour rating. The ceiling to adjacent Turbine Building fire zones is reinforced concrete on unprotected steel framing. The floor to adjacent fire zones is reinforced concrete in excess of a 3-hour rating. The freight elevator is constructed of concrete block of an unspecified rating.

Fire Zone 80: Walls to adjacent fire areas are reinforced concrete in excess of a 3-hour rating with two exceptions to Fire Area AA15 -Fire Zone 16 and Fire Area AA16 - Fire Zone 17A. The first exception is the 4-hour 8-inch concrete block that has been covered on each side by a 3/8" structural steel plate (EC-0000054448/FPPR-2015-0027) used in the east wall for equipment removal from Fire Zone 16. Secondly, the walls and floor to Fire Zone 17A are steel plates coated on the outside with a coating of Pyrocrete Fireproofing to give a 3-hour rating. The wall separating the Unit 1 Turbine Building from Unit 2 is constructed of reinforced concrete in excess of a 3-hour rating and 12-inch concrete block of at least a 2-hour rating. The block is used to decrease the size of an opening for the installation of a single leaf door.

The ceiling to adjacent fire zones is reinforced concrete on unprotected steel framing. The floor to adjacent fire zones is reinforced concrete in excess of a 3-hour rating. The passenger elevator is constructed of 8-inch concrete block of an unspecified rating with exposed-steel columns at the corners. A fire area boundary evaluation was performed for the rated and unrated fire barriers of the stairwells and elevators located in the Turbine and Auxiliary Buildings.

Fire Zone 81: Walls to adjacent fire areas are reinforced concrete in excess of a 3-hour rating. Walls to adjacent Fire Zones 28, 83 and 142 are constructed of 4-hour 8-inch concrete block. The wall separating the Unit 1 Turbine Building from Unit 2 is constructed of reinforced concrete in excess of a 3-hour rating. The west wall to the exterior is constructed of unrated metal siding. The ceiling to adjacent fire zones is reinforced concrete on unprotected steel framing. The floor to adjacent fire zones is reinforced concrete in excess of a 3-hour rating.

Fire Zone 82: There are no walls, floors or ceilings to adjacent fire areas. Walls to adjacent Fire Zones 78 and the Service Building at 595 ft. 0 in. elevation are constructed of concrete block having a 4-hour rating. The west wall to the exterior is constructed of unrated metal siding. The ceiling to adjacent fire zones is reinforced concrete on unprotected steel framing. The floor to adjacent fire zones is reinforced concrete in excess of a 3-hour rating.

Fire Zone 83: There are no walls, floors or ceilings to adjacent fire areas. All floors to adjacent fire zones are reinforced concrete in excess of a 3-hour rating. The walls of this fire zone are constructed of 8-inch 4-hour rated concrete block. The ceiling to the adjacent fire zone is constructed of reinforced concrete on protected steel framing. Exposed structural steel has 4-hour rated fire protection.

Fire Zone 84: Walls to adjacent fire areas are reinforced concrete in excess of a 3-hour rating with two exceptions to Fire Area AA23 - Fire Zone 18 and Fire Area AA17 - Fire Zone 17B. The first exception is the 4-hour 8-inch concrete block used in the east wall for equipment removal from Fire Zone 17. Secondly, the walls and floor to Fire Zone 17B are steel plates coated on the outside with a coating of Pyrocrete Fireproofing to give a 3-hour rating. The wall separating the Unit 1 Turbine Building from Unit 2 is constructed of reinforced concrete in excess of a 3-hour rating and 12-inch concrete block of at least a 2-hour rating. The block is used to decrease the size of an opening for the installation of a single leaf door.

The ceiling to adjacent fire zones is reinforced concrete on unprotected steel framing. The floor to adjacent fire zones is reinforced concrete in excess of a 3-hour rating.

Fire Zone 85: Walls to adjacent fire areas are reinforced concrete in excess of a 3-hour rating with two exceptions to Fire Area AA23. Fire Zone 18 and Fire Area AA24 - Fire Zone 19. These exceptions are the 3-hour 8-inch concrete block used to reduce the wall opening size for the exchange of a pair of doors to a single leaf door and the 4-hour, 8-inch concrete block used in the east wall for equipment removal.

The ceiling to adjacent Auxiliary Building fire areas is reinforced concrete in excess of a 3-hour rating. The ceiling to adjacent Turbine Building fire zones is reinforced concrete on unprotected steel framing. The floor to the adjacent fire zone is reinforced concrete in excess of a 3-hour rating. The walls to adjacent Fire Zone 128 are 8-inch concrete block of an unspecified rating. The ceiling of Fire Zone 128 is of concrete construction of an unspecified rating.

Fire Zone 86: There are no walls, floors, or ceilings to adjacent fire areas. Walls to adjacent Fire Zones 89 are constructed of concrete block having a 3-hour rating. The west wall to the exterior is constructed of unrated metal siding. The south wall to the yard is constructed of reinforced concrete in excess of a 3-hour rating. The walls adjacent to Fire Zone 124 are constructed of 8-inch concrete block of an unspecified rating. The ceiling of Fire Zone 124 is constructed of concrete with an unspecified rating. The ceiling to adjacent fire zones is reinforced concrete on unprotected steel framing. The floor to adjacent fire zones is reinforced concrete in excess of a 3-hour rating.

Fire Zone 87: Walls to adjacent fire areas are reinforced concrete in excess of a 3-hour rating. Walls to adjacent Fire Zones 30, 88 and 142 are constructed of 4-hour 8-inch concrete block. The wall separating the Unit 1 Turbine Building from Unit 2 is constructed of reinforced concrete in excess of a 3-hour rating. The west wall to the exterior is constructed of unrated metal siding. The ceiling to adjacent fire zones is reinforced concrete on unprotected steel framing. The floor to adjacent fire zones is reinforced concrete in excess of a 3-hour rating.

Fire Zone 88: There are no walls, floors, or ceilings to adjacent fire areas. All floors to adjacent fire zones are reinforced concrete in excess of a 3-hour rating. The walls of this fire zone are constructed at 8-inch 4-hour rated concrete block. The ceiling to the adjacent fire zone is constructed of reinforced concrete on steel framing. Exposed structural steel has 4-hour rated fire protection.

Fire Zone 89: There are no walls, floors, or ceilings to adjacent fire areas. The floor to the adjacent yard is reinforced concrete in excess of a 3-hour rating. The walls of this fire zone are constructed of 8-inch 3-hour rated concrete block. The ceiling to the adjacent fire zone is constructed of reinforced concrete on unprotected steel beams. Columns are protected with 4-inch concrete block.

Fire Zone 90: Walls to adjacent fire areas are reinforced concrete in excess of a 3-hour rating. The exterior wall of the freight elevator facing the transformer area is constructed of 8-inch concrete block having a 4-hour rating. Exterior walls facing the transformer area are constructed of 8-inch concrete block having a 4-hour rating and unrated metal siding. The north wall facing the Service Building is constructed of concrete block with a four hour rating on the 609 ft. 0 in. elevation. The floor and ceiling to adjacent fire zones are reinforced concrete on unprotected steel framing.

Fire Zone 91: Walls and floors to adjacent fire areas are reinforced concrete in excess of a 3-hour rating. The passenger elevator is constructed of 8-inch concrete block of an unspecified rating with exposed steel columns at the corners. The wall separating the Unit 1 Turbine Building from Unit 2 is constructed of 12-inch concrete block having a 4-hour rating. The floor and ceiling to adjacent fire zones are reinforced concrete on unprotected steel framing.

Fire Zone 92: The walls to the Turbine Oil Tank Room (Fire Zone 95) are constructed of 8-inch concrete block having a 4-hour rating. The wall separating the Unit 1 Turbine Building from Unit 2 is constructed of 12-inch concrete block having a 4-hour rating. The wall separating the Unit 1 Turbine Building from the Screen house (Fire Zone 142) is constructed of 8-inch concrete block having a 4-hour rating. The flanges of the steel columns located in the wall are exposed on both sides of the wall. Exterior wall to the yard is constructed of unrated metal siding. The floor and ceiling to adjacent fire zones is constructed of reinforced concrete on unprotected steel framing.

Fire Zone 93: The walls to the adjacent Fire Zone 94 (west wall only) and the Service Building, 609 ft. 0 in. elevation, are constructed of 8-inch concrete block with a 4-inch brick facing having a

combined fire rating of 4-hours. The north wall to adjacent Fire Zone 94 is constructed of 12-inch concrete block having a 4-hour rating. The exterior wall to the yard is constructed of unrated metal siding. The floor and ceiling to adjacent fire zones is constructed of reinforced concrete on unprotected steel framing.

Fire Zone 94: There are no walls, floors, or ceilings to adjacent fire areas. The south wall to the adjacent Turbine Building, Fire Zone 93, is constructed of 12-inch concrete block having a 4-hour rating. The portions of the steel columns inside the room are encased by 4-inch solid concrete block with web space filled with block and mortar. The wall to the adjacent Service Building and the east wall to the Turbine Building are constructed of 8-inch concrete block and 4-inch brick face having a combined fire rating of 4-hours. The exterior west wall is constructed of unrated metal siding. The ceiling to adjacent Fire Zone 129 is reinforced concrete on protected steel framing having a 3-hour fire rating. The floor to adjacent Fire Zone 78 is reinforced concrete on protected steel framing having a fire rating of at least 3 hours.

Fire Zone 95: There are no walls, floors, or ceilings to adjacent fire areas. The floor and ceiling to adjacent fire zones are constructed of reinforced concrete on steel framing. The steel supporting the floor is unprotected. Exposed structural steel within the room and supporting the ceiling has 4-hour rated fire protection. The lower portion of the walls are constructed of reinforced concrete in excess of a 3-hour rating. The upper walls of this fire zone (above 3 ft. - 9 inches high) are constructed of 8-inch 4-hour rated concrete block.

Fire Zone 96: Walls and floors to adjacent fire areas are reinforced concrete in excess of a 3-hour rating. The wall separating the Unit 1 Turbine Building from Unit 2 is constructed of 12-inch concrete block having a 4-hour rating. The floor and ceiling to adjacent fire zones are reinforced concrete on unprotected steel framing.

Fire Zone 97: Walls to adjacent fire areas are reinforced concrete in excess of a 3-hour rating. Exterior walls facing the transformer area are constructed of 8-inch concrete block having a 4-hour rating and metal siding. The south exterior wall is constructed of unrated metal siding. The floor and ceiling to adjacent fire zones are reinforced concrete on unprotected steel framing.

Fire Zone 98: The exterior walls to the yard is constructed of unrated metal siding. A 3-hour rated concrete block firewall separates the fuel gas cylinder storage area of the Gas Cylinder Storage Building from the connecting corridor that is attached to the south wall of this fire zone. The floor and ceiling to adjacent fire zones are constructed of reinforced concrete on unprotected steel framing. There are no walls, floors or ceilings to adjacent fire areas.

Fire Zone 99: The walls to the Turbine Oil Tank Room (Fire Zone 100) are constructed of 8-inch concrete block having a 4-hour rating. The wall separating the Unit 1 Turbine Building from Unit 2 is constructed of 12-inch concrete block having a 4-hour rating. The wall separating the Unit 1 Turbine Building from the Screen house (Fire Zone 142) is constructed of 8-inch concrete block having a 4-hour rating. The flanges of the steel columns located in the wall are exposed on both sides of the wall. Exterior wall to the Yard is constructed of unrated metal siding. The floor and ceiling to adjacent fire zones are constructed of reinforced concrete on unprotected steel framing.

Fire Zone 100: There are no walls, floors, or ceilings to adjacent fire areas. The floor and ceiling to adjacent fire zones are constructed of reinforced concrete on steel framing. The steel supporting the floor is unprotected. Exposed structural steel within the room and supporting the ceiling has 4-hour rated fire protection. The lower portion of the walls are constructed of reinforced concrete in

excess of a 3-hour rating. The upper walls of this fire zone (above 3 ft. high) are constructed of 8-inch 4-hour rated concrete block.

Fire Zone 108: Walls, floors and ceilings to adjacent fire areas are reinforced concrete in excess of a 3-hour rating. Unrated steel blow out panels are provided near the ceiling to vent high pressure steam from a HELB to the exterior.

Fire Zone 109: Walls, floors and ceilings to adjacent fire areas are reinforced concrete in excess of a 3-hour rating. Unrated steel blowout panels are provided near the ceiling to vent high pressure steam from a HELB to the exterior.

Fire Zone 110: Walls, floors and ceilings to adjacent fire areas and fire zones are reinforced concrete in excess of a 3-hour rating.

Fire Zone 111: Walls, floors and ceilings to adjacent fire areas and fire zones are reinforced concrete in excess of a 3-hour rating.

Fire Zone 126: There are no walls, floors, or ceilings to adjacent fire areas. A void space of approximately 2 feet exists between the east wall of the TSC and the west wall of the Auxiliary Building. Walls to adjacent fire zones are 4-inch brick and 4-inch concrete block of an unspecified rating. The ceiling has an unspecified rating and is constructed of 5-inch concrete slab on metal decking or a 5 1/2-inch concrete slab on top of 4-inch concrete block on metal deck. The first floor is part of the turbine deck floor/ceiling assembly. The second floor is 4-inch concrete slab.

Fire Zone 127: The south wall to adjacent fire area AA57A - Fire Zone 70 is of reinforced concrete in excess of a 3-hour rating. The west wall to the turbine deck (Fire Zone 129) is constructed of gypsum wallboard having a 3-hour rating. The interior wall between the battery room and inverter room is constructed of gypsum wallboard having a 2-hour rating. The exterior walls are prefabricated insulated metal panel siding. The roof is of built up construction on metal decking. The floor is of reinforced concrete having a 3-hour rating.

Fire Zone 129: The east wall to adjacent fire areas is reinforced concrete in excess of a 3-hour rating. The east wall to the TSC UPS Inverter and Battery Rooms (Fire Zone 127) is constructed of gypsum wallboard having a 3-hour rating. The roof is of built up construction on metal decking supported by unprotected steel framing. The heater bay and turbine bay roofs have a UL Class A & FM Class I roof covering consisting of insulation and a single EPDM membrane covering. The floor is a concrete slab on unprotected steel framing.

The north wall to the Service Building and Fire Zone 131A at the 633 ft. 0 in. elevation is constructed of a combination of 8 in. concrete block and 4 in. wide fire brick and is rated at four hours. The walls of the freight elevator facing the Turbine Building are constructed of 6-inch concrete block with a 4-inch brick facing. The walls of the passenger elevator area constructed of 8-inch concrete block with a 4-inch brick facing which also encloses the steel columns at the corners. All exterior walls are metal siding. The west wall to adjacent Fire Zone 142 is constructed of unprotected steel. The interface between these two fire zones is approximately 18 inches high for the length of the Screen house. The portions of the east exterior wall adjacent to the GSU transformer are constructed of 8-inch concrete block having a 4-hour rating and metal siding up to the heater bay roof. The portion of the east wall adjacent to the GSU transformer above the heater bay roof and below the turbine building roof is constructed of metal siding only. This unrated portion is protected by an open head water spray system which operates simultaneously with the

GSU transformer deluge system.

Fire Zone 130: The east wall to adjacent fire areas is reinforced concrete in excess of a 3-hour rating. The roof is of built-up construction on metal decking supported by unprotected steel framing. The heater bay and turbine bay roofs have a UL Class A & FM Class I roof covering consisting of insulation and a single EPDM membrane covering. The floor is a concrete slab on unprotected steel framing. The west wall to adjacent Fire Zone 142 is constructed of unprotected steel. The west wall to the adjacent Turbine Craft Facility (TCF) is separated by a 2-hour rated fire barrier. The interface between these two zones is approximately 18-inches high for the length of the Screen house.

A two story building has been installed in the southwest corner of the fire zone. This building is designed to be a completely enclosed structure on all sides. The structure design includes factory installed roof and wall insulation of 4" thick rigid mineral wool insulation with an interior liner of 29 gauge flat steel. (EC-0000054462, FPPR-2015-0067)

All exterior walls are metal siding. The portions of the east exterior wall adjacent to the GSU transformers are constructed of 8-inch concrete block having a 4-hour rating with metal siding up to the heater bay roof. The portion of the east wall adjacent to the GSU transformers above the heater bay roof and below the turbine building roof is constructed of metal siding only. This unrated portion is protected by an open head water spray system which operates simultaneously with any of the GSU transformer deluge systems.

Fire Zone 131A: The north barrier wall of the room is constructed of 8 inch thick concrete block which separates the Containment Cooling Chiller Equipment Room and the Office Building Addition floor areas. This barrier wall includes a section where structural steel installed in a horizontal configuration, within the wall barrier, obstructs the full concrete face of the block wall and fire proofing materials were applied to the exposed steel on the Containment Cooling Chiller Equipment Room side of the barrier wall in order to provide a continuous barrier wall. This wall barrier is considered to be three hour rated based upon its construction composition which is similar to other three hour rated barriers at the facility.

This structural steel within the north barrier wall is located approximately 24 ft. above the Containment Cooling Chiller Equipment Room floor elevation and it provides part of the structural support framework for the Office building addition area when the building was built. The fire proofing materials provide structural protection of the steel over the entire width of the room.

The north wall of the room at the west end also interfaces with rest room areas that are only accessible from the Office Building Addition side of the barrier wall. This wall barrier also includes a 30 inch wide by 24 inch high 1/4 in. thick plate steel access panel which was installed in order to gain access to various plumbing fixtures on the other side of the barrier wall and below the Office Building addition floor elevation. This wall barrier appears to be constructed of the same 8 inch thick block as other barrier walls and structural steel at the same elevation in the wall is visible without fire proofing material. In addition, the restroom east wall was field verified to have been constructed of drywall and plaster materials. The unprotected structural steel and access plate arrangement within the wall barrier along with the drywall configuration were evaluated as being acceptable (Engineering Equivalency Evaluation 11-19).

The south wall, constructed of a combination of 8 inch concrete block and 4 inch wide face brick,

and abuts to the Turbine building (Fire Zone 129) at elevation 633 ft. 0 in. This wall barrier is rated at four hours based upon a review of locations where this combination of materials is utilized.

The south wall of the room also includes a 54 ft. long by 12 ft. wide enclosed extension corridor which extends south over to the Turbine building freight elevator on the 633 ft. 0 in. Unit I Turbine operating floor elevation. The wall barriers, constructed of a combination of 8 in. concrete block and 4 in. wide face brick, making up the enclosure to the freight elevator are rated at four hours based upon their construction and a review of CNP drawing 1-4052-13.

It should be noted that the east and west walls of the extension corridor south over to the Turbine building freight elevator are constructed of the same materials, a combination of 8 in. concrete block and 4 inch wide face brick, in order to provide four hour rated barriers that interface with the exterior main transformer to the east. The west wall of the extension corridor interfaces with the 633 ft. 0 in. elevation of the Turbine building northeast end.

The floor barrier in the extension walkway is constructed of 12 in. thick minimum poured concrete. This floor barrier supports Turbine building equipment loads and is easily rated at three hours based upon its construction and the construction of other three hour rated floor barriers that were evaluated previously.

The ceiling barrier in the extension walkway is constructed of metal decking and built up roofing materials. This ceiling barrier separates the Containment Cooling Chiller Equipment Room and the outdoors above the 659 ft. 0 in. of the Turbine Building. The Turbine building operating floor level is 633'-0" and the masonry barrier wall is visible up to the exterior Turbine building wall barrier at the 659 ft. 0 in. elevation which is constructed of metal siding.

The south barrier wall of the room on the east end also includes an exterior exposure to the station 345 KV main transformer that is constructed of the same combination of 8 inch concrete block and 4 inch wide face brick. This wall barrier is rated at four hours based upon its construction and a review of CNP drawing 1-4052-13.

The west wall of the room abuts to the Service Building general storage area. This barrier wall is constructed of 8 in. thick block based upon field measurements. This wall barrier is also interrupted in one location by an unprotected vertical structural steel column within the barrier wall and no fire proofing materials are installed on the exposed steel on either side of the wall. This wall barrier is rated at three hours based upon its construction and this type of configuration being credited as three hour rated elsewhere in the facility. The unprotected structural steel configuration within the wall barrier was evaluated as being acceptable (Engineering Equivalency Evaluation 11-19).

The west wall of the room also abuts to an enclosed stairwell that is constructed of the same 8 inch thick concrete block.

The east wall of the room includes an exterior barrier wall constructed of metal siding. This wall barrier is not rated based upon its construction. This wall separates the Containment Cooling Chiller Equipment Room from two large power transformers which supply power to the equipment located within the equipment room. An elevated structural platform supports the installation of two (2) exterior power transformers above the ground and an access door into the room from the platform is provided. The non rated barrier wall was evaluated as being acceptable (Engineering Equivalency Evaluation 11-19).

The small portion of the east wall of the room on the north end abuts to the Engineering Office Building Addition which is also constructed of metal siding. This wall barrier is also not rated based upon its construction. The exterior masonry Office Building Addition Extension wall barrier materials provide suitable separation between Fire Zone 131A and these other plant office areas.

The floor barrier for the room separates this Fire Zone 131A from the rest of the lower Service building areas on the 623 ft. 8 in. elevation and is constructed of 5 1/2 in. minimum thick poured concrete on metal decking. This floor barrier is rated at three hours minimum based upon its construction and a review of the NFPA Fire Protection Handbook, figure 19.2.20 of the 20th edition (Engineering Equivalency Evaluation 11-19).

The ceiling barrier is an exposure barrier to the outdoors as no additional floors of the Service building are installed above the Containment Cooling Chiller Equipment room or other areas of the Service building. Wall barriers in the Containment cooling chiller Equipment Room and the corridor over to the Turbine building freight elevator are approximately 26 ft. 0 in. in height and as discussed previously the ceiling of the corridor is constructed of non rated materials since the barrier separates the room from the outdoors.

Fire Zone 139: There are no walls, floors, or ceilings to adjacent fire areas. Walls, floors and ceilings to adjacent turbine building fire zones are reinforced concrete in excess of a 3-hour rating.

Fire Zone 140: There are no walls, floors, or ceilings to adjacent fire areas. The walls below the 591 ft. elevation to the adjacent Fire Zone 143 are reinforced concrete in excess of a 3-hour rating. The stair enclosure above the 591 ft. elevation is constructed of 8-inch concrete block of an unspecified rating with a 5-inch concrete slab ceiling. The floor and ceiling to adjacent fire zones are reinforced concrete in excess of a 3-hour rating. Drawings 12-5976, 12-5978 and 1-4052-13 provide additional details.

Fire Zone 141: The wall to the adjacent fire area is reinforced concrete in excess of a 3-hour rating. The walls and ceiling to the adjacent fire zones are reinforced concrete in excess of a 3-hour rating.

Fire Zone 142: Walls and floors to the adjacent fire area are reinforced concrete in excess of a 3-hour rating. The east wall to the adjacent Turbine Building Fire Zones 81 and 87 is 8-inch concrete block with at least a 4-hour rating. The east wall facing adjacent Turbine Building Fire Zones 92 and 99 is constructed of 8-inch concrete block having a 4-hour rating. The flanges of the steel columns located in the wall are exposed on both sides of the wall. Structural steel forming the upper portion of the east wall of the Screen house which faces Fire Zones 129 and 130 in the Turbine Building is unprotected. The walls to the Unit 1 and Unit 2 diesel fire pump rooms (Fire Zones 28 and 30) are 8-inch concrete having a 4-hour rating. The exterior walls are constructed of unrated metal panels on unprotected steel framing. The roof is of built-up construction on metal deck supported by unprotected steel framing. The roofs have a Class A & FM Class I covering consisting of insulation and a single EPDM membrane. The floor is constructed of concrete.

Applicable Engineering Equivalency Evaluations are documented in Attachment 1.

### **3.1.2 Doors and Access Openings**

In Fire Zones 28 and 30, a fire door having a 3-hour rating is provided to adjacent Fire Zone 142.



In Fire Zone 77, there are no openings to adjacent fire areas. There is an unrated man door and an unrated roll-up door provided to adjacent Fire Zone 79 and an unrated man door provided to Fire Zone 82.

In Fire Zone 78, there are no door openings to adjacent fire areas. Fire doors having a 3-hour rating are provided to adjacent Fire Zone 82. An unrated door is provided to the yard.

In Fire Zone 79, fire doors having a 3-hour rating are provided to adjacent Fire Areas AA9, AA14 and AA15 - Fire Zones 10, 15 and 16. An unlabeled Class A (3-hour) roll-up fire door is provided to adjacent Fire Area AA13 - Fire Zone 14.

In Fire Zone 80, fire doors having a 3-hour rating are provided to adjacent Fire Areas AA18 - Fire Zones 17C and to adjacent Fire Zone 84. A manual Class A (3-hour) roll-up fire door is provided to adjacent Fire Area AA16 - Fire Zone 17A. An unrated sliding door is also provided for missile and jet impingement protection to adjacent Fire Area AA16 - Fire Zone 17A. The elevator doors have a 1 1/2-hour rating. An unrated door is provided to adjacent Fire Zone 110. An unrated watertight door is provided to adjacent Fire Zone 2. An open stairwell connects this fire zone with Fire Zones 91 above and 2 below. Fire Zone 80 provides access down into Fire Zone 139 by a laddered floor opening.

In Fire Zone 81, fire doors having a 3-hour rating are provided to adjacent Fire Zones 83, 87 and 142. An unlabeled Class A (3-hour) roll-up fire door is provided to adjacent Fire Zone 87. An unrated door is provided at the stairway leading to Fire Zone 140. An open stairwell connects this fire zone with Fire Zones 92 and 141 below.

In Fire Zone 82, fire doors having a 3-hour rating are provided to adjacent Fire Zone 78 and the Service Building 595 ft. 0 in. elevation. An unlabeled Class A (3 hour) roll-up fire door is provided to the adjacent Service Building. A non-UL/FM approved electromagnetic door lock is provided on one Class A door (EEE-11-69).

In Fire Zone 83, a fire door having a 3-hour rating is provided to adjacent Fire Zone 81. There are no door openings to adjacent fire areas.

In Fire Zone 84, fire doors having a 3-hour rating are provided to adjacent Fire Areas AA18 - Fire Zones 17C and to adjacent Fire Zone 80. An unrated door is provided to adjacent Fire Zone 111. A manual Class A (3 hour) roll-up fire door is provided to adjacent Fire Area AA17 - Fire Zone 17B. An unrated sliding door is also provided for missile and jet impingement protection to adjacent Fire Area AA17 - Fire Zone 17B. An unrated watertight door is provided to adjacent Fire Zone 2.

In Fire Zone 85, fire doors having a 3-hour rating are provided to adjacent Fire Areas AA23, AA24 and AA29 - Fire Zones 18, 19 and 24. An unlabeled Class A (3-hour) roll-up fire door is provided to adjacent Fire Area AA25 - Fire Zone 20. An unrated door is provided to adjacent Fire Zone 128.

In Fire Zone 86, a fire door having a 3-hour rating is provided to adjacent Fire Zone 89. An open stairwell connects this fire zone with Fire Zone 98 above. A fire area boundary evaluation was performed for the rated and unrated fire barriers of the stairwells and elevators located in the Turbine and Auxiliary Buildings (Engineering Equivalency Evaluation 11-12). A non-UL/FM approved electromagnetic door lock is provided on one Class A door (EEE-11-69).

In Fire Zone 87, fire doors having a 3-hour rating are provided to adjacent Fire Zones 81, 88 and 142. An unlabeled Class A (3-hour) roll-up fire door is provided to adjacent Fire Zone 81.

In Fire Zone 88, a fire door having a 3-hour rating is provided to adjacent Fire Zone 87. There are no door openings to adjacent fire areas.

In Fire Zone 89, there are no door openings to adjacent fire areas. Two fire doors each having a 3-hour rating are provided to adjacent Fire Zone 86.

In Fire Zone 90, fire doors having a 3-hour rating are provided to adjacent Fire Areas AA39B - Fire Zones 40B and to the yard. One unlabeled Class A (3-hour) roll-up fire door is provided to the adjacent Service Building 609 ft. 0 in. elevation. One unlabeled Class D (1 1/2-hour) roll-up fire door is provided to the yard. The Access ventilation opening between this fire zone and adjacent Fire Zone 42A (Fire Area AA41) is provided with a combined multi-section fire damper assembly and personnel door. The fire dampers, door, doorframe and supporting structure are installed as a 3-hour rated assembly. The dampers are furnished with fusible Electro-thermal links (ETLs). The links are temperature rated for 286°F. to preclude the possibility of inadvertent closure during a high energy line break (HELB) in the Turbine Building. The ETLs are actuated through the existing CO2 system in Fire Zone 42A. Actuation of the ETLs is accomplished through existing relays in the CO2 control cabinets. The design for this opening also incorporates non-rated HELB dampers on the West side of the fire damper assembly and a security barrier. The elevator doors have a 1 1/2-hour rating. A fire area boundary evaluation was performed for the rated and unrated fire barriers of the stairwells and elevators located in the Turbine and Auxiliary Buildings (Engineering Equivalency Evaluation 11-12).

In Fire Zone 91, fire doors having a 3-hour rating are provided to adjacent Fire Area AA36/42 - Fire Zone 43. An unlabeled Class A (3-hour) roll-up fire door is provided to adjacent Fire Zone 96. The elevator doors have a 1 1/2-hour rating. An open stairwell connects this fire zone with Fire Zones 129 above and 80 below. A fire area boundary evaluation was performed for the rated and unrated fire barriers of the stairwells and elevators located in the Turbine and Auxiliary Buildings (Engineering Equivalency Evaluation 11-12).

In Fire Zone 92, fire doors having a 3-hour rating are provided to adjacent Fire Zone 95. An unlabeled Class A (3-hour) roll-up fire door is provided to adjacent Fire Zone 99. An open stairwell connects this fire zone with Fire Zones 129 above and 81 below.

In Fire Zone 93, fire doors having a 3-hour rating are provided to adjacent Fire Zone 94. An unlabeled Class A (3-hour) roll-up fire door is provided to adjacent Fire Zone 94 and the Service Building 609 ft. 0 in. elevation. An open stairwell connects this fire zone with Fire Zones 129 above and 82 below. A fire area boundary evaluation was performed for the rated and unrated fire barriers of the stairwells and elevators located in the Turbine and Auxiliary Buildings (Engineering Equivalency Evaluation 11-12).

In Fire Zone 94, there are no door openings to adjacent fire areas. Fire doors having a 3-hour rating are provided to adjacent Fire Zone 93 and the Service Building 609 ft. 0 in. elevation. An unlabeled Class A (3-hour) roll up fire door is provided to adjacent Fire Zone 93.

In Fire Zone 95, fire doors having a 3-hour rating are provided to adjacent Fire Zone 92. There are no door openings to adjacent fire areas.

In Fire Zone 96, an unlabeled Class A (3-hour) roll-up fire door is provided to adjacent Fire Zone 91.

In Fire Zone 97, fire doors having a 3-hour rating are provided to adjacent Fire Areas AA45B - Fire Zones 47B and to the yard. The Access ventilation opening between this fire zone and adjacent Fire Zone 46A (Fire Area AA44) is provided with a combined multi-section fire damper assembly and personnel door. The fire dampers, door, doorframe and supporting structure are installed as a 3-hour rated assembly. The dampers are furnished with fusible Electro-thermal links (ETLs). The links are temperature rated for 286°F. to preclude the possibility of inadvertent closure during a high energy line break (HELB) in the Turbine Building. The ETLs are actuated through the existing CO2 system in Fire Zone 46A. Actuation of the ETLs is accomplished through existing relays in the CO2 control cabinets. The design for this opening also incorporates non-rated HELB dampers on the West Side of the fire damper assembly and a security barrier. One unrated railroad overhead roll-up fire door is provided to the yard. A non-UL/FM approved electromagnetic door lock is provided on one Class A door (EEE-11-69).

In Fire Zone 98, there are no fire doors to adjacent fire areas or fire zones. A Class A (3-hour) double door is provided in the concrete block fire wall that separates the full gas cylinder storage area of the Gas Cylinder Storage Building from the connecting corridor. An open stairwell connects this fire zone with Fire Zones 130 above and 86 below. A fire area boundary evaluation was performed for the rated and unrated fire barriers of the stairwells and elevators located in the Turbine and Auxiliary Buildings (Engineering Equivalency Evaluation 11-12).

In Fire Zone 99, fire doors having a 3-hour rating are provided to adjacent Fire Zone 100. An unlabeled Class A (3 hour) roll-up fire door is provided to adjacent Fire Zone 92.

In Fire Zone 100, fire doors having a 3-hour rating are provided to adjacent Fire Zone 99. The bottom of the door openings are 3 ft. above the turbine floor. There are no door openings to adjacent fire areas.

In Fire Zone 108, there are no door openings to adjacent fire areas. Door to exterior is unrated.

In Fire Zone 109, there are no door openings to adjacent fire areas. Door to exterior is unrated.

In Fire Zone 110, a fire area boundary evaluation was performed for three unrated fire doors to Fire Area AA36/42 - Fire Zone 43 (Engineering Equivalency Evaluation 9-21). An unrated door is provided to adjacent Fire Zone 80.

In Fire Zone 111, a fire area boundary evaluation was performed for three unrated fire doors to Fire Area AA36/42 - Fire Zone 44S (Engineering Equivalency Evaluation 9-21). An unrated door is provided to adjacent Fire Zone 84.

In Fire Zone 126, there are no door openings to adjacent fire areas. Unrated doors are provided to adjacent Fire Zones 129 and 130.

In Fire Zone 127, there are no door openings to adjacent fire areas. A fire door having a 3-hour rating is provided to adjacent Fire Zone 129. The door separating the battery room and inverter room within the fire zone has a 3-hour rating.

In Fire Zone 129, a fire area boundary evaluation was performed for an unrated fire door to Fire

Area AA57A - Fire Zone 70 (Engineering Equivalency Evaluation 9-39). Fire doors having a 3-hour rating are provided to the adjacent: Unit 1 Control Room Fire Area AA46 - Fire Zone 53; Service Building corridor, Service Building Maintenance area; and TSC UPS Inverter and Battery Rooms - Fire Area AA2 - Fire Zone 127. An unlabeled Class A (3-hour) roll-up fire door is provided to adjacent in the wall barrier which separates the Turbine Building Northeast and the Service Building Maintenance Area. In addition, an unlabeled Class A (3-hour) roll up fire door is provided in the barrier wall which separates the Service Building Maintenance area and Fire Zone 131A. Elevator doors have a 1 1/2-hour rating. Unrated doors provide access to the Electrical Switchgear Room roof and the TSC. Open stairwells connect this fire zone with Fire Zones 91, 92 and 93 below. A fire area boundary evaluation was performed for the rated and unrated fire barriers of the stairwells and elevators located in the Turbine and Auxiliary Buildings (Engineering Equivalency Evaluation 11-12). A non-UL/FM approved electromagnetic door lock is provided on one Class A door (EEE-11-69).

In Fire Zone 130, a fire door having a 3-hour rating is provided to adjacent Fire Area AA47 - Fire Zone 54. Two 3-hour rated doors provide access from Fire Zone 130 to the Turbine Craft facility located over the screenhouse. Unrated doors provide access to the Electrical Switchgear Room roof and the TSC. An open stairwell connects this fire zone with Fire Zone 98 below. A fire area boundary evaluation was performed for the rated and unrated fire barriers of the stairwells and elevators located in the Turbine and Auxiliary Buildings (Engineering Equivalency Evaluation 11-12). A non-UL/FM approved electromagnetic door lock is provided on one Class A door (EEE-11-69).

In fire Zone 131A, the north wall of the room is a barrier wall abuts to the office building addition. This wall barrier does not contain any fire doors for access or egress. However, a 30" wide by 24" high 1/4" plate steel arrangement in the north wall barrier that interfaces with the rest rooms wall barrier was verified to have been provided. The acceptability of this access panel configuration was evaluated (Engineering Equivalency Evaluation 11-19).

The south wall abuts to the Turbine building (Fire Zone 129) at elevation 633 ft. 0 in and it is not provided with any fire doors for access or egress. However, access to the Unit 1 Turbine building is available via use of the freight elevator. Elevator doors have a 1 1/4 hour minimum rating per the Fire Hazards Analysis. In addition a three (3) rated fire door is provided in the west wall of the extension corridor if needed for access to the Turbine building on the 633 ft. 0 in. elevation.

The south wall of the room also includes an exterior exposure barrier wall to the station main transformer yard area and no access or egress doors are provided in this area.

The west wall of the room abuts to the Service building general storage area. A three (3) hour rated fire door at the south end of the wall barrier is provided to gain access to a small chemical storage room on the Service Building side of the wall barrier which is only accessible through the Containment Cooling Chiller Equipment Room.

An additional three (3) hour rated access door and a large roll up style three hour rated fire door are provided between the Containment Cooling Chiller Equipment Room and the Service Building general storage room. Access to the Containment Cooling Chiller Equipment Room is generally provided through these two doors and exit from Service Building storage room to the Turbine Building and other areas of the Service Building are provided within the Service Building general storage area room.

The north end of the west wall is also provided with a B labeled 1 1/2 hour rated fire door which provides access to an enclosed stairwell down to the 623 ft. 8 in. elevation of the Service building. Access to this enclosed stairwell is only available in the Service Building shop area adjacent to the Containment Cooling Chiller Equipment Room.

The east wall of the room includes an exterior barrier wall constructed of metal siding and it includes a three hour rated exit door at the south end of the Containment Cooling Chiller Equipment Room to the outdoor elevated platform where structural steel was installed to support and allow the installation of the outdoor electrical transformer equipment adjacent to this space.

In Fire Zone 139, there are no door openings to this fire zone. A ladder opening from the Turbine Building Fire Zone 80 provides access down into this fire zone.

In Fire Zone 140, there are no door openings to adjacent fire areas. An unrated door is provided to the adjacent turbine building Fire Zone 81. Access to the area is provided by the enclosed stairway at elevation 591 of the Turbine Building.

In Fire Zone 141, there are no door openings to adjacent fire areas or fire zones. An open stairway provides access to this fire zone from the 591 ft. elevation of the Turbine Building, Fire Zone 81.

In Fire Zone 142, a fire area boundary evaluation was performed for unrated wire mesh gates to Fire Area AA32 and AA33 - Fire Zone 29A, 29B, 29C and 29D (Engineering Equivalency Evaluation 9-25). The wire mesh gates are provided for ventilation purposes. Fire doors having a 3-hour rating are provided to the adjacent turbine building Fire Zones 81 and 87 and diesel fire pump rooms Fire Zones 28 and 30. Wire mesh gates are provided for ventilation purposes to Fire Zones 29E and 29F. A non-UL/FM approved electromagnetic door lock is provided on one Class A door (EEE-11-69).

### 3.1.3 Penetrations

Note: Statements regarding fire resistance rating of penetration seals are not applicable to seals in barriers to Analysis Area YD.

In Fire Zone 28, penetrations in fire barriers between this fire zone and adjacent Turbine Building and Screen House fire zones are provided with fire seals.

In Fire Zone 30, penetrations in fire barriers between this fire zone and adjacent Turbine Building and Screen House fire zones are provided with fire seals.

In Fire Zone 77, penetrations in the fire barrier between this fire zone and the adjacent Service Building are provided with fire seals. However, barriers between this fire zone and all other adjacent fire zones are not fire sealed.

In Fire Zone 78, penetrations in fire barriers between this fire zone and adjacent fire zones are provided with fire seals, with the exception of the auxiliary heating boiler exhaust stack as it penetrates the ceiling of this fire zone.

In Fire Zone 79, penetrations in fire barriers between this fire zone and adjacent fire areas are provided with fire seals. However, barriers between this fire zone and adjacent fire zones are not fire sealed. Some of the seismic gaps are sealed with a glass fiber reinforced silicone sheeting.

In Fire Zone 80, penetrations in fire barriers between this fire zone and adjacent fire areas are provided with fire seals. Additionally, penetrations in the fire barrier between Unit 1 and Unit 2 (Fire Zone 84) Turbine Buildings are also fire sealed. However, barriers between this fire zone and the other adjacent fire zones are not fire sealed. Seismic gaps are sealed with a glass fiber reinforced silicone sheeting. A fire area engineering equivalency evaluation was prepared to evaluate a fire seal design between Fire Zones 16 and 80 (Engineering Equivalency Evaluation 11-29). Some of the seismic gaps are sealed with a glass fiber reinforced silicone sheeting. The seismic gaps to the Auxiliary Feed Pump Complex (Fire Zone 17C) are provided with fire seals.

In Fire Zone 81, penetrations in fire barriers between this fire zone and adjacent fire areas are provided with fire seals. Additionally, penetrations in the fire barrier between Unit 1 and Unit 2 (Fire Zone 87) Turbine Buildings, and the fire barriers to the Diesel Fire Pump Room (Fire Zone 28), Lube Oil Room (Fire Zone 83) and Turbine Oil Tank Room (Fire Zone 95) are also fire sealed. However, barriers between this fire zone and the other adjacent fire zones are not fire sealed. A fire area boundary evaluation was performed for the unrated 8-inch thick silicone foam fire seals installed between this fire zone and adjacent fire zones (Engineering Equivalency Evaluation 11-16).

In Fire Zone 82, penetrations in fire barriers between this fire zone and adjacent Fire Zone 78 and the Service Building are provided with fire seals. However, barriers between this fire zone and the other adjacent fire zones are not fire sealed.

In Fire Zone 83, penetrations in fire barriers between this fire zone and adjacent fire zones are provided with fire seals. A fire area boundary evaluation was performed for the unrated 8-inch thick silicone foam fire seals installed between this fire zone and adjacent fire zones (Engineering Equivalency Evaluation 11-16). Seismic gaps are sealed with a glass fiber reinforced silicone sheeting.

In Fire Zone 84, one of the fan penetrations is used to run the water filled piping (ESW) to the room cooler as well as the power and control cables for the room cooler. Two 2" diameter pipes are routed through two 4" diameter sleeves in this penetration. The penetration around the pipes are closed using a fire seal. Also, a 1" and a 1½" rigid electrical conduit pass through this opening and are sealed using silicone grout. A 3/8" thick blank plate is installed inside and outside of this penetration restoring the wall around the penetrations for the pipes and rigid conduits. The outside plate is covered with a 3-hour coating of Pyrocrete. In addition, a penetration consisting of a 2" diameter Schedule 40-pipe sleeve is provided in the north wall of the room below the fan penetration. A 1/2" diameter Condensate drain line for the cooler is routed through this penetration. The penetration is maintained closed with a fire seal. Penetrations in fire barriers between this fire zone and adjacent fire areas are provided with fire seals. Additionally, penetrations in the fire barrier between Unit 1 (Fire Zone 80) and Unit 2 Turbine Buildings are also fire sealed. However, barriers between this fire zone and the other adjacent fire zones are not fire sealed. Some of the seismic gaps are sealed with a glass fiber reinforced silicone sheeting.

In Fire Zone 85, penetrations in fire barriers between this fire zone and adjacent fire areas are provided with fire seals. However, barriers between this fire zone and adjacent fire zones are not fire sealed. Some of the seismic gaps are sealed with a glass fiber reinforced silicone sheeting.

In Fire Zone 86, penetrations in fire barriers between this fire zone and adjacent Fire Zone 89 are provided with fire seals. Penetrations in the walls between this fire zone and Fire Zone 124 are sealed, but not fire rated. A fire area engineering equivalency evaluation was prepared to evaluate

a fire seal design between Fire Zones 86 and 89 (Engineering Equivalency Evaluation 11-32).

In Fire Zone 87, penetrations in fire barriers between this fire zone and adjacent fire areas are provided with fire seals. Additionally, penetrations in the fire barrier between Unit 1 (Fire Zone 81) and Unit 2 Turbine Buildings and the fire barriers to the Diesel Fire Pump Room (Fire Zone 30), Lube Oil Room (Fire Zone 88) and Turbine Oil Tank Room (Fire Zone 100) are also fire sealed. However, barriers between this fire zone and adjacent fire zones are not fire sealed. A fire area boundary evaluation was performed for the unrated 8-inch thick silicone foam fire seals installed between this fire zone and adjacent fire zones (Engineering Equivalency Evaluation 11-16). Fire Area engineering equivalency evaluations were prepared to evaluate fire seal designs between Fire Zones 87 and 88 (Engineering Equivalency Evaluations 11-29 and 11-32).

In Fire Zone 88, penetrations in fire barriers between this fire zone and adjacent fire zones are provided with fire seals. A fire area boundary evaluation was performed for the unrated 8-inch thick silicone foam fire seals installed between this fire zone and adjacent fire zones (Engineering Equivalency Evaluation 11-16). Fire Area engineering equivalency evaluations were prepared to evaluate fire seal designs between Fire Zones 87 and 88 (Engineering Equivalency Evaluations 11-29 and 11-32). Seismic gaps are sealed with a glass fiber reinforced silicone sheeting.

In Fire Zone 89, penetrations in fire barriers between this fire zone and adjacent fire zones are provided with fire seals. A fire area engineering equivalency evaluation was prepared to evaluate a fire seal design between Fire Zones 86 and 89 (Engineering Equivalency Evaluation 11-32).

In Fire Zone 90, penetrations in fire barriers between this fire zone and adjacent fire areas and the Service Building are provided with fire seals. However, barriers between this fire zone and adjacent fire zones are not fire sealed. Seismic expansion gaps are sealed with a glass fiber reinforced silicone sheeting.

In Fire Zone 91, penetrations in fire barriers between this fire zone and adjacent fire areas are provided with fire seals. Additionally, penetrations in the fire barrier separating the Unit 1 Turbine Building from Unit 2 is provided with fire seals. However, barriers between this fire zone and adjacent fire zones are not fire sealed.

In Fire Zone 92, penetrations in fire barriers between this fire zone and adjacent Fire Zones 83, 95 and 99 are provided with fire seals. However, penetrations in barriers between this fire zone and the other adjacent fire zones are not fire sealed. A fire area boundary evaluation was performed for the unrated 8-inch thick silicone foam fire seals installed between this fire zone and adjacent fire zones (Engineering Equivalency Evaluation 11-16). Fire Area engineering equivalency evaluations were prepared to evaluate fire seal designs between Fire Zones 92 and 95 (Engineering Equivalency Evaluations 11-30 and 11-32).

In Fire Zone 93, penetrations in fire barriers between this fire zone and adjacent Fire Zones 78, 94 and the Service Building are provided with fire seals. However, barriers between this fire zone and the other adjacent fire zones are not fire sealed.

In Fire Zone 94, penetrations in fire barriers between this fire zone, adjacent fire zones, and the Service Building are provided with fire seals.

In Fire Zone 95, penetrations in fire barriers between this fire zone and adjacent fire zones are provided with fire seals. A fire area boundary evaluation was performed for the unrated 8-inch

thick silicone foam fire seals installed between this fire zone and adjacent fire zones (Engineering Equivalency Evaluation 11-16). Fire Area engineering equivalency evaluations were prepared to evaluate fire seal designs between Fire Zones 92 and 95 (Engineering Equivalency Evaluations 11-30 and 11-32).

In Fire Zone 96, penetrations in fire barriers between this fire zone and adjacent fire areas are provided with fire seals. Additionally, penetrations in the fire barrier separating the Unit 1 Turbine Building from Unit 2 is provided with fire seals. However, barriers between this fire zone and adjacent fire zones are not fire sealed.

In Fire Zone 97, penetrations in fire barriers between this fire zone and adjacent fire areas are provided with fire seals. Additionally, penetrations in the exterior wall fire barriers facing the transformer area are provided with fire seals. However, barriers between this fire zone and adjacent fire zones are not fire sealed. Seismic expansion gaps are sealed with a glass fiber reinforced silicone sheeting.

In Fire Zone 98, penetrations in fire barriers between this fire zone and adjacent Fire Zone 89 are provided with fire seals. Penetrations in the firewall in the Gas Cylinder Storage Building are provided with fire seals. Barriers between this fire zone and the adjacent fire zones are not fire sealed. There are no penetrations to adjacent fire areas.

In Fire Zone 99, penetrations in fire barriers between this fire zone and adjacent Fire Zones 88, 92 and 100 are provided with fire seals. However, penetrations in barriers between this fire zone and the other adjacent fire zones are not fire sealed. A fire area boundary evaluation was performed for the unrated 8-inch thick silicone foam fire seals installed between this fire zone and adjacent fire zones (Engineering Equivalency Evaluation 11-16). A fire area engineering equivalency evaluation was prepared to evaluate a fire seal design between Fire Zones 99 and 100 (Engineering Equivalency Evaluation 11-32).

In Fire Zone 100, penetrations in fire barriers between this fire zone and adjacent fire zones are provided with fire seals. A fire area boundary evaluation was performed for the unrated 8-inch thick silicone foam fire seals installed between this fire zone and adjacent fire zones (Engineering Equivalency Evaluation 11-16). A fire area engineering equivalency evaluation was prepared to evaluate a fire seal design between Fire Zones 100 and 142 (Engineering Equivalency Evaluation 11-32.)

In Fire Zone 108, penetrations in fire barriers between this fire zone and adjacent fire areas are provided with fire seals except as noted below. A fire area boundary evaluation was performed for open penetrations to Fire Area AA34 - Fire Zone 33A (Engineering Equivalency Evaluation 9-35). Seismic gaps are sealed with a glass fiber reinforced silicone sheeting. Seismic gap exemption was granted for Fire Zone 108 interface with Fire Area AA34 - Fire Zone 33A and Fire Area AA3 - Fire Zones 49 and 69 (Engineering Equivalency Evaluation 11-46).

In Fire Zone 109, penetrations in fire barriers between this fire zone and adjacent fire areas are provided with fire seals except as noted below. A fire area boundary evaluation was performed for open penetrations to Fire Area AA35 - Fire Zone 34A (Engineering Equivalency Evaluation 9-36). The seismic gaps are sealed with a glass fiber reinforced silicone sheeting. Seismic gap exemption was granted for Fire Zone 109 interface with Fire Area AA35 - Fire Zone 34B and Fire Area AA3 - Fire Zones 50 and 69 (Engineering Equivalency Evaluation 11-46).



In Fire Zone 110, penetrations in fire barriers between this fire zone and adjacent fire areas are provided with fire seals. However, barriers between this fire zone and adjacent fire zones are not fire sealed. The seismic gaps are sealed with a glass fiber reinforced silicone sheeting.

In Fire Zone 111, penetrations in fire barriers between this fire zone and adjacent fire areas are provided with fire seals. However, barriers between this fire zone and adjacent fire zones are not fire sealed. The seismic gaps are sealed with a glass fiber reinforced silicone sheeting.

In Fire Zone 126, there are no penetrations in fire barriers between this fire zone and adjacent fire areas. All penetrations in fire barriers between this fire zone and adjacent fire zones are provided with fire seals.

In Fire Zone 127, penetrations in fire barriers between this fire zone and adjacent fire areas and fire zones are provided with fire seals.

In Fire Zone 129, penetrations in fire barriers between this fire zone and adjacent fire areas and to adjacent Fire Zones 94, 95, 126, 127, 131A and the Service Building are provided with fire seals. However, barriers between this fire zone and the other adjacent fire zones are not fire sealed.

In Fire Zone 130, penetrations in fire barriers between this fire zone and adjacent fire areas and to adjacent Fire Zones 100 and 126 are provided with fire seals. Penetrations in the fire barrier between this fire zone and the Turbine Craft Facility corridor are provided with fire seals. However, barriers between this fire zone and the other adjacent fire zones are not fire sealed.

For Fire Zone 131A penetrations into and out of the Containment Cooling Chiller Equipment Room are sealed with approved materials and no unsealed openings were observed.

Floor penetrations were observed to have been appropriately sealed and three HVAC ducts which pass through the floor barrier are provided with fire dampers and the presence of access doors installed at the bottom of the ductwork at the floor level for the purpose of testing and inspection of the fire dampers.

In Fire Zone 139, there are no penetrations in the fire barriers between this fire zone and adjacent fire zones that need to be provided with fire seals.

In Fire Zone 140, there are no fire barriers to adjacent fire areas. Penetrations in fire barriers between this fire zone and adjacent fire zones are not sealed.

In Fire Zone 141, penetrations in fire barriers between this fire zone and adjacent fire areas are provided with fire seals. However, barriers between this fire zone and adjacent fire zones are not fire sealed.

In Fire Zone 142, penetrations in fire barriers between this fire zone and adjacent fire areas are provided with fire seals. Penetrations in fire barriers between this fire zone and the adjacent Diesel Fire Pump Rooms (Fire Zones 28 and 30) and Turbine Building (Fire Zones 83 and 88) are provided with fire seals. A fire area boundary evaluation was performed for the unrated 8-inch thick silicone foam fire seals installed between this fire zone and adjacent fire zones (Engineering Equivalency Evaluation 11-16). A fire area engineering equivalency evaluation was prepared to evaluate a fire seal design between Fire Zones 100 and 142 (Engineering Equivalency Evaluation 11-32).

### 3.1.4 Detection

The table below outlines the fire detection system(s) provided in the Fire Area:

Table 3-1, Fire Area AA2 Detection Systems								
Fire Zone	Type of System	Local (L) / Remote (R)	Detection Actuates Suppression?	Required System?				
				S	L	E	R	D
2N	None	N/A	N/A	N/A	N/A	N/A	N/A	N/A
2S	None	N/A	N/A	N/A	N/A	N/A	N/A	N/A
28	None	N/A	N/A	N/A	N/A	N/A	N/A	N/A
30	None	N/A	N/A	N/A	N/A	N/A	N/A	N/A
77	None	N/A	N/A	N/A	N/A	N/A	N/A	N/A
78	None	N/A	N/A	N/A	N/A	N/A	N/A	N/A
79	Ionization	L/R	N	Y	N	Y	Y	N
80	None	N/A	N/A	N/A	N/A	N/A	N/A	N/A
81	None	N/A	N/A	N/A	N/A	N/A	N/A	N/A
82	None	N/A	N/A	N/A	N/A	N/A	N/A	N/A
83	None	N/A	N/A	N/A	N/A	N/A	N/A	N/A
84	None	N/A	N/A	N/A	N/A	N/A	N/A	N/A
85	Ionization	L/R	N	Y	N	Y	Y	N
86	None	N/A	N/A	N/A	N/A	N/A	N/A	N/A
87	None	N/A	N/A	N/A	N/A	N/A	N/A	N/A
88	None	N/A	N/A	N/A	N/A	N/A	N/A	N/A
89	None	N/A	N/A	N/A	N/A	N/A	N/A	N/A
90	None	N/A	N/A	N/A	N/A	N/A	N/A	N/A
91	None	N/A	N/A	N/A	N/A	N/A	N/A	N/A
92	None	N/A	N/A	N/A	N/A	N/A	N/A	N/A
93	None	N/A	N/A	N/A	N/A	N/A	N/A	N/A
94	None	N/A	N/A	N/A	N/A	N/A	N/A	N/A
95	None	N/A	N/A	N/A	N/A	N/A	N/A	N/A
96	None	N/A	N/A	N/A	N/A	N/A	N/A	N/A
97	None	N/A	N/A	N/A	N/A	N/A	N/A	N/A
98	None	N/A	N/A	N/A	N/A	N/A	N/A	N/A
99	None	N/A	N/A	N/A	N/A	N/A	N/A	N/A
100	None	N/A	N/A	N/A	N/A	N/A	N/A	N/A
108	None	N/A	N/A	N/A	N/A	N/A	N/A	N/A
109	None	N/A	N/A	N/A	N/A	N/A	N/A	N/A
110	None	N/A	N/A	N/A	N/A	N/A	N/A	N/A
111	None	N/A	N/A	N/A	N/A	N/A	N/A	N/A
124	Ionization	L/R	No	N/A	N/A	N/A	N/A	N/A
126	Ionization	L/R	N	N	N	N	Y	N
127	Ionization	L/R	N	N	N	N	Y	N
128	Ionization	L/R	N/A	N/A	N/A	N/A	N/A	N/A
129	Ionization	L/R	N	N	N	N	N	N
129	Thermal	L/R	N	N	N	Y	N	N
130	Photoelectric	L/R	N	N	N	N	N	N
130	Photoelectric	Local/Remote	No	N	N	N	N	N
130	Thermal	L/R	N	N	N	Y	N	N
131A	Ionization	L/R	N	N	N	N	Y	N
139	None	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Table 3-1, Fire Area AA2 Detection Systems									
Fire Zone	Type of System	Local (L) / Remote (R)	Detection Actuates Suppression?	Required System?					
				S	L	E	R	D	
140	None	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
141	None	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
142	None	N/A	N/A	N/A	N/A	N/A	N/A	N/A	

Table 3-1 Legend:	
Table Field: "Required System?"	
S	- Required for Chapter 4 Separation Criteria
L	- Required for NRC Approved Licensing Action
E	- Required for Engineering Equivalency Evaluation
R	- Required for Risk Significance
D	- Required to maintain adequate balance of Defense-in-Depth in a Change Evaluation or Fire Risk Evaluation

For Fire Zone 126, low voltage ionization detection is provided with alarm annunciation on the Unit 2 Control Room EF panel. The detectors are located in the Computer Room (4), Console Room (2 under raised floor, 2 on ceiling), Consultation Rooms (4 total - 2 per room), File Room (1) and Shift Supervisor's Office (2).

For Fire Zone 127, the Battery Room and Inverter Room are each provided with 2 ionization detectors on separate circuits which alarm in the Unit 2 Control Room.

For Fire Zone 129, line type thermistor heat detection is provided under the turbine lagging. Four (4) ionization detectors are provided for the Chem. Lab. Two (2) ionization detectors have also been added in the I&E shop. These detection systems alarm in the Unit 1 Control Room.

For Fire Zone 130, line type thermistor heat detection is provided under the turbine lagging which alarms in the Unit 2 Control Room. Two (2) intelligent photo-electric type plug-in addressable detectors have been provided on each floor of the two story building in the southwest corner of the fire zone. (EC-0000054462, FPPR-2015-0067)

For Fire Zone 131A, ten ionization detectors are provided in the Containment Cooling Chiller Equipment Room which alarms in the Unit 1 Control Room

For Fire Zone 79, four ionization detectors are provided in the diesel generator ramp/corridor which alarm in the Unit 1 Control Room.

For Fire Zone 85, four ionization detectors are provided in the diesel generator ramp/corridor which alarm in the Unit 2 Control Room.

Fire Zone 97 and 90 are not provided with detection, however, two detectors from Fire Zones 46A and 42A are located above the Fire Door/Fire Damper Assembly on the West (Fire Zones 97 and 90) side of the assembly to assure that a fire in the Turbine Building would promptly actuate the dampers.

Other fire zones within this fire area are not provided with automatic detection.

### 3.1.5 Fixed Suppression

The table below outlines the fixed fire suppression system(s) provided in the Fire Area:

Table 3-2, Fire Area AA2 Suppression Systems								
Fire Zone	Type of System	Full (F) / Partial (P)	Required System?					
			S	L	E	R	D	
2N	None	N/A	N/A	N/A	N/A	N/A	N/A	N/A
2S	None	N/A	N/A	N/A	N/A	N/A	N/A	N/A
28	Wet Pipe	F	N	N	Y	N	N	
30	Wet Pipe	F	N	N	Y	N	N	
77	Wet Pipe	F	N	N	Y	N	N	
78	Wet Pipe	F	N	N	Y	N	N	
79	Wet Pipe	F	Y	N	Y	Y	N	
80	Wet Pipe	F	N	N	Y	Y	N	
81	Wet Pipe	F	N	N	Y	Y	N	
82	Wet Pipe	F	N	N	Y	Y	N	
83	Wet Pipe	F	N	N	Y	Y	N	
84	Wet Pipe	F	N	N	Y	Y	N	
85	Wet Pipe	F	Y	N	Y	Y	N	
86	Wet Pipe	F	N	N	Y	Y	N	
87	Wet Pipe	F	N	N	Y	Y	N	
88	Wet Pipe	F	N	N	Y	Y	N	
89	Wet Pipe	F	N	N	Y	Y	N	
90	Water Curtain	P	N	N	Y	Y	N	
90	Wet Pipe	F	N	N	Y	Y	N	
91	Wet Pipe	F	N	N	Y	Y	N	
92	Wet Pipe	F	N	N	Y	Y	N	
93	Wet Pipe	F	N	N	Y	Y	N	
94	Wet Pipe	F	N	N	Y	Y	N	
95	Manual CO2	F	N	N	N	N	N	
95	Wet Pipe	F	N	N	Y	Y	N	
96	Wet Pipe	F	N	N	Y	Y	N	
97	Water Curtain	P	N	N	Y	Y	N	
97	Wet Pipe	F	N	N	Y	Y	N	
98	Wet Pipe	F	N	N	Y	Y	N	
99	Wet Pipe	F	N	N	Y	Y	N	
100	Manual CO2	F	N	N	N	N	N	
100	Wet Pipe	F	N	N	Y	Y	N	
108	None	N/A	N/A	N/A	N/A	N/A	N/A	
109	None	N/A	N/A	N/A	N/A	N/A	N/A	
110	None	N/A	N/A	N/A	N/A	N/A	N/A	
111	None	N/A	N/A	N/A	N/A	N/A	N/A	

Table 3-2, Fire Area AA2 Suppression Systems							
Fire Zone	Type of System	Full (F) / Partial (P)	Required System?				
			S	L	E	R	D
124	none	N/A	N/A	N/A	N/A	N/A	N/A
126	Water Curtain	P	N	N	N	Y	N
127	None	N/A	N/A	N/A	N/A	N/A	N/A
128	None	N/A	N/A	N/A	N/A	N/A	N/A
129	Manual Spray	P	N	N	N	N	N
129	Water Curtain	P	N	N	Y	Y	N
130	Manual Spray	P	N	N	N	N	N
130	Water Curtain	P	N	N	Y	Y	N
131A	Wet Pipe	F	N	N	N	N	N
139	None	N/A	N/A	N/A	N/A	N/A	N/A
140	None	N/A	N/A	N/A	N/A	N/A	N/A
141	None	N/A	N/A	N/A	N/A	N/A	N/A
142	None	N/A	N/A	N/A	N/A	N/A	N/A
<b>Table 3-2 Legend:</b>							
Table Field: "Required System?"							
S	- Required for Chapter 4 Separation Criteria						
L	- Required for NRC Approved Licensing Action						
E	- Required for Engineering Equivalency Evaluation						
R	- Required for Risk Significance						
D	- Required to maintain adequate balance of Defense-in-Depth in a Change Evaluation or Fire Risk Evaluation						

Fire Zone 126: A wet pipe sprinkler system is provided in each of the Consultation Rooms and a deluge water curtain is also provided.

Fire Zones 129 and 130: The portion of the east wall adjacent to the GSU transformer above the heater bay roof and below the Turbine Building roof is protected by a deluge water curtain from a transformer exposure fire. This water curtain is part of the transformer deluge suppression system and applies water on the outside surface of the wall. These fire zones are also provided with a manual pre-action sprinkler system. The system is only provided for the turbine generator under skirt.

Fire Zone 131A: An automatic wet pipe sprinkler system is provided which alarms in the Unit 1 Control Room.

Fire Zone 28: An automatic wet pipe sprinkler system is provided which alarms in the Unit 1 Control Room.

Fire Zone 30: An automatic wet pipe sprinkler system is provided which alarms in the Unit 2 Control Room.

Fire Zone 77: A wet pipe sprinkler system is provided which alarms in the Unit 1 Control Room upon operation. This sprinkler system is part of the larger Turbine Building sprinkler system.

Fire Zone 78: A wet pipe sprinkler system on extra hazard spacing is provided which alarms in the Unit 1 Control Room upon operation. Boiler front protection at the oil burner guns with closed spray nozzles and sprinkler protection inside the auxiliary heating boiler fuel oil pump room is also provided by this sprinkler system.

Fire Zone 79, 80, 81 and 82: A wet pipe sprinkler system is provided for area coverage which alarms in the Unit 1 Control Room upon operation. Automatic sprinkler protection is provided under the condensers and condenser pit areas. A wet pipe sprinkler system is provided for stacked cable trays and for the oil piping in the Turbine Building. This system uses closed spray nozzles and is part of the larger sprinkler system providing general area coverage for other Turbine Building fire zones. This system also alarms in the Unit 1 Control Room upon operation. EC-53240 approved the replacement of 250F upright or pendant sprinkler heads with 286F heads for sprinkler systems supplied by 1-AFP-504 and 1-ZFP-186(FPPR-2015-0069).

Fire Zone 83: An automatic wet pipe sprinkler system provides primary suppression coverage and alarms in the Unit 1 Control Room. This system is part of the larger sprinkler system providing general area coverage for other Turbine Building fire zones.

Fire Zone 84, 85, 86 and 87: A wet pipe sprinkler system is provided for area coverage that alarms in the Unit 2 Control Room upon operation. Automatic sprinkler protection is provided under the condensers and condenser pit areas. This system is part of the larger sprinkler system providing general area coverage for other Turbine Building fire zones. A wet pipe sprinkler system is also provided for stacked cable trays and for the oil piping in the Turbine Building. This system uses closed spray nozzles and is part of the larger sprinkler system providing cable tray. This system also alarms in the Unit 2 Control Room upon operation.

Fire Zone 88: An automatic wet pipe sprinkler system provides primary suppression coverage and alarms in the Unit 2 Control Room. This system is part of the larger sprinkler system providing general area coverage for other Turbine Building fire zones.

Fire Zone 89: An automatic wet pipe sprinkler system that alarms in the Unit 2 Control Room. This system is part of the larger sprinkler system providing general area coverage in other Turbine Building fire zones.

Fire Zone 90: A wet pipe sprinkler system is provided for area coverage that alarms in the Unit 1 Control Room upon operation. Automatic sprinkler protection is provided under the condensers and condenser pit areas. This system is part of the larger sprinkler system providing general area coverage for other Turbine Building fire zones. A wet pipe sprinkler system is also provided for stacked cable trays and for the oil piping in the Turbine Building. This system uses closed spray nozzles and is part of the larger sprinkler system providing cable tray and oil piping protection for other Turbine Building fire zones. This system also alarms in the Unit 1 Control Room upon operation. EC-53240 approved the replacement of 250F upright or pendant sprinkler heads with 286F heads for the sprinkler system supplied by 1-ZFP-185 (FPPR-2015-0069).

A wet pipe sprinkler system is also provided for the crane bay area located at the far north end of this fire zone. This system uses closed head nozzles and is part of the larger sprinkler system protecting the plant heating boiler and backup boiler. This system also alarms in the Unit 1 Control Room upon operation. The railroad overhead roll-up fire door is protected by a deluge water curtain from a transformer exposure fire. This water curtain is part of the transformer deluge

suppression system and applies water on the outside surface of the door.

Fire Zone 91 and 92: A wet pipe sprinkler system is provided for area coverage that alarms in the Unit 1 Control Room upon operation. Automatic sprinkler protection extends to the Units 1 and 2 condenser pit areas. This system is part of the larger sprinkler system providing general area coverage for other Turbine Building fire zones. A wet pipe sprinkler system is also provided for stacked cable trays and for the oil piping in the Turbine Building. This system uses closed spray nozzles and is part of the larger sprinkler system providing cable tray and oil piping protection for other Turbine Building fire zones. This system also alarms in the Unit 1 Control Room upon operation. EC-53240 approved the replacement of 250F upright or pendant sprinkler heads with 286F heads for the sprinkler systems supplied by 1-ZFP-506 (FPPR-2015-0069).

Fire Zone 93: A wet pipe sprinkler system is provided for area coverage that alarms in the Unit 1 Control Room upon operation. Automatic sprinkler protection extends to the Units 1 and 2 condenser pit areas. This system is part of the larger sprinkler system providing general area coverage for other Turbine Building fire zones. A wet pipe sprinkler system is also provided for stacked cable trays and for the oil piping in the Turbine Building. This system uses closed spray nozzles and is part of the larger sprinkler system providing cable tray and oil piping protection for other Turbine Building fire zones. This system also alarms in the Unit 1 Control Room upon operation. A wet pipe sprinkler system is also provided for the Crane Bay Area located at the far north end of this fire zone. This system uses closed head nozzles and is part of the larger sprinkler system protecting the plant heating boiler and backup boiler. This system also alarms in the Unit 1 Control Room upon operation. EC-53240 approved the replacement of 250F upright or pendant sprinkler heads with 286F heads for the sprinkler system supplied by 1-ZFP-185 (FPPR-2015-0069).

Fire Zone 94: An automatic wet pipe sprinkler system is provided which alarms in the Unit 1 Control Room. This system is part of the larger sprinkler system providing general area coverage for the plant heating boiler (Fire Zone 78) and the Turbine Building Crane Bay Area (Fire Zones 90 and 93).

Fire Zone 95: An automatic wet pipe sprinkler system provides primary suppression coverage and alarms in the Unit 1 Control Room. This system is part of the larger sprinkler system providing general area coverage for other Turbine Building fire zones.

Fire Zone 96: A wet pipe sprinkler system is provided for area coverage that alarms in the Unit 2 Control Room upon operation. This system is part of the larger sprinkler system providing general area coverage for other Turbine Building fire zones. A wet pipe sprinkler system is also provided for stacked cable trays and for the oil piping in the Turbine Building. This system uses closed spray nozzles and is part of the larger sprinkler system providing cable tray and oil piping protection for other Turbine Building fire zones. This system also alarms in the Unit 2 Control Room upon operation.

Fire Zone 97: A wet pipe sprinkler system is provided for area coverage (with the exception of the Crane Bay Area) which alarms in the Unit 2 Control Room upon operation. Automatic sprinkler protection extends to the Units 1 and 2 condenser pit areas. This system is part of the larger sprinkler system providing general area coverage for other Turbine Building fire zones. A wet pipe sprinkler system is also provided for stacked cable trays and for the oil piping in the Turbine Building. This system uses closed spray nozzles and is part of the larger sprinkler system providing cable tray and oil piping protection for other Turbine Building fire zones. This system

also alarms in the Unit 2 Control Room upon operation. The unrated railroad overhead roll-up door is protected by a deluge water curtain from a transformer exposure fire. This water curtain is part of the transformer deluge suppression system and applies water on the outside surface of the door.

Fire Zone 98: A wet pipe sprinkler system is provided for area coverage (with the exception of the Crane Bay Area) which alarms in the Unit 2 Control Room upon operation. Automatic sprinkler protection extends to the Units 1 and 2 condenser pit areas. This system is part of the larger sprinkler system providing general area coverage for other Turbine Building fire zones. A wet pipe sprinkler system is also provided for stacked cable trays and for the oil piping in the Turbine Building. This system has closed spray nozzles and is part of the larger sprinkler system providing cable tray and oil piping protection for other Turbine Building fire zones. This system also alarms in the Unit 2 Control Room upon operation.

Fire Zone 99: A wet pipe sprinkler system is provided for area coverage that alarms in the Unit 2 Control Room upon operation. This system is part of the larger sprinkler system providing general area coverage for other Turbine Building fire zones. A wet pipe sprinkler system is also provided for stacked cable trays and for the oil piping in the Turbine Building. This system uses closed spray nozzles and is part of the larger sprinkler system providing cable tray and oil piping protection for other Turbine Building fire zones. This system also alarms in the Unit 2 Control Room upon operation.

Fire Zone 131A and the Service Building: An automatic wet pipe sprinkler system is provided for area coverage that alarms in the Unit 1 Control Room

Fire Zone 100: An automatic wet pipe sprinkler system provides primary suppression coverage and alarms in the Unit 2 Control Room. This system is part of the larger sprinkler system providing general area coverage for other Turbine Building fire zones.

Other fire zones within this fire area are not provided with fixed suppression.

### **3.1.6 Manual Suppression / Response Strategy**

For fire zones within AA2 equipped with automatic detection systems, a postulated fire will be identified by early detection using ionization type smoke detection or by plant personnel using plant communication system to notify the control room. The automatic detection systems alarm in the control room. A low pressure CO<sub>2</sub> total flooding system supplied from the 17 ton tank is provided in Fire Zones 83, 88, 95 and 100. These systems are manually actuated. Note: The manually actuated CO<sub>2</sub> total flooding systems in these Fire Zones are available but no longer maintained.

For fire zones within AA2 which are not equipped with automatic detection systems but contain an automatic sprinkler system, a postulated fire will be identified by the wet pipe sprinkler system actuating in the main control room or by plant personnel using plant communication system to notify the control room. A fire in these fire areas will be contained by the construction features discussed in Section 3.1.1. Manual suppression is provided by the CNP Fire Brigade.

For fire zones within AA2 which are not equipped with automatic detection or suppression systems, a postulated fire will be identified by plant personnel using plant communication system to notify the control room. The Control Room operator will dispatch the fire brigade for initiation



of manual fire fighting. A fire in these fire areas will be contained by the construction features discussed in Section 3.1.1. Manual suppression is provided by the CNP Fire Brigade.

All fire zones within this fire area are provided with fire extinguishers except Fire Zones 124, 128, and 139. These fire zones represent a very small portion of the total number of fire zones (40) within this fire area. For these fire zones, fire extinguishers are provided in an adjacent fire zone.

Fire Zones 2N, 79, 80, 81, 82, 84, 85, 86, 87, 90, 91, 92, 93, 96, 97, 98, 99, 129, 130, and 142 are provided with 25-gallon carts which contain foam liquid and foam nozzle.

Manual fire hose stream stations are provided in Fire zone 2N, 2S, 79, 80, 81, 82, 84, 85, 86, 87, 90, 91, 92, 93, 96, 97, 98, 99, 129, 130, 131A and 142.

Fire Zones 28, 30, 77, 78, 83, 88, 89, 94, 95, 100, 108, 109, 110, 111, 124, 126, 127, 128, 139, 140 and 141. For these fire zones, water hose reels are provided in an adjacent fire zone.

All fire zones within this fire area are provided with floor drains except Fire Zones 83, 88, 94, 95, 100, 108, 109, 124, 126, 127, 128, 139, 140, 141, and 142. These fire zones represent a very small portion of the total number of fire zones within this fire area. For Fire Zone 142, drainage is provided by the trash trench which drains to the trash strainer where it further drains to the intake tunnel upstream of the traveling screens. For Fire Zone 127, drainage is via a doorway to the turbine deck. For Fire Zones 108 and 109, drainage is down to Fire Zones 110 and 111, respectively. Fire Zones 2N, 2S, 140 and 141 are provided with sumps to remove liquids. For other fire zones not equipped with floor drains, the fire brigade is equipped with a sump pump that may be used to remove an accumulation of water from the fire zone. Diking is provided in Fire Zones 89, 110 and 111 to contain potential liquids. Fire Zone 28 has a floor drain that has been sealed and is not available.

Breathing apparatuses are provided in Fire Zones 97 and 130 for the Fire Brigade.

### 3.1.7 Ventilation

A fire in this area will be contained by the fire barriers. Smoke can be removed by venting to the outdoors. This fire area is listed as a non-controlled area in the Fire Pre Plans and therefore there is reasonable assurance that products of combustion will not be contaminated.

The following fire zones within AA2 do not contain ventilation penetrations to adjacent fire areas:

Fire Zone 78: There are no ventilation penetrations to adjacent fire areas. Fire dampers having a 3-hour rating are provided to adjacent Fire Zone 82 (1-HV-BRX-1) and the Service Building (12-HV-ABRD-FD-2 and 12-HV-BFOR-FD 1 and 2) in an interior wall between the Heating Boiler Room and the Fuel Oil Pump Room.

Fire Zone 81: Fire dampers having a 3-hour rating are provided to adjacent Fire Zone 83. There are undampened ventilation penetrations to adjacent Fire Zones 140 and 141.

Fire Zone 82: Fire dampers having a 3-hour rating are provided to adjacent Fire Zone 78. There are no ventilation penetrations to adjacent fire areas.

Fire Zone 83: Fire dampers 1-HV-LORS-1 and 1-HV-LORX-FD-1 each 3-hour rated are provided to adjacent Fire Zone 81.

Fire Zone 86: Fire dampers having a 1 1/2-hour rating are provided to adjacent Fire Zone 89.

Unrated fire dampers are provided to adjacent Fire Zone 124.

Fire Zone 87: Fire dampers having a 3-hour rating are provided to adjacent Fire Zone 88. There is

an undampered ventilation penetration to adjacent Fire Zone 99.

Fire Zone 88: Fire dampers 2-HV-LORS-1 and 2-HV-LORX-1 which are adjacent to Fire Zone 87 each have a 3-hour rating

Fire Zone 89: A fire damper having a 1 1/2-hour rating (12-HV-TORS-FD-1) is provided to adjacent Fire Zone 86.

Fire Zone 90: Fire dampers having a 3-hour rating are provided to the adjacent Service Building.

Fire Zone 92: Fire dampers having a 3-hour rating are provided to adjacent Fire Zone 95. There is an undampered ventilation penetration to adjacent Fire Zone 129.

Fire Zone 93: Fire dampers having a 3-hour rating are provided to the adjacent Fire Zone 94 and the Service Building.

Fire Zone 94: Fire dampers having a 3-hour rating are provided to adjacent Fire Zone 93.

Fire Zone 95: Fire dampers having a 3-hour rating are provided to adjacent Fire Zone 92.

Fire Zone 99: Fire dampers having a 3-hour rating are provided to adjacent Fire Zone 100. There is an undampered ventilation penetration to adjacent Fire Zone 87.

Fire Zone 100: Fire dampers having a 3-hour rating are provided to adjacent Fire Zones 99 and 130.

Fire Zone 110: Four undampered ventilation penetrations to adjacent Fire Zone 114.

Fire Zone 111: Four undampered ventilation penetrations to adjacent Fire Zone 115.

Fire Zone 126: Fire dampers having a 1 1/2-hour rating and undampered ducts are provided to adjacent Turbine Building Fire Zones 129 and 130.

Fire Zone 127: Three hour rated fire dampers 12 are installed to adjacent Turbine Building Fire Zone 129. A 3-hour fire damper is also provided between the battery room and the inverter room.

Fire Zone 129: There is an undampered ventilation penetration to the adjacent Fire Zone 92. Fire dampers having a 3-hour rating are provided to adjacent Fire Zone 127. Fire dampers having a 1 1/2-hour rating and undampered ducts are provided to adjacent Fire Zone 126. Smoke and heat vents are provided in the roof. Fourteen Pyrojector automatic roof vents in Unit 1 that will open in the event of a fire. When all are functioning, they provide a venting ratio of 1 sq. ft. to every 112 sq. ft. of floor area in the turbine building.

Fire Zone 130: Fire dampers having a 1 1/2-hour rating and undampered ducts are provided to adjacent Fire Zone 126. Fire damper having a 3-hour rating is provided to adjacent Fire Zone 100. Smoke and heat vents are provided in the roof. Fourteen Pyrojector automatic roof vents in Unit 1 that will open in the event of a fire. When all are functioning, they provide a venting ratio of 1 sq. ft. to every 112 sq. ft. of floor area in the turbine building.

Fire Zone 140: There are undampered duct penetrations to Fire Zone 81.

Fire Zone 141: There is an undampered ventilation penetration to Fire Zone 81.

Boundary evaluations were performed on the following fire zones:

Fire Zone 91: Undampered ventilation duct to Fire Area AA36/42 - Fire Zone 43.

Fire Zone 108: Undampered ventilation duct to Fire Area AA3 - Fire Zone 69 and to Fire Area AA34 - Fire Zone 33A.

Fire Zone 109: Undampered ducts to Fire Area AA3 - Fire Zone 69 and to Fire Area AA35 - Fire Zone 34A.

Fire Zone 142: Undampered ventilation duct to Fire Area AA33 - Fire Zone 29A and 29B. Fire dampers having a 3-hour rating are provided to adjacent Fire Area AA33 - Fire Zone 29C and 29D.

The following fire zones have ventilations penetrations to adjacent fire areas:

Fire Zone 77: There are two open ventilation ducts from Fire Zone 77 "Welding Shop" hood system that enters the Service Building 591 ft. 0 in. elevation. The duct rises vertically within the

Service Building and at elevation 633ft Fire damper 12-HV-WS-FD-1 is provided.

Fire Zone 79: Fire dampers having a 3-hour rating are provided to adjacent Fire Areas AA14 and AA15 - Fire Zones 15 and 16, respectively. Fire dampers having a 1 1/2-hour rating are provided to adjacent Fire Area AA13 - Fire Zone 14. 3-hour fire dampers are also installed.

Fire Zone 80: The opening in the west wall that contains a HELB vent path to Fire Zone 80 and has a non-rated blowout panel installed in series contains a 3-hour fire damper. The fire damper is 3-hour rated and is normally open to allow venting for a HELB Condition. A fusible link is provided to close the damper in the event of fire. The fire dampers and backdraft dampers are from these penetrations. For one of the penetrations a 3/8" thick blank plate is installed inside and outside. The outside plate is covered with a 3-hour coating of Pyrocrete. The other penetration in the south wall is used for the room cooler installation, a portion of which, is located in Fire Zone 80. The room cooler penetration in the south wall is non-rated. There are undampened duct penetrations to Fire Zone 2.

Fire Zone 84: Fire dampers having a 3-hour rating are provided to adjacent Fire Area AA17 - Fire Zone 17B. Fire dampers in the three air intakes (2-HV-AFP-FD-4A, B, and C) are installed to assure the fire barrier is maintained. Two fire dampers (2-HV-AFP-FD-A and C) are maintained closed and the penetrations are sealed using a plate on the opposite side of the wall from the fire damper. The steel plate is 1/4" thick ASTM A36, sized as required to cover the opening. D.C. 96-081 RTV silicone adhesive/sealant or approved equal, at open gaps between the existing frame and the 1/4" plate. The 1/4" plate installed outside the pump room and the existing fire two dampers (2-HV-AFP-FD-4A, and C) are on the opposite side of the wall. Fire damper 2-HV-AFP-FD-4B is installed and has a blowout panel on the outside of the opening to prevent a HELB in the turbine building from affecting the pump room. The fusible links for the fire dampers are 350°F due to HELB concerns.

Fire Zone 85: Fire dampers having a 3-hour rating are provided to adjacent Fire Areas AA23 and AA24 - Fire Zones 18 and 19, respectively, and to adjacent Fire Zone 128. Fire dampers having a 1 1/2-hour rating are provided to adjacent Fire Area AA25 - Fire Zone 20.

### 3.1.8 Other Features

For Fire Zone 140, a 6-inch curb is provided at the top of the stairs. A 7-ft. high dike separates the caustic storage tank from the acid storage tank.

For Fire Zones 28 and 30, a curb is provided at the entrance to the room.

For Fire Zone 79, Electrical Raceway Fire Barrier Systems (ERFBS) with a rating of a 1-hour rating are provided, for raceways 1AZ-C34, 1-80009PR-1, and 1-80046PR-1.

For Fire Zone 85, Electrical Raceway Fire Barrier Systems (ERFBS) with a rating of a 1-hour rating are provided, for raceways 2AZ-C55, 2AZ-C99, 2E-C9 and 2E-C10.

For Fire Zones 83 and 88, a 6-inch curb is provided at the entrance.

For Fire Zone 89, a ramp/curb 4-inches high is provided at the door entrance.

For Fire Zone 95, an 8-inch curb is provided at the entrance. The floor is sunken 3.75 feet below the top of the curb.

### 3.2 Fire Hazards Identification

The fire area contains both ignition sources and combustible fire hazards. The ignition sources

consist of the Unit 1 and 2 turbine generators, the main feedwater pumps, the lube oil holding tanks, the feed pump turbine condensers, condensate booster pumps, H2 seal oil units, various MCCs and electrical cabinets and other associated turbine generator system components. Combustibles consist primarily of exposed electrical cables in trays and lube oil.

The high level of active fire protection provided in the Turbine Building below the operating deck is sufficient to prevent collapse of unprotected structural steel and subsequent adverse impact on fire barriers protecting safety related equipment. General area wet pipe sprinkler coverage is provided throughout the mezzanine and basement elevations and separate wet pipe sprinkler systems using directional spray closed head nozzles are provided over turbine lube oil piping runs and cable tray concentrations. Curbs and drains are provided to limit the area of fire involvement during a turbine lube oil fire. Turbine lube oil storage rooms are provided with rated cut-offs from the remainder of the building, as well as, automatic sprinkler protection.

The exterior fire hazards that are adjacent to exterior walls are the transformers and hydrogen storage tanks. However, water spray suppression systems are provided for the transformers and those portions of the Turbine Building exterior walls in the immediate vicinity of the transformers. In addition, four-hour rated concrete block walls are provided for the Turbine Building walls at the 609' elevation facing the transformer. The missile barriers around each transformer also provide a measure of fire barrier protection, limiting radiant heat in the direction of the Fire Area.

The Hydrogen storage tank farm is located west of the Unit 2 Turbine Building and south of the Screenhouse. The tank farm orientation and the separation from the building eliminated the need for an automatic suppression system or fire barriers on the Turbine Building. A 3 hr rated blast wall is provide between the tank farm and the Make-up Water Treatment containers and Turbine Building.

The Auxiliary Plant Boiler is located outside of Fire Zone 93. This boiler is enclosed in a C-Van Container and provided with a CO2 Suppression System.

The 3-hour rated concrete wall that separates the full bottle storage area of the Gas Bottle Storage Building is a maximum fire loss (MFL) type firewall. The combination of the firewall and spatial separation from the south wall of Fire Zones 97 and 98 provides assurance that a gas cylinder fire would not damage credited equipment.

The unrated exterior walls of the Turbine Building are considered acceptable because there are no NSCA or NPO credited components located in close proximity to the Turbine Building in the Yard that could be exposed by an uncontrolled fire within the Fire Area. The impact of a fire in the yard on the Turbine Building would be limited to radiant heat with no ceiling to contain the fire plume. Along with the combination of spatial separation and fire suppression provided for fire hazards in the yard, plus the fire suppression capability provided in the Turbine Building, are sufficient to prevent an exposure to credited equipment inside the plant through the unrated exterior walls of this Fire Area.

The roof of the Turbine Building is at such an elevation that exterior fire hazards will not impact the unrated construction and is sufficient in protecting equipment within the plant.

The current fire loading classification of Fire Zones 83, 88, 89, 95 and 100 is high. The current fire loading classification of Fire Zones 94 and 126 is moderate. All other fire zones in this fire area have a low fire loading classification.

Combustible loading and construction features for Fire zone 124 is incorporated in Fire Zone 86 (FPPR-2015-0003)

Combustible loading and construction features for Fire zone 128 is incorporated in Fire Zone 85 (FPPR-20015-0003).

### 3.3 NSCA Compliance Summary

Fire Area AA2 contains Red Train (AB) and Green Train (CD) Unit 1 and Unit 2 cables and equipment including Main Steam and Auxiliary Feedwater system safe shutdown components.

Compliance with the nuclear safety performance criteria is achieved using the performance-based approach in accordance with NFPA 805, Section 4.2.4.2.

Safe and stable condition for Unit 1 will be accomplished using Steam Generators 2 and 3 via the Unit 1 East Motor Driven Auxiliary Feedwater Pump or Steam Generators 1 and 4 via West Motor Driven Auxiliary Feedwater Pump for fire scenarios which impact Control Room indication of the 2 and 3 loop, Unit 1 CVCS via the East Charging Pump, and Unit 1 Component Cooling Water via the East Pump. Unit 1 Essential Service Water via the Unit 1 East Pump with crosstie to the Unit 2 West Pump available for scenarios which impact the affected unit's ESW flowpath. Most essential Green Train electrical systems remain available. Process Monitoring Indication is credited in the Control Room.

Safe and stable condition for Unit 2 will be accomplished using Steam Generators 2 and 3 via the Unit 2 East Motor Driven Auxiliary Feedwater Pump or Steam Generators 1 and 4 via the Unit 2 West Motor Driven Auxiliary Feedwater Pump for fire scenarios which impact Control Room indication of the 2 and 3 loop, Unit 2 CVCS via the East Charging Pump, and Unit 2 Component Cooling Water crediting the East Pump. Unit 2 Essential Service Water credits the Unit 2 East Pump with crosstie to the Unit 1 West Pump available for scenarios which impact the affected unit's ESW flowpath. Most essential Green Train electrical systems remain available. Process Monitoring Indication is credited in the Control Room.

The Nuclear Safety Performance Criteria compliance strategy for Fire Area AA2 is documented within the NSCA Report.

#### 3.3.1 Variances

The variances identified for evaluation for this fire area are grouped as follows:

##### 3.3.1.1 VFDR No. AA2-001

1-11A-NORM - 600 Volt Bus 11A (normal) is required to be operable to support Electrical Distribution Unit 1 Red (AB) Train. The 600 Volt Bus needs to be recovered in order to mitigate a spurious SI signal (control power to reset circuitry) and allow valve reposition (valve control power) from the Control Room as well as maintain Process Monitoring from the Control Room. A spurious SI can occur for a fire in this area due to monitoring circuitry cable failures. Bus 11A may fail due to fire induced damage of 600VAC Bus Supply Transformer 1-TR11A and cable 1209-1. 1-TR11A fails due to failure of upstream supplies. This condition represents a variance from the deterministic requirements of NFPA 805, Section 4.2.3. This is a separation issue.

This VFDR has been evaluated and it was determined that the risk, safety margin and defense-in-depth meet the acceptance criteria of NFPA 805 Section 4.2.4 with a defense-in-depth action credited.

### 3.3.1.2 VFDR No. AA2-002

1-MPP-220-CRI and 1-MPP-230-CRI – SG pressure indication is required to be operable to support process monitoring. Process monitoring is required to be available to monitor key primary and secondary parameters of the SGs. SGs 2 and 3 are credited for decay heat removal for a fire within Fire Area AA2 due to the failure of the Unit 1 West AFW Pump. This condition represents a variance from the deterministic requirements of NFPA 805, Section 4.2.3. This is a separation issue.

This VFDR has been evaluated and it was determined that the risk, safety margin and defense-in-depth meet the acceptance criteria of NFPA 805 Section 4.2.4 with no further action required.

### 3.3.1.3 VFDR No. AA2-003

1-MRV-220, 1-MRV-230 and 1-URV-P – Main Steam Stop Valves for SGs 2 and 3 are required to be closed to support main steam isolation. If the Main Steam Stop Valves cannot be closed turbine trip and closure of Steam Dump to Condenser Valves will provide main steam isolation. Main steam isolation is required to prevent uncontrolled cooldown through over-steaming. 1-MRV-220 is not available due to the failure of 1-MMO-220, 1-MRV-221 and 1-MRV-222. 1-MMO-220, 3 Way Air Open Valve for Steam Generator 2 Stop Valve vents air from the main steam stop valve to either 1-MRV-221 or 1-MRV-222. Cable failures to the 3 way stop valve will spuriously operate it to either position. 1-MRV-230 is not available due to the failure of 1-MMO-230, 1-MRV-231 and 1-MRV-232. 1-MMO-230, 3 Way Air Open Valve for Steam Generator 3 Stop Valve vents air from the main steam stop valve to either 1-MRV-231 or 1-MRV-232. Cable failures to the 3 way stop valve will spuriously operate it to either position. 1-URV-P may fail due to fire induced damage of cables 12294-1, 12295-1, 12296-1, 12300-1, 12304-1, 12305-1, 12308-1, 12313-1, 12314-1, 12379-1, 12380-1, 12381-1, 12385-1, 12389-1, 12390-1, 12393-1, 12398-1, 12399-1, 12446-1, 12447-1, 12448-1, 12452-1, 12456-1, 12457-1, 12460-1, 12465-1, 12466-1, 4202-1, 4203-1, 4204-1, 4208-1, 4212-1, 4213-1, 4216-1, 4221-1, 4222-1, 5163-1, 7020-1, 7021-1, 7022-1, 7026-1, 7030-1, 7031-1, 7034-1, 7039-1 and 7040-1. This condition represents a variance from the deterministic requirements of NFPA 805, Section 4.2.3. This is a separation issue.

This VFDR has been evaluated and it was determined that the risk, safety margin and defense-in-depth meet the acceptance criteria of NFPA 805 Section 4.2.4 with a defense-in-depth action credited.

### 3.3.1.4 VFDR No. AA2-004

1-WMO-733 - Unit 1 East ESW CCW HX Outlet Valve is required to be open to support Unit 1 and required to be closed to support Unit 2. The Unit 1 and Unit 2 ESW systems are normally cross-tied and are capable of providing cooling to the alternate Unit. ESW is required to provide cooling to the DGs, CCW HX and Control Room HVAC. 1-WMO-733 may fail due to a spurious SI signal. A SI signal will throttle the valve. This condition represents a variance from the deterministic requirements of NFPA 805, Section 4.2.3. This is a separation issue.

This VFDR has been evaluated and it was determined that the risk, safety margin and defense-in-depth meet the acceptance criteria of NFPA 805 Section 4.2.4 with no further action required.

**3.3.1.5 VFDR No. AA2-005**

2-21A-NORM - 600 Volt Bus 21A (normal) is required to be operable to support Electrical Distribution Unit 2 Red (AB) Train. The 600V Bus needs to be recovered in order to mitigate a spurious SI signal (control power to reset circuitry) and allow valve reposition (valve control power) from the Control Room as well as maintain Process Monitoring from the Control Room. A spurious SI can occur for a fire in this area due to monitoring circuitry cable failures. Bus 21A may fail due to fire induced damage of 600VAC Bus Supply Transformer 2-TR21A and cable 1209-2. 2-TR21A may fail due to failure of upstream supplies. This condition represents a variance from the deterministic requirements of NFPA 805, Section 4.2.3. This is a separation issue.

This VFDR has been evaluated and it was determined that the risk, safety margin and defense-in-depth meet the acceptance criteria of NFPA 805 Section 4.2.4 with a defense -in-depth action credited.

**3.3.1.6 VFDR No. AA2-006**

2-MPP-220-CRI and 2-MPP-230-CRI – SG pressure indication is required to be operable to support process monitoring. Process monitoring is required to be available to monitor key primary and secondary parameters of the SGs. SGs 2 and 3 are credited for decay heat removal for a fire within Fire Area AA2 due to the failure of the Unit 2 West AFW Pump. This condition represents a variance from the deterministic requirements of NFPA 805, Section 4.2.3. This is a separation issue.

This VFDR has been evaluated and it was determined that the risk, safety margin and defense-in-depth meet the acceptance criteria of NFPA 805 Section 4.2.4 with no further action required.



**3.3.1.7 VFDR No. AA2-007**

2-MRV-220, 2-MRV-230 and 2-URV-P – Main Steam Stop Valves for Steam Generators 2 and 3 are required to be closed to support main steam isolation. If the Main Steam Stop Valves cannot be closed turbine trip and closure of Steam Dump to Condenser Valves will provide main steam isolation. Main steam isolation is required to prevent uncontrolled cooldown through over-steaming. 2-MRV-220 may not be available due to the failure of 2-MMO-220, 2-MRV-221 and 2-MRV-222. 2-MMO-220, 3 Way Air Open Valve for Steam Generator 2 Stop Valve vents air from the main steam stop valve to either 2-MRV-221 or 2-MRV-222. Cable failures to the 3 way stop valve will spuriously operate it to either position. 2-MRV-230 may not be available due to the failure of 2-MMO-230, 2-MRV-231 and 2-MRV-232. 2-MMO-230, 3 Way Air Open Valve for Steam Generator 2 Stop Valve vents air from the main steam stop valve to either 2-MRV-231 or 2-MRV-232. Cable failures to the 3 way stop valve will spuriously operate it to either position. 2-URV-P may fail due to fire induced damage of cables 12294-1, 12295-2, 12296-2, 12300-2, 12303-2, 12304-2, 12308-2, 12310-2, 12311-2, 12379-2, 12380-2, 12381-2, 12385-2, 12388-2, 12389-2, 12393-2, 12395-2, 12396-2, 12446-2, 12447-2, 12448-2, 12452-2, 12455-2, 12456-2, 12460-2, 12462-2, 4202-2, 4203-2, 4204-2, 4208-2, 4211-2, 4212-2, 4216-2, 4218-2, 4219-2, 5163-2, 7020-2, 7021-2, 7022-2, 7026-2, 7029-2, 7030-2, 7034-2, 7036-2, 7037-2 and 9318O-2. This condition represents a variance from the deterministic requirements of NFPA 805, Section 4.2.3. This is a separation issue.

This VFDR has been evaluated and it was determined that the risk, safety margin and defense-in-depth meet the acceptance criteria of NFPA 805 Section 4.2.4 with a defense-in-depth action credited.

**3.3.1.8 VFDR No. AA2-008**

2-WMO-734 - Unit 2 East ESW CCW HX Outlet Valve is required to be open to support Unit 2 and required to be closed to support Unit 1. The Unit 1 and Unit 2 ESW systems are normally cross-tied and are capable of providing cooling to the alternate Unit. ESW is required to provide cooling to the DGs, CCW HX and Control Room HVAC. 2-WMO-734 may fail due to a spurious SI signal. A SI signal will throttle the valve. This condition represents a variance from the deterministic requirements of NFPA 805, Section 4.2.3. This is a separation issue.

This VFDR has been evaluated and it was determined that the risk, safety margin and defense-in-depth meet the acceptance criteria of NFPA 805 Section 4.2.4 with no further action required.



**3.3.1.9 VFDR No. AA2-009**

1-PP-7E, 1-PP-7W, 2-PP-7E and 2-PP-7W - Unit 1 and Unit 2 ESW East and West Pumps are required to be operable to support ESW. Unit 1 and Unit 2 ESW are normally cross-tied. 1-PP-7E supports the Unit 1 East ESW system and the Unit 2 West ESW system. 1-PP-7W supports the Unit 1 West ESW system and the Unit 2 East ESW system. 2-PP-7E supports the Unit 2 East ESW system and the Unit 1 West ESW system. 2-PP-7W supports the Unit 2 West ESW system and the Unit 1 East ESW system. ESW is required to provide cooling to the DGs, CCW HX and Control Room HVAC. 1-PP-7E may fail due to fire induced damage of ESW Supply Fans 12-HV-ESW-7 and 12-HV-ESW-8. 1-PP-7W may fail due to fire induced damage of ESW Supply Fans 12-HV-ESW-5 and 12-HV-ESW-6, 4kV Bus 1-T11A and cable 8915R-1. 2-PP-7E may fail due to fire induced damage of ESW Supply Fans 12-HV-ESW-1 and 12-HV-ESW-2. 2-PP-7W may fail due to fire induced damage of ESW Supply Fans 12-HV-ESW-3 and 12-HV-ESW-4, 4kV Bus 2-T21A and cable 8915R-2. This condition represents a variance from the deterministic requirements of NFPA 805, Section 4.2.3. This is a separation issue.

This VFDR has been evaluated and it was determined that the risk, safety margin and defense-in-depth meet the acceptance criteria of NFPA 805 Section 4.2.4 with a recovery action required.

**3.3.2 Recovery Actions Credited**

For each VFDR, a Fire Risk Evaluation has been performed to assess the acceptability of risk, defense-in-depth, and safety margin. This evaluation determined whether or not recovery actions are required to ensure that one success path necessary to achieve and maintain the nuclear safety performance criteria is maintained free of fire damage by a single fire. Table 3-3 identifies the credited recovery actions for this area. Actions retained for DID are identified as "DID Actions" within Table 3-3. Additional information for DID actions is contained within Section 3.8 of this report. Note that, for completeness, all VFDRs are contained within Table 3-3, even if the Fire Risk Evaluation has determined that a recovery action is not required. In those instances where a recovery action has been determined to not be required, the word "None" is provided in the "Action" column in the table.

<b>Table 3-3, Recovery Actions Credited</b>		
<b>VFDR</b>	<b>Component</b>	<b>Action</b>
AA2-001	1-11A-NORM	DID ACTION 1-11A-XFER (Transfer to alternate power supply)
AA2-002	1-MPP-220-CRI 1-MPP-230-CRI	None
AA2-003	1-MRV-220 1-MRV-230 1-URV-P	DID ACTION 1-MRV-221-OPEN (Manually Open 1-MRV-221 to close 1-MRV-220)  1-MRV-231-OPEN (Manually Open 1-MRV-231 to close 1-MRV-230)

Table 3-3, Recovery Actions Credited		
VFDR	Component	Action
AA2-004	1-WMO-733	None
AA2-005	2-21A-NORM	DID ACTION 2-21A-XFER (Transfer to alternate power supply)
AA2-006	2-MPP-220-CRI 2-MPP-230-CRI	None
AA2-007	2-MRV-220 2-MRV-230 2-URV-P	DID ACTION 2-MRV-221-OPEN (Manually Open 2-MRV-221 to close 2-MRV-220)  2-MRV-231-OPEN (Manually Open 2-MRV-231 to close 2-MRV-230)
AA2-008	2-WMO-734	None
AA2-009	2-PP-7E 2-PP-7W	2-CS-302-CLOSE (Close manual valve 2-CS-302)  2-CS-534-OPEN (Open manual valve 2-CS-534)  1-CS-536-OPEN (Open manual valve 1-CS-536)

### 3.4 Non-Power Operational Modes Compliance Summary

A review of CNP for the potential effects of a fire in this Fire Area while in non-power modes of operation (NPO) was conducted. This review was conducted using the guidance provided in NEI 04-02 and FAQ 07-0040, "Non-Power Operations Clarifications".

The review determined that there are potential failures that affect certain Key Safety Functions (KSF) as a result of the fire in this area, and the fire could result in the loss of one or more KSF paths. Compensatory measures are required during high risk evolution periods to provide reasonable assurance a fire will not adversely affect key safety functions and the NFPA 805 performance goal for NPO is therefore satisfied. The results of the NPO analysis are contained within Technical Evaluation R1900-005-001, Non-Power Operation Modes Transition Review Report.

### 3.5 Radioactive Release Compliance Summary

The NFPA 805 radiological release goal is to provide reasonable assurance that a fire will not result in a radiological release that adversely affects the public, plant personnel or the environment. The NFPA 805 requirement is to ensure a radiation release to any unrestricted area due to the direct effects of fire suppression activities (but not involving fuel damage) shall be as low as reasonably achievable and shall not exceed applicable plant Technical Specification limits.

AA2 is located outside the Radiological Controlled Area (RCA) and is not a storage location for contaminated materials, therefore there is reasonable assurance a fire in this area will not result in

radiation release. The review of this fire area, with respect to radioactive release, is documented in the NFPPM.

### 3.6 Probabilistic Risk Assessment-Summary of Results

A Fire PRA (FPRA) quantification of Fire Area AA2 was performed and is documented in PRA-NB-FIRE-FQ, Fire PRA Model Quantification Notebook. The fire risk quantification for Fire Area AA2 is analyzed using detailed fire modeling to consider risk of fire scenarios of ignition sources. PRA-NB-FIRE-FQ includes a summary of all potentially risk-significant fire scenarios (i.e., CDF > 1.0E-7 or LERF > 1.0E-8). Bounding CDF / LERF per calendar year values are reported that are based on the risk values documented in PRA-NB-FIRE-FSS, Fire PRA Fire Scenario Selection.

Fire Protection features credited in the Fire PRA are documented in R1900-0411-AA2, Detailed Fire Modeling Report: Fire Compartment: AA2 Unit 1 and Unit 2 Turbine Building, Main Steam Enclosures and Pipe Tunnels. PRA-NB-FIRE-FSS documents the revision level of the fire modeling reports used in the most recent Fire PRA quantification.

### 3.7 Risk-Informed, Performance-Based Evaluations

Fire Risk Evaluations (FREs) have been performed to ensure that variances from the NFPA 805 deterministic requirements are acceptable. The evaluation process consists of an integrated assessment of the acceptability of risk, defense-in-depth, and safety margins.

#### 3.7.1 Transition Risk-Informed, Performance-Based Evaluations

The 'changes' associated with NFPA 805 transition were those variances from the deterministic requirements of NFPA 805 or with the existing fire protection licensing basis that were brought into compliance with the NFPA 805 performance based approach. The change identified for evaluation for Fire Area AA2 is as follows:

- Separation Issues

The Fire Risk Evaluation has determined that the change is acceptable based upon:

- The measured change in CDF and LERF.
- Adequate defense-in-depth and safety margins being maintained.

Refer to Attachment 2 for a summary of results associated with the Fire Risk Evaluations.

### 3.8 Defense-in-Depth

A comprehensive risk-informed, performance-based analysis includes consideration of defense-in-depth (DID) as part of an integrated evaluation of risk considerations. In general, defense-in-depth involves consideration of the extent to which fire protection systems and features are provided within the three echelons of fire-protection:

- Preventing fires from starting,
- Rapidly detecting fires and controlling and extinguishing promptly those fires that do occur, thereby limiting fire damage,
- Providing an adequate level of fire protection for structures, systems, and components important to safety, so that a fire that is not promptly extinguished will not prevent the nuclear safety performance criteria from being met.

Each VFDR was evaluated for DID. The following recovery actions have been retained for DID.

VFDR No. AA2-001: 1-11A-NORM - 600 Volt Bus 11A (normal) is required to be operable to support Electrical Distribution Unit 1 Red Train. The 600 Volt Bus needs to be recovered in order to mitigate a spurious SI signal (control power to reset circuitry) and allow valve reposition (valve control power) from the Control Room as well as maintain Process Monitoring from the Control Room. If power is not transferred both Unit 1 CCW trains will be lost, resulting in the failure of the Unit 1 charging pumps. Transfer to alternate power supply for 1-11A-NORM is being retained for DID to ensure Unit 1 charging is maintained.

VFDR No. AA2-003: 1-MRV-220 and 1-MRV-230 - The Main Steam Stop Valves for SGs 2 and 3 are required to be closed to support main steam isolation. Main steam isolation is required to prevent uncontrolled cooldown through over-steaming. The Main Steam Stop Valves may spuriously open due to a fire in AA2. These failures can be mitigated by locally closing the valves by dumping the control air. These recovery actions are being retained for DID to ensure main steam isolation is maintained.

VFDR No. AA2-005: 2-21A-NORM - 600 Volt Bus 21A (normal) is required to be operable to support Electrical Distribution Unit 2 Red Train. The 600 Volt Bus needs to be recovered in order to mitigate a spurious SI signal (control power to reset circuitry) and allow valve reposition (valve control power) from the Control Room as well as maintain Process Monitoring from the Control Room. If power is not transferred both Unit 2 CCW trains will be lost, resulting in the failure of the Unit 2 charging pumps. Transfer to alternate power supply for 2-21A-NORM is being retained for DID to ensure Unit 1 charging is maintained.

VFDR No. AA2-007: 2-MRV-220 and 2-MRV-230 - The Main Steam Stop Valves for SGs 2 and 3 are required to be closed to support main steam isolation. Main steam isolation is required to prevent uncontrolled cooldown through over-steaming. The Main Steam Stop Valves may spuriously open due to a fire in AA2. These failures can be mitigated by locally closing the valves by dumping the control air. These recovery actions are being retained for DID to ensure main steam isolation is maintained.

Based on the assessment in support of the Fire Risk Evaluation, defense-in-depth is maintained for fire area AA2. Refer to Attachment 2 for details associated with the Fire Risk Evaluation.

### 3.9 Monitoring Program Input

A Monitoring Program will be developed in accordance with FAQ 10-0059, Rev. 1. Methods to monitor availability, reliability, and performance of fire protection program structures, systems, and components (SSCs), as well as programmatic elements will be provided. Additionally, effectiveness measures are established to review program related performance and trends. For AA2 the following systems and features are candidates for inclusion in the CNP Fire Protection Monitoring Program:

- Fire Area boundary barriers discussed in Section 3.1
- Fire Detection System
- Fire Suppression System
- Electrical Raceway Fire Barrier Systems (ERFBS)

#### 4.0 CONCLUSION

The nuclear safety and radioactive release performance criteria of NFPA 805 are met for a fire in Fire Area AA2. This Fire Risk Evaluation for Fire Area AA2 has demonstrated that

- The change in core damage frequency (delta CDF) is acceptable, and
- The change in large early release frequency (delta LERF) is acceptable, and
- Defense-in-depth and safety margins are maintained.

This is confirmation that a success path effectively remains free of fire damage and that the performance-based approach is acceptable per Section 4.2.4.2 of NFPA 805.

#### 5.0 REFERENCES

- 5.1 Calculation PRA-FIRE-NB-CRE, Fire PRA Cumulative Risk Evaluations
- 5.2 CNP Fire Pre-Plans, Volumes I, II, and III, Revisions 17, 14, and 18 respectively
- 5.3 Fire Hazards Analysis
- 5.4 NFPA 805, Performance-Based Standard for Fire Protection for Light Water Reactor Electric Generating Plants
- 5.5 NFPPM, NFPA 805 Fire Protection Program Manual (NFPPM)
- 5.6 Nuclear Energy Institute (NEI) 04-02, Guidance for Implementing a Risk-Informed, Performance-Based Fire Protection Program under 10 CFR 50.48(c), Rev. 2
- 5.7 Nuclear Safety Capability Assessment Report
- 5.8 PRA-NB-FIRE-FQ, Fire PRA Model Quantification Notebook
- 5.9 PRA-NB-FIRE-FSS, Fire PRA Fire Scenario Selection
- 5.10 R1900-0411-AA2, AA2 - Detailed Fire Modeling Report
- 5.11 Regulatory Guide 1.205, Risk-Informed, Performance-Based Fire Protection for Existing Light-Water Nuclear Power Plants, Rev. Revision 1
- 5.12 Technical Evaluation R1900-005-001, Non-Power Operation Modes Transition Review

**Fire Area AA2 – Attachment 1 - Table B-3 - Fire Area Transition**

<u>Unit</u>	<u>Fire Area</u>	<u>Description</u>
1, 2	AA2	Unit 1 and Unit 2 Turbine Building, Main Steam Enclosures and Pipe Tunnels

**Fire Zone   Description**

2N	Pump Bay Turbine Building – El. 569 ft. 6 in. – Unit 1
2S	Pump Bay Turbine Building – El. 569 ft. 6 in. – Unit 2
28	(Back-up Diesel Fire Pump Room) Sodium Hypochlorite System Room - El. 591 ft. 0 in. - Unit 1
30	Back-up Diesel Fire Pump Room - El. 591 ft. 0 in. - Unit 2
77	Welding Shop Unit 1 - El. 591 ft. 0 in. - Turbine Building
78	Heating Boiler Room Unit 1 - El. 591 ft. 0 in. - Turbine Building
79	Turbine Room Unit 1 (N.E. Portion) - El. 591 ft. 0 in.
80	Turbine Room Unit 1 (S.E. Portion) - El. 591 ft. 0 in.
81	Turbine Room Unit 1 (S.W. Portion) - El. 591 ft. 0 in.
82	Turbine Room Unit 1 (N.W. Portion) - El. 591 ft. 0 in.
83	Turbine Room Unit 1 Lube Oil Room - El. 591 ft. 0 in.
84	Turbine Room Unit 2 (N.E. Portion) - El. 591 ft. 0 in.
85	Turbine Room Unit 2 (S.E. Portion) - El. 591 ft. 0 in.
86	Turbine Room Unit 2 (S.W. Portion) - El. 591 ft. 0 in.
87	Turbine Room Unit 2 (N.W. Portion) - El. 591 ft. 0 in.
88	Turbine Room Unit 2 Lube Oil Room - El. 591 ft. 0 in.
89	Turbine Room Unit 2 Storage Room - El. 591 ft. 0 in.
90	Turbine Room Unit 1 (N.E. Portion) - El. 609 ft. 0 in.
91	Turbine Room Unit 1 (S.E. Portion) - El. 609 ft. 0 in.
92	Turbine Room Unit 1 (S.W. Portion) - El. 609 ft. 0 in.
93	Turbine Room Unit 1 (N.W. Portion) - El. 609 ft. 0 in.
94	Turbine Room Unit 1 Office Space - El. 609 ft. 0 in.
95	Turbine Room Unit 1 Turb. Oil Tank Room - El. 605 ft. 11 in.
96	Turbine Room Unit 2 (N.E. Portion) - El. 609 ft. 0 in.
97	Turbine Room Unit 2 (S. E. Portion) - El. 609 ft. 0 in.
98	Turbine Room Unit 2 (S.W. Portion) - El. 609 ft. 0 in.
99	Turbine Room Unit 2 (N.W. Portion) - El. 609 ft. 0 in.
100	Turbine Room Unit 2 Turbine Oil Tank Room - El. 609 ft. 0 in.
108	West Steam Valve Enclosure - Unit 1 - El. 635 ft. 0 in.

**Fire Area AA2 – Attachment 1 - Table B-3 - Fire Area Transition**

<b><u>Unit</u></b>	<b><u>Fire Area</u></b>	<b><u>Description</u></b>
1, 2	AA2	Unit 1 and Unit 2 Turbine Building, Main Steam Enclosures and Pipe Tunnels
109		West Steam Valve Enclosure - Unit 2 - El. 635 ft. 0 in.
110		Main Steam Accessway - Unit 1 - El. 587 ft. 0 in.
111		Main Steam Accessway - Unit 2 - El. 587 ft. 0 in.
124		UPS Inverter Room Security - El. 591 ft. 0 in.
126		Tech Support Center - El. 633 ft. 0 in. - Both Units
127		TSC, UPS Inverter and Battery Rooms - El. 650 ft. 0 in. - Both Units
128		UPS Battery Room Security - El. 591 f-t. 0 in.
129		Unit 1 Turbine Deck - El. 633 ft. 0 in.
130		Unit 2 Turbine Deck - El. 633 ft. 0 in.
131A		Containment Cooling Area - El. 633 ft. 0 in.
139		Turbine Room Sump - El. 570 ft. 9 in.
140		Turbine Caustic and Acid Storage Tank Area - El. 569 ft. 0 in.
141		Turbine Pump Pit - El. 571 ft. 0 in.
142		Screen House - El. 591 ft. 0 in. - Both Units

**Regulatory Basis**

4.2.4.2 - Performance-Based Approach - Fire Risk Evaluation with simplifying deterministic assumptions

<b>Performance Goal</b>	<b>Method of Accomplishment</b>	<b>Comments</b>
<b>Reactivity Control</b>	Unit 1 - Trip the reactor from the Control Room. Borate using Unit 1 East Charging Pump supplied from the RWST. Use source range monitoring for indication.	None
	Unit 2 - Trip the reactor from the Control Room. Borate using Unit 2 East Charging Pump supplied from the RWST. Use source range monitoring for indication.	
<b>Inventory and Pressure Control</b>	Unit 1 - Control inventory using Unit 1 East Charging Pump. Control pressure using Unit 1 Pressurizer Safety Relief Valves.	None
	Unit 2 - Control inventory using Unit 2 East Charging. Control pressure using Unit 2 Pressurizer Safety Relief Valves.	



**Fire Area AA2 – Attachment 1 - Table B-3 - Fire Area Transition**

<u>Unit</u>	<u>Fire Area</u>	<u>Description</u>
1, 2	AA2	Unit 1 and Unit 2 Turbine Building, Main Steam Enclosures and Pipe Tunnels
Decay Heat Removal		<p>Unit 1 - Feed SGs 2 &amp; 3 with Unit 1 East MDAFW Pump. The DHR function also requires MS isolation with a steam release path through the Safety Relief Valves.</p> <p>Unit 2 - Feed SGs 2 &amp; 3 with Unit 2 East MDAFW Pump. The DHR function also requires MS isolation with a steam release path through the Safety Relief Valves.</p>
Process Monitoring		<p>Unit 1 Process Monitoring - Use Unit 1 process monitoring in the Control Room except pressure indication for SGs 2 and 3 which is required at LSI4 powered from Unit 2 for the following: Pressurizer level, RCS pressure and temperature, and S/G level.</p> <p>Unit 1 Source Range Monitoring - Use Unit 1 source range monitoring in the Control Room.</p> <p>Unit 2 Process Monitoring - Use Unit 2 process monitoring in the Control Room except pressure indication for SGs 2 and 3 which is required at LSI4 powered from Unit 1 for the following: Pressurizer level, RCS pressure and temperature, and S/G level.</p> <p>Unit 2 Source Range Monitoring - Use Unit 2 source range monitoring in the Control Room.</p>
Vital Auxiliaries		<p>Unit 1 Electrical - Control Unit 1 Green (CD) Train Electrical Distribution with Unit 1 Green (CD) Train Offsite Power.</p> <p>Unit 1 ESW - Operate Unit 1 East ESW.</p> <p>Unit 1 CCW - Operate Unit 1 East CCW.</p> <p>Unit 1 HVAC - Operate Unit 1 Control Room HVAC. Operate Unit 1 Auxiliary Building HVAC. Operate Unit 1 Green (CD) Train Switchgear HVAC supply fan, the exhaust fan is not available. Operate Unit 1 East AFW Pump Room HVAC system. Unit 1 ESW HVAC is not available.</p> <p>Unit 2 Electrical - Control Unit 2 Green (CD) Train Electrical Distribution with Unit 2 Green (CD) Train Offsite Power or Unit 2 Green (CD) DG.</p> <p>Unit 2 ESW - Operate Unit 2 East ESW.</p> <p>Unit 2 CCW - Operate Unit 2 East CCW.</p> <p>Unit 2 HVAC - Operate Unit 2 Control Room HVAC. Operate Unit 2 Auxiliary Building HVAC. Operate Unit 2 Green (CD) Train Switchgear HVAC supply</p>



**Fire Area AA2 – Attachment 1 - Table B-3 - Fire Area Transition**

<u>Unit</u>	<u>Fire Area</u>	<u>Description</u>
1, 2	AA2	Unit 1 and Unit 2 Turbine Building, Main Steam Enclosures and Pipe Tunnels

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fan, the exhaust fan is not available. Operate Unit 2 East AFW Pump Room HVAC system. Unit 2 ESW HVAC is not available.

**Reference Documents**

Genesis Solution Suite, EDISON / SAFE-PB, DC Cook V 3.4.0

Nuclear Safety Capability Assessment Report

**Licensing Actions**

None

**Existing Engineering Equivalency Evaluations (EEEE)****EEEE Title Engineering Equivalency Evaluation 9-1 - Fire Zone 43 (Fire Area AA36/42) and 91 (Fire Area AA2) Duct Evaluation**

**Summary** The purpose of this engineering equivalency evaluation is to document the acceptability of an undampened HVAC steel duct that penetrates the wall between the Access Control Area and the southeast portion of the Unit 1 Turbine Room, Fire Zones 43 (Fire Area AA36/42) and Fire Zone 91 (Fire Area AA2), respectively.

Reasonable assurance is provided that a fire in Fire Zone 43 or Fire Zone 91 would not impair the safe shutdown capabilities of CNP Unit 1. This engineering equivalency evaluation does not adversely impact other engineering equivalency evaluations.

The HVAC duct was evaluated and found to be acceptable based on the fire hazards and construction features within the evaluated areas.

**Fire Area AA2 – Attachment 1 - Table B-3 - Fire Area Transition**

<b><u>Unit</u></b>	<b><u>Fire Area</u></b>	<b><u>Description</u></b>
1, 2	AA2	Unit 1 and Unit 2 Turbine Building, Main Steam Enclosures and Pipe Tunnels
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<b><u>EEEE Title</u></b>	<b>Engineering Equivalency Evaluation 9-21 - Fire Zone 110 (Fire Area AA2) and Fire Zone 43 (Fire Area AA36/42) Door Evaluation</b>	
<b><u>Summary</u></b>	<p>The purpose of this engineering equivalency evaluation is to document the acceptability of three unrated door assemblies located between the Unit 1 Main Steam Accessway and the Access Control Area in Fire Zones 110 (Fire Area AA2) and 42 (Fire Area AA36/42), respectively.</p> <p>Reasonable assurance is provided that a fire in Fire Zone 43 or Fire Zone 110 would not impair the safe shutdown capabilities of Unit 1. This engineering equivalency evaluation does not adversely impact other engineering equivalency evaluations.</p> <p>The doors were evaluated and found to be acceptable based on the fire hazards, fire protection systems and construction features within the evaluated areas. Also, one of the areas being evaluated is normally manned.</p>	
<b><u>EEEE Title</u></b>	<b>Engineering Equivalency Evaluation 9-22 - Fire Zone 111 (Fire Area AA2) and Fire Zone 44S (Fire Area AA36/42) Door Evaluation</b>	
<b><u>Summary</u></b>	<p>The purpose of this engineering equivalency evaluation is to document the acceptability of three unrated door assemblies located between the Unit 2 Main Steam Accessway and the south end of the 609 ft. elevation of the Auxiliary Building in Fire Zones 111 (Fire Area AA2) and 44S (Fire Area AA36/42) respectively.</p> <p>Reasonable assurance is provided that a fire in Fire Zone 44S or Fire Zone 111 would not impair the safe shutdown capabilities of Unit 1 or Unit 2. This engineering equivalency evaluation does not adversely impact other engineering equivalency evaluations.</p> <p>The doors were evaluated and found to be acceptable based on the fire hazards, fire protection systems and construction features within the evaluated areas.</p>	

**Fire Area AA2 – Attachment 1 - Table B-3 - Fire Area Transition**

<b><u>Unit</u></b>	<b><u>Fire Area</u></b>	<b><u>Description</u></b>
1, 2	AA2	Unit 1 and Unit 2 Turbine Building, Main Steam Enclosures and Pipe Tunnels

<b><u>EEEE Title</u></b>	<b>Engineering Equivalency Evaluation 9-25 - Essential Service Water Pump House Hatch and Fire Damper Evaluation (Fire Areas AA2, AA32 and AA33)</b>
<b><u>Summary</u></b>	<p>The purpose of this engineering equivalency evaluation is to document the acceptability of: (1) an unrated steel plate hatch located between the ceiling of the Circulating Water Pump Motor Control Room, Fire Zone 29G (Fire Area AA32), and the floor of Unit 2 ESW Pump Cubicle, Fire Zone 29C (a 3-hr fire-rated hatch assembly is not commercially available for use in this location); (2) undampered ventilation ducts located in the ceiling of Fire Zones 29A and 29B (Fire Area AA32) and Fire Zones 29C and 29D (Fire Area AA33); and (3) screen mesh access gates from Fire Zone 142 (Fire Area AA142) into the Unit 1 and Unit 2 ESW pump cubicles.</p> <p>Reasonable assurance is provided that a fire originating: (1) on the roof of ESW Pump House; (2) in Fire Zones 29A and 29B; (3) in Fire Zone 29G; (4) in Fire Zones 29C and 29D; or (5) in Fire Zone 142, would not impair safe shutdown capabilities of CNP Unit 1 and Unit 2. In addition, this engineering equivalency evaluation does not impact the bases of the full area and fixed suppression exemption requests in the ESW Pump House. This engineering equivalency evaluation does not adversely impact other engineering equivalency evaluations or exemption requests.</p> <p>The unrated steel plate hatch, the undampered ventilation ducts and the screen mesh access gates were evaluated and found to be acceptable based on the fire hazards, fire protection systems and construction features within the evaluated areas.</p>
<b><u>EEEE Title</u></b>	<b>Engineering Equivalency Evaluation 9-35 - Fire Zone 108 (Fire Area AA2) to Fire Zone 33A (Fire Area AA34) Boundary Evaluation</b>
<b><u>Summary</u></b>	<p>The purpose of this evaluation is to document the acceptability of unsealed penetrations and an undampered installation duct in the barrier separating Fire Zone 108 (Fire Area AA2) from Fire Zone 33A (Fire Area AA34). This engineering equivalency evaluation does not adversely impact other engineering equivalency evaluations or exemption requests.</p> <p>Reasonable assurance is provided that a fire will not impact the redundant safe shutdown capability in Fire Zones 108, 33A, and 33. In addition, the evaluation does not adversely impact other evaluations or exemption requests.</p> <p>The unsealed penetrations and undampered duct were evaluated and found to be acceptable based on the fire hazards, fire protection systems and construction features within the evaluated areas.</p>

**Fire Area AA2 – Attachment 1 - Table B-3 - Fire Area Transition**

<u>Unit</u>	<u>Fire Area</u>	<u>Description</u>
1, 2	AA2	Unit 1 and Unit 2 Turbine Building, Main Steam Enclosures and Pipe Tunnels
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<b><u>EEEE Title</u></b>	<b>Engineering Equivalency Evaluation 9-36 - Fire Zone 109 (Fire Area AA2) to Fire Zone 34A (Fire Area AA35) Boundary Evaluation</b>	
<b><u>Summary</u></b>	<p>The purpose of this engineering equivalency evaluation is to document the acceptability of unprotected steam line pipe penetrations and an undampered ventilation duct in the barrier separating Fire Zone 109 (Fire Area AA2) from Fire Zone 34A (Fire Area AA35).</p> <p>Reasonable assurance is provided that a fire will not impact on redundant safe shutdown capability located in Fire Zones 109, 34A, and 34. This engineering equivalency evaluation does not adversely impact other engineering equivalency evaluations.</p> <p>The unsealed penetrations and undampered duct were evaluated and found to be acceptable based on the fire hazards, fire protection systems and construction features within the evaluated areas.</p>	
<b><u>EEEE Title</u></b>	<b>Engineering Equivalency Evaluation 9-38 - Fire Zone 69 (Fire Area AA3) to Fire Zones 108 (Fire Area AA2) and 109 (Fire Area AA2) Boundary Evaluation</b>	
<b><u>Summary</u></b>	<p>The purpose of this engineering equivalency evaluation is to document the acceptability of undampered containment instrumentation room exhaust ductwork that penetrate the barriers separating Fire Zone 69 (Fire Area AA3) from Fire Zones 108 (Fire Area AA2) and 109 (Fire Area AA2). The purpose of this engineering equivalency evaluation is to demonstrate that it does not adversely impact other engineering equivalency evaluations or exemption requests.</p> <p>The undampered piping/ductwork does not affect safe shutdown due to the low combustible loading, automatic detection in Fire Zone 69, and a lack of credible fire events (based on this and previous engineering equivalency evaluations involving these areas). This engineering equivalency evaluation does not adversely impact other engineering equivalency evaluations or exemption requests.</p> <p>The penetrations were evaluated and found to be acceptable based on the fire hazards and fire protection systems within the evaluated areas.</p>	

**Fire Area AA2 – Attachment 1 - Table B-3 - Fire Area Transition**

<u>Unit</u>	<u>Fire Area</u>	<u>Description</u>
1, 2	AA2	Unit 1 and Unit 2 Turbine Building, Main Steam Enclosures and Pipe Tunnels

<b><u>EEEE Title</u></b>	<b>Engineering Equivalency Evaluation 9-39 - Fire Zone 70 (Fire Area AA57A) to Fire Zone 129 (Fire Area AA2) Boundary Evaluation</b>
<b><u>Summary</u></b>	<p>The purpose of this engineering equivalency evaluation is to document the acceptability of an unrated door connecting the Unit 1 Turbine Deck in Fire Zone 129 (Fire Area AA2) and the Unit 1 Control Room HVAC Room in Fire Zone 70 (Fire Area AA57A).</p> <p>Reasonable assurance is provided that the unrated door between Fire Zones 129 and 70 does not adversely impact redundant safe shutdown capabilities. This engineering equivalency evaluation does not adversely impact other engineering equivalency evaluations or exemption requests</p> <p>The door was evaluated and found to be acceptable based on the construction features within the evaluated areas. Also, one of the fire zones being evaluated does not contain systems, components or cables important to nuclear safety.</p>
<b><u>EEEE Title</u></b>	<b>Engineering Equivalency Evaluation 11-8 - Yard to Fire Zones 34 (Fire Area AA35), 34A (Fire Area AA35), 90 (Fire Area AA2), 97 (Fire Area AA2), 129 (Fire Area AA2) and 130 (Fire Area AA2) Boundary Evaluations</b>
<b><u>Summary</u></b>	<p>The purpose of this engineering equivalency evaluation is to document the acceptability of fire barriers separating the oil filled transformers located in the yard and the Unit 1 and Unit 2 Turbine Building and Unit 2 Auxiliary Building for their impact on preventing the spread of fire. This engineering equivalency evaluation does not impact on other engineering equivalency evaluations or exemption requests.</p> <p>Reasonable assurance is provided that a transformer fire will not impair the safe shutdown capabilities of Unit 1 or Unit 2. This engineering equivalency evaluation does not impact on other engineering equivalency evaluations.</p> <p>The fire barriers were evaluated and found to be acceptable based on the fire hazards, fire protection systems and construction features within the evaluated areas.</p>
<b><u>EEEE Title</u></b>	<b>Engineering Equivalency Evaluation 11-9 - Turbine, Auxiliary and Containment Buildings Boundary Evaluation</b>
<b><u>Summary</u></b>	<p>The purpose of this engineering equivalency evaluation is to describe in general, the approach and existence of evaluations performed to determine and reconcile fire area boundaries having components or designs with less than a 3-hr fire rating on preventing the spread of fire. This engineering equivalency evaluation also specifically evaluates the impact of unrated door assemblies on the spread of fire.</p> <p>Reasonable assurance is provided that the fire area boundaries having components or design less than a 3-hr fire rating will not increase the spread of fire or impair the safe shutdown capabilities of Units 1 or 2. In addition, this engineering equivalency evaluation does not adversely impact on other engineering equivalency evaluations or exemption requests.</p> <p>This evaluation supports additional evaluations credited in this fire area.</p>

**Fire Area AA2 – Attachment 1 - Table B-3 - Fire Area Transition**

<b><u>Unit</u></b>	<b><u>Fire Area</u></b>	<b><u>Description</u></b>
1, 2	AA2	Unit 1 and Unit 2 Turbine Building, Main Steam Enclosures and Pipe Tunnels

<b><u>EEEE Title</u></b>	<b>Engineering Equivalency Evaluation 11-11 - Storage of Flammable Gases in Fire Areas AA2 and YD</b>
<b><u>Summary</u></b>	<p>The purpose of this evaluation is to address a (1) Fire/Explosion within or outside of the Gas Cylinder Storage Building, (2) Fire/Explosion near the U1 &amp; U2 Seal Oil Skid Area, (3) Fire/Explosion at the Generator Hydrogen Bulk Storage Containers. The Fire Protection Pump House was analyzed in the event of a fire/explosion in the Generator Bulk Hydrogen Bulk Storage Containers.</p> <p>The bottle and bulk gas storage of compressed or cryogenic gases is acceptable for maintaining the fire safety of CNP. In addition, this engineering equivalency evaluation does not impact other engineering equivalency evaluations or exemption requests.</p> <p>The hydrogen storage configuration was evaluated and found to be acceptable based on the fire hazards, fire protection systems and construction features within the areas. Also, some fire zones being evaluated do not contain systems, components or cables important to safe shutdown.</p>
<b><u>EEEE Title</u></b>	<b>Engineering Equivalency Evaluation 11-12 - Stairwells and Elevator Construction and Boundary Evaluation (Fire Analysis Areas AA 1, AA2, AA3, AA5/6, AA3 6 and AA42)</b>
<b><u>Summary</u></b>	<p>The purpose of this engineering equivalency evaluation is to document the acceptability of the rated and unrated fire barriers of the stairwells and elevators located in the Turbine and Auxiliary Buildings for their impact on preventing the spread of fire in Fire Areas AA1, AA2, AA3, AA5/6, and AA36/42.</p> <p>Reasonable assurance is provided that the open stairwells and elevators of the Turbine and Auxiliary Buildings will not result in an increased potential for the spread of fire or potential impairment of the safe shutdown capabilities of Unit 1 or Unit 2. This engineering equivalency evaluation does not impact other engineering equivalency evaluations.</p> <p>The stairwells and elevator boundaries were evaluated and found to be acceptable based on the fire hazards, fire protection systems and construction features within the areas.</p>

**Fire Area AA2 – Attachment 1 - Table B-3 - Fire Area Transition**

<b><u>Unit</u></b>	<b><u>Fire Area</u></b>	<b><u>Description</u></b>
1, 2	AA2	Unit 1 and Unit 2 Turbine Building, Main Steam Enclosures and Pipe Tunnels
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<b><u>EEEE Title</u></b>	<b>Engineering Equivalency Evaluation 11-16 - Lube Oil Storage Rooms Fire Zones 83, 88, 95 and 100 (Fire Area AA2), Boundary Evaluation</b>	
<b><u>Summary</u></b>	<p>The purpose of this engineering equivalency evaluation is to document the acceptability of the 8 in. thick silicone foam fire seals protecting the penetrations between the lube oil storage rooms in Fire Area AA2 and the Unit 1 and Unit 2 Turbine Buildings and the Screenhouse for their impact on preventing the spread of fire. This engineering equivalency evaluation analyzes unlisted fire dampers between Fire Zones 81 and 83 as well as Fire Zones 87 and 88 and their impact on preventing the spread of fire.</p> <p>The existing unlisted fire dampers and/or the 8 in. silicone foam fire seals located within the penetrations between the turbine lube oil rooms and their adjacent fire zones are acceptable for maintaining the rating of the fire boundary. This engineering equivalency evaluation does not impact other engineering equivalency evaluations.</p> <p>The fire seals were evaluated and found to be acceptable based on the fire hazards and fire protection systems within the areas.</p>	
<b><u>EEEE Title</u></b>	<b>Engineering Equivalency Evaluation 11-19 - Fire Barriers between the Service/Office Building and the Containment Cooling Chiller Equipment Room for Non-Standard Fire Barrier Configurations</b>	
<b><u>Summary</u></b>	<p>The purpose of this evaluation is to analyze the non-standard fire barriers separating the Service/Office Buildings from the Containment Cooling Chiller Equipment Room Fire Zone 131A/(AA2) for their impact on preventing the spread of fire.</p> <p>Based on this evaluation, the fire barriers between the Containment Cooling Chiller Equipment Room and the Service Building, adjacent to general storage, office areas and miscellaneous shops are adequate for the hazard. In addition, this evaluation does not adversely impact other evaluations or exemptions.</p> <p>The boundary configurations were evaluated and found to be acceptable based on the lack of NSCA credited equipment and cables within the Containment Cooling Chiller Equipment Room and additional fire barriers separating the Containment Cooling Chiller Equipment Room from the rest of the Turbine Building.</p>	

**Fire Area AA2 – Attachment 1 - Table B-3 - Fire Area Transition**

<u>Unit</u>	<u>Fire Area</u>	<u>Description</u>
1, 2	AA2	Unit 1 and Unit 2 Turbine Building, Main Steam Enclosures and Pipe Tunnels

<b><u>EEEE Title</u></b>	<b>Engineering Equivalency Evaluation 11-24 - Fire Retention Capability of Nonconforming Fire Seals in Fire Zones having a Low Combustible Loading Classification</b>
<b><u>Summary</u></b>	<p>The purpose of this engineering equivalency evaluation is to document the acceptability of fire seal designs which do not meet the requirements of the installation specification or fire test data in fire zones having a low combustible loading classification would have on preventing the spread of fire.</p> <p>Reasonable assurance is provided that fire seals which do not meet the requirements of the installation specification or fire test data in fire zones having a low combustible loading classification, will provide adequate fire retention capabilities and will not impair the safe shutdown capabilities of CNP or increase the spread of fire between fire zones. In addition, this engineering equivalency evaluation does not adversely impact other engineering equivalency evaluations or exemptions.</p> <p>Refer to Engineering Equivalency Evaluations 11.30 and 11.32.</p>
<b><u>EEEE Title</u></b>	<b>Engineering Equivalency Evaluation 11-30 - Generic Fire Seal Design 4 (Fire Area AA2)</b>
<b><u>Summary</u></b>	<p>The purpose of this engineering equivalency evaluation is to document the acceptability of deviations to Generic Fire Seal Design 4 (Fire Area AA2) on preventing the spread of fire.</p> <p>Reasonable assurance is provided that deviations to Generic Fire Seal Design 4, Fire Seals W7252 and W7253, and the attributes discussed in this engineering equivalency evaluation will not impair the safe shutdown capabilities of CNP or increase the spread of fire between fire zones. This engineering equivalency evaluation does not impact other engineering equivalency evaluations.</p> <p>Attribute Nos. 2, 3, 4, 5, 6, 7, 8 and 10 and Fire Seals W7252 and W7253 of Generic Fire Seal Design 4 were evaluated and found to be acceptable based on the fire hazards, fire protection systems and construction features within the evaluated area.</p>



**Fire Area AA2 – Attachment 1 - Table B-3 - Fire Area Transition**

<b><u>Unit</u></b>	<b><u>Fire Area</u></b>	<b><u>Description</u></b>
1, 2	AA2	Unit 1 and Unit 2 Turbine Building, Main Steam Enclosures and Pipe Tunnels

<b><u>EEEE Title</u></b>	<b>Engineering Equivalency Evaluation 11-32 - Generic Fire Seal Design 6 (Fire Area AA2)</b>
<b><u>Summary</u></b>	<p>The purpose of this engineering equivalency evaluation is to document the acceptability of deviations to Generic Fire Seal Design 6 (Fire Area AA2) on preventing the spread of fire.</p> <p>Reasonable assurance is provided that deviations to Generic Fire Seal Design 6, Fire Seals W7226, W7280, W7289, W9366, W9367, W9358, W9417, W9418, and the attributes discussed in this engineering equivalency evaluation will not impair the safe shutdown capabilities for CNP or increase the spread of fire between fire zones. This engineering equivalency evaluation does not impact other engineering equivalency evaluations.</p> <p>Attribute No. 8 and the eight fire seals of Generic Fire Seal Design 6 were evaluated and found to be acceptable based on the fire hazards, fire protection systems and construction features within the evaluated area.</p>
<b><u>EEEE Title</u></b>	<b>Engineering Equivalency Evaluation 11-39 - Fireproofing for the West Motor Driven Auxiliary Feedwater Pump Enclosures Fire Zones 17A (Fire Area AA16), 17B (Fire Area AA17), 80 (Fire Area AA2) and 84 (Fire Area AA2)</b>
<b><u>Summary</u></b>	<p>The purpose of this engineering equivalency evaluation is to document the acceptability of the pyrocrete fireproofing installation for the for the Unit 1 and Unit 2 west motor driven auxiliary feedwater pump enclosures in Fire Areas AA16 and AA17 (Fire Zones 17A and 17B, respectively) on preventing the spread of fire. Pyrocrete fireproofing material has not and cannot be applied completely due to interferences which include a 9 in. wide by 48 in. high section between the HVAC security cage and the concrete wall, 4 in. wide HVAC overlap angles for fire dampers are unprotected along the top, bottom, and west perimeters, and a 11.5 in. wide by 48 in. high section between adjacent fire dampers.</p> <p>The engineering equivalency evaluation also addresses minor deficiencies including small areas between the 3-hr rated rollup fire door and opening in the structure, and where penetrations prevent the required thickness of fireproofing.</p> <p>The partially protected structural steel for Unit 1 and Unit 2 auxiliary feedwater pump enclosures (Fire Zones 17A and 17B) and the minor gaps associated with the 3-hr rated roll up door/sliding missile barrier or blowout panel will not impair the safe shutdown capabilities for CNP or increase the ability of fire to spread between fire zones based on combustible loadings, automatic suppression in Fire Zones 80 and 84, CNP layout, and fire test data.</p> <p>The pyrocrete fireproofing was evaluated and found to be acceptable based on the fire hazards, fire protection systems and construction features within the evaluated areas.</p>

**Fire Area AA2 – Attachment 1 - Table B-3 - Fire Area Transition**

<u>Unit</u>	<u>Fire Area</u>	<u>Description</u>
1, 2	AA2	Unit 1 and Unit 2 Turbine Building, Main Steam Enclosures and Pipe Tunnels
<b><u>EEEE Title</u></b>	<b>Engineering Equivalency Evaluation 11-46 - Seismic Gaps between the Containment and Auxiliary Buildings Boundary Evaluation (Fire Areas AA2, AA3, AA7, AA8, AA9, AA10, AA11, AA27, AA29, AA30, AA31, AA34, AA35, AA37 and AA38)</b>	
<b><u>Summary</u></b>	<p>A seismic gap exists around the Containment Building of each unit that provides an opening of approximately 6 in. between the Containment Building and the walls, ceilings and floors of the structures immediately adjacent to containment. These Fire Areas include AA2, AA3, AA7, AA8, AA9, AA10, AA11, AA27, AA29, AA30, AA31, AA34, AA35, AA37 and AA38. This engineering equivalency evaluation has been performed to document the acceptability of these seismic gaps in the fire boundaries.</p> <p>This seismic gap evaluation shows the safe shutdown capability for CNP Unit 1 and Unit 2 has not been compromised as a result of seismic gaps. The analysis performed and the results presented in the tables indicate, on a system basis, the capability to safely shut down both units when considering fire damage to safe shutdown components and circuits contained in the seismic gap evaluation areas. The method of analysis is conservative when considering the fire hazards involved in the vicinity of the seismic gaps. That is, it is not anticipated that the evaluated areas would be affected to the extent that fire would propagate through the seismic gaps and cause damage throughout the evaluated area. This engineering equivalency evaluation has no impact on the exemption requests contained in other engineering equivalency evaluations.</p> <p>The seismic gaps were evaluated and found to be acceptable based on the fire hazards, fire protection systems and construction features within the evaluated areas.</p>	

**Fire Area AA2 – Attachment 1 - Table B-3 - Fire Area Transition**

<u>Unit</u>	<u>Fire Area</u>	<u>Description</u>
1, 2	AA2	Unit 1 and Unit 2 Turbine Building, Main Steam Enclosures and Pipe Tunnels
<b>EEEE Title</b>	<b>Engineering Equivalency Evaluation 11-51 - Screenhouse and Water Intake System Boundary Evaluation Fire Zone 142 (Fire Area AA2) to Fire Zone 143 (YD)</b>	
<b>Summary</b>	<p>The purpose of this engineering equivalency evaluation is to analyze the concrete floor assembly separating the Screenhouse structure in Fire Zone 142 (Fire Area AA2), elevation 591 ft., from the Water Intake and Discharge System in Fire Zone 143 (YD) located below so that it may be credited as part of the boundary of Fire Area AA2. The floor separating these two fire zones is reinforced concrete with several openings to accommodate equipment and piping. The floor has not been assigned a fire rating. The basis for excluding Fire Zone 143 as a fire analysis area is that the area is a submerged water bay. Therefore, the purpose of this engineering equivalency evaluation is to demonstrate that:</p> <ul style="list-style-type: none"><li>○ The Water Intake and Discharge System does not present a hazard to the Screenhouse area above.</li><li>○ The concrete floor assembly separating the Screenhouse structure from the Water Intake and Discharge System is an adequate boundary against fire spread.</li></ul> <p>Additionally, this engineering equivalency evaluation does not adversely impact other engineering equivalency evaluations or exemption requests.</p> <p>Reasonable assurance is provided that the concrete floor boundary separating Fire Zones 142 and 143 will not impact redundant safe shutdown capability.</p> <p>The Screenhouse and Water Intake boundary was evaluated and found to be acceptable based on the fire hazards and other features within the evaluated area. Also, one of the fire zones being evaluated does not contain systems, components or cables important</p>	

**Fire Area AA2 – Attachment 1 - Table B-3 - Fire Area Transition**

<u>Unit</u>	<u>Fire Area</u>	<u>Description</u>
1, 2	AA2	Unit 1 and Unit 2 Turbine Building, Main Steam Enclosures and Pipe Tunnels
<b><u>EEEE Title</u></b>	<b>Engineering Equivalency Evaluation 11-54 - Unit 1 Main Control Room Cable Vault Penetration Seal W5111 Fire Zone 57 and 91 (Fire Areas AA50 and AA2)</b>	
<b><u>Summary</u></b>	<p>The purpose of this Engineering Equivalency Evaluation 11-54 is to document the acceptability of the installed configuration of wall penetration seal W5111. The seal is located at elevation 624 ft. west wall of the Unit One Main Control Room Cable Vault (MCRCV) (Fire Area AA50), is a 3-hr fire-rated and provides pressure retention capability for the MCRCV automatic Halon and manual CO2 fire suppression systems. The seal is not in strict compliance with design details and test reports described in Design Specification ES-FIRE-0601-QCF, "Fire Rated Seals" and Engineering Desk-Top-Guide (DTG) 2270-066-001, "Fire Rated Barrier Penetration Seal Qualification Manual." Therefore, consistent with guidance provide in Generic Letter 86-10, this engineering equivalency evaluation documents the technical attributes required to conclude the installed configuration provides an equivalent fire and pressure rating in a fire event impacting Fire Zone 57 and 91.</p> <p>Reasonable assurance is provided repaired penetration seal W5111 will provide adequate fire resistance and pressure retention to support safe shutdown in a fire event.</p> <p>The penetration seal was evaluated and found to be acceptable based on the fire hazards, fire protection systems and construction features within the evaluated areas.</p>	

**Fire Area AA2 – Attachment 1 - Table B-3 - Fire Area Transition**

<u>Unit</u>	<u>Fire Area</u>	<u>Description</u>
1, 2	AA2	Unit 1 and Unit 2 Turbine Building, Main Steam Enclosures and Pipe Tunnels

**EEEE Title** Engineering Equivalency Evaluation 11-56 - Turbine Building Main Steam Access Way Fire Zones 110 to 114, Fire Zones 111 to 115, Fire Zones 112 to 2N, Fire Zones 113 to 2S (Fire Areas AA2 and AA2C)

**Summary** The purpose of this engineering equivalency evaluation is to document the acceptability of:

- Four (4) undampered ventilation penetrations between Unit 1 Fire Area AA2 (Fire Zone 110) and Fire Area AA2C (Fire Zone 114) on the 587 ft. elevation of the Auxiliary Building. The analysis also pertains to Unit 2 Fire Area AA2 (Fire Zone 111) and Fire Area AA2C (Fire Zone 115) on the 587 ft. elevation of the Auxiliary Building.
- Two (2) unrated watertight doors between Unit 1 Fire Area AA2C (Fire Zone 112) and Fire Area AA2 (Fire Zone 2N). There is also one (1) unrated watertight door between Unit 2 Fire Area AA2C (Fire Zone 113) and Fire Area AA2 (Fire Zone 2S).
- Unrated penetrations which exist between Fire Area AA2C (Fire Zones 112 & 113) and Fire Area AA2 (Fire Zones 2N and 2S), respectively.

Reasonable assurance is provided that a fire starting in Fire Zone 110 or 111 is not capable of propagating through the undampered ducts to Fire Zone 114 or 115, respectively. Similarly, reasonable assurance is provided that a fire starting in Fire Zone 114 or 115 is not capable of propagating through the undampered ducts to Fire Zone 110 or 111, respectively. Since a fire in either fire zone will not affect adjacent fire zones, the fire will not adversely impact safe shutdown capabilities of CNP.

It is determined that a fire starting in Fire Zones 112 or 113 (Fire Area AA2C) is not capable of propagating through the unrated watertight doors or unrated watertight penetration seals to Fire Zones 2N or 2S (Fire Area AA2). Similarly, reasonable assurance is provided that a fire starting in Fire Zones 2N or 2S (Fire Area AA2) is not capable of propagating to adjacent Fire Zones 112 and 113 (Fire Area AA2C). Since a fire in either fire zone will not affect adjacent fire zones, the fire will not adversely impact safe shutdown capabilities of CNP.

The ventilation openings, unrated penetrations and watertight doors were evaluated and found to be acceptable based on the fire hazards and construction features within the evaluated areas.

**Fire Area AA2 – Attachment 1 - Table B-3 - Fire Area Transition**

<u>Unit</u>	<u>Fire Area</u>	<u>Description</u>
1, 2	AA2	Unit 1 and Unit 2 Turbine Building, Main Steam Enclosures and Pipe Tunnels
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<b><u>EEEE Title</u></b>	<b>Engineering Equivalency Evaluation 11-57 - Fire-Wrapped Cable Trays and Conduit Evaluations (Fire Areas AA32, AA39A, AA45A, and AA2)</b>	
<b><u>Summary</u></b>	<p>The purpose of this engineering equivalency evaluation is document the acceptability of the fire-wrapped cable trays and conduits that are credited in support of NFPA 805 PRA. This review will include the acceptability of the exposed structural supports that support these trays, as well as review the fire wrap for potential damage from high hazard fire sources.</p> <p>CNP uses fire wrap systems over cable trays and conduits to provide 1-hr protection of cables credited for safe shutdown in the event of a fire in compliance with NFPA 805, Chapter 4 separation requirements. Many of these wrapped trays are supported by exposed structural steel. This engineering equivalency evaluation examines the ability of these exposed supports in Fire Areas AA32, AA39A, AA45A and AA2 to withstand the fire exposure presented by combustibles present in the area.</p> <p>Reasonable assurance is provided that the exposed steel structural supports on raceways wrapped in accordance with the requirements of NFPA 805, Chapter 4, will not be adversely affected by the combustibles or hazards present in the area. In addition, the fire-wrap on these raceways is not subject to mechanical damage by high hazard fire sources.</p> <p>The exposed steel structural supports were evaluated and found to be acceptable based on the fire hazards and fire protection systems within the evaluated areas.</p>	
<b><u>EEEE Title</u></b>	<b>Engineering Equivalency Evaluation 11-60 - Fire Zone 80/114 and 84/115 (Fire Areas AA2 and AA2C) Boundary Evaluation</b>	
<b><u>Summary</u></b>	<p>The purpose of this engineering equivalency evaluation is to document the acceptability of open penetrations between Unit 1 Fire Zone 80 (Fire Area AA2) and Fire Zone 114 (Fire Area AA2C) on the 587. ft. elevation of the Auxiliary Building, and to Unit 2 Fire Zone 84 (Fire Area AA2) and Fire Zone 115 (Fire Area AA2C) on the 587 ft. elevation of the Auxiliary Building. This evaluation will also verify that there is no adverse impact to other evaluations or exemption requests.</p> <p>Based on the preceding analysis, reasonable assurance can be provided that a fire starting in Fire Zone 80 or 84 is not capable of propagating through the open penetration seals to Fire Zone 114 or 115, respectively. Similarly, reasonable assurance can be provided that a fire starting in Fire Zone 114 or 115 is not capable of propagating through the open penetration seals to Fire Zone 80 or 84, respectively. Since a fire in either fire zone will not affect adjacent fire zones, the fire will not adversely impact safe shutdown capabilities of CNP. In addition, this evaluation does not adversely impact on other evaluations or exemption requests.</p> <p>The penetrations were evaluated and found to be acceptable based on the fire hazards and construction features within the evaluated areas.</p>	

**Fire Area AA2 – Attachment 1 - Table B-3 - Fire Area Transition**

<b><u>Unit</u></b>	<b><u>Fire Area</u></b>	<b><u>Description</u></b>
1, 2	AA2	Unit 1 and Unit 2 Turbine Building, Main Steam Enclosures and Pipe Tunnels

<b><u>EEEE Title</u></b>	<b>Engineering Equivalency Evaluation 11-69 - Electromagnetic Fire/Security Door Locks</b>
<b><u>Summary</u></b>	<p>The purpose of this evaluation is to document acceptability of non-UL/FM approved DynaLock Model 2280 electromagnetic door locks that were installed under EC-0000050114. NFPA 80 1970 Ed. Section 516 Builders Hardware, sub-section b. Locks and Latches states, in part, "Only labeled fire exit hardware shall be used." The Dynalock Model 2280 magnetic door locks are installed primarily for Security purposes and are not UL/FM approved devices as required by code. Therefore, this evaluation is necessary to provide technical justification supporting acceptability of the Dynalock Model 2280 electromagnetic lock mechanism.</p> <p>This evaluation shows that the use of the DynaLock Model 2280 magnetic lock devices provides, reasonable assurance fire doors will remain closed and retain the required passive fire protection function. The use of the DynaLock Model 2280 magnetic lock devices has no impact on the ability of CNP to achieve and maintain a safe and stable condition, nor does it increase the risk of the spread of fire between plant fire zones.</p> <p>EEE-11-69 evaluated magnetic door latches installed on doors 1-DR-SCN216, 1-DR-TUR200, 2-DR-TUR221, 2-DR-TUR259, 1-DR-AUX412B, and 2-DR-AUX411B in this Analysis Area boundary. This evaluation shows that the use of the DynaLock Model 2280 magnetic lock devices provides reasonable assurance fire doors will remain closed and retain the required passive fire protection function.</p>
<b><u>EEEE Title</u></b>	<b>Engineering Equivalency Evaluation 12-11 - Structural Steel Evaluations in Fire Areas AA2, AA3, AA34, AA35, AA56 and AA58.</b>
<b><u>Summary</u></b>	<p>The purpose of this engineering equivalency evaluation is to document the acceptability of the unprotected structural steel located throughout CNP and ensure its ability to withstand the fire exposure presented by combustibles present in the area. This engineering equivalency evaluation is concerned with structural steel members that form a part of or support fire barriers required by NFPA 805, Chapter 4.</p> <p>Reasonable assurance is provided that exposed structural steel supporting fire barriers will not be adversely impacted by the combustibles or hazards present in the areas evaluated. In addition, reasonable assurance is provided that falling structures supported by structural steel will not have an adverse impact on other fire barriers inside the area that are required for separation of safe shutdown components.</p> <p>The unprotected structural steel was evaluated and found to be acceptable based on the fire hazards and fire protection systems within the evaluated areas.</p>

**Fire Area AA2 – Attachment 1 - Table B-3 - Fire Area Transition**

<u>Unit</u>	<u>Fire Area</u>	<u>Description</u>
1, 2	AA2	Unit 1 and Unit 2 Turbine Building, Main Steam Enclosures and Pipe Tunnels

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**EEEE Title**   **Engineering Equivalency Evaluation 12-20 - Unit 1 Turbine Oil Tank Room Fire Zone 95 (Fire Area AA2)**

**Summary**   The purpose of this engineering equivalency evaluation is to document the acceptability of the automatic sprinkler system installed in the Unit 1 and Unit 2 Turbine Oil Tank Rooms in Fire Zones 95 and 100 (Fire Area AA2) on the 605 ft. elevation of the Turbine Building. This engineering equivalency evaluation addresses the functional code non-conformances based on a review of the requirements of the National Fire Protection Association (NFPA) Standard 13, "Automatic Sprinkler Systems," 1971 edition.

Reasonable assurance is provided that the sprinklers will contain the fire until the Fire Brigade arrives to ensure that any fire is contained within the fire zone and does not spread to adjacent fire zones. In addition, there are no safe shutdown equipment in either fire zone.

The sprinkler systems were evaluated and found to be acceptable based on the fire hazards, fire protection systems and construction features within the evaluated area.

**Fire Suppression Effects on Nuclear Safety Performance Criteria**

The CNP fire brigade is trained to discharge water in a judicious manner and instructed to direct hose streams and portable extinguishers at the base of the fire to limit the amount of overspray beyond the immediate fire zone. For this reason, fire brigade activities are not expected to fail components not already considered damaged by fire. It has been concluded that water impingement on cables is not a concern. Electrical cabinets are provided with a seal at the conduit interface. Per visual inspection any side vents for this equipment are pointed downward to prevent water intrusion. In the event of discharge, any damage caused by the wet pipe sprinkler system to other equipment operating within the fire area which is not immediately involved in the originating fire is bounded by the analysis approach of postulating whole room damage. The drainage features of the fire area mitigate the potential for flooding damage due to fire suppression, such that the standing water would not affect credited equipment.

Since it is shown that suppression effects will not impact the nuclear safety performance criteria, the fire area configuration is deemed acceptable.

**References:**

Technical Evaluation 12.1, "Fire Suppression Effects Study"

Technical Evaluation 12.1, "Supplemental Information to Fire Suppression Effects Study – Supplement 1"

**Fire Area Comments**

Appendix R Analysis Areas AA2A and AA2B are transitioned to the NFPA 805 analysis as a combined Fire Area of AA2.



## Fire Area AA2 – Attachment 2 - Fire Risk Evaluation Results Summary

### A2.1 Introduction

The ‘changes’ associated with NFPA 805 transition were those variances from the deterministic requirements of NFPA 805. The changes identified for evaluation for fire area AA2 are grouped as follows:

- Separation Issues

This attachment is a summary of the Fire Risk Evaluation for the fire area. The complete results and methodology are contained in the Cumulative Fire Risk Evaluation, PRA-FIRE-NB-CRE. (FPCE 2017-0009)

### A2.2 Inputs/Assumptions

Fire modeling processes and inputs provided in NUREG/CR-6850 are appropriate for use in a risk-informed, performance-based evaluation. The complete list of assumptions used in the fire modeling methodology for this fire area is contained in Detailed Fire Modeling Technical Evaluation R1900-0411-AA2.

### A2.3 Fire Modeling Methodology

Fire PRA fire modeling results are used as the initial input into this Fire Risk Evaluation. The process consists of conservative bounding analyses using NUREG/CR-6850 methods. As needed, refinements are made to utilize more realistic parameters. The complete fire modeling methodology for this fire area is contained in Detailed Fire Modeling Technical Evaluation R1900-0411-AA2.

### A2.4 Scenario Descriptions and Model Results

Fire Area AA2 was evaluated for the impact of fires originating from both fixed and transient ignition sources. Complete descriptions of each fire scenario is contained within the Detailed Fire Modeling Technical Evaluation R1900-0411-AA2.

For Fire Zone 129, a scenario was developed for the Unit 1 Turbine Generator fire. This fire zone was used for the Unit 1 TG fire because the TG is located on this elevation, for the most part. Other fixed ignition source scenarios within the Unit 1 area of Fire Area AA2 in which suppression fails are mapped to this scenario. When suppression succeeds for fixed ignition sources and fails for transient sources, scenarios are designed to fail all interconnecting fire zones within Unit 1 on a specific elevation. For this reason, scenarios AA2.79-82-1 and AA2.90-93 were created. Transient scenarios in which suppression succeeds result in no damage.

For Fire Zone 130, a scenario was developed for the Unit 2 Turbine Generator fire. This fire zone was used for the Unit 2 TG fire because the TG is located on this elevation, for the most part. Other fixed ignition source scenarios within the Unit 2 area of Fire Area AA2 in which suppression fails are mapped to this scenario. When suppression succeeds for fixed ignition sources and fails for transient sources, scenarios are designed to fail all interconnecting fire zones within Unit 2 on a specific elevation. For this reason, scenarios AA2.84-87-1 and AA2.96-99 were created. Transient scenarios in which suppression succeeds result in no damage.

Transient and fixed ignition sources in Fire Zones 108 and 110 fail both fire zones simultaneously and scenario AA2.2A-2 was created to represent these failures. Transient and fixed ignition sources in Fire Zones 109 and 111 fail both fire zones simultaneously and scenario AA2.2B-2 was created to represent these failures. Fire Zones 2N and 2S fail both fire zones at the same time for fixed and transient ignition

## **Fire Area AA2 – Attachment 2 - Fire Risk Evaluation Results Summary**

sources. All scenarios for Fire Zone 142 lead to whole room damage.

Fire Zones within AA2 which are separated from the open portions of the turbine building interconnected to each units TG are considered with whole room damage for fixed and transient ignition sources. These Fire Zones include 28, 30, 77, 78, 83, 88, 89, 94, 95, 100, 126, 127, 129, 139, 140 and 141

### **A2.4.1 Ignition Sources**

Fire Area AA2 contains the turbine generators and associated system components. The damage set for the scenarios grouped several fire zones together and a conservative approach of failing all adjacent fire zones which were connected within the analysis area was taken.

In Fire Area AA2, the 98th percentile HRR was used for all transient fires. The 98th percentile HRR bounds the possible transient ignition sources expected for this fire area, which were fire tested and identified in NUREG/CR-6850, Appendix G, Table G-7. These scenarios were mapped to larger, bounding damage sets created for the fixed ignition sources.

### **A2.4.2 Scenario Results**

A delta risk calculation has been performed to quantify the risk associated with the VFDRs in the fire area.

### **A2.5 Fire Risk Evaluation Results**

PRA-FIRE-NB-CRE documents scenarios and corresponding impacted VFDRs that were evaluated for delta risk during the transition to NFPA 805 and also all changes to the Fire Protection Program that are currently incorporated into the Fire PRA model. The acceptability of the Cumulative Fire Risk Evaluations was based on calculated delta risk meeting the thresholds of NEI 04-02, RG 1.205 and RG 1.174. (FPCE 2017-0009)

## Fire Area AA2 – Attachment 2 - Fire Risk Evaluation Results Summary

### A-2.6 Impact of VFDR on Defense-in-Depth

Defense-in-Depth has been evaluated for this fire area. The impacts of this evaluation are summarized in the table below:

Defense-in-Depth Impact Review for AA2			
Method of Providing DID	Required to Support Deterministic Analysis or Fire PRA?	Changes or Improvements Necessary for DID?	Basis/Justification
Echelon 1: Prevent fires from starting			
Combustible Control is implemented in accordance with Procedure PMP-2270-CCM-001, Control of Combustible Materials.	Yes	No	• This element is adequate based on no perceived weakness of, or over-reliance on, another echelon of defense-in-depth.
Hot Work Control is implemented in accordance with Procedure PMP-2270-WBG-001, Welding, Burning and Grinding Activities.	Yes	No	
Echelon 2: Rapidly detect, control and extinguish promptly those fires that do occur thereby limiting fire damage			
Fire Detection System	Yes	No	• Although fire fighting activities may be challenging, suppression and detection are provided for the major fire hazards in the fire area and therefore no changes or improvements to Echelon 2 attributes are necessary to maintain defense-in-depth.
Fixed Fire Suppression	Yes	No	
Portable Fire Extinguishers	Yes	No	
Hose stations and hydrants	Yes	No	
Pre-Fire Plan	Yes	No	
Echelon 3: Provide adequate level of fire protection for systems and structures so that a fire will not prevent essential safety functions from being performed			
Walls, floors ceilings and structural elements are rated or have been evaluated as adequate for the hazard.	Yes	No	• Although VFDRs AA2-001, AA2-003, AA2-005 and AA2-007 are not considered a significant contribution to core damage frequency, the variances are considered important enough to the NSCA to retain as a recovery actions to ensure that defense-in-depth is maintained.  • Where the remaining variances can possibly be affected in a potentially high risk scenario, based on a detailed review, the VFDRs are either not the cause for the high risk of the scenario or the mitigating recovery action is credited; therefore no changes or improvements to Echelon 3 attributes are necessary to maintain defense-in-depth.
Penetrations in the fire area barrier are rated or have been evaluated as adequate for the hazard.	Yes	No	
Supplemental barriers (e.g., ERFBS, cable tray covers, etc.)	Yes	No	
Guidance provided to operations personnel detailing the required success path(s) including recovery actions to achieve nuclear safety performance criteria.	Yes	Yes	

## Fire Area AA2 – Attachment 2 - Fire Risk Evaluation Results Summary

### A-2.7 Safety Margin Considerations

In accordance with NEI 04-02, the maintenance of adequate Safety Margin is assessed by the consideration categories of analyses utilized by this Fire Risk Evaluation.

Safety margins are considered to be maintained if:

- Codes and Standards or their alternatives accepted for use by the NRC are met.

AND

- Safety analyses acceptance criteria in the licensing basis (e.g., FSAR, supporting analyses) are met, or provides sufficient margin to account for analysis and data uncertainty.

The following summarizes the bases for ensuring the maintenance of safety margins:

- The risk-informed, performance based processes utilized are based upon NFPA 805, 2001 edition, endorsed by the NRC in 10 CFR 50.48(c).
- The Fire Risk Evaluation process is in accordance with NEI 04-02, Revision 2, which is endorsed by the NRC in Regulatory Guide 1.205, Revision 1.
- The Fire PRA is developed in accordance with NUREG/CR-6850, which was developed jointly between the NRC and EPRI.
- The Fire PRA has undergone an industry peer review, in order to ensure the Fire PRA meets the appropriate quality standards of ASME/ANS RA-Sa-2009, "Standard for Level 1/Large Early Release Frequency Probabilistic Risk Assessment for Nuclear Power Plant Applications," Dated February 2, 2009
- The "combined analysis approach" is used during transition (NEI 04-02, Section 5.3.4.3); therefore, MEFS/LFS is not analyzed separately from the Fire PRA results.
- The CNP internal events PRA model received two formal industry peer reviews conducted in accordance with applicable NEI guidelines. The initial peer review was performed in 2001, while a subsequent focused scope (i.e., limited scope) peer review was conducted in 2009. The initial, full-scope WOG peer review covered all aspects of the CNP PRA model and the administrative processes used to maintain and update the model. The CNP PRA model has been revised to address all significant issues (i.e., Category A and B Facts & Observations) identified during the initial peer review. None of the findings from the focused-scope peer review were judged to reach the significance level of a Category A or B Fact & Observation; as a result, no changes to the PRA model have yet been made to include resolutions for these latter issues.
- Fire protection systems and features determined to be required by NFPA 805 Chapter 4 have been confirmed to meet the requirements of NFPA 805 Chapter 3 and their associated referenced codes and listings, or provided with acceptable alternatives using processes accepted for use by the NRC (i.e., FAQ 06-0008, FAQ 06-0004, 07-0033).
- Fire modeling performed in support of the transition has been performed within the Fire PRA utilizing codes and standards developed by industry and NRC staff which have been verified and validated in authoritative publications, such as NUREG 1824, "Verification and Validation of Selected Fire Models for Nuclear Power Plant Applications". In general, the fire modeling performed in support of the Fire Risk Evaluations has been performed using conservative methods and input parameters that are based upon

### **Fire Area AA2 – Attachment 2 - Fire Risk Evaluation Results Summary**

NUREG/CR-6850 as documented in the AA2 Detailed Fire Modeling Report, section 7.2. While this is generally not ideal in the context of best estimate probabilistic risk analysis, it is a pragmatic approach given the current state of knowledge regarding the uncertainties related to the application of the fire modeling tools and associated input parameters for specific plant configurations.

- In accordance with the requirements of 10 CFR 50.48(c)(2)(iii), the Fire PRA results, including cutsets for the scenarios of concern, have been reviewed and it was verified that the results presented above do not rely solely on feed and bleed as the fire-protected safe shutdown path for maintaining reactor coolant inventory, pressure control, and decay heat removal capability for this fire area.

#### **A-2.8 Transition Risk Evaluation Conclusions**

The transition change evaluation determined that these changes:

- Are acceptable based upon the measured change in CDF and LERF
- Maintained adequate defense-in-depth and safety margins

The results of this evaluation meet the requirements of NFPA 805 Risk Evaluation; therefore, the use of the performance based analysis approach is acceptable.

D. C. Cook Nuclear Plant  
Fire Safety Analysis

Fire Area: AA2C

Unit 1 and Unit 2 Sub-Basement and Essential Service Water Pipe  
Tunnels

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Attachments

Fire Area AA2C – Attachment 1 - Table B-3 - Fire Area Transition

## **1.0 PURPOSE**

This report documents the Fire Safety Analysis (FSA) for Cook Nuclear Plant (CNP) Fire Area AA2C, Unit 1 and Unit 2 Sub-Basement and Essential Service Water Pipe Tunnels which comprises fire zone(s) 112, 113, 114, 115. Fire zones 112 and 114 are Unit 1 and fire zones 113 and 115 are Unit 2. The purpose of this analysis is to demonstrate the achievement of the nuclear safety and radioactive release performance criteria of NFPA 805 as required by 10 CFR 50.48(c). The Fire Safety Analysis is a key part of compliance with Section 2.7.1.2 Fire Protection Program Design Basis Document of NFPA 805.

## **2.0 ANALYSIS METHODOLOGY**

The FSA is the design basis document as described in NFPA 805 Section 2.7.1.2. The following steps are performed to develop the FSA on a fire area basis:

- Identify significant fire hazards in the fire area. This is based on NFPA 805 approach to analyze the plant from an ignition source and fuel package perspective.
- Summarize Nuclear Safety Capability Analysis (NSCA) compliance strategies. This is the result of the NEI 04-02 B-3 Table review of the Safe Shutdown Analysis.
- Summarize Non-Power Operations Modes compliance strategies.
- Summarize Radioactive Release compliance strategies. The transition review process required per NEI 04-02 is used to develop these results.
- Provide Fire Probabilistic Risk Assessment summary of results. This is based on the results from the plant Fire PRA.
- Perform risk informed, performance based evaluations if needed for the performance based approach.
- Summarize Defense-in-Depth strategy for each fire area.
- Determine key analysis assumptions which are candidates to be included in the NFPA 805 monitoring program.
- Provide conclusions relative to NFPA 805 compliance.

### 3.0 ANALYSIS

#### 3.1 Classical Fire Protection

##### 3.1.1 Construction

For all fire zones within this fire area, walls, floors and ceilings to adjacent fire areas and fire zones are reinforced concrete in excess of a 3-hour rating.

Applicable Engineering Equivalency Evaluations are documented in Attachment 1.

##### 3.1.2 Doors and Access Openings

For Fire Zones 112 and 113, there are no door openings to adjacent fire areas. Fire Zone 112 has two unrated watertight doors which are provided to Fire Zone 2. Fire Zone 113 has one unrated watertight door which is provided to Fire Zone 2. The watertight doors have been evaluated (Engineering Equivalency Evaluation 11-56).

For Fire Zone 114, a fire door having a 3-hour rating is provided to adjacent Fire Area AA15 - Fire Zone 16.

For Fire Zone 115, a fire door having a 3-hour rating is provided to adjacent Fire Area AA23 - Fire Zone 18.

##### 3.1.3 Penetrations

For Fire Zones 112 and 113, penetrations in fire barriers between this fire zone and adjacent fire areas are provided with fire seals. However, barriers between this fire zone and adjacent fire zones are not fire sealed. Penetrations between this fire zone and Fire Zone 2 have been sealed to prevent flooding of this fire zone from a pipe rupture in Fire Zone 2. These seals are unrated. A engineering equivalency evaluation has been performed for unsealed penetrations between AA2C and AA2.

For Fire Zones 114 and 115, Penetrations in fire barriers between this fire zone and adjacent fire areas are provided with fire seals. However, barriers between this fire zone and adjacent fire zones are not fire sealed. The seismic gaps are sealed with a glass fiber reinforced silicone sheeting. A engineering equivalency evaluation has been performed for unsealed penetrations between AA2C and AA2.



### 3.1.4 Detection

The table below outlines the fire detection system(s) provided in the Fire Area:

Table 3-1, Fire Area AA2C Detection Systems									
Fire Zone	Type of System	Local (L) / Remote (R)	Detection Actuates Suppression?	Required System?					
				S	L	E	R	D	
112	None	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
113	None	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
114	None	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
115	None	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

**Table 3-1 Legend:**

Table Field: "Required System?"	
S	- Required for Chapter 4 Separation Criteria
L	- Required for NRC Approved Licensing Action
E	- Required for Engineering Equivalency Evaluation
R	- Required for Risk Significance
D	- Required to maintain adequate balance of Defense-in-Depth in a Change Evaluation or Fire Risk Evaluation

Automatic fire detection is not provided for this fire area.

### 3.1.5 Fixed Suppression

The table below outlines the fixed fire suppression system(s) provided in the Fire Area:

Table 3-2, Fire Area AA2C Suppression Systems									
Fire Zone	Type of System	Full (F) / Partial (P)	Required System?						
			S	L	E	R	D		
112	None	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
113	None	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
114	None	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
115	None	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

**Table 3-2 Legend:**

Table Field: "Required System?"	
S	- Required for Chapter 4 Separation Criteria
L	- Required for NRC Approved Licensing Action
E	- Required for Engineering Equivalency Evaluation
R	- Required for Risk Significance
D	- Required to maintain adequate balance of Defense-in-Depth in a Change Evaluation or Fire Risk Evaluation

Fixed fire suppression is not provided for this fire area.

### 3.1.6 Manual Suppression / Response Strategy

A postulated fire will be identified by plant personnel using plant communication system to notify

the control room. The Control Room operator will dispatch the fire brigade for initiation of manual fire fighting. A fire in this fire area will be contained by the construction features discussed in Section 3.1.1. Manual suppression is provided by the CNP Fire Brigade.

Fire extinguishers are available in Fire Zones 112 and 113. For Fire Zone 114, fire extinguishers are provided in adjacent Fire Zone 16. For Fire Zone 115, fire extinguishers are provided in adjacent Fire Zone 18.

For Fire Zones 112 and 113, water hose reels are provided in adjacent Fire Area AA2 - Fire Zone 2. For Fire Zone 114, water hose reels are provided in the diesel generator ramp/corridor of adjacent Fire Area AA2 - Fire Zone 79. For Fire Zone 115, water hose reels are provided in the diesel generator ramp/corridor of adjacent Fire Area AA2 - Fire Zone 85.

Floor drains are available in all fire zones within this fire area.

### **3.1.7 Ventilation**

A fire in this area will be contained by the fire barriers. Smoke can be removed by venting to the outdoors or to other parts of the turbine building. The normal building ventilating systems in the Turbine Building will then exhaust the smoke via filtered monitored pathways. This fire area is listed as a non-controlled area in the Fire Pre Plans and therefore there is reasonable assurance that products of combustion will not be contaminated.

For Fire Zones 112 and 113, there are no ventilation penetrations to adjacent fire areas.

For Fire Zone 114, four undampered ventilation penetrations to adjacent Fire Zone 110.

For Fire Zone 115, four undampered ventilation penetrations to adjacent Fire Zone 111.

### **3.1.8 Other Features**

No other fire protection features provided for Fire Area AA2C.

## **3.2 Fire Hazards Identification**

The fire area does not contain fixed ignition sources. The main hazards are the ESW pipe tunnel sump pumps and instrumentation and control cables. Combustibles contained in the Fire Area include cellulose, rubber, and plastics.

This Fire Area is below grade and any exterior wall penetrations need not be rated based on the protection provided by the ground covering the exterior walls.

All fire zones within this fire area have a combustible loading classification of low.

## **3.3 NSCA Compliance Summary**

Fire Area AA2C, U1 & U2 Sub-Basement & ESW Pipe Tunnels, contains Unit 1 and Unit 2 Red and Green Train cables, conduits and raceways as well as Unit 1 and 2 Service Water equipment. Consequently, both Units are affected by the fire.

Compliance with the nuclear safety performance criteria is achieved using the deterministic approach in accordance with NFPA 805, Section 4.2.3.2.

Safe and stable condition of Unit 1 will be accomplished using Steam Generators 2 and 3 via Unit 1 East Motor Driven Auxiliary Feedwater Pump or Unit 1 Turbine Driven Auxiliary Feedwater Pump or Steam Generators 1 and 4 via the Unit 1 West Motor Driven Auxiliary Feedwater Pump, Control Room process monitoring, Unit 1 Charging via the West or East pump, Unit 1 Component Cooling Water via the East or West Pump, Unit 1 ESW via the East or West Pump. The ESW system is not available to support the Red and Green Train EDGs. Electrical power is supplied to either Red or Green Trains via offsite power.

Safe and stable condition of Unit 2 will be accomplished using the Steam Generators 2 and 3 via Unit 2 East Motor Driven Auxiliary Feedwater Pump or Unit 2 Turbine Driven Auxiliary Feedwater Pump or Steam Generators 1 and 4 via the Unit 2 West Motor Driven Auxiliary Feedwater Pump, Control Room process monitoring, Unit 2 Charging via the East or West pump, Unit 2 ESW via East or West pump and power from offsite. The ESW system is not available to support the Red and Green Train EDGs. Electrical power is supplied to either Red or Green Trains via offsite power.

The Nuclear Safety Performance Criteria compliance strategy for AA2C is documented within the NSCA Report.

### **3.3.1 Variances**

There are no variances for this fire area.

### **3.3.2 Recovery Actions Credited**

There are no recovery actions for this fire area.

## **3.4 Non-Power Operational Modes Compliance Summary**

A review of CNP for the potential effects of a fire in this Fire Area while in non-power modes of operation (NPO) was conducted. This review was conducted using the guidance provided in NEI 04-02 and FAQ 07-0040, "Non-Power Operations Clarifications".

The review determined that there are potential failures that affect certain Key Safety Functions (KSF) as a result of the fire in this area, and the fire could result in the loss of one or more KSF paths. Compensatory measures are required during high risk evolution periods to provide reasonable assurance a fire will not adversely affect key safety functions and the NFPA 805 performance goal for NPO is therefore satisfied. The results of the NPO analysis are contained within Technical Evaluation R1900-005-001, Non-Power Operation Modes Transition Review Report.

## **3.5 Radioactive Release Compliance Summary**

The NFPA 805 radiological release goal is to provide reasonable assurance that a fire will not result in a radiological release that adversely affects the public, plant personnel or the environment. The NFPA 805 requirement is to ensure a radiation release to any unrestricted area due to the direct effects of fire suppression activities (but not involving fuel damage) shall be as low as reasonably achievable and shall not exceed applicable plant Technical Specification limits.

AA2C is located outside the Radiological Controlled Area (RCA) and is not a storage location for contaminated materials, therefore there is reasonable assurance a fire in this area will not result in radiation release. The review of this fire area, with respect to radioactive release, is documented in the NFPPM.

### 3.6 Probabilistic Risk Assessment-Summary of Results

A Fire PRA (FPRA) quantification of Fire Area AA2C was performed and is documented in PRA-NB-FIRE-FQ, Fire PRA Model Quantification Notebook. The fire risk quantification for Fire Area AA2C is analyzed assuming whole room burnup. PRA-NB-FIRE-FQ includes a summary of all potentially risk-significant fire scenarios (i.e., CDF > 1.0E-7 or LERF > 1.0E-8). Bounding CDF / LERF per calendar year values are reported that are based on the risk values documented in PRA-NB-FIRE-FSS, Fire PRA Fire Scenario Selection.

### 3.7 Risk-Informed, Performance-Based Evaluations

There are no VFDRs for this fire area, and therefore, no Fire Risk Evaluations have been performed.

#### 3.7.1 Transition Risk-Informed, Performance-Based Evaluations

There are no VFDRs for this fire area, and therefore this section is not applicable to Fire Area AA2C.

### 3.8 Defense-in-Depth

Per NFPA 805, section 2.4.4.2, “Defense-in-Depth”: The deterministic approach for meeting the performance criteria shall be deemed to satisfy this defense-in-depth requirement.

### 3.9 Monitoring Program Input

A Monitoring Program will be developed in accordance with FAQ 10-0059, Rev. 1. Methods to monitor availability, reliability, and performance of fire protection program structures, systems, and components (SSCs), as well as programmatic elements will be provided. Additionally, effectiveness measures are established to review program related performance and trends. For AA2C the following systems and features are candidates for inclusion in the CNP Fire Protection Monitoring Program:

- Fire Area boundary barriers discussed in Section 3.1

## 4.0 CONCLUSION

The nuclear safety and radioactive release performance criteria of NFPA 805 are met for a fire in Fire Area AA2C. This Fire Safety Analysis has demonstrated that for Fire Area AA2C a success path remains free of fire damage using the deterministic approach per Section 4.2.3 of NFPA 805.

## **5.0 REFERENCES**

- 5.1 CNP Fire Pre-Plans, Volumes I, II, and III, Revisions 17, 14, and 18 respectively
- 5.2 Fire Hazards Analysis
- 5.3 NFPA 805, Performance-Based Standard for Fire Protection for Light Water Reactor Electric Generating Plants
- 5.4 NFPPM, NFPA 805 Fire Protection Program Manual (NFPPM)
- 5.5 Nuclear Energy Institute (NEI) 04-02, Guidance for Implementing a Risk-Informed, Performance-Based Fire Protection Program under 10 CFR 50.48(c), Rev. 2
- 5.6 Nuclear Safety Capability Assessment Report
- 5.7 PRA-NB-FIRE-FQ, Fire PRA Model Quantification Notebook
- 5.8 PRA-NB-FIRE-FSS, Fire PRA Fire Scenario Selection
- 5.9 Regulatory Guide 1.205, Risk-Informed, Performance-Based Fire Protection for Existing Light-Water Nuclear Power Plants, Rev. Revision 1
- 5.10 Technical Evaluation R1900-005-001, Non-Power Operation Modes Transition Review

**Fire Area AA2C – Attachment 1 - Table B-3 - Fire Area Transition**

<u>Unit</u>	<u>Fire Area</u>	<u>Description</u>
1, 2	AA2C	Unit 1 and Unit 2 Sub-Basement and Essential Service Water Pipe Tunnels

**Fire Zone   Description**

112	Essential Service Water Pipe Tunnel - Unit 1 - El. 570 ft. 6 in.
113	Essential Service Water Pipe Tunnel - Unit 2 - El. 570 ft. 6 in.
114	Essential Service Water Pipe Tunnel - Unit 1 - El. 587 ft. 0 in.
115	Essential Service Water Pipe Tunnel - Unit 2 - El. 587 ft. 0 in.

**Regulatory Basis**

4.2.3.2 - Deterministic Approach

<b>Performance Goal</b>	<b>Method of Accomplishment</b>	<b>Comments</b>
<b>Reactivity Control</b>	Unit 1 - Trip the reactor from the Control Room. Borate using Unit 1 East or West Charging Pump from the RWST. Use source range monitoring for indication.	None
	Unit 2 - Trip the reactor from the Control Room. Borate using Unit 2 East or West Charging Pump supplied from the RWST. Use source range monitoring for indication.	
<b>Inventory and Pressure Control</b>	Unit 1 - Control inventory using Unit 1 East or West Charging Pump. Control pressure using Unit 1 Pressurizer Safety Relief Valves.	None
	Unit 2 - Control inventory using Unit 2 East or West Charging Pump. Control pressure using Unit 2 Pressurizer Safety Relief Valves.	
<b>Decay Heat Removal</b>	Unit 1 - Feed SGs 2 & 3 with Unit 1 East MDAFW Pump or Unit 1 TDAFW Pump or feed SGs 1 & 4 with Unit 1 West MDAFW Pump. The DHR function also requires MS isolation with a steam release path through the Safety Relief Valves.	None
	Unit 2 - Feed SGs 2 & 3 with Unit 2 TDAFW Pump or feed SGs 1 & 4 with Unit 2 West MDAFW Pump. The DHR function also requires MS isolation with a steam release path through the Safety Relief Valves.	
<b>Process Monitoring</b>	Unit 1 Process Monitoring - Use Unit 1 process monitoring in the Control	None

**Fire Area AA2C – Attachment 1 - Table B-3 - Fire Area Transition**

<u>Unit</u>	<u>Fire Area</u>	<u>Description</u>
1, 2	AA2C	Unit 1 and Unit 2 Sub-Basement and Essential Service Water Pipe Tunnels
Vital Auxiliaries		<p>Room for the following: Pressurizer level, RCS pressure and temperature, and S/G level and Pressure.</p> <p>Unit 1 Source Range Monitoring - Use Unit 1 source range monitoring in the Control Room.</p> <p>Unit 2 Process Monitoring - Use Unit 2 process monitoring in the Control Room for the following: Pressurizer level, RCS pressure and temperature, and S/G level and Pressure.</p> <p>Unit 2 Source Range Monitoring - Use Unit 2 source range monitoring in the Control Room.</p>
		<p>Unit 1 Electrical - Control Unit 1 Red (AB) Train Electrical Distribution with Unit 1 Red (AB) Train Offsite Power. Control Unit 1 Green (CD) Train with Unit 1 Green (CD) Train Offsite Power.</p> <p>Unit 1 ESW - Operate Unit 1 East or West ESW. East and West ESW are not available for Red (AB) DG and Green (CD) DG cooling.</p> <p>Unit 1 CCW - Operate Unit 1 East or West CCW.</p> <p>Unit 1 HVAC - Operate Unit 1 Control Room HVAC. Operate Unit 1 Auxiliary Building HVAC. Operate Unit 1 DG HVAC for Red (AB) DG and Green (CD) DG. Operate Unit 1 Switchgear HVAC systems. Operate Unit 1 AFW Pump Room HVAC systems. Operate the Unit 1 East and West ESW Pump HVAC systems.</p>
		<p>Unit 2 Electrical - Control Unit 2 Red (AB) Train Electrical Distribution with Unit 2 Red (AB) Train Offsite Power. Control Unit 2 Green (CD) Train Electrical Distribution with Unit 2 Green (CD) Train Offsite Power.</p> <p>Unit 2 ESW - Operate Unit 2 East or West ESW. East and West ESW are not available for Red (AB) DG and Green (CD) DG cooling.</p> <p>Unit 2 CCW - Operate Unit 2 East or West CCW.</p> <p>Unit 2 HVAC - Operate Unit 2 Control Room HVAC. Operate Unit 2 Auxiliary Building HVAC. Operate Unit 2 DG HVAC for Red (AB) DG and Green (CD) DG. Operate Unit 2 Switchgear HVAC. Operate Unit 2 AFW Pump Room HVAC systems. Operate the Unit 2 East and West ESW Pump HVAC systems.</p>
		<p>Failure of emergency diesel service water lineup valves is mitigated by the availability of the offsite power system lineup for both Unit 1 and 2.</p>

**Fire Area AA2C – Attachment 1 - Table B-3 - Fire Area Transition**

<u>Unit</u>	<u>Fire Area</u>	<u>Description</u>
1, 2	AA2C	Unit 1 and Unit 2 Sub-Basement and Essential Service Water Pipe Tunnels

**Reference Documents**

Genesis Solution Suite, EDISON / SAFE-PB, DC Cook V 3.4.0

Nuclear Safety Capability Assessment Report

**Licensing Actions**

None

**Existing Engineering Equivalency Evaluations (EEEE)****EEEE Title Engineering Equivalency Evaluation 11-9 - Turbine, Auxiliary and Containment Buildings Boundary Evaluation**

**Summary** The purpose of this engineering equivalency evaluation is to describe in general, the approach and existence of evaluations performed to determine and reconcile fire area boundaries having components or designs with less than a 3-hr fire rating on preventing the spread of fire. This engineering equivalency evaluation also specifically evaluates the impact of unrated door assemblies on the spread of fire.

Reasonable assurance is provided that the fire area boundaries having components or design less than a 3-hr fire rating will not increase the spread of fire or impair the safe shutdown capabilities of Units 1 or 2. In addition, this engineering equivalency evaluation does not adversely impact on other engineering equivalency evaluations or exemption requests.

This evaluation supports additional evaluations credited in this fire area.



**Fire Area AA2C – Attachment 1 - Table B-3 - Fire Area Transition**

<u>Unit</u>	<u>Fire Area</u>	<u>Description</u>
1, 2	AA2C	Unit 1 and Unit 2 Sub-Basement and Essential Service Water Pipe Tunnels

**EEEE Title** Engineering Equivalency Evaluation 11-56 - Turbine Building Main Steam Access Way Fire Zones 110 to 114, Fire Zones 111 to 115, Fire Zones 112 to 2N, Fire Zones 113 to 2S (Fire Areas AA2 and AA2C)

**Summary** The purpose of this engineering equivalency evaluation is to document the acceptability of:

- Four (4) undampened ventilation penetrations between Unit 1 Fire Area AA2 (Fire Zone 110) and Fire Area AA2C (Fire Zone 114) on the 587 ft. elevation of the Auxiliary Building. The analysis also pertains to Unit 2 Fire Area AA2 (Fire Zone 111) and Fire Area AA2C (Fire Zone 115) on the 587 ft. elevation of the Auxiliary Building.
- Two (2) unrated watertight doors between Unit 1 Fire Area AA2C (Fire Zone 112) and Fire Area AA2 (Fire Zone 2N). There is also one (1) unrated watertight door between Unit 2 Fire Area AA2C (Fire Zone 113) and Fire Area AA2 (Fire Zone 2S).
- Unrated penetrations which exist between Fire Area AA2C (Fire Zones 112 & 113) and Fire Area AA2 (Fire Zones 2N and 2S), respectively.

Reasonable assurance is provided that a fire starting in Fire Zone 110 or 111 is not capable of propagating through the undampened ducts to Fire Zone 114 or 115, respectively. Similarly, reasonable assurance is provided that a fire starting in Fire Zone 114 or 115 is not capable of propagating through the undampened ducts to Fire Zone 110 or 111, respectively. Since a fire in either fire zone will not affect adjacent fire zones, the fire will not adversely impact safe shutdown capabilities of CNP.

It is determined that a fire starting in Fire Zones 112 or 113 (Fire Area AA2C) is not capable of propagating through the unrated watertight doors or unrated watertight penetration seals to Fire Zones 2N or 2S (Fire Area AA2). Similarly, reasonable assurance is provided that a fire starting in Fire Zones 2N or 2S (Fire Area AA2) is not capable of propagating to adjacent Fire Zones 112 and 113 (Fire Area AA2C). Since a fire in either fire zone will not affect adjacent fire zones, the fire will not adversely impact safe shutdown capabilities of CNP.

The ventilation openings, unrated penetrations and watertight doors were evaluated and found to be acceptable based on the fire hazards and construction features within the evaluated areas.

**Fire Area AA2C – Attachment 1 - Table B-3 - Fire Area Transition**

<u>Unit</u>	<u>Fire Area</u>	<u>Description</u>
1, 2	AA2C	Unit 1 and Unit 2 Sub-Basement and Essential Service Water Pipe Tunnels

<b><u>EEEE Title</u></b>	<b>Engineering Equivalency Evaluation 11-60 - Fire Zone 80/114 and 84/115 (Fire Areas AA2 and AA2C) Boundary Evaluation</b>
<b><u>Summary</u></b>	<p>The purpose of this engineering equivalency evaluation is to document the acceptability of open penetrations between Unit 1 Fire Zone 80 (Fire Area AA2) and Fire Zone 114 (Fire Area AA2C) on the 587. ft. elevation of the Auxiliary Building, and to Unit 2 Fire Zone 84 (Fire Area AA2) and Fire Zone 115 (Fire Area AA2C) on the 587 ft. elevation of the Auxiliary Building. This evaluation will also verify that there is no adverse impact to other evaluations or exemption requests.</p> <p>Based on the preceding analysis, reasonable assurance can be provided that a fire starting in Fire Zone 80 or 84 is not capable of propagating through the open penetration seals to Fire Zone 114 or 115, respectively. Similarly, reasonable assurance can be provided that a fire starting in Fire Zone 114 or 115 is not capable of propagating through the open penetration seals to Fire Zone 80 or 84, respectively. Since a fire in either fire zone will not affect adjacent fire zones, the fire will not adversely impact safe shutdown capabilities of CNP. In addition, this evaluation does not adversely impact on other evaluations or exemption requests.</p> <p>The penetrations were evaluated and found to be acceptable based on the fire hazards and construction features within the evaluated areas.</p>

**Fire Suppression Effects on Nuclear Safety Performance Criteria**

The CNP fire brigade is trained to discharge water in a judicious manner and instructed to direct hose streams and portable extinguishers at the base of the fire to limit the amount of overspray beyond the immediate fire zone. For this reason, fire brigade activities are not expected to fail components not already considered damaged. It has been concluded that water impingement on cables is not a concern. Electrical cabinets are provided with a seal at the conduit interface. Possible impacts to surrounding equipment due to manual fire fighting activities is bounded by the analysis approach of postulating whole room damage. The drainage features of the fire area mitigate the potential for flooding damage due to fire suppression, such that the standing water would not affect credited equipment.

This fire area is not equipped with a fixed fire suppression system. Since it is shown that suppression effects will not impact the nuclear safety performance criteria, the fire area configuration is deemed acceptable.

**References:**

Technical Evaluation 12.1, "Fire Suppression Effects Study"

Technical Evaluation 12.1, "Supplemental Information to Fire Suppression Effects Study – Supplement 1"

**Fire Area Comments**

None

## D. C. Cook Nuclear Plant Fire Safety Analysis

## Fire Area: AA3

Unit 1 and Unit 2 Auxiliary Building and Fuel Handling Areas (El. 609 ft., 633 ft. and 650 ft.)

## Table of Contents

<b>Purpose</b>	Section 1.0
<b>Analysis Methodology</b>	Section 2.0
<b>Analysis</b>	Section 3.0
<b>Conclusion</b>	Section 4.0
<b>References</b>	Section 5.0

## Attachments

Fire Area AA3 – Attachment 1 - Table B-3 - Fire Area Transition

## Fire Area AA3 – Attachment 2 - Fire Risk Evaluation Results Summary

## 1.0 PURPOSE

This report documents the Fire Safety Analysis (FSA) for Cook Nuclear Plant (CNP) Fire Area AA3, Unit 1 and Unit 2 Auxiliary Building and Fuel Handling Areas (El. 609 ft., 633 ft. and 650 ft.) which comprises fire zone(s) 3, 31, 32, 35, 36, 48, 49, 50, 51, 52, 69, 106, 107. The purpose of this analysis is to demonstrate the achievement of the nuclear safety and radioactive release performance criteria of NFPA 805 as required by 10 CFR 50.48(c). The Fire Safety Analysis is a key part of compliance with Section 2.7.1.2 Fire Protection Program Design Basis Document of NFPA 805. This analysis also documents results of risk-informed, performance-based Fire Risk Evaluations (FREs). These evaluations are associated with Variances from Deterministic Requirements (VFDRs) of NFPA 805 Chapter 4.

## 2.0 ANALYSIS METHODOLOGY

The FSA is the design basis document as described in NFPA 805 Section 2.7.1.2. The following steps are performed to develop the FSA on a fire area basis:

- Identify significant fire hazards in the fire area. This is based on NFPA 805 approach to analyze the plant from an ignition source and fuel package perspective.
- Summarize Nuclear Safety Capability Analysis (NSCA) compliance strategies. This is the result of the NEI 04-02 B-3 Table review of the Safe Shutdown Analysis.
- Summarize Non-Power Operations Modes compliance strategies.
- Summarize Radioactive Release compliance strategies. The transition review process required per NEI 04-02 is used to develop these results.
- Provide Fire Probabilistic Risk Assessment summary of results. This is based on the results from the plant Fire PRA.
- Perform risk informed, performance based evaluations if needed for the performance based approach.
- Summarize Defense-in-Depth strategy for each fire area.
- Determine key analysis assumptions which are candidates to be included in the NFPA 805 monitoring program.
- Provide conclusions relative to NFPA 805 compliance.

### 3.0 ANALYSIS

#### 3.1 Classical Fire Protection

##### 3.1.1 Construction

For Fire Zone 3, walls and floors to adjacent fire areas and fire zones are reinforced concrete in excess of a 3-hour rating. Eight inch concrete block having a four hour rating is used to reduce the opening for the installation of the fire door to adjacent Fire Area AA5/6 - Fire Zone 5. A fire area boundary evaluation was performed for the construction features (i.e. unsealed penetrations) of the radwaste areas which have a fire resistance rating of less than 3 hours (Engineering Equivalency Evaluation 11-18)

For Fire Zone 31, the east wall to Fire Zone 147 in the Yard Fire Area is constructed of reinforced concrete wainscoting 5 feet high and metal sandwich panels with fiberglass insulation. The east wall of Fire Zone 147 where it abuts to Fire Zone 31 is constructed of a concrete block and gypsum wallboard having a 3- hour rating. Two new 3 hour rated fire doors (2-DR-AUX-126 & 2-DR-AUX128) have been installed per EC-52984 to provide access/egress between Fire Zone 31 and Fire Zone 147. The wall adjoining the Auxiliary Building, Fire Zone 32, is reinforced and/or precast concrete having a 3-hour rating. The floor is concrete. The roof is of built up construction on metal decking. A fire area boundary evaluation was performed for the construction features (i.e. unprotected steel framing, unsealed penetrations and unrated fire doors) of the rad waste areas which have a fire resistance rating of less than 3 hours (Engineering Equivalency Evaluation 11-18). Engineering Change EC-52984 removed the rated fire door 1-DR-AUX371 from the north wall of Fire Zone 32 and repaired the opening with a metal clad and gypsum wallboard having a 3 hour fire rating.

For Fire Zone 32, the stair enclosure at the 609 ft. elevation to Fire Area AA5/6 -Fire Zone 5 is constructed of 8-inch thick concrete block walls with a 5-inch thick concrete ceiling of unspecified ratings. A fire area boundary evaluation was performed evaluating this construction (Engineering Equivalency Evaluation 9-37). Walls and floors to adjacent fire zones, with the exception of the wall to Fire Zone 31, are reinforced concrete in excess of a 3-hour rating. The walls to Fire Zone 31 and the yard (east of column line S) constructed of 6-inch precast concrete panels on unprotected steel framing. Unrated steel blow out panels are also provided in the east wall facing the Containment Access Building (Fire Zone 147). The north and south walls west of column line S are a composite of steel frame and poured concrete construction and carry the equivalent of a 3-hour rating for an external (yard) fire exposure. The roof is constructed of reinforced concrete in excess of the 3-hour rating on unprotected steel framing. The roof concrete is covered with built-up roofing materials meeting UL Class A/FM Class 1 Construction. A fire area boundary evaluation was performed for the construction features (i.e. unrated stair enclosure and unsealed penetrations) of the radwaste areas which have a fire resistance rating of less than 3 hours (Engineering Equivalency Evaluation 11-18).

For Fire Zone 35, walls and floors to adjacent fire areas are reinforced concrete in excess of a 3-hour rating. The ceiling (roof) construction is UL Class A/FM Class 1.

For Fire Zone 36, walls, floors and ceilings to adjacent fire areas and fire zones are reinforced concrete in excess of a 3-hour rating.

For Fire Zone 48, walls, floors and ceilings to adjacent fire areas and fire zones are reinforced

concrete in excess of a 3-hour rating.

For Fire Zone 49, walls, floors and ceilings to adjacent fire areas and fire zones are reinforced concrete in excess of a 3-hour rating. The concrete roof has a UL Class A roof covering.

For Fire Zone 50, walls, floors and ceilings to adjacent fire areas are reinforced concrete in excess of a 3-hour rating. The concrete roof has a UL Class A roof covering.

For Fire Zone 51, walls, floors and ceilings to adjacent fire areas and fire zones are reinforced concrete in excess of a 3-hour rating. The elevator shaft is constructed of reinforced concrete in excess of a 3-hour rating. The Hot Tool Decontamination Facility within Fire Zone 51 is separated from the remainder of the fire zone by a nonrated metal wall that extends from floor to ceiling.

For Fire Zone 52, walls, floors and ceilings to adjacent fire areas and fire zones are reinforced concrete in excess of a 3-hour rating. The elevator shaft is constructed of reinforced concrete in excess of a 3-hour rating.

For Fire Zone 69, walls and floors to adjacent fire areas and fire zones are reinforced concrete in excess of a 3-hour rating. The elevator shaft above the 650 ft. elevation is constructed of 8-inch concrete block in excess of a 3-hour rating with an unrated 4-inch concrete slab roof on steel framing. The roof is constructed of reinforced concrete in excess of a 3-hour rating on unprotected steel framing. The roof concrete is covered with built-up roofing materials meeting UL Class A/FM Class 1 construction. For the eastern section of the exterior wall, construction is a composite of steel framing members and poured concrete and carries the equivalent of a 3-hour rating for an external (yard) fire exposure. On the northwest and southwest ends of the fire zone, the section of wall between column lines L and J parallel to column lines 11A and 15A (approximately 25 feet each) and between work lines WL4 and WL5 and work lines WL7 and WL8 along column line H (approximately 48 feet each) is of unrated metal construction. Columns and horizontal struts for the lower portion of Columns P11A and P15A (both walls). The columns and struts in the west wall are fully embedded and could withstand an internal (Fire Zone 69) fire exposure of 3 hours on the standard time-temperature curve. North and South of the wall in this area is the roof of Fire Zone 52, the west end of the Auxiliary Building. This roof is constructed of concrete with a three hour fire rating. The combustible loading classification for this fire zone is low, thus there is no chance of fire from this fire zone presenting a hazard to the wall. The roof itself is covered with composite modified Bituminous Sheet Roofing (DCC-CEST-200-QCS). The membrane materials are base sheet, lower ply and upper ply. Of asphalt-coated fiberglass reinforced sheet.

For Fire Zone 106, the floor to the adjacent fire area is reinforced concrete in excess of a 3-hour rating. Walls are constructed of pre-fabricated metal panels having a 2-hour rating. Columns are designed to have a 2-hour rating. Ceiling is constructed of 4 inches of concrete on metal decking on steel beams. The steel decking and beams are coated with a spray on fire proofing material having a 2-hour rating. A boundary evaluation has been performed where fireproofing material could not be applied to the steel beams (Engineering Equivalency Evaluation 11-22).

For Fire Zone 107, the floor to the adjacent fire area is reinforced concrete in excess of a 3-hour rating. Walls are constructed of pre-fabricated metal panels having a 2-hour rating. Columns are designed to have a 2-hour rating. Ceiling is constructed of 4 inches of concrete on metal decking on steel beams. The steel decking and beams are coated with a spray on fire proofing material having a 2-hour rating.

Applicable Engineering Equivalency Evaluations are documented in Attachment 1.

### 3.1.2 Doors and Access Openings

For Fire Zone 3, a fire door having a 3-hour rating is provided to adjacent Fire Area AA5/6 - Fire Zone 5.

For Fire Zone 31, an unrated door is provided to adjacent Fire Zone 146. Two new 3 hour rated fire doors (2-DR-AUX-126 & 2-DR-AUX128) have been installed per EC-52984 to provide access/egress between Fire Zone 31 and Fire Zone 147.

For Fire Zone 32, a fire area boundary evaluation was performed for an unrated fire door to Fire Area AA5/6 - Fire Zone 5 (Engineering Equivalency Evaluation 9-37). Engineering Change EC-52984 removed the rated fire door 1-DR-AUX371 from the north wall of Fire Zone 32 and repaired the opening with a metal clad and gypsum wallboard having a 3 hour fire rating. Fire doors having a 3-hour rating are provided at the entrance to the adjacent New Fuel Storage Room, Fire Zone 48, and at the entrance to the lower containment personnel walkway of Fire Area AA34 - Fire Zone 33. A three hour rated fire double door, 2-DR-AUX383, is provided to adjacent Fire Zone 146, the loading area (AAYD). This fire zone provides access to Fire Zone 36 through an opening in the west wall. A pair of double leaf fire doors having a 3-hour rating are provided in the north wall which provide access to the connecting stair enclosure over to the Containment Access Building (Fire Zone 147).

For Fire Zone 35, there are no door openings to adjacent fire areas. An unrated door is provided to adjacent Fire Zone 146, (AAYD). This boundary is evaluated in Engineering Equivalency Evaluation 11-18.

For Fire Zone 36, there are no door openings to adjacent fire areas. A fire area boundary evaluation was performed for an unrated steel plate hatch in the floor to Fire Area AA5/6 - Fire Zone 5 (Engineering Equivalency Evaluation 11-1). Access to this fire zone is through an opening in the east wall from adjacent Fire Zone 32.

For Fire Zone 48, there are no door openings to adjacent fire areas. A fire door having a 3-hour rating is provided to adjacent Fire Zone 32.

For Fire Zone 49, there are no door openings to adjacent fire areas. Access to this fire zone is through an opening in the west wall from Fire Zone 52.

For Fire Zone 50, there are no door openings to adjacent fire areas. Access to this fire zone is through an opening in the west wall from Fire Zone 52. A fire door having a 3-hour rating is provided to adjacent Fire Zone 107.

For Fire Zone 51, there are no door openings to adjacent fire areas. An open stairway protected by a water curtain connects the 633 ft. elevation of the Auxiliary Building with the 609 ft. elevation (Fire Area AA36/42 - Fire Zone 44N) and the 650 ft. elevation (Fire Area AA3 - Fire Zone 69). The elevator doors have a 1 1/2-hour rating. A fire area boundary evaluation was performed for the rated and unrated fire barriers of the stairwells and elevators located in the Turbine and Auxiliary Buildings (Engineering Equivalency Evaluation 11-12).

For Fire Zone 52, fire doors having a 3-hour rating are provided to adjacent Fire Areas AA46 and

AA47 - Fire Zones 53 and 54. A fire door having a 1 1/2-hour rating is provided to adjacent Fire Zone 106. The elevator doors have a 1 1/2-hour rating. Fire boundary evaluations were performed for unrated floor hatches to Fire Area AA52 - Fire Zone 59 (Engineering Equivalency Evaluation 9-18) and to Fire Area AA36/42 - Fire Zone 44N (Engineering Equivalency Evaluation 11-37). This fire zone provides access to Fire Zones 49 and 50 through openings in the east wall. Open stairways protected by a water curtain connects the 633 ft. elevation of the Auxiliary Building with the 609 ft. elevation (Fire Area AA36/42 - Fire Zones 44N and 44S) and the 650 ft. elevation (Fire Area AA3 - Fire Zone 69). A fire area boundary evaluation was performed for the rated and unrated fire barriers of the stairwells and elevators located in the Turbine and Auxiliary Buildings (Engineering Equivalency Evaluation 11-12).

For Fire Zone 69, upper containment access is provided into Unit 1 containment Fire Area AA56 - Fire Zone 68 and Unit 2 containment Fire Area AA58 - Fire Zone 76 from this fire zone through the equipment hatch air locks. The elevator doors have a 1 1/2-hour rating. Open stairways protected by a water curtain connects the 650 ft. elevation of the Auxiliary Building with the 633 ft. elevation (Fire Zones 51 and 52). A fire area boundary evaluation was performed for the rated and unrated fire barriers of the stairwells and elevators located in the Turbine and Auxiliary Buildings (Engineering Equivalency Evaluation 11-12).

For Fire Zone 106, there are no door openings to adjacent fire areas. A fire door having a 1 1/2-hour rating is provided to adjacent Fire Zone 52.

For Fire Zone 107, there are no door openings to adjacent fire areas. A fire door having a 3-hour rating is provided to adjacent Fire Zone 50.

### 3.1.3 Penetrations

Note: Statements regarding fire resistance rating of penetration seals are not applicable to seals in barriers to Analysis Area YD.

For Fire Zone 3, penetrations in fire barriers between this fire zone and adjacent fire areas are provided with fire seals. However, barriers between this fire zone and adjacent fire zones are not fire sealed.

For Fire Zone 31, penetrations in fire barriers between this fire zone and adjacent fire zones are not fire sealed.

For Fire Zone 32, penetrations in fire barriers between this fire zone and adjacent fire areas are provided with fire seals except as noted below. However, barriers between this fire zone and adjacent fire zones are not fire sealed. A fire area boundary evaluation was performed for open penetrations to Fire Area AA5/6 - Fire Zone 5 (Engineering Equivalency Evaluation 9-37).

For Fire Zones 35 and 36, penetrations in fire barriers between these fire zones and adjacent fire areas are provided with fire seals. However, barriers between these fire zones and adjacent fire zones are not fire sealed.

For Fire Zone 48, penetrations in fire barriers between this fire zone and adjacent fire areas are provided with fire seals. Additionally, the penetrations in the fire barriers to the N-Train Battery Room, Fire Zone 107, are also sealed. However, barriers between this fire zone and the other adjacent fire zones are not fire sealed.



For Fire Zone 49, penetrations in fire barriers between this fire zone and adjacent fire areas are provided with fire seals. Additionally, the penetrations in the fire barriers to the N-Train Battery Room (Fire Zone 106) and the east wall to the yard are also sealed. However, barriers between this fire zone and the other adjacent fire zones are not fire sealed. Seismic gaps are sealed with a glass fiber reinforced silicone sheeting. Seismic gap exemption was granted for Fire Zone 49 interface with Fire Areas AA7, AA37, AA3 and AA2 - Fire Zones 7, 38, 69 and 108 (Engineering Equivalency Evaluation 11-46).

For Fire Zone 50, penetrations in fire barriers between this fire zone and adjacent fire areas are provided with fire seals. Additionally, the penetrations in the fire barriers to the N-Train Battery Room, Fire Zone 107, are also sealed. However, barriers between this fire zone and adjacent fire zones are not fire sealed. Seismic gaps are sealed with a glass fiber reinforced silicone sheeting. Seismic gap exemption was granted for Fire Zone 50 interface with Fire Zone AA31, AA38, AA3 and AA2 - Fire Zones 27, 39, 69, 108 and 109 (Engineering Equivalency Evaluation 11-46).

For Fire Zone 51, penetrations in fire barriers between this fire zone and adjacent fire areas are provided with fire seals. Penetrations into the elevator shaft are also sealed. However, barriers between this fire zone and adjacent fire zones are not fire sealed.

For Fire Zone 52, penetrations in fire barriers between this fire zone and adjacent fire areas are provided with fire seals. Additionally, the penetrations in the fire barriers to the N-Train Battery Room (Fire Zone 106) and the elevator shaft are also sealed. However, barriers between this fire zone and the other adjacent fire zones are not fire sealed.

For Fire Zone 69, penetrations in fire barriers between this fire zone and adjacent fire areas are provided with fire seals. However, barriers between this fire zone and adjacent fire zones are not fire sealed. Seismic gaps are sealed with a glass fiber reinforced silicone sheeting. Seismic gap exemption was granted for Fire Zone 69 interface with Fire Areas AA7, AA31, AA37, AA38 and AA2 - Fire Zones 7, 27, 38, 39 and 108, 109 respectively.

For Fire Zone 106, penetrations in fire barriers between this fire zone and adjacent fire zones and fire areas are provided with fire seals.

For Fire Zone 107, penetrations in fire barriers between this fire zone and adjacent fire areas and fire zones are provided with fire seals.

### 3.1.4 Detection

The table below outlines the fire detection system(s) provided in the Fire Area:

Table 3-1, Fire Area AA3 Detection Systems								
Fire Zone	Type of System	Local (L) / Remote (R)	Detection Actuates Suppression?	Required System?				
				S	L	E	R	D
3	Ionization	L/R	N	N	N	Y	Y	N
31	None	N/A	N/A	N/A	N/A	N/A	N/A	N/A
32	Ionization	L/R	N	N	N	Y	Y	N
35	None	N/A	N/A	N/A	N/A	N/A	N/A	N/A
36	None	N/A	N/A	N/A	N/A	N/A	N/A	N/A
48	Ionization	L/R	No Auto Supp. (N/A)	N	N	Y	Y	N
49	Ionization	L/R	N	N	N	Y	Y	N
50	Ionization	L/R	N	N	N	Y	Y	N
51	Ionization	L/R	N	N	N	Y	Y	N
52	Ionization	L/R	N	N	N	Y	Y	N
69	Ionization	L/R	N	N	N	Y	Y	N
106	Thermal	L/R	No Auto Supp. (N/A)	N	N	Y	Y	N
107	Thermal	L/R	No Auto Supp. (N/A)	N	N	Y	Y	N

**Table 3-1 Legend:**

Table Field: "Required System?"	
S	- Required for Chapter 4 Separation Criteria
L	- Required for NRC Approved Licensing Action
E	- Required for Engineering Equivalency Evaluation
R	- Required for Risk Significance
D	- Required to maintain adequate balance of Defense-in-Depth in a Change Evaluation or Fire Risk Evaluation

For Fire Zone 3, two ionization detectors are provided over the drumming area which alarm in the Unit 1 Control Room. These detectors are part of the larger detection circuit for elevation 587' of the Auxiliary Building which includes Fire Zones 3, 4, 5, 6N, 6M, 6S, 61, 62A-C, 63A-C, 64A-B and 65A-B. No detectors are provided over the drum storage area.

For Fire Zone 32, six ionization detectors are provided which alarm in the Unit 1 Control Room. These detectors are part of the larger detection circuit for the 650 ft. elevation of the Auxiliary Building which includes Fire Zones 32 and 69.

For Fire Zone 48, five ionization are provided which alarm in the Unit 1 Control Room.

For Fire Zone 49, seven ionization detectors are provided which alarm in the Unit 1 Control Room. These detectors are part of a larger detection circuit on the 633 ft. elevation which includes Fire Zones 49, 50, 51, 52, 106 and 107.

For Fire Zone 50, seven ionization detectors are provided which alarm in the Unit 1 Control Room. These detectors are part of a larger detection circuit on the 633 ft. elevation which includes Fire Zones 49, 50, 51, 52, 106 and 107.

For Fire Zone 51, twelve ionization detectors are provided which alarm in the Unit 1 Control

Room. These detectors are located in the normally accessible portions of the fire zone and are part of the larger detection circuit for elevation 633 ft. of the Auxiliary Building which includes Fire Zones 49, 50, 51, 52, 106 and 107. Two ionization duct detectors are located in the supply and return ducts of the Hot Tool Decontamination Facility HVAC system (12-HV-HTAH-1).

For Fire Zone 52, seventeen ionization detectors are provided which alarm in the Unit 1 Control Room. These detectors are located in the normally accessible portions of the fire zone and are part of the larger detection circuit for elevation 633 ft. of the Auxiliary Building which includes Fire Zones 49, 50, 51, 52, 106 and 107.

For Fire Zone 69, twenty-eight ionization detectors are provided which alarm in the Unit 1 Control Room. These detectors are part of a larger detection circuit for the 650 ft. elevation of the Auxiliary Building that includes Fire Zone 32.

For Fire Zone 106, one heat (fixed temperature/rate of rise) detector is provided which alarms in the Unit 1 Control Room. This detector is part of the larger Auxiliary Building El. 633 ft. detection circuit that includes Fire Zones 49, 50, 51, 52, 106 and 107.

For Fire Zone 107, one heat (fixed temperature/rate of rise) detector is provided which alarms in the Unit 1 Control Room. This detectors is part of the larger Auxiliary Building El. 633 ft. detection circuit which includes Fire Zones 49, 50, 51, 52, 106 and 107.

Fire detection is not provided for Fire Zones 31, 35 or 36.

### 3.1.5 Fixed Suppression

The table below outlines the fixed fire suppression system(s) provided in the Fire Area:

Table 3-2, Fire Area AA3 Suppression Systems								
Fire Zone	Type of System	Full (F) / Partial (P)	Required System?					
			S	L	E	R	D	
3	Pre-Action	P	N	N	Y	N	N	
31	Pre-Action	F	N	N	Y	N	N	
32	Pre-Action	F	N	N	Y	N	N	
35	None	N/A	N/A	N/A	N/A	N/A	N/A	
36	None	N/A	N/A	N/A	N/A	N/A	N/A	
48	None	N/A	N/A	N/A	N/A	N/A	N/A	
49	None	N/A	N/A	N/A	N/A	N/A	N/A	
50	None	N/A	N/A	N/A	N/A	N/A	N/A	
51	Pre-Action	F	N	N	Y	N	N	
51	Water Curtain	P	N	N	Y	Y	N	
52	Pre-Action	F	N	N	Y	N	N	
52	Water Curtain	P	N	N	Y	Y	N	
69	None	N/A	N/A	N/A	N/A	N/A	N/A	
106	None	N/A	N/A	N/A	N/A	N/A	N/A	
107	None	N/A	N/A	N/A	N/A	N/A	N/A	

**Table 3-2 Legend:**

Table Field: "Required System?"	
S	- Required for Chapter 4 Separation Criteria
L	- Required for NRC Approved Licensing Action
E	- Required for Engineering Equivalency Evaluation
R	- Required for Risk Significance
D	- Required to maintain adequate balance of Defense-in-Depth in a Change Evaluation or Fire Risk Evaluation

For Fire Zone 3, a preaction sprinkler system is provided in the Drumming area which is actuated by dry pilot sprinkler detection. Pilot sprinklers are rated at 175°F and water sprinklers are rated at 250°F. Manual release capability is provided at the access door and at the valve station in the Concrete Mixing Building. No sprinklers are provided over the drum storage area.

For Fire Zone 31, a dry pilot preaction sprinkler system is provided which alarms in the Unit 1 Control Room. This system is part of the larger sprinkler system providing general area coverage for other Auxiliary Building fire zones.

For Fire Zone 32, a dry pilot preaction sprinkler system is provided for this fire zone. The pilot sprinklers are rated at 175°F and the water sprinklers are rated at 250°F (NOTE: FPCE-2017-0030 approved the use of 286F sprinkler heads as replacements for 250F heads in Fire Zone 32). Manual release capability is provided at the entrance to the fire zone and at the valve station.

For Fire Zone 51, dry pilot preaction sprinklers are provided throughout the normally accessible portions of the fire zone and in a close spaced configuration around the perimeter of the open

stairways to form a water curtain between fire areas. The pilot sprinklers are rated at 175°F and the water sprinklers are rated at 250°F. Manual release capability is provided on the 633 ft. elevation of the Auxiliary Building and at the valve station in the Turbine Building. These sprinklers are part of a larger sprinkler system for the 633 ft. elevation of the Auxiliary Building which includes Fire Zone 52.

For Fire Zone 52, dry pilot preaction sprinklers are provided throughout the normally accessible portions of the fire zone and in a close spaced configuration around the perimeter of the open stairways to form a water curtain between fire areas. The pilot sprinklers are rated at 175°F and the water sprinklers are rated at 250°F. Manual release capability is provided on the 633 ft. elevation of the Auxiliary Building and at the valve station in the Turbine Building. These sprinklers are part of a larger sprinkler system for the 633 ft. elevation of the Auxiliary Building which includes Fire Zone 51.

Automatic suppression is not provided in Fire Zones 35, 36, 48, 49, 50, 69, 106 or 107.

### **3.1.6 Manual Suppression / Response Strategy**

For fire zones within AA3 equipped with automatic detection systems, a postulated fire will be identified by early detection using ionization type smoke detection, heat detection or by plant personnel using plant communication system to notify the control room. The automatic detection systems alarm in the control room. For fire zones within AA3 which are not equipped with automatic detection systems, a postulated fire will be identified by plant personnel using plant communication system to notify the control room. The Control Room operator will dispatch the fire brigade for initiation of manual fire fighting. A fire in this fire area will be contained by the construction features discussed in Section 3.1.1. Manual suppression is provided by the CNP Fire Brigade.

Fire extinguishers are located in all fire zones within Fire Area AA3 except Fire Zones 35, 48, 106 and 107. For Fire Zone 35, fire extinguishers are provided in Fire Zone 31, 32 or 146. For Fire Zone 48, fire extinguishers are provided in adjacent Fire Zone 32. Fire Zones 106 and 107, fire extinguishers are provided in adjacent Fire Zone 52. Fire extinguishers are also located in adjacent Fire Zone 5.

Water hose reels are located in Fire Zones 32, 51, 52 and 69. For Fire Zone 3, water hose reel located in adjacent Fire Zone 5. For Fire Zone 31, water hose reel located in adjacent Fire Zone 32. For Fire Zone 35, water hose reel located in adjacent Fire Zone 32. For Fire Zone 36, water hose reel located in adjacent Fire Zone 32. For Fire Zone 48, water hose reels located in adjacent Fire Zones 32 and 69. For Fire Zones 49 and 50, 106 and 107, water hose reels located in adjacent Fire Zone 52.

Floor Drains are available in Fire Zones 3, 32, 36, 48, 49, 50, 51, 52, 69 and 107. For Fire Zone 31 & 35, floor drains are not available. The Fire Brigade is equipped with a sump pump that may be used to remove an accumulation of water. For Fire Zone 69, floor drains are available at floor elevation 650'-0" only, and are not available for the spent fuel storage pit and fuel transfer canal. For Fire Zone 106, floor drains are available in adjacent Fire Zone 52.

For Fire Zone 69, a breathing apparatus is also available.

### **3.1.7 Ventilation**

A fire in this area will be contained by the fire barriers. Smoke can be removed by portable fans and flexible ducting to other areas of the Auxiliary Building and outdoors if not contaminated. Contaminated smoke can be removed by portable fans and flexible ducting to other areas of the Auxiliary Building per the Fire Pre-Plans. The normal building ventilating systems in the Auxiliary Building will then exhaust the smoke via filtered monitored pathways.

For Fire Zone 3, fire dampers having a 3-hour rating are provided to adjacent Fire Area AA5/6 - Fire Zone 5.

For Fire Zone 31, there are no ventilation penetrations to adjacent fire areas.

For Fire Zone 32, a fire area boundary evaluation was performed for an undampered ventilation duct to Fire Area AA5/6 - Fire Zone 5 (Engineering Equivalency Evaluation 9-37).

For Fire Zone 35, there are no ventilation penetrations to adjacent fire areas.

For Fire Zone 36, there is an undampered ventilation penetration to adjacent Fire Zone 48. A fire area boundary evaluation was performed for an undampered ventilation duct to Fire Area AA5/6 - Fire Zone 5 (Engineering Equivalency Evaluation 9-34).

For Fire Zone 48, there are no ventilation penetrations to adjacent fire areas. There is an undampered ventilation penetration to adjacent Fire Zone 36.

For Fire Zone 49, there are ventilation penetrations to adjacent fire areas provided with isolation valves on the outside of containment. These valves are assumed to provide adequate protection; therefore, the undampered ventilation ducts to Fire Area AA56, Fire Zone 101, do not require fire dampers. A fire area boundary evaluation was performed for undampered ventilation ducts to Fire Area AA11 - Fire Zone 12 (Engineering Equivalency Evaluation 9-4). There is an undampered ventilation penetration to the adjacent Fire Zone 51.

For Fire Zone 50, there are ventilation penetrations to adjacent fire areas provided with isolation valves on the outside of containment. These valves are assumed to provide adequate protection; therefore, the undampered ventilation ducts to Fire Area AA58, Fire Zone 102, do not require fire dampers. A fire area boundary evaluation was performed for an undampered ventilation duct to Fire Area AA27 - Fire Zone 22 (Engineering Equivalency Evaluation 9-4). Fire dampers having a 3-hour rating are provided to adjacent Fire Zone 107. There is an undampered ventilation penetration to the adjacent Fire Zone 51.

For Fire Zone 51, a fire area boundary evaluation was performed for undampered ventilation penetrations to the adjacent Fire Area AA36/42 - Fire Zone 37 (Engineering Equivalency Evaluation 9-41). There are undampered ventilation penetrations to the adjacent Fire Zones 49 and 50.

For Fire Zone 52, a 3-hour fire damper assembly is provided to meet the requirements of NFPA 90A. Fire dampers having a 3-hour rating are provided to adjacent Fire Area AA52 - Fire Zone 59 and the adjacent Fire Zone 106.

For Fire Zone 69, there are ventilation penetrations to adjacent fire areas provided with isolation valves on the outside of containment. These valves are assumed to provide adequate protection; therefore, the undampered ventilation ducts to Fire Areas AA56 & AA58 - Fire Zones 68 and 76

do not require fire dampers. A fire area boundary evaluation was performed for an undampened ventilation duct to Fire Area AA2 - Fire Zones 108 and 109 (Engineering Equivalency Evaluation 9-38).

For Fire Zone 106, there are no ventilation penetrations to adjacent fire areas. Fire dampers 1-HV-AFP-BR-FD-1A, 1-HV-AFP-BR-FD-1B, 1-HV-AFP-BR-FD-2 having a 1½ -hour rating are provided to adjacent Fire Zone 52.

For Fire Zone 107, there are no ventilation penetrations to adjacent fire areas. Fire dampers 2-HV-AFP-BR-FD-1A, 2-HV-AFP-BR-FD-1A, and 2-HV-AFP-BR-FD-2 having a 1½-hour rating are provided to adjacent Fire Zone 50.

### 3.1.8 Other Features

For Fire Zone 32, Pyrojector smoke and heat roof vents are provided, however, for security/health-physics reasons they are locked closed. These vents can be opened if deemed necessary by a RP official.

For Fire Zone 48, precast concrete hatch covers are provided in the ceiling.

For Fire Zone 51, floor hatches provide access down into Fire Area AA36/42 - Fire Zone 37.

For Fire Zone 52, the N-Train Battery Room, Fire Zone 106, is located within the much larger Fire Zone 52.

Some cable trays within Fire Zone 52 are provided with bottom covers and/or are fully enclosed.

For Fire Zone 69, Pyrojector smoke and heat roof vents are provided, however, for health-physics reasons are normally held closed. These vents can be opened if deemed necessary by a RP official.

For Fire Zones 49, 50, 52 and 69, each charcoal filter unit is provided with a manual deluge water spray system. The system is a temperature regulating system and is not treated as a manual suppression system. The system isolating valve is normally closed and must be manually opened. Each charcoal filter unit is provided with a thermistor heat detector. The thermistor has a pre-alarm temperature setting and a high temperature alarm setting. The high temperature thermistor alarm automatically opens the suppression system valve. The water flow period is timed to run for approximately 20-30 seconds after the opening of the suppression system valve and then shut off. Subsequent temperatures above the thermistor high temperature setting will restart the water application for as many as is necessary until the temperature is lowered below the high temperature setting. Operation of the system alarms in the Control Room.

## 3.2 Fire Hazards Identification

The fire area contains both ignition sources and combustible fire hazards. The ignition sources consist of the "N" train battery, refrigeration units, chiller compressors, ice condenser refrigeration glycol pump, charcoal filters, motor control centers, train A and B battery chargers and the train-N battery distribution cabinets.

Combustibles in the Fire Area include cellulose, rubber, and plastics. Fire Zones 49 and 50 include charcoal. Fire Zone 52 includes damper grease and oil. Fire Zone 69 includes lube oil and ethylene glycol (500 gallons). Fire Zones 106 and 107 include 40 battery cells in each fire zone.

The fire hazards in the Yard in the vicinity of AA3 are the Containment Access Building (CAB, Fire Zone 147) and Rad-Waste Loading Area (Fire Zone 146). The west wall of the CAB is 1-hour rated and the building is fully sprinklered. The CAB is located 5 ft. away from the east wall of Fire Zone 32 and is connected to Fire Zone 31 by way of 3-hour fire rated doors. The west wall of Fire Zone 147 adjacent to Fire Zone 31 is constructed of concrete block and gypsum wallboard having a 3-hour rating. The Rad-waste Loading Area is adjacent to Fire Zones 31, 32, and 35. Three hour protection is provided by concrete construction and 3-hour rated fire doors into Fire Zone 32. Unrated features for Fire Zones 31 and 35 adjacent to Fire Zone 146 are evaluated in Engineering Equivalency Evaluation 11-18.

The exterior walls of this Fire Area do not require a rating for protection beyond that of which is described above. The spatial separation between the yard equipment and fire hazards to this Fire Area is sufficient to provide protection against heat damage. The impact of a fire in the yard on AA3 would be limited to radiant heat with no ceiling to contain the fire plume. Spatial separation is sufficient to prevent an exposure to credited equipment inside the plant through the unrated exterior walls of this Fire Area.

The roof of the AA3 is at such an elevation that exterior fire hazards will not impact the unrated construction and is sufficient in protecting equipment within the plant.

All fire zones within this fire area have a combustible loading classification of low with the exception of Fire Zone 49 which has a combustible loading classification of moderate.

### **3.3 NSCA Compliance Summary**

Fire Area AA3, U1&U2 Aux Building and Fuel Handling Areas (El. 609', 633, 650'), contains Unit 1 and Unit 2 Red and Green Train cables, conduits and raceways as well as Unit 1 and 2 ventilation equipment, local shutdown indication panels, N Train batteries and chargers, Red and Green train 600V MCCs, Component Cooling Water MOVs, and other safe shutdown equipment.

Compliance with the nuclear safety performance criteria is achieved using the performance-based approach in accordance with NFPA 805, Section 4.2.4.2.

Safe and stable condition of Unit 1 will be accomplished using Steam Generators 1 and 4 via the Unit 1 West Motor Driven Auxiliary Feedwater Pump, Control Room Process Monitoring, Unit 1 Charging via the West or East Pump, Unit 1 Component Cooling Water via the West Pump, Unit 1 ESW via the West Pump. The East ESW system remains available to support the Green Train EDG. Electrical power is supplied to either Red or Green Trains via offsite power with both trains Emergency Diesels also available.

Safe and stable condition of Unit 2 will be accomplished using the Steam Generators 1 and 4 via the Unit 2 West Motor Driven Auxiliary Feedwater Pump, Control Room Process Monitoring, Unit 2 Charging via the West or East Pump, Unit 2 Component Cooling Water via the West Pump, Unit 2 ESW via the West Pump. The East ESW system remains available to support the Green Train EDG. Electrical power is supplied to either Red or Green Trains via offsite power with both trains Emergency Diesels also available.

The Nuclear Safety Performance Criteria compliance strategy for AA3 is documented within the NSCA Report.



### 3.3.1 Variances

The variances identified for evaluation for this fire area are grouped as follows:

#### 3.3.1.1 VFDR No. AA3-001

1-MRV-213-P and 1-MRV-243-P - SG 1 and 4 PORVs are required to be closed to support main steam isolation. Main steam isolation provides integrity of the secondary side of the SGs to prevent uncontrolled cooldown through over-steaming. 1-MRV-213-P may fail due to fire induced damage of cable 6841-1. 1-MRV-243-P may fail due to fire induced damage of cable 6842-1. These cable failures could spuriously open the valves. SG 1 and 4 are credited for decay heat removal due to a fire within Fire Area AA3. This condition represents a variance from the deterministic requirements of NFPA 805, Section 4.2.3. This is a separation issue.

This VFDR has been evaluated and it was determined that the risk, safety margin and defense-in-depth meet the acceptance criteria of NFPA 805 Section 4.2.4 with a recovery action credited.

#### 3.3.1.2 VFDR No. AA3-002

1-MRV-223-P and 1-MRV-233-P - SG 2 and 3 PORVs are required to be closed to support main steam isolation. Main steam isolation provides integrity of the secondary side of the SGs to prevent uncontrolled cooldown through over-steaming. 1-MRV-223-P may fail due to fire induced damage of cable 18132-1. 1-MRV-233-P may fail due to fire induced damage of cable 18133-1. These cable failures could spuriously open the valves. SGs 2 and 3 are not credited for decay heat removal due to fire within Fire Area AA3. This condition represents a variance from the deterministic requirements of NFPA 805, Section 4.2.3. This is a separation issue.

This VFDR has been evaluated and it was determined that the risk, safety margin and defense-in-depth meet the acceptance criteria of NFPA 805 Section 4.2.4 with a defense-in-depth action credited.

#### 3.3.1.3 VFDR No. AA3-003

1-NRI-1 - Source Range Monitoring is required to be operable to ensure that subcritical conditions are achieved by monitoring the fission activity. 1-NRI-1 may fail due to fire induced damage of cables 9251O-1, 9252O-1, 9253O-1 and 9254O-1. This condition represents a variance from the deterministic requirements of NFPA 805, Section 4.2.3. This is a separation issue.

This VFDR has been evaluated and it was determined that the risk, safety margin and defense-in-depth meet the acceptance criteria of NFPA 805 Section 4.2.4 with no further action required.

**3.3.1.4 VFDR No. AA3-004**

1-HV-ACR-1, 1-HV-ACRA-1 and 1-PP-82N - Control Room Ventilation is required to be operable for habitability. The Control Room HVAC system may fail due to the loss of 1-HV-ACR-1, 1-HV-ACRA-1 and 1-PP-82N. 1-HV-ACR-1 may fail due to cables 14430G-1, 3010G-1 and 6124G-1. 1-HV-ACRA-1 may fail due to cables 8987G-1, 8989G-1 and 8992G-1. 1-PP-82N may fail due to fire induced damage cables 14430G-1, 3010G-1 and 6124G-1. This condition represents a variance from the deterministic requirements of NFPA 805, Section 4.2.3. This is a separation issue.

This VFDR has been evaluated and it was determined that the risk, safety margin and defense-in-depth meet the acceptance criteria of NFPA 805 Section 4.2.4 with a recovery action credited.

**3.3.1.5 VFDR No. AA3-005**

1-CMO-411.P, 1-CMO-413.P, 1-CMO-415.P, 1-CMO-416.P, 1-CMO-419.P, 1-CMO-420.P and 1-CMO-429.P – Passive CCW valves are required to remain in their normal position to support the Unit 1 West CCW system. Both trains of Unit 1 CCW systems may fail due to a full area fire within Fire Area AA3. The West CCW system is required to provide cooling to the Unit 1 Charging Pumps. Loss of cooling to the pumps would result in pump failure. The charging pumps are required to maintain inventory and pressure control. 1-CMO-411.P, 1-CMO-413.P, 1-CMO-416.P, 1-CMO-416.P and 1-CMO-420.P are required to be open to support the West CCW system. 1-CMO-419.P and 1-CMO-429.P are required to be closed to support the West CCW system. 1-CMO-411.P may fail due to fire induced damage of cable 8871G-1. 1-CMO-413.P may fail due to fire induced damage of cable 8171R-1. 1-CMO-415.P may fail due to fire induced damage of cable 8906R-1. 1-CMO-416.P may fail due to fire induced damage of cable 8194R-1. 1-CMO-419.P may fail due to fire induced damage of 600v MCC 1-AM-D and cables 8251G-1 and 8904G-1. 1-CMO-420.P may fail due to fire induced damage of cable 8170R-1. 1-CMO-429.P may fail due to fire induced damage of 600v MCC 1-AM-A and cables 8195R-1, 8902R-1, 8903R-1, 8904R-1, 8905R-1 and 8907R-1. These cable failures could spuriously operate the valves. This condition represents a variance from the deterministic requirements of NFPA 805, Section 4.2.3. This is a separation issue.

This VFDR has been evaluated and it was determined that the risk, safety margin and defense-in-depth meet the acceptance criteria of NFPA 805 Section 4.2.4 with a recovery action credited.

**3.3.1.6 VFDR No. AA3-006**

2-ILS-950 and 2-ILS-951 - RWST Level is required to be operable to support CVCS. CVCS is required to maintain positive control over inventory, pressure and reactivity. 2-ILS-950 may fail due to fire induced damage of cable 27554-2. 2-ILS-951 may fail due to fire induced damage of cable 27541-2. This condition represents a variance from the deterministic requirements of NFPA 805, Section 4.2.3. This is a separation issue.

This VFDR has been evaluated and it was determined that the risk, safety margin and defense-in-depth meet the acceptance criteria of NFPA 805 Section 4.2.4 with no further action required.

**3.3.1.7 VFDR No. AA3-007**

2-MRV-213-P and 2-MRV-243-P - SG 1 and 4 PORVs are required to be closed to support main steam isolation. Main steam isolation provides integrity of the secondary side of the SGs to prevent uncontrolled cooldown through over-steaming. 2-MRV-213-P may fail due to fire induced damage of cable 6841-2. 2-MRV-243-P may fail due to fire induced damage of cable 6842-2. These cable failures could spuriously open the valves. SGs 1 and 4 are credited for decay heat removal due to a fire within AA3. This condition represents a variance from the deterministic requirements of NFPA 805, Section 4.2.3. This is a separation issue.

This VFDR has been evaluated and it was determined that the risk, safety margin and defense-in-depth meet the acceptance criteria of NFPA 805 Section 4.2.4 with a recovery action credited.

**3.3.1.8 VFDR No. AA3-008**

2-MRV-223-P and 2-MRV-233-P - SG 2 and 3 PORVs are required to be closed to support main steam isolation. Main steam isolation provides integrity of the secondary side of the SGs to prevent uncontrolled cooldown through over-steaming. 2-MRV-223-P may fail due to fire induced damage of cable 18132-2. 2-MRV-233-P may fail due to fire induced damage of cable 18133-2. These cable failures could spuriously open the valve. SGs 2 and 3 are not credited for decay heat due to a fire within AA3. This condition represents a variance from the deterministic requirements of NFPA 805, Section 4.2.3. This is a separation issue.

This VFDR has been evaluated and it was determined that the risk, safety margin and defense-in-depth meet the acceptance criteria of NFPA 805 Section 4.2.4 with a defense-in-depth action credited.

**3.3.1.9 VFDR No. AA3-009**

2-HV-ACR-1, 2-HV-ACRA-1 and 2-PP-82N - Control Room Ventilation is required to be operable to protect equipment and operators from excessive temperatures. The Control Room HVAC system may fail due to the loss of 2-HV-ACR-1, 2-HV-ACRA-1 and 2-PP-82N. 2-HV-ACR-1 may fail due to fire induced damage of cables 14430G-2, 3014G-2 and 6123G-2. 2-HV-ACRA-1 may fail due to fire induced damage of cables 8987G-2, 8989G-2 and 8992G-2. 2-PP-82N may fail due to fire induced damage of cables 14430G-2, 3010G-2 and 6124G-2. This condition represents a variance from the deterministic requirements of NFPA 805, Section 4.2.3. This is a separation issue.

This VFDR has been evaluated and it was determined that the risk, safety margin and defense-in-depth meet the acceptance criteria of NFPA 805 Section 4.2.4 with a recovery action credited.

### 3.3.1.10 VFDR No. AA3-010

2-CMO-411.P, 2-CMO-413.P, 2-CMO-415.P, 2-CMO-416.P, 2-CMO-419.P, 2-CMO-420.P and 2-CMO-429.P – Passive CCW Valves are required to remain in their normal position to support the Unit 2 West CCW system. Both trains of Unit 2 CCW systems may fail due to a full area fire within Fire Area AA3. The West CCW system is required to provide cooling to the Unit 2 Charging Pumps. Loss of cooling to the pumps would result in pump failure. The charging pumps are required to maintain inventory and pressure control. 2-CMO-411.P, 2-CMO-413.P, 2-CMO-416.P, 2-CMO-416.P and 2-CMO-420.P are required to be open to support the West CCW system. 2-CMO-419.P and 2-CMO-429.P are required to be closed to support the West CCW system. 2-CMO-411.P may fail due to fire induced damage of cable 8871G-2. 2-CMO-413.P may fail due to fire induced damage of cable 8171R-2. 2-CMO-415.P may fail due to fire induced damage of cable 8906G-2. 2-CMO-416.P may fail due to fire induced damage of cable 8194R-2. 2-CMO-419.P may fail due to fire induced damage of cables 8251G-2 and 8904G-2. 2-CMO-420.P may fail due to fire induced damage of cable 8170R-2. 2-CMO-429.P may fail due to fire induced damage of 600v MCC 2-AM-A and cables 8195R-2, 8902R-2, 8903R-2, 8904R-2, 8905R-2 and 8907R-2. These cable failures could spuriously operate the valves. This condition represents a variance from the deterministic requirements of NFPA 805, Section 4.2.3. This is a separation issue.

This VFDR has been evaluated and it was determined that the risk, safety margin and defense-in-depth meet the acceptance criteria of NFPA 805 Section 4.2.4 with a recovery action credited.

### 3.3.1.11 VFDR No. AA3-011

1-NSO-023 and 1-NSO-024 - RX Head Vent Valves are required to be closed to support RCS Integrity. RCS integrity is required to maintain positive control over RCS inventory and pressure. 1-NSO-023 and 1-NSO-024 are in series requiring one of the valves to remain closed to provide RCS integrity. 1-NSO-023 may fail due to cable 9914PR-1. 1-NSO-024 may fail due to fire induce damage of cable 9920PR-1. Failure of these cables could spuriously open the valves. This condition represents a variance from the deterministic requirements of NFPA 805, Section 4.2.3. This is a separation issue.

This VFDR has been evaluated and it was determined that the risk, safety margin and defense-in-depth meet the acceptance criteria of NFPA 805 Section 4.2.4 with a defense-in-depth action credited.

### 3.3.1.12 VFDR No. AA3-012

1-NSO-063 and 1-NSO-064 - Post Accident Vent Valves are required to be closed to support RCS integrity. RCS integrity is required to maintain positive control over RCS inventory and pressure. 1-NSO-063 and 1-NSO-064 are in series requiring one of the valves to remain closed to provide RCS integrity. 1-NSO-063 may fail due to fire induced damage of cable 9901PR-1. 1-NSO-064 may fail due to fire induced damage of cable 9907PR-1. Failure of these cables could spuriously open the valves. This condition represents a variance from the deterministic requirements of NFPA 805, Section 4.2.3. This is a separation issue.

This VFDR has been evaluated and it was determined that the risk, safety margin and defense-in-depth meet the acceptance criteria of NFPA 805 Section 4.2.4 with a defense-in-depth action credited.

**3.3.1.13 VFDR No. AA3-013**

2-DCR-310 and 2-DCR-340 - SG 1 and 4 Blowdown Isolation Valves are required to be closed to support main steam isolation. Main steam isolation is required to prevent uncontrolled cooldown through over-steaming. SG 1 and 4 Blowdown Isolation Valves may fail due to a full area fire within Fire Area AA3. 2-DCR-310 may fail due to fire induced damage of cable 8682G-2. 2-DCR-340 may fail due to fire induced damage of cable 8686G-2. These cable failures could spuriously open the valves. SGs 1 and 4 are credited for decay heat removal for a fire within Fire Area AA3. This condition represents a variance from the deterministic requirements of NFPA 805, Section 4.2.3. This is a separation issue.

This VFDR has been evaluated and it was determined that the risk, safety margin and defense-in-depth meet the acceptance criteria of NFPA 805 Section 4.2.4 with a defense-in-depth action credited.

**3.3.1.14 VFDR No. AA3-014**

2-NSO-023 and 2-NSO-024 - RX Head Vent Valves are required to be closed to support RCS integrity. RCS integrity is required to maintain positive control over RCS inventory and pressure. 2-NSO-023 and 2-NSO-024 are in series requiring one of the valves to be closed to maintain RCS integrity. 2-NSO-023 may fail due to fire induced damage of cable 9801PR-2. 2-NSO-024 may fail due to fire induced damage of cable 9807PR-2. Failure of these cables could spuriously open the valves. This condition represents a variance from the deterministic requirements of NFPA 805, Section 4.2.3. This is a separation issue.

This VFDR has been evaluated and it was determined that the risk, safety margin and defense-in-depth meet the acceptance criteria of NFPA 805 Section 4.2.4 with a defense-in-depth action credited.

**3.3.1.15 VFDR No. AA3-015**

2-NSO-063 and 2-NSO-064 - Post Accident Vent Valves are required to be closed to support RCS integrity. RCS integrity is required to maintain positive control over RCS inventory and pressure. 2-NSO-063 and 2-NSO-064 are in series requiring one of the valves to be closed to maintain RCS integrity. 2-NSO-063 may fail due to fire induced damage of cable 9814PR-2. 2-NSO-064 may fail due to fire induced damage of cable 9820PR-2. Failure of these cables could spuriously open the valves. This condition represents a variance from the deterministic requirements of NFPA 805, Section 4.2.3. This is a separation issue.

This VFDR has been evaluated and it was determined that the risk, safety margin and defense-in-depth meet the acceptance criteria of NFPA 805 Section 4.2.4 with a defense-in-depth action credited.

**3.3.1.16 VFDR No. AA3-016**

1-QVR-10 and 1-QVR-40 - RCP Seal Water Return Isolation Valves are required to be open to support RCS integrity by maintaining the RCP seal. RCS integrity is required to maintain positive control over RCS inventory and pressure. 1-QVR-10 may fail due to fire induced damage of cable 4418PR-1. 1-QVR-40 may fail due to fire induced damage of cable 5002PR-1. These cables could cause spurious closure of these valves. This condition represents a variance from the deterministic requirements of NFPA 805, Section 4.2.3. This is a separation issue.

This VFDR has been evaluated and it was determined that the risk, safety margin and defense-in-depth meet the acceptance criteria of NFPA 805 Section 4.2.4 with a defense-in-depth action credited.

**3.3.1.17 VFDR No. AA3-017**

2-QVR-10 and 2-QVR-40 - RCP Seal Water Return Isolation Valves are required to be open to support RCS integrity by maintaining the RCP seal. RCS integrity is required to maintain positive control over RCS inventory and pressure. 2-QVR-10 may fail due to fire induced damage of cable 4418-2. 2-QVR-40 may fail due to fire induced damage of cable 5002-2. These cables could cause spurious closure of these valves. This condition represents a variance from the deterministic requirements of NFPA 805, Section 4.2.3. This is a separation issue.

This VFDR has been evaluated and it was determined that the risk, safety margin and defense-in-depth meet the acceptance criteria of NFPA 805 Section 4.2.4 with a defense-in-depth action credited.

**3.3.2 Recovery Actions Credited**

For each VFDR, a Fire Risk Evaluation has been performed to assess the acceptability of risk, defense-in-depth, and safety margin. This evaluation determined whether or not recovery actions are required to ensure that one success path necessary to achieve and maintain the nuclear safety performance criteria is maintained free of fire damage by a single fire. Table 3-3 identifies the credited recovery actions for this area. Actions retained for DID are identified as “DID Actions” within Table 3-3. Additional information for DID actions is contained within Section 3.8 of this report. Note that, for completeness, all VFDRs are contained within Table 3-3, even if the Fire Risk Evaluation has determined that a recovery action is not required. In those instances where a recovery action has been determined to not be required, the word “None” is provided in the “Action” column in the table.

<b>Table 3-3, Recovery Actions Credited</b>		
<b>VFDR</b>	<b>Component</b>	<b>Action</b>
AA3-001	1-MRV-213-P	1-MRV-213-P-CLOSE (Manually vent air to close 1-MRV-213)
	1-MRV-243-P	1-MRV-243-P-CLOSE (Manually vent air to close 1-MRV-243)

Table 3-3, Recovery Actions Credited		
VFDR	Component	Action
AA3-002	1-MRV-223-P 1-MRV-233-P	DID ACTION 1-MRV-223-P-CLOSE (Manually vent air to close 1-MRV-223)  1-MRV-233-P-CLOSE (Manually vent air to close 1-MRV-233)
AA3-003	1-NRI-1	None
AA3-004	1-HV-ACR-1 1-HV-ACRA-1 1-PP-82N	1-CR-HVAC-TEMP (Establish temporary control room ventilation)
AA3-005	1-CMO-411.P 1-CMO-413.P 1-CMO-415.P 1-CMO-416.P 1-CMO-419.P 1-CMO-420.P 1-CMO-429.P	1-CS-302-CLOSE (Close manual valve 1-CS-302)  1-CS-534-OPEN (Open manual valve 1-CS-534)  2-CS-536-OPEN (Open manual valve 2-CS-536)
AA3-006	2-ILS-950 2-ILS-951	None
AA3-007	2-MRV-213-P 2-MRV-243-P	2-MRV-213-P-CLOSE (Vent air to manually close 2-MRV-213)  2-MRV-243-P-CLOSE (Vent air to manually close 2-MRV-243)
AA3-008	2-MRV-223-P 2-MRV-233-P	DID ACTION 2-MRV-223-P-CLOSE (Vent air to manually close 2-MRV-223)  2-MRV-233-P-CLOSE (Vent air to manually close 2-MRV-233)
AA3-009	2-HV-ACR-1 2-HV-ACRA-1 2-PP-82N	2-CR-HVAC-TEMP (Establish temporary ventilation)



Table 3-3, Recovery Actions Credited		
VFDR	Component	Action
AA3-010	2-CMO-411.P 2-CMO-413.P 2-CMO-415.P 2-CMO-416.P 2-CMO-419.P 2-CMO-420.P 2-CMO-429.P	1-CS-536-OPEN (Open manual valve 1-CS-536)  2-CS-302-CLOSE (Close manual valve 2-CS-302)  2-CS-534-OPEN (Open manual valve 2-CS-534)
AA3-011	1-NSO-023	DID ACTION(S) 1-NSO-023-CLOSE (Remove fuses in MCR to fail closed AOV 1-NSO-023)
AA3-012	1-NSO-063	DID ACTION(S) 1-NSO-063-CLOSE (Remove fuses in MCR to fail closed AOV 1-NSO-063)
AA3-013	2-DCR-310 2-DRC-340	DID ACTION(S) 2-DCR-310-CLOSE 2-DCR-340-CLOSE (Remove fuses in MCR to fail closed AOVs 2-DCR-310 and 2-DCR-340)
AA3-014	2-NSO-023	DID ACTION(S) 2-NSO-023-CLOSE (Remove fuses in MCR to fail closed AOV 2-NSO-023)
AA3-015	2-NSO-063	DID ACTION(S) 2-NSO-063-CLOSE (Remove fuses in MCR to fail closed AOV 2-NSO-063)
AA3-016	1-QVR-10 1-QVR-40	DID ACTION(S) 1-QVR-10-OPEN 1-QVR-40-OPEN (Remove fuses in MCR to fail open AOVs 1-QRV-10 and 1-QRV-40).
AA3-017	2-QVR-10 2-QVR-40	DID ACTION(S) 2-QVR-10-OPEN 2-QVR-40-OPEN (Remove fuses in MCR to fail open AOVs 2-QRV-10 and 2-QRV-40).

### 3.4 Non-Power Operational Modes Compliance Summary

A review of CNP for the potential effects of a fire in this Fire Area while in non-power modes of operation (NPO) was conducted. This review was conducted using the guidance provided in NEI 04-



02 and FAQ 07-0040, “Non-Power Operations Clarifications”.

The review determined that there are potential failures that affect certain Key Safety Functions (KSF) as a result of the fire in this area, and the fire could result in the loss of one or more KSF paths. Compensatory measures are required during high risk evolution periods to provide reasonable assurance a fire will not adversely affect key safety functions and the NFPA 805 performance goal for NPO is therefore satisfied. The results of the NPO analysis are contained within Technical Evaluation R1900-005-001, Non-Power Operation Modes Transition Review Report.

### **3.5 Radioactive Release Compliance Summary**

The NFPA 805 radiological release goal is to provide reasonable assurance that a fire will not result in a radiological release that adversely affects the public, plant personnel or the environment. The NFPA 805 requirement is to ensure a radiation release to any unrestricted area due to the direct effects of fire suppression activities (but not involving fuel damage) shall be as low as reasonably achievable and shall not exceed applicable plant Technical Specification limits.

AA3 is within the Radiological Controlled Area (RCA) and has been identified as a potential fire area for radioactive release due to fire fighting activities. In accordance with NFPA 805 FAQ 09-0056, this potential has been reviewed to ensure that engineering controls, fire pre-plans, and fire brigade training materials are provided for containment and monitoring of gaseous and liquid effluents associated with fire suppression agents and products of combustion.

The review concludes that the steps to limit radiation release to other areas due to the direct effects of fire suppression activities, in addition to compliance with NFPA 805, Chapter 4, ensure that any radioactive release will be as low as reasonably achievable and will not exceed limits designated in the CNP Technical Specifications.

The review of this fire area, with respect to radioactive release, is documented in the NFPPM.

### **3.6 Probabilistic Risk Assessment-Summary of Results**

A Fire PRA (FPRA) quantification of Fire Area AA3 was performed and is documented in PRA-NB-FIRE-FQ, Fire PRA Model Quantification Notebook. The fire risk quantification for Fire Area AA3 is analyzed using detailed fire modeling to consider risk of fire scenarios of ignition sources. PRA-NB-FIRE-FQ includes a summary of all potentially risk-significant fire scenarios (i.e., CDF > 1.0E-7 or LERF > 1.0E-8). Bounding CDF / LERF per calendar year values are reported that are based on the risk values documented in PRA-NB-FIRE-FSS, Fire PRA Fire Scenario Selection.

Fire Protection features credited in the Fire PRA are documented in R1900-0411-AA3, Detailed Fire Modeling Report: Fire Compartment: AA3 Unit 1 and Unit 2 Auxiliary Building and Fuel Handling Areas (EL. 609 FT, 633 FT and 650 FT). PRA-NB-FIRE-FSS documents the revision level of the fire modeling reports used in the most recent Fire PRA quantification.

### 3.7 Risk-Informed, Performance-Based Evaluations

Fire Risk Evaluations (FREs) have been performed to ensure that variances from the NFPA 805 deterministic requirements are acceptable. The evaluation process consists of an integrated assessment of the acceptability of risk, defense-in-depth, and safety margins.

#### 3.7.1 Transition Risk-Informed, Performance-Based Evaluations

The ‘changes’ associated with NFPA 805 transition were those variances from the deterministic requirements of NFPA 805 or with the existing fire protection licensing basis that were brought into compliance with the NFPA 805 performance based approach. The change identified for evaluation for Fire Area AA3 is as follows:

- Separation Issues

The Fire Risk Evaluation has determined that the change is acceptable based upon:

- The measured change in CDF and LERF.
- Adequate defense-in-depth and safety margins being maintained.

Refer to Attachment 2 for a summary of results associated with the Fire Risk Evaluations.

### 3.8 Defense-in-Depth

A comprehensive risk-informed, performance-based analysis includes consideration of defense-in-depth (DID) as part of an integrated evaluation of risk considerations. In general, defense-in-depth involves consideration of the extent to which fire protection systems and features are provided within the three echelons of fire-protection:

- Preventing fires from starting,
- Rapidly detecting fires and controlling and extinguishing promptly those fires that do occur, thereby limiting fire damage,
- Providing an adequate level of fire protection for structures, systems, and components important to safety, so that a fire that is not promptly extinguished will not prevent the nuclear safety performance criteria from being met.

Each VFDR was evaluated for DID. The following recovery actions have been retained for DID.

VFDR No. AA3-002: 1-MRV-223-P and 1-MRV-233-P - SG 2 and 3 PORVs are required to be closed to support main steam isolation. Main steam isolation provides integrity of the secondary side of the SGs to prevent uncontrolled cooldown through over-steaming. SG 2 and 3 PORVs could spuriously open due cable failures cause by a full area fire within Fire Area AA3. These failures can be mitigated by locally venting air to close to the SG 2 and 3 PORVs. This recovery action is being retained for DID to ensure main steam isolation is maintained.

VFDR No. AA3-008: 2-MRV-223-P and 2-MRV-233-P - SG 2 and 3 PORVs are required to be closed to support main steam isolation. Main steam isolation provides integrity of the secondary side of the SGs to prevent uncontrolled cooldown through over-steaming. SG 2 and 3 PORVs could spuriously open due cable failures cause by a full area fire within Fire Area AA3. These failures can be mitigated by locally venting air to close to the SG 2 and 3 PORVs. This recovery action is being retained for DID to ensure main steam isolation is maintained.

VFDR No. AA3-011: 1-NSO-023 and 1-NSO-024 - RX Head Vent Valves are required to be closed to support RCS Integrity. RCS integrity is required to maintain positive control over RCS inventory and pressure. 1-NSO-023 and 1-NSO-024 are in series requiring one of the valves to remain closed to provide RCS integrity. The spurious opening can be mitigated by de-energizing the valve to fail it closed. This recovery action is being retained for DID to ensure RCS pressure and inventory control is maintained.

VFDR No. AA3-012: 1-NSO-063 and 1-NSO-064 - Post Accident Vent Valves are required to be closed to support RCS integrity. RCS integrity is required to maintain positive control over RCS inventory and pressure. 1-NSO-063 and 1-NSO-064 are in series requiring one of the valves to remain closed to provide RCS integrity. The spurious opening can be mitigated by de-energizing the valve to fail it closed. This recovery action is being retained for DID to ensure RCS pressure and inventory control is maintained.

VFDR No. AA3-013: 2-DCR-310 and 2-DCR-340 - SG 1 and 4 Blowdown Isolation Valves are required to be closed to support main steam isolation. Main steam isolation is required to prevent uncontrolled cooldown through over-steaming. SG 1 and 4 Blowdown Isolation Valves may fail due to a full area fire within Fire Area AA3. Loss of Main Steam isolation can be mitigated by removing fuses to ensure valves fail shut. This recovery action is being retained for DID to ensure Main Steam

isolation is maintained.

VFDR No. AA3-014: 2-NSO-023 and 2-NSO-024 - RX Head Vent Valves are required to be closed to support

RCS integrity. RCS integrity is required to maintain positive control over RCS inventory and pressure. 2-NSO-023 and 2-NSO-024 are in series requiring one of the valves to be closed to maintain RCS integrity. The spurious opening can be mitigated by de-energizing the valve to fail it closed. This recovery action is being retained for DID to ensure RCS pressure and inventory control is maintained.

VFDR No. AA3-015: 2-NSO-063 and 2-NSO-064 - Post Accident Vent Valves are required to be closed to support

RCS integrity. RCS integrity is required to maintain positive control over RCS inventory and pressure. 2-NSO-063 and 2-NSO-064 are in series requiring one of the valves to be closed to maintain RCS integrity. The spurious opening can be mitigated by de-energizing the valve to fail it closed. This recovery action is being retained for DID to ensure RCS pressure and inventory control is maintained.

VFDR No. AA3-016: 1-QVR-10, 1-QVR-40, 2-QVR-10 and 2-QVR-40 - RCP Seal Water Return Isolation Valves are required to be open to support RCS integrity by maintaining the RCP seal. RCS integrity is required to maintain positive control over RCS inventory and pressure. The spurious closing can be mitigated by de-energizing the valve to fail it open. This recovery action is being retained for DID to ensure RCS integrity is maintained.

Based on the assessment in support of the Fire Risk Evaluation, defense-in-depth is maintained for fire area AA3. Refer to Attachment 2 for details associated with the Fire Risk Evaluation.

### 3.9 Monitoring Program Input

A Monitoring Program will be developed in accordance with FAQ 10-0059, Rev. 1. Methods to monitor availability, reliability, and performance of fire protection program structures, systems, and components (SSCs), as well as programmatic elements will be provided. Additionally, effectiveness measures are established to review program related performance and trends. For AA3 the following systems and features are candidates for inclusion in the CNP Fire Protection Monitoring Program:

- Fire area and zone boundary barriers discussed in Section 3.1
- Fire Detection System
- Fire Suppression System
- Cable tray covers

### 4.0 CONCLUSION

The nuclear safety and radioactive release performance criteria of NFPA 805 are met for a fire in Fire Area AA3. This Fire Risk Evaluation for Fire Area AA3 has demonstrated that

- The change in core damage frequency (delta CDF) is acceptable, and
- The change in large early release frequency (delta LERF) is acceptable, and
- Defense-in-depth and safety margins are maintained.

This is confirmation that a success path effectively remains free of fire damage and that the performance-based approach is acceptable per Section 4.2.4.2 of NFPA 805.

## **5.0 REFERENCES**

- 5.1 Calculation PRA-FIRE-NB-CRE, Fire PRA Cumulative Risk Evaluations
- 5.2 CNP Fire Pre-Plans, Volumes I, II, and III, Revisions 17, 14, and 18 respectively
- 5.3 Fire Hazards Analysis
- 5.4 NFPA 805, Performance-Based Standard for Fire Protection for Light Water Reactor Electric Generating Plants
- 5.5 NFPPM, NFPA 805 Fire Protection Program Manual (NFPPM)
- 5.6 Nuclear Energy Institute (NEI) 04-02, Guidance for Implementing a Risk-Informed, Performance-Based Fire Protection Program under 10 CFR 50.48(c), Rev. 2
- 5.7 Nuclear Safety Capability Assessment Report
- 5.8 PRA-NB-FIRE-FQ, Fire PRA Model Quantification Notebook
- 5.9 PRA-NB-FIRE-FSS, Fire PRA Fire Scenario Selection
- 5.10 R1900-0411-AA3, AA3 - Detailed Fire Modeling Report
- 5.11 Regulatory Guide 1.205, Risk-Informed, Performance-Based Fire Protection for Existing Light-Water Nuclear Power Plants, Rev. Revision 1
- 5.12 Technical Evaluation R1900-005-001, Non-Power Operation Modes Transition Review

**Fire Area AA3 – Attachment 1 - Table B-3 - Fire Area Transition**

<b><u>Unit</u></b>	<b><u>Fire Area</u></b>	<b><u>Description</u></b>
1, 2	AA3	Unit 1 and Unit 2 Auxiliary Building and Fuel Handling Areas (El. 609 ft., 633 ft. and 650 ft.)

<b><u>Fire Zone</u></b>	<b><u>Description</u></b>
3	Drumming/Drum Storage - El. 587 ft. 0 in.
31	Concrete Mixing Building/Drumming Area - El. 609 ft. 0 in.
32	Cask Handling Area - El. 609 ft. 0 in. - Both Units
35	Instrument Calibration Room - El. 609 ft. 0 in.
36	Spent Fuel Pit Heat Exchanger Pump Room - El. 609 ft. 0 in.
48	New Fuel Storage Room - El. 633 ft. 0 in.
49	HVAC Vestibule - El. 633 ft. 0 in. - Unit 1
50	HVAC Vestibule - El. 633 ft. 0 in. - Unit 2
51	Auxiliary Building - El. 633 ft. 0 in. (East End) - Both Units
52	Auxiliary Building - El. 633 ft. 0 in. (West End) - Both Units
69	Auxiliary Building - El. 633 ft. 0 in. and 650 ft. 0 in. - Both Units
106	Aux. F.W. Battery Room #1 - Auxiliary Building - El. 633 ft. 0 in. - Unit 1
107	Aux. F.W. Battery Room #2 - El. 633 ft. 0 in. - Unit 2

**Regulatory Basis**

4.2.4.2 - Performance-Based Approach - Fire Risk Evaluation with simplifying deterministic assumptions

<b>Performance Goal</b>	<b>Method of Accomplishment</b>	<b>Comments</b>
<b>Reactivity Control</b>	Unit 1 - Trip the reactor from the Control Room. Borate using Unit 2 East or West Charging Pump supplied from the Unit 2 RWST injecting through the Unit 1 BIT. Use source range monitoring for indication for Unit 1.  Unit 2 - Trip reactor from the Control Room. Borate using Unit 1 East or West Charging Pump supplied from the RWST injecting through the Unit 1 BIT. Use source range monitoring for indication for Unit 2.	VFDR identified for Unit 2 RWST level indication.
<b>Inventory and Pressure Control</b>	Unit 1 - Control inventory using Unit 2 East or West Charging Pump. Control pressure using Unit 1 Pressurizer Safety Relief Valves.  Unit 2 - Control inventory using Unit 1 East or West Charging Pump. Control	VFDRs identified for Unit 1 and Unit 2 RX Head Vent Valves, Post Accident Vent Valves and RCP Seal Water Return Valves.

**Fire Area AA3 – Attachment 1 - Table B-3 - Fire Area Transition**

<u>Unit</u>	<u>Fire Area</u>	<u>Description</u>
1, 2	AA3	Unit 1 and Unit 2 Auxiliary Building and Fuel Handling Areas (El. 609 ft., 633 ft. and 650 ft.)
Decay Heat Removal		<p>pressure using Unit 2 Pressurizer Safety Relief Valves.</p> <p>Unit 1 - Feed SGs 1 &amp; 4 with Unit 1 West MDAFW Pump. The DHR function also requires MS isolation with a steam release path through the Safety Relief Valves.</p> <p>Unit 2 - Feed SGs 1 &amp; 4 with Unit 2 West MDAFW Pump. The DHR function also requires MS isolation with a steam release path through the Safety Relief Valves.</p>
Process Monitoring		<p>Unit 1 Process Monitoring - Use Unit 1 process monitoring in the Control Room for the following: Pressurizer level, RCS pressure and temperature, and S/G level and Pressure.</p> <p>Unit 1 Source Range Monitoring - Use Unit 1 alternate source range monitoring powered from Unit 2 at the local shutdown panels.</p> <p>Unit 2 Process Monitoring - Use Unit 2 process monitoring in the Control Room for the following: Pressurizer level, RCS pressure and temperature, and S/G level and Pressure.</p> <p>Unit 2 Source Range Monitoring - Use Unit 2 source range monitoring in the Control Room.</p>
Vital Auxiliaries		<p>Unit 1 Electrical - Control Unit 1 Red (AB) Train Electrical Distribution with Unit 1 Red (AB) Train Offsite Power or Unit 1 Red (AB) DG. Control Unit 1 Green (CD) Train Electrical Distribution with Unit 1 Green (CD) Train Offsite Power or Unit 1 Green (CD) DG.</p> <p>Unit 1 ESW - Operate Unit 1 West ESW.</p> <p>Unit 1 CCW - Operate Unit 1 West CCW.</p> <p>Unit 1 HVAC - Temporary ventilation required for Unit 1 Control Room HVAC. Operate Unit 1 Auxiliary Building HVAC. Operate Unit 1 Red (AB) and Green (CD) DG HVAC. Operate Unit 1 Switchgear HVAC. Operate Unit 1 AFW Pump Room HVAC systems. Operate Unit 1 East and West ESW HVAC system.</p> <p>Unit 2 Electrical - Control Unit 2 Red (AB) Train Electrical Distribution with Unit 2 Red (AB) Train Offsite Power or Unit 2 Red (AB) DG. Control Unit 2 Green (CD) Train Electrical Distribution with Unit 2 Green (CD) Train Offsite</p>

**Fire Area AA3 – Attachment 1 - Table B-3 - Fire Area Transition**

<u>Unit</u>	<u>Fire Area</u>	<u>Description</u>
1, 2	AA3	Unit 1 and Unit 2 Auxiliary Building and Fuel Handling Areas (El. 609 ft., 633 ft. and 650 ft.)
		Power or Unit 2 Green (CD) DG. Unit 2 ESW - Operate Unit 2 West ESW. Unit 2 CCW - Operate Unit 2 West CCW. Unit 2 HVAC - Temporary ventilation required for Unit 2 Control Room HVAC. Operate Unit 2 Auxiliary Building HVAC. Operate Unit 2 Red (AB) and Green (CD) DG HVAC. Operate Unit 2 Switchgear HVAC. Operate Unit 2 AFW Pump Room HVAC systems. Operate Unit 2 East and West ESW HVAC system.

**Reference Documents**

Genesis Solution Suite, EDISON / SAFE-PB, DC Cook V 3.4.0

Nuclear Safety Capability Assessment Report

**Licensing Actions**

None

**Existing Engineering Equivalency Evaluations (EEEE)****EEEE Title Engineering Equivalency Evaluation 9-3 - CCW Pump Air Supply Duct Evaluation: Fire Zone 44S (Fire Area AA36/42)**

**Summary** The purpose of this engineering equivalency evaluation is to document the acceptability of the common supply air duct for the Unit 1, Unit 2 and spare CCW pumps located at elevation 609 ft. of the Auxiliary Building in Fire Zone 44S (Fire Area AA36/42). This engineering equivalency evaluation does not adversely impact other engineering equivalency evaluations or exemption requests.

A fire-rated damper is required at the point where the main duct enters at the top of the air shaft from Fire Zone 52 on the 633 ft. elevation; however, fire-rated dampers are not required at any of the branch ducts to the CCW pump supply air hoods. This engineering equivalency evaluation does not adversely impact other engineering equivalency evaluations.

The ducts were evaluated and found to be acceptable based on the fire hazards, fire protection systems and construction features within the evaluated areas.



**Fire Area AA3 – Attachment 1 - Table B-3 - Fire Area Transition**

<u>Unit</u>	<u>Fire Area</u>	<u>Description</u>
1, 2	AA3	Unit 1 and Unit 2 Auxiliary Building and Fuel Handling Areas (El. 609 ft., 633 ft. and 650 ft.)
<b><u>EEEE Title</u></b>	<b>Engineering Equivalency Evaluation 9-4 - Auxiliary Building Vertical Air Shafts Evaluation: Fire Zones 12 (Fire Area AA11) and 22 (Fire Area AA27)</b>	
<b><u>Summary</u></b>	<p>The purpose of this engineering equivalency evaluation is to document the acceptability of two vertical air shafts, located in the Auxiliary Building (Fire Areas AA11 and AA27), that extend from the 573 ft. elevation to just below the 650 ft. elevation with dampered and undampered ventilation openings.</p> <p>Reasonable assurance is provided that a fire in any of the adjoining fire areas to the Auxiliary Building air shafts with undampered or unrated duct penetrations or a fire in either air shaft will not adversely impact on safe shutdown capabilities of CNP. In addition, this engineering equivalency evaluation does not adversely impact other engineering equivalency evaluations.</p> <p>The air shafts were evaluated and found to be acceptable based on the fire hazards, fire protection systems and construction features within the evaluated areas.</p>	
<b><u>EEEE Title</u></b>	<b>Engineering Equivalency Evaluation 9-18 - Fire Zone 52 (Fire Area AA3) and Fire Zone 59 (Fire Area AA52) Hatch Evaluation</b>	
<b><u>Summary</u></b>	<p>The purpose of this engineering equivalency evaluation is to document the acceptability of an unrated steel plate floor hatch located between the 633 ft. elevation of the Auxiliary Building and the Auxiliary Cable Vault in Fire Zones 52 (Fire Area AA3) and 59 (Fire Area AA52) respectively. A 3-hr fire-rated hatch assembly is not commercially available for use in this location.</p> <p>Note: This engineering equivalency evaluation has been reviewed by the NRC. Refer to NRC SER dated June 17, 1988, for acceptance of unrated fire hatches in fire area boundaries. The NRC concluded that the level of fire safety is equivalent to that achieved by conformance with the guidelines of Section D.1.j of Appendix A to BTP APCSB 9.5-1, and, therefore, the deviations for the unrated fire hatches were found acceptable.</p> <p>Reasonable assurance is provided that a fire in Fire Zone 52 or Fire Zone 59 would not impair safe shutdown capabilities of Unit 1 or Unit 2. This engineering equivalency evaluation does not adversely impact other engineering equivalency evaluations.</p> <p>The hatch was evaluated and found to be acceptable based on the fire hazards and fire protection systems within the evaluated areas.</p>	

**Fire Area AA3 – Attachment 1 - Table B-3 - Fire Area Transition**

<u>Unit</u>	<u>Fire Area</u>	<u>Description</u>
1, 2	AA3	Unit 1 and Unit 2 Auxiliary Building and Fuel Handling Areas (El. 609 ft., 633 ft. and 650 ft.)

<b><u>EEEE Title</u></b>	<b>Engineering Equivalency Evaluation 9-34 - Fire Zone 36 (Fire Area AA3) to Fire Zone 5 (Fire Area AA5/6) Boundary Evaluation</b>
<b><u>Summary</u></b>	<p>The purpose of this engineering equivalency evaluation is to document the acceptability of an undampered duct penetrating the barrier separating Fire Zone 36 (Fire Area AA3) from Fire Zone 5 (Fire Area AA5/6).</p> <p>Reasonable assurance is provided that the undampered ventilation duct passing through the barrier separating Fire Zones 5 and 36 will not impact either safe shutdown capability or other engineering equivalency evaluations or exemptions.</p> <p>The duct was evaluated and found to be acceptable based on the fire hazards and fire protection systems within the evaluated areas.</p>
<b><u>EEEE Title</u></b>	<b>Engineering Equivalency Evaluation 9-37 - Fire Zones 5 (Fire Area AA5/6) and 32 (Fire Area AA3) Boundary Evaluations</b>
<b><u>Summary</u></b>	<p>The purpose of this engineering equivalency evaluation is to document the acceptability of: (1) an undampered duct; (2) unrated construction including an unrated door; and (3) several minor unsealed penetrations in the wall and ceiling of a stairway enclosure separating Fire Zone 5 (Fire Area AA5/6) from Fire Zone 32 (Fire Area AA3).</p> <p>Reasonable assurance is provided that the undampered ventilation duct, unrated door, unrated construction, and unsealed penetrations through the barriers separating Fire Zones 5 and 32 will not impact the redundant safe shutdown capability for either fire zone. This engineering equivalency evaluation does not adversely impact other engineering equivalency evaluations or exemption requests and is limited in scope to those items stated above.</p> <p>The duct, door and penetrations were evaluated and found to be acceptable based on the fire hazards, fire protection systems and construction features within the evaluated areas.</p>

**Fire Area AA3 – Attachment 1 - Table B-3 - Fire Area Transition**

<b><u>Unit</u></b>	<b><u>Fire Area</u></b>	<b><u>Description</u></b>
1, 2	AA3	Unit 1 and Unit 2 Auxiliary Building and Fuel Handling Areas (El. 609 ft., 633 ft. and 650 ft.)

<b><u>EEEE Title</u></b>	<b>Engineering Equivalency Evaluation 9-38 - Fire Zone 69 (Fire Area AA3) to Fire Zones 108 (Fire Area AA2) and 109 (Fire Area AA2) Boundary Evaluation</b>
<b><u>Summary</u></b>	<p>The purpose of this engineering equivalency evaluation is to document the acceptability of undampened containment instrumentation room exhaust ductwork that penetrate the barriers separating Fire Zone 69 (Fire Area AA3) from Fire Zones 108 (Fire Area AA2) and 109 (Fire Area AA2). The purpose of this engineering equivalency evaluation is to demonstrate that it does not adversely impact other engineering equivalency evaluations or exemption requests.</p> <p>The undampened piping/ductwork does not affect safe shutdown due to the low combustible loading, automatic detection in Fire Zone 69, and a lack of credible fire events (based on this and previous engineering equivalency evaluations involving these areas). This engineering equivalency evaluation does not adversely impact other engineering equivalency evaluations or exemption requests.</p> <p>The penetrations were evaluated and found to be acceptable based on the fire hazards and fire protection systems within the evaluated areas.</p>
<b><u>EEEE Title</u></b>	<b>Engineering Equivalency Evaluation 9-41 - Fire Zones 37 (Fire Area AA36/42) and 51 (Fire Area AA3) HVAC Duct Penetrations</b>
<b><u>Summary</u></b>	<p>The purpose of this engineering equivalency evaluation is to document the acceptability of 15 undampened HVAC penetrations connecting the 617 ft. and 633 ft. elevations of the Auxiliary Building between Fire Zones 37 (Fire Area AA36/42) and 51 (Fire Area AA3).</p> <p>Reasonable assurance is provided that a fire starting from Fire Zones 37 and/or 44N and propagating through the undampened ducts to Fire Zone 51 and 52 will not adversely impact safe shutdown capabilities of CNP. This engineering equivalency evaluation also verifies that there is no adverse impact to other engineering equivalency evaluations.</p> <p>The HVAC penetrations were evaluated and found to be acceptable based on the fire protection systems and construction features within the evaluated areas.</p>

**Fire Area AA3 – Attachment 1 - Table B-3 - Fire Area Transition**

<b><u>Unit</u></b>	<b><u>Fire Area</u></b>	<b><u>Description</u></b>
1, 2	AA3	Unit 1 and Unit 2 Auxiliary Building and Fuel Handling Areas (El. 609 ft., 633 ft. and 650 ft.)
<hr/>		
<b><u>EEEE Title</u></b>	<b>Engineering Equivalency Evaluation 11-1 - Auxiliary Building Elevation 587 ft. to Spent Fuel Heat Exchanger Pit Pump Room Hatch Boundary Evaluation Fire Zone 5 (Fire Area AA5/6) and Fire Zone 36 (Fire Area AA3) Hatch Evaluation</b>	
<b><u>Summary</u></b>	<p>The purpose of this engineering equivalency evaluation is to document the acceptability of an unrated steel plate floor hatch located between the east end of the Auxiliary Building in Fire Zone 5 (Fire Area AA5/6) at elevation 587 ft. and the spent fuel heat exchanger pit pump room in Fire Zone 36 (Fire Area AA3) at elevation 609 ft. A 3-hr fire-rated hatch assembly is not commercially available for use in this location.</p> <p>Reasonable assurance is provided that the unrated steel plate hatch passing through the barrier separating Fire Zones 5 and 36 will not impact redundant safe shutdown capability. This engineering equivalency evaluation does not adversely impact other engineering equivalency evaluations.</p> <p>The unrated steel plate floor hatch was evaluated and found to be acceptable based on the fire hazards, fire protection systems and construction features within the areas.</p>	
<b><u>EEEE Title</u></b>	<b>Engineering Equivalency Evaluation 11-9 - Turbine, Auxiliary and Containment Buildings Boundary Evaluation</b>	
<b><u>Summary</u></b>	<p>The purpose of this engineering equivalency evaluation is to describe in general, the approach and existence of evaluations performed to determine and reconcile fire area boundaries having components or designs with less than a 3-hr fire rating on preventing the spread of fire. This engineering equivalency evaluation also specifically evaluates the impact of unrated door assemblies on the spread of fire.</p> <p>Reasonable assurance is provided that the fire area boundaries having components or design less than a 3-hr fire rating will not increase the spread of fire or impair the safe shutdown capabilities of Units 1 or 2. In addition, this engineering equivalency evaluation does not adversely impact on other engineering equivalency evaluations or exemption requests.</p> <p>This evaluation supports additional evaluations credited in this fire area.</p>	

**Fire Area AA3 – Attachment 1 - Table B-3 - Fire Area Transition**

<u>Unit</u>	<u>Fire Area</u>	<u>Description</u>
1, 2	AA3	Unit 1 and Unit 2 Auxiliary Building and Fuel Handling Areas (El. 609 ft., 633 ft. and 650 ft.)
<b><u>EEEE Title</u></b>	<b>Engineering Equivalency Evaluation 11-12 - Stairwells and Elevator Construction and Boundary Evaluation (Fire Analysis Areas AA 1, AA2, AA3, AA5/6, AA3 6 and AA42)</b>	
<b><u>Summary</u></b>	<p>The purpose of this engineering equivalency evaluation is to document the acceptability of the rated and unrated fire barriers of the stairwells and elevators located in the Turbine and Auxiliary Buildings for their impact on preventing the spread of fire in Fire Areas AA1, AA2, AA3, AA5/6, and AA36/42.</p> <p>Reasonable assurance is provided that the open stairwells and elevators of the Turbine and Auxiliary Buildings will not result in an increased potential for the spread of fire or potential impairment of the safe shutdown capabilities of Unit 1 or Unit 2. This engineering equivalency evaluation does not impact other engineering equivalency evaluations.</p> <p>The stairwells and elevator boundaries were evaluated and found to be acceptable based on the fire hazards, fire protection systems and construction features within the areas.</p>	
<b><u>EEEE Title</u></b>	<b>Engineering Equivalency Evaluation 11-14 - Cable Spreading Room Construction Boundary Evaluation (Fire Areas AA3, AA7, AA8, AA9, AA10, AA29, AA30, AA31, AA34, AA35, AA36/42, AA37, AA38, AA48, AA50, AA51 and AA52)</b>	
<b><u>Summary</u></b>	<p>The purpose of this engineering equivalency evaluation is to document the acceptability of the construction features of the cable spreading rooms which have a fire resistance rating of less than 3 hours for their impact on the spread. In particular, fire dampers having a 1 1/2-hr fire rating were analyzed by this evaluation. Other unrated construction features have been previously analyzed under separate engineering equivalency evaluations. The applicable fire areas include: AA3, AA7, AA8, AA9, AA10, AA29, AA30, AA31, AA34, AA35, AA36/42, AA37, AA38, AA48, AA50, AA51 and AA52.</p> <p>Reasonable assurance is provided that the construction features of the cable spreading rooms which have a fire resistance rating of less than 3 hours will prevent the spread of fire and not impair the safe shutdown capabilities of Unit 1 and Unit 2. In addition, this engineering equivalency evaluation does not adversely impact other engineering equivalency evaluations.</p> <p>The construction features of the cable spreading room were evaluated and found to be acceptable based on the fire hazards, fire protection systems and construction features within the areas.</p>	

**Fire Area AA3 – Attachment 1 - Table B-3 - Fire Area Transition**

<u>Unit</u>	<u>Fire Area</u>	<u>Description</u>
1, 2	AA3	Unit 1 and Unit 2 Auxiliary Building and Fuel Handling Areas (El. 609 ft., 633 ft. and 650 ft.)

<b><u>EEEE Title</u></b>	<b>Engineering Equivalency Evaluation 11-18 - Fire Zones 3, 31, 32, and 35 (Fire Area AA3) Boundary Evaluation</b>
<b><u>Summary</u></b>	<p>The purpose of this engineering equivalency evaluation is to document the acceptability of the unrated construction features of the radwaste area boundaries in Fire Area AA3 for their impact on the spread of fire.</p> <p>Reasonable assurance is provided that the unrated construction features of the radwaste area boundaries will not result in an increased potential for the spread of fire or potential impairment of the safe shutdown capabilities of Units 1 and Unit 2. This engineering equivalency evaluation does not impact other engineering equivalency evaluations.</p> <p>The unrated boundary construction features were evaluated and found to be acceptable based on the fire hazards and the fire protection systems and features within the evaluated areas.</p>
<b><u>EEEE Title</u></b>	<b>Engineering Equivalency Evaluation 11-37 - Fire Zones 52 (Fire Area AA3) and Fire Zone 44N (Fire Area AA36/42) Hatch Evaluation</b>
<b><u>Summary</u></b>	<p>The purpose of this engineering equivalency evaluation is to document the acceptability of an unrated Auxiliary Building floor hatch between Fire Zones 52 (Fire Area AA3) and 44N (Fire Area AA36/42) on preventing the spread of fire. This engineering equivalency evaluation determines the impact that the unrated floor hatch will have on other engineering equivalency evaluations or exemption requests.</p> <p>Reasonable assurance is provided that the unrated floor/ceiling hatch located at the 633 ft. elevation of the Auxiliary Building will not impair the safe shutdown capabilities of CNP or increase the spread of fire between Fire Zones 52 and 44N.</p> <p>The unrated floor hatch was evaluated and found to be acceptable based on the fire hazards, fire protection systems and construction features within the evaluated areas.</p>

**Fire Area AA3 – Attachment 1 - Table B-3 - Fire Area Transition**

<u>Unit</u>	<u>Fire Area</u>	<u>Description</u>
1, 2	AA3	Unit 1 and Unit 2 Auxiliary Building and Fuel Handling Areas (El. 609 ft., 633 ft. and 650 ft.)
<b><u>EEEE Title</u></b>	<b>Engineering Equivalency Evaluation 11-44 - Unrated Fire Doors (361 and 362) and Unrated Personnel Walkways (AA3, AA34, AA35, and AAYD)</b>	
<b><u>Summary</u></b>	<p>The purpose of this engineering equivalency evaluation is to document the acceptability of the impact the erection of new personnel walkways in each operating unit will have on the expansion of an existing fire area boundary and an existing area that neighbors other fire areas, on the potential spread of fire.</p> <p>The defense-in-depth fire protection philosophy installed in these areas adequately protects the fire safety of the plant and that the installed unrated personnel walkways and doors #361 and #362 are acceptable. The personnel walkways in each unit will not impair the safe shutdown capability of CNP, aid in the spread of fire between fire areas or jeopardize existing fire area boundaries. This engineering equivalency evaluation does not impact other engineering equivalency evaluations.</p> <p>The personnel walkways were evaluated and found to be acceptable based on the fire hazards, fire protection systems and construction features within the evaluated areas.</p>	
<b><u>EEEE Title</u></b>	<b>Engineering Equivalency Evaluation 11-45 - Auxiliary Building HVAC Duct Penetrations Boundary Evaluation Fire Analysis Areas AA1, AA3, AA5/6 and AA36/42</b>	
<b><u>Summary</u></b>	<p>The purpose of this engineering equivalency evaluation is to document the acceptability of not installing fire dampers in the ventilation system duct penetrations that communicate between fire areas vertically from elevation to elevation in Fire Areas AA1, AA3, AA5/6, and AA36/42. The ventilation ducts associated with the 22 penetrations were located on HVAC drawings showing the entire flow path of each duct. Penetrations into fire zones/areas equipped with rated fire dampers were eliminated and what remained is discussed in this engineering equivalency evaluation.</p> <p>This analysis verifies that the safe shutdown system requirements relative to the guidelines of NFPA 805 are being met, and the exclusion of fire dampers in the ventilation ducts is justified.</p> <p>The ventilation ducts were evaluated and found to be acceptable based on the fire hazards, fire protection systems and construction features within the evaluated areas.</p>	

**Fire Area AA3 – Attachment 1 - Table B-3 - Fire Area Transition**

<b><u>Unit</u></b>	<b><u>Fire Area</u></b>	<b><u>Description</u></b>
1, 2	AA3	Unit 1 and Unit 2 Auxiliary Building and Fuel Handling Areas (El. 609 ft., 633 ft. and 650 ft.)
<hr/>		
<b><u>EEEE Title</u></b>	<b>Engineering Equivalency Evaluation 11-46 - Seismic Gaps between the Containment and Auxiliary Buildings Boundary Evaluation (Fire Areas AA2, AA3, AA7, AA8, AA9, AA10, AA11, AA27, AA29, AA30, AA31, AA34, AA35, AA37 and AA38)</b>	
<b><u>Summary</u></b>	<p>A seismic gap exists around the Containment Building of each unit that provides an opening of approximately 6 in. between the Containment Building and the walls, ceilings and floors of the structures immediately adjacent to containment. These Fire Areas include AA2, AA3, AA7, AA8, AA9, AA10, AA11, AA27, AA29, AA30, AA31, AA34, AA35, AA37 and AA38. This engineering equivalency evaluation has been performed to document the acceptability of these seismic gaps in the fire boundaries.</p> <p>This seismic gap evaluation shows the safe shutdown capability for CNP Unit 1 and Unit 2 has not been compromised as a result of seismic gaps. The analysis performed and the results presented in the tables indicate, on a system basis, the capability to safely shut down both units when considering fire damage to safe shutdown components and circuits contained in the seismic gap evaluation areas. The method of analysis is conservative when considering the fire hazards involved in the vicinity of the seismic gaps. That is, it is not anticipated that the evaluated areas would be affected to the extent that fire would propagate through the seismic gaps and cause damage throughout the evaluated area. This engineering equivalency evaluation has no impact on the exemption requests contained in other engineering equivalency evaluations.</p> <p>The seismic gaps were evaluated and found to be acceptable based on the fire hazards, fire protection systems and construction features within the evaluated areas.</p>	
<b><u>EEEE Title</u></b>	<b>Engineering Equivalency Evaluation 11-47 - Fire Zones 44N (Fire Area AA36/42), 44S (Fire Area AA36/42) and 52 (Fire Area AA3) Penetration Seals</b>	
<b><u>Summary</u></b>	<p>The purpose of this engineering equivalency evaluation is to document the acceptability of fire-rated penetration seals F-6414, F-6415 and F-6417. The seals are physically located in the floor of Fire Zone 52 (Aux. Bldg. 633 ft.) which communicates with Fire Zones 44N and 44S (Aux. Bldg. 609 ft.) below. The seals separate Fire Areas AA3 and AA36/42.</p> <p>Basis for the engineering equivalency evaluation is regulatory guidance provided in Generic Letter 86-10 and NUREG 1552, which endorses the concept of defense-in-depth for fire protection evaluation. In summary, the engineering equivalency evaluation concludes the subject seals provide an acceptable level of fire protection.</p> <p>The existing configuration for fire-rated penetration seals F6414, F6415 and F6417 is acceptable and will not affect the stations ability to achieve and maintain safe shutdown.</p> <p>The fire rated penetration seals were evaluated and found to be acceptable based on the fire hazards and fire protection systems within the evaluated areas.</p>	



**Fire Area AA3 – Attachment 1 - Table B-3 - Fire Area Transition**

<u>Unit</u>	<u>Fire Area</u>	<u>Description</u>
1, 2	AA3	Unit 1 and Unit 2 Auxiliary Building and Fuel Handling Areas (El. 609 ft., 633 ft. and 650 ft.)

**EEEE Title** Engineering Equivalency Evaluation 12-11 - Structural Steel Evaluations in Fire Areas AA2, AA3, AA34, AA35, AA56 and AA58.

**Summary** The purpose of this engineering equivalency evaluation is to document the acceptability of the unprotected structural steel located throughout CNP and ensure its ability to withstand the fire exposure presented by combustibles present in the area. This engineering equivalency evaluation is concerned with structural steel members that form a part of or support fire barriers required by NFPA 805, Chapter 4.

Reasonable assurance is provided that exposed structural steel supporting fire barriers will not be adversely impacted by the combustibles or hazards present in the areas evaluated. In addition, reasonable assurance is provided that falling structures supported by structural steel will not have an adverse impact on other fire barriers inside the area that are required for separation of safe shutdown components.

The unprotected structural steel was evaluated and found to be acceptable based on the fire hazards and fire protection systems within the evaluated areas.

**Fire Suppression Effects on Nuclear Safety Performance Criteria**

The CNP fire brigade is trained to discharge water in a judicious manner and instructed to direct hose streams and portable extinguishers at the base of the fire to limit the amount of overspray beyond the immediate fire zone. For this reason, fire brigade activities are not expected to fail components which are not immediately involved in the fire scenario. It has been concluded that water impingement on cables is not a concern. Electrical cabinets are provided with a seal at the conduit interface to prevent water intrusion. Per visual inspection any side vents for this equipment are pointed downward to prevent water intrusion. Therefore, in the event of discharge, the pre-action system will not adversely effect the other equipment operating within the fire zone. The drainage features of the fire area mitigate the potential for flooding damage due to fire suppression, such that the standing water would not affect credited equipment.

Since it is shown that suppression effects will not impact the nuclear safety performance criteria, the fire area configuration is deemed acceptable.

**References:**

Technical Evaluation 12.1, "Fire Suppression Effects Study"

Technical Evaluation 12.1, "Supplemental Information to Fire Suppression Effects Study – Supplement 1"

**Fire Area Comments**

None

## Fire Area AA3 – Attachment 2 - Fire Risk Evaluation Results Summary

### A2.1 Introduction

The ‘changes’ associated with NFPA 805 transition were those variances from the deterministic requirements of NFPA 805. The changes identified for evaluation for fire area AA3 are grouped as follows:

- Separation Issues

This attachment is a summary of the Fire Risk Evaluation for the fire area. The complete results and methodology are contained in the Cumulative Fire Risk Evaluation, PRA-FIRE-NB-CRE. (FPCE 2017-0009)

### A2.2 Inputs/Assumptions

Fire modeling processes and inputs provided in NUREG/CR-6850 are appropriate for use in a risk-informed, performance-based evaluation. The complete list of assumptions used in the fire modeling methodology for this fire area is contained in Detailed Fire Modeling Technical Evaluation R1900-0411-AA3.

### A2.3 Fire Modeling Methodology

Fire PRA fire modeling results are used as the initial input into this Fire Risk Evaluation. The process consists of conservative bounding analyses using NUREG/CR-6850 methods. As needed, refinements are made to utilize more realistic parameters. The complete fire modeling methodology for this fire area is contained in Detailed Fire Modeling Technical Evaluation R1900-0411-AA3.

### A2.4 Scenario Descriptions and Model Results

Fire Area AA3 was evaluated for the impact of fires originating from both fixed and transient ignition sources. Complete descriptions of each fire scenario is contained within the Detailed Fire Modeling Technical Evaluation R1900-0411-AA3.

#### A2.4.1 Ignition Sources

Fire Area AA3 contains the "N" train batter, refrigeration units, chiller compressors, ice condenser refrigeration glycol pump, charcoal filters, motor control centers, train A and B battery chargers and the train-N battery distribution cabinets.

Per discussion with plant personnel, the heat release rates for all switchgear, load centers, and MCC electrical cabinets have been characterized as qualified cable because items of this nature are generally constructed on-site. For other electrical cabinet types, where the internal cable qualification was unknown, the heat release rates have been assumed as non-qualified. As a screening approach, all ignition sources with the were modeled using a 98th heat release rate percentile fire scenario.

Ignition sources 2-PPC-+/-0-6/0-7, 1-DCN, and the ten (10) OME chiller compressors were refined and modeled using a 75th heat release rate percentile fire scenario which included a 10% oil spill pump analysis for the compressors. The OME chiller compressors were also modeled as an electrical pump fire which resulted in no target damage.

For all fire zones in Fire Area AA3 with the exception of Fire Zone 52, the 98th percentile HRR was used for all transient fires. The 98th percentile HRR bounds the possible transient ignition sources expected for this fire area, which were fire tested and identified in NUREG/CR-6850, Appendix G, Table G-7.

## **Fire Area AA3 – Attachment 2 - Fire Risk Evaluation Results Summary**

For Fire Zone 52, the 75th percentile transient HRR was used. For a fire zone such as 52 with no pumps, motors or potential oil fires, the 75th percentile HRR bounds the possible transient ignition sources expected in Fire Zone 52.

### **A2.4.2 Scenario Results**

A delta risk calculation has been performed to quantify the risk associated with the VFDRs in the fire area.

### **A2.5 Fire Risk Evaluation Results**

PRA-FIRE-NB-CRE documents scenarios and corresponding impacted VFDRs that were evaluated for delta risk during the transition to NFPA 805 and also all changes to the Fire Protection Program that are currently incorporated into the Fire PRA model. The acceptability of the Cumulative Fire Risk Evaluations was based on calculated delta risk meeting the thresholds of NEI 04-02, RG 1.205 and RG 1.174. (FPCE 2017-0009)

## Fire Area AA3 – Attachment 2 - Fire Risk Evaluation Results Summary

### A-2.6 Impact of VFDR on Defense-in-Depth

Defense-in-Depth has been evaluated for this fire area. The impacts of this evaluation are summarized in the table below:

Defense-in-Depth Impact Review for AA3			
Method of Providing DID	Required to Support Deterministic Analysis or Fire PRA?	Changes or Improvements Necessary for DID?	Basis/Justification
Echelon 1: Prevent fires from starting			
Combustible Control is implemented in accordance with Procedure PMP-2270-CCM-001, Control of Combustible Materials.	Yes	No	• This element is strengthened to off set potential over-reliance on another echelon of defense-in-depth.
Hot Work Control is implemented in accordance with Procedure PMP-2270-WBG-001, Welding, Burning and Grinding Activities.	Yes	No	
Echelon 2: Rapidly detect, control and extinguish promptly those fires that do occur thereby limiting fire damage			
Fire Detection System	Yes	No	• Detection and suppression are already required and fire fighting activities are not expected to be challenging, therefore, no changes or improvements to Echelon 2 attributes are necessary to maintain defense-in-depth.
Fixed Fire Suppression	Yes	No	
Portable Fire Extinguishers	Yes	No	
Hose stations and hydrants	Yes	No	
Pre-Fire Plan	Yes	No	

**Fire Area AA3 – Attachment 2 - Fire Risk Evaluation Results Summary**

<b>Defense-in-Depth Impact Review for AA3</b>			
<b>Method of Providing DID</b>	<b>Required to Support Deterministic Analysis or Fire PRA?</b>	<b>Changes or Improvements Necessary for DID?</b>	<b>Basis/Justification</b>
<b>Echelon 3: Provide adequate level of fire protection for systems and structures so that a fire will not prevent essential safety functions from being performed</b>			
Walls, floors ceilings and structural elements are rated or have been evaluated as adequate for the hazard.	Yes	No	<ul style="list-style-type: none"> <li>• There are significant modeling differences between the Fire PRA and nuclear safety capability assessment (i.e., due to different success criteria, end states, etc.) and therefore recovery actions for VFDR AA3-002 and AA3-008 have been credited to ensure that defense-in-depth is maintained.</li> <li>• Defense in Depth actions were credited to remove fuses or open breakers in the Control Room to prevent spurious equipment operation due to internal shorts.</li> <li>• Where the remaining variances can possibly be affected in a potentially high risk scenario, based on a detailed review, the VFDRs are either not the cause for the high risk of the scenario or the mitigating recovery action is credited; therefore no changes or improvements to Echelon 3 attributes are necessary to maintain defense-in-depth.</li> </ul>
Penetrations in the fire area barrier are rated or have been evaluated as adequate for the hazard.	Yes	No	
Supplemental barriers (e.g., ERFBS, cable tray covers, etc.)	Yes	No	
Guidance provided to operations personnel detailing the required success path(s) including recovery actions to achieve nuclear safety performance criteria.	Yes	Yes	<ul style="list-style-type: none"> <li>• Cable tray covers are credited in the detailed fire modeling to reduce fire spread and target damage, and, are therefore, credited for defense-in-depth.</li> </ul>

## Fire Area AA3 – Attachment 2 - Fire Risk Evaluation Results Summary

### A-2.7 Safety Margin Considerations

In accordance with NEI 04-02, the maintenance of adequate Safety Margin is assessed by the consideration categories of analyses utilized by this Fire Risk Evaluation.

Safety margins are considered to be maintained if:

- Codes and Standards or their alternatives accepted for use by the NRC are met.

AND

- Safety analyses acceptance criteria in the licensing basis (e.g., FSAR, supporting analyses) are met, or provides sufficient margin to account for analysis and data uncertainty.

The following summarizes the bases for ensuring the maintenance of safety margins:

- The risk-informed, performance based processes utilized are based upon NFPA 805, 2001 edition, endorsed by the NRC in 10 CFR 50.48(c).
- The Fire Risk Evaluation process is in accordance with NEI 04-02, Revision 2, which is endorsed by the NRC in Regulatory Guide 1.205, Revision 1.
- The Fire PRA is developed in accordance with NUREG/CR-6850, which was developed jointly between the NRC and EPRI.
- The Fire PRA has undergone an industry peer review, in order to ensure the Fire PRA meets the appropriate quality standards of ASME/ANS RA-Sa-2009, "Standard for Level 1/Large Early Release Frequency Probabilistic Risk Assessment for Nuclear Power Plant Applications," Dated February 2, 2009
- The "combined analysis approach" is used during transition (NEI 04-02, Section 5.3.4.3); therefore, MEFS/LFS is not analyzed separately from the Fire PRA results.
- The CNP internal events PRA model received two formal industry peer reviews conducted in accordance with applicable NEI guidelines. The initial peer review was performed in 2001, while a subsequent focused scope (i.e., limited scope) peer review was conducted in 2009. The initial, full-scope WOG peer review covered all aspects of the CNP PRA model and the administrative processes used to maintain and update the model. The CNP PRA model has been revised to address all significant issues (i.e., Category A and B Facts & Observations) identified during the initial peer review. None of the findings from the focused-scope peer review were judged to reach the significance level of a Category A or B Fact & Observation; as a result, no changes to the PRA model have yet been made to include resolutions for these latter issues.
- Fire protection systems and features determined to be required by NFPA 805 Chapter 4 have been confirmed to meet the requirements of NFPA 805 Chapter 3 and their associated referenced codes and listings, or provided with acceptable alternatives using processes accepted for use by the NRC (i.e., FAQ 06-0008, FAQ 06-0004, 07-0033).
- Fire modeling performed in support of the transition has been performed within the Fire PRA utilizing codes and standards developed by industry and NRC staff which have been verified and validated in authoritative publications, such as NUREG 1824, "Verification and Validation of Selected Fire Models for Nuclear Power Plant Applications". In general, the fire modeling performed in support of the Fire Risk Evaluations has been performed using conservative methods and input parameters that are based upon

### Fire Area AA3 – Attachment 2 - Fire Risk Evaluation Results Summary

NUREG/CR-6850 as documented in the AA3 Detailed Fire Modeling Report, section 7.2. While this is generally not ideal in the context of best estimate probabilistic risk analysis, it is a pragmatic approach given the current state of knowledge regarding the uncertainties related to the application of the fire modeling tools and associated input parameters for specific plant configurations.

- In accordance with the requirements of 10 CFR 50.48(c)(2)(iii), the Fire PRA results, including cutsets for the scenarios of concern, have been reviewed and it was verified that the results presented above do not rely solely on feed and bleed as the fire-protected safe shutdown path for maintaining reactor coolant inventory, pressure control, and decay heat removal capability for this fire area.

#### A-2.8 Transition Risk Evaluation Conclusions

The transition change evaluation determined that these changes:

- Are acceptable based upon the measured change in CDF and LERF
- Maintained adequate defense-in-depth and safety margins

The results of this evaluation meet the requirements of NFPA 805 Risk Evaluation; therefore, the use of the performance based analysis approach is acceptable.

D. C. Cook Nuclear Plant  
Fire Safety Analysis

Fire Area: AA5/6

Auxiliary Building (El. 587 ft.)

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Attachments

Fire Area AA5/6 – Attachment 1 - Table B-3 - Fire Area Transition

Fire Area AA5/6 – Attachment 2 - Fire Risk Evaluation Results Summary



## 1.0 PURPOSE

This report documents the Fire Safety Analysis (FSA) for Cook Nuclear Plant (CNP) Fire Area AA5/6, Auxiliary Building (El. 587 ft.) which comprises fire zone(s) 4, 5, 6A, 6M, 6N, 6S, 6I, 64A, 65A, 64B, 65B. The purpose of this analysis is to demonstrate the achievement of the nuclear safety and radioactive release performance criteria of NFPA 805 as required by 10 CFR 50.48(c). The Fire Safety Analysis is a key part of compliance with Section 2.7.1.2 Fire Protection Program Design Basis Document of NFPA 805. This analysis also documents results of risk-informed, performance-based Fire Risk Evaluations (FREs). These evaluations are associated with Variances from Deterministic Requirements (VFDRs) of NFPA 805 Chapter 4.

## 2.0 ANALYSIS METHODOLOGY

The FSA is the design basis document as described in NFPA 805 Section 2.7.1.2. The following steps are performed to develop the FSA on a fire area basis:

- Identify significant fire hazards in the fire area. This is based on NFPA 805 approach to analyze the plant from an ignition source and fuel package perspective.
- Summarize Nuclear Safety Capability Analysis (NSCA) compliance strategies. This is the result of the NEI 04-02 B-3 Table review of the Safe Shutdown Analysis.
- Summarize Non-Power Operations Modes compliance strategies.
- Summarize Radioactive Release compliance strategies. The transition review process required per NEI 04-02 is used to develop these results.
- Provide Fire Probabilistic Risk Assessment summary of results. This is based on the results from the plant Fire PRA.
- Perform risk informed, performance based evaluations if needed for the performance based approach.
- Summarize Defense-in-Depth strategy for each fire area.
- Determine key analysis assumptions which are candidates to be included in the NFPA 805 monitoring program.
- Provide conclusions relative to NFPA 805 compliance.

### 3.0 ANALYSIS

#### 3.1 Classical Fire Protection

##### 3.1.1 Construction

For Fire Zone 4, walls, floors and ceilings to adjacent fire areas are reinforced concrete in excess of a 3-hour rating.

For Fire Zone 5, walls, floors and ceilings to adjacent fire areas and fire zones are reinforced concrete in excess of a 3-hour rating. Eight inch concrete block having a four hour rating is used to reduce the opening for the installation of the fire door to adjacent Fire Area AA3 - Fire Zone 3. A fire area boundary evaluation was performed for the unrated removable un-mortared high density concrete block walls installed between Fire Area AA5/6 - Fire Zone 5 and Fire Areas AA54 -Fire Zones 62A, 62B, 62C and Fire Area AA55 - Fire Zones 63A, 63B and 63C (Engineering Equivalency Evaluation 11-7). The stair enclosure at the 609 ft. elevation to Fire Area AA32 - Fire Zone 32 is constructed of 8-inch thick concrete block walls with a 5-inch thick concrete ceiling of unspecified ratings. A fire area boundary evaluation was performed evaluating this construction (Engineering Equivalency Evaluation 9-37). Miscellaneous walls, radiation and missile barriers of reinforced concrete or concrete block are provided within the fire zone which compartmentalize various equipment and systems.

For Fire Zone 6A, walls, floors and ceilings to adjacent fire areas are reinforced concrete in excess of a 3-hour rating.

For Fire Zone 6M, walls, floors and ceilings to adjacent fire areas and fire zones are reinforced concrete in excess of a 3-hour rating. Elevator shaft is constructed of reinforced concrete in excess of a 3-hour rating. Miscellaneous walls, missile and radiation barriers of reinforced concrete or concrete block are provided within the fire zone which compartmentalize various equipment and systems.

For Fire Zone 6N, walls, floors and ceilings to adjacent fire areas and fire zones are reinforced concrete in excess of a 3-hour rating. Miscellaneous walls, missile and radiation barriers of reinforced concrete or concrete block are provided within the fire zone which compartmentalize various equipment and systems

For Fire Zone 6S, walls, floors and ceilings to adjacent fire areas and fire zones are reinforced concrete in excess of a 3-hour rating. Miscellaneous walls, missile and radiation barriers of reinforced concrete or concrete block are provided within the fire zone which compartmentalize various equipment and systems.

For Fire Zone 61, walls, floors and ceilings to adjacent fire areas and fire zones are reinforced concrete in excess of a 3-hour rating.

For Fire Zone 64A and 65A, walls, floors and ceilings to adjacent fire areas and fire zones are reinforced concrete in excess of a 3-hour rating with the exception of the equipment removal opening which is filled with high density concrete block set without mortar to a depth of 2 ft. and braced with joint reinforcing.

For Fire Zone 64B and 65B, walls, floors and ceilings to adjacent fire areas and fire zones are

reinforced concrete in excess of a 3-hour rating with the exception of the equipment removal opening which is filled with high density concrete block set without mortar to a depth of 1 1/2 ft. and braced with joint reinforcing.

Applicable Engineering Equivalency Evaluations are documented in Attachment 1.

### 3.1.2 Doors and Access Openings

For Fire Zone 4, a fire door (with a louver) having a 1 1/2-hour rating and a 3-hour fire door are provided to adjacent Fire Area AA5/6 - Fire Zone 5.

For Fire Zone 5, fire doors having a 3-hour rating are provided to adjacent Fire Areas AA3, AA5/6, AA54 and AA55 - Fire Zone 3, 4, 62A and 63A, respectively. The 3-hour fire doors provided at the entrances to adjacent Fire Areas AA54 and AA55 - Fire Zones 62A and 63A are normally held open by fusible links for ventilation purposes. Fire doors having a 1 1/2-hour rating are provided to adjacent Fire Area AA5/6 - Fire Zone 4 and for the elevator doors. A fire door having a 1 1/2-hour rating is provided to adjacent Fire Zone 61.

A fire area boundary evaluation was performed for an unrated fire door to Fire Area AA3 - Fire Zone 32 (Engineering Equivalency Evaluation 9-37). A fire area boundary evaluation was performed for an unrated steel plate hatch in the ceiling to Fire Area AA3 - Fire Zone 36 (Refer Engineering Equivalency Evaluation 11-1). An open stairway protected by a water curtain connects the 587 ft. elevation of the Auxiliary Building with the 573 ft. elevation (Fire Area AA1 - Fire Zone 1) and 609 ft. elevation (Fire Area AA36/42 - Fire Zone 44N). A fire area boundary evaluation was performed for the rated and unrated fire barriers of the stairwells and elevators located in the Turbine and Auxiliary Buildings (Engineering Equivalency Evaluation 11-12).

For Fire Zone 6A, access to the pipe tunnel is from adjacent Fire Area AA36/42 - Fire Zone 44N at elevation 609 ft. through a fire door having a 3- hour rating or through two unrated floor hatches.

For Fire Zone 6M, elevator doors having a 1 1/2-hour rating are provided. A fire area boundary evaluation was performed for the rated and unrated fire barriers of the stairwells and elevators located in the Turbine and Auxiliary Buildings (Engineering Equivalency Evaluation 11-12).

For Fire Zone 6N, a fire door having a 3-hour rating is provided to adjacent Fire Area AA11 - Fire Zone 12. An open stairway protected by a water curtain connects the 587 ft. elevation of the Auxiliary Building with the 609 ft. elevation (Fire Area AA36/42 - Fire Zone 44N). A fire area boundary evaluation was performed for the rated and unrated fire barriers of the stairwells and elevators located in the Turbine and Auxiliary Buildings (Engineering Equivalency Evaluation 11-12).

For Fire Zone 6S, a fire door having a 3-hour rating is provided to adjacent Fire Area AA27 - Fire Zone 22.

An open stairway protected by a water curtain connects the 587 ft. elevation of the Auxiliary Building with the 609 ft. elevation (Fire Area AA36/42 - Fire Zone 44S). A fire area boundary evaluation was performed for the rated and unrated fire barriers of the stairwells and elevators in the Turbine and Auxiliary Buildings (Engineering Equivalency Evaluation 11-12).

For Fire Zone 61, there are no door openings to adjacent fire areas. A fire door having a 1 1/2-hour rating is provided to adjacent Fire Zone 5.

For Fire Zone 64A, there are no door openings to adjacent fire areas. No doors are provided at the entrance to this fire zone from Fire Zone 6N. Fire Zone 64A is also open to Fire Zone 64B through a passageway in the south wall.

For Fire Zone 64B, there are no door openings to adjacent fire areas. Access to this fire zone is provided by an opening in the north wall from Fire Zone 64A.

For Fire Zone 65A, there are no door openings to adjacent fire areas. No doors are provided at the entrance to this fire zone from Fire Zone 6S. Fire Zone 65A is also open to Fire Zone 65B through a passageway in the south wall.

For Fire Zone 65B, there are no door openings to adjacent fire areas. Access to this fire zone is provided by an opening in the south wall from Fire Zone 65A.

### 3.1.3 Penetrations

Note: Statements regarding fire resistance rating of penetration seals are not applicable to seals in barriers to Analysis Area YD.

For Fire Zone 4, penetrations in fire barriers between this fire zone and adjacent fire areas are provided with fire seals.

For Fire Zone 5, penetrations in fire barriers between this fire zone and adjacent fire areas are provided with fire seals except as noted. Penetrations into the elevator shaft are also provided with fire seals. However, barriers between this fire zone and adjacent fire zones are not fire sealed with the exception of Fire Zone 61. A fire area boundary evaluation was performed for open penetrations to Fire Area AA3 - Fire Zone 32 (Engineering Equivalency Evaluation 9-37).

For Fire Zone 6A, penetrations in fire barriers between this fire zone and adjacent fire areas are provided with silicone foam. High density lead plates cover some of the penetrations. Barriers between this fire zone and adjacent fire zones are not fire sealed. A fire area boundary evaluation was performed for unsealed penetrations in the rated fire barrier to adjacent Fire Areas AA1, AA36/42, AA37 and AA38 - Fire Zones 138B, 37 and 44N, 38 and 39, respectively (Engineering Equivalency Evaluation 9-33).

For Fire Zone 6M, penetrations in fire barriers between this fire zone and adjacent fire areas are provided with fire seals. Penetrations into the elevator shaft are also provided with fire seals. However, barriers between this fire zone and adjacent fire zones are not fire sealed.

For Fire Zone 6S and 6N, penetrations in fire barriers between this fire zone and adjacent fire areas are provided with fire seals. However, barriers between this fire zone and adjacent fire zones are not fire sealed.

For Fire Zone 61, penetrations in fire barriers between this fire zone and adjacent fire areas are provided with fire seals. Barriers between this fire zone and the adjacent fire zones are not provided with fire seals.

For Fire Zone 64A, penetrations in fire barriers between this fire zone and adjacent fire areas are provided with fire seals. However, barriers between this fire zone and adjacent fire zones are not fire sealed.

For Fire Zone 64B, penetrations in fire barriers between this fire zone and adjacent fire areas are provided with fire seals. Additionally, penetration in the ceiling to the adjacent Fire Zone 6A, Auxiliary Building Pipe Tunnel, are also provided with fire seals. However, all other barriers between this fire zone and adjacent fire zones are not fire sealed.

For Fire Zone 65A, penetrations in fire barriers between this fire zone and adjacent fire areas are provided with fire seals. However, barriers between this fire zone and adjacent fire zones are not fire sealed.

For Fire Zone 65B, penetrations in fire barriers between this fire zone and adjacent fire areas are provided with fire seals. Additionally, penetrations in the ceiling to adjacent Fire Zone 6A, Auxiliary Building Pipe Tunnel, are also provided with fire seals. However, all other barriers between this fire zone and adjacent fire zones are not fire sealed.

### 3.1.4 Detection

The table below outlines the fire detection system(s) provided in the Fire Area:

Table 3-1, Fire Area AA5/6 Detection Systems								
Fire Zone	Type of System	Local (L) / Remote (R)	Detection Actuates Suppression?	Required System?				
				S	L	E	R	D
4	Ionization	L/R	N	N	N	N	Y	N
5	Ionization	L/R	N	N	N	Y	Y	N
5	Thermal	L/R	N	N	N	N	N	N
6A	None	N/A	N/A	N/A	N/A	N/A	N/A	N/A
6M	Ionization	L/R	N	N	N	Y	Y	N
6N	Ionization	L/R	N	N	N	Y	Y	N
6S	Ionization	L/R	N	N	N	Y	Y	N
61	Ionization	L/R	N	N	N	Y	Y	N
64A	Ionization	L/R	N	N	N	Y	Y	N
64B	Ionization	L/R	N	N	N	Y	Y	N
65A	Ionization	L/R	N	N	N	Y	Y	N
65B	Ionization	L/R	N	N	N	Y	Y	N

**Table 3-1 Legend:**

Table Field: "Required System?"	
S	- Required for Chapter 4 Separation Criteria
L	- Required for NRC Approved Licensing Action
E	- Required for Engineering Equivalency Evaluation
R	- Required for Risk Significance
D	- Required to maintain adequate balance of Defense-in-Depth in a Change Evaluation or Fire Risk Evaluation

For Fire Zone 4, there are 4 ionization detectors which alarm in the Unit 1 Control Room. These detectors are part of the larger detector circuit for elevation 587' of the Auxiliary Building which includes Fire Zones 3, 4, 5, 6M, 6N, 6S, 61, 62A-C, 63A-C, 64A-B and 65A-B.

For Fire Zone 5, fifteen ionization detectors are provided which alarm in the Unit 1 Control Room. These detectors are located in the normally accessible portions of the fire zone and are part of the larger detection circuit for elevation 587' of the Auxiliary Building which includes Fire Zones 3, 4, 5, 6M, 6N, 6S, 61, 62A-C, 63A-C, 64A-B and 65A-B. A line type thermistor heat detector is provided for the spray additive tank charcoal filter unit.

For Fire Zone 6M, six ionization detectors are provided which alarm in the Unit 1 Control Room.

For Fire Zone 6S and 6N, four ionization detectors are provided which alarm in the Unit 1 Control Room.

For Fire Zone 61, two ionization detectors are provided which alarm in the Unit 1 Control Room. These detectors are part of the larger detection circuit for elevation 587 ft. of the Auxiliary Building which includes Fire Zones 3, 4, 5, 6M, 6N, 6S, 61, 62A-C, 63A-C, 64A-B and 65A-B.

For Fire Zone 64A, 64B, 65A and 65B, two ionization detectors are provided which alarm in the Unit 1 Control Room. These detectors are part of a larger detection circuit for the 587 ft. elevation

of the Auxiliary Building which includes Fire Zones 3, 4, 5, 6M, 6N, 6S, 61, 62A-C, 65A-C, 64A-B and 65A-B.

Fire Zone 6A is not provided with an automatic fire detection system.

### 3.1.5 Fixed Suppression

The table below outlines the fixed fire suppression system(s) provided in the Fire Area:

Table 3-2, Fire Area AA5/6 Suppression Systems								
Fire Zone	Type of System	Full (F) / Partial (P)	Required System?					
			S	L	E	R	D	
4	None	N/A	N/A	N/A	N/A	N/A	N/A	
5	Pre-Action	F	N	N	Y	N	N	
5	Water Curtain	P	Y	N	Y	Y	N	
6A	None	N/A	N/A	N/A	N/A	N/A	N/A	
6M	Pre-Action	F	N	N	Y	N	N	
6N	Pre-Action	F	N	N	Y	N	N	
6N	Water Curtain	P	Y	N	Y	Y	N	
6S	Pre-Action	F	N	N	Y	N	N	
6S	Water Curtain	P	Y	N	Y	Y	N	
61	None	N/A	N/A	N/A	N/A	N/A	N/A	
64A	Pre-Action	F	N	N	Y	Y	N	
64B	Pre-Action	F	N	N	Y	Y	N	
65A	Pre-Action	F	N	N	Y	Y	N	
65B	Pre-Action	F	N	N	Y	Y	N	

Table 3-2 Legend:	
Table Field: "Required System?"	
S	- Required for Chapter 4 Separation Criteria
L	- Required for NRC Approved Licensing Action
E	- Required for Engineering Equivalency Evaluation
R	- Required for Risk Significance
D	- Required to maintain adequate balance of Defense-in-Depth in a Change Evaluation or Fire Risk Evaluation

A fixed fire suppression system is not provided for Fire Zone 4.

For Fire Zone 5, Dry pilot preaction sprinklers are provided throughout most of the normally accessible portions of the fire zone and in a close spaced configuration around the perimeter of the open stairway to form a water curtain between fire areas. The pilot sprinklers are rated at 175°F and the water sprinklers are rated at 250°F. Manual release capability is provided on the 587 ft. elevation of the Auxiliary Building and at the valve station in the Turbine Building. The area sprinkler system is located beneath the obstructions in order to extinguish floor based fires. In a few areas, sprinklers are also located at the ceiling. These sprinklers are part of a larger sprinkler system for the 587 ft. elevation of the Auxiliary Building which includes Fire Zones 5, 6M, 6N, 6S, 62A-C, 63A-C, 64A-B and 65A-B.

A fixed fire suppression system is not provided for Fire Zone 6A or 6I.

For Fire Zone 6M, Dry pilot preaction sprinklers are provided throughout the normally accessible portions of the fire zone. The pilot sprinklers are rated at 175°F and the water sprinklers are rated at 250°F. Manual release capability is provided on the 587 ft. elevation of the Auxiliary Building and at the valve station in the Turbine Building. The area sprinkler system is located beneath the obstructions in order to extinguish floor based fires. In a few areas, the sprinklers are also located at the ceiling. These sprinklers are part of a larger sprinkler system for the 587 ft. elevation of the Auxiliary Building which includes Fire Zones 5, 6M, 6N, 6S, 62A-C, 63A-C, 64A-B and 65A-B.

For Fire Zone 6N and 6S, Dry pilot preaction sprinklers are provided throughout the normally accessible portions of the fire zone and in a close spaced configuration around the perimeter of the open stairway to form a water curtain between fire areas. The pilot sprinklers are rated at 175°F and the water sprinklers are rated at 250°F. Manual release capability is provided on the 587 ft. elevation of the Auxiliary Building and at the valve station in the Turbine Building. The area sprinkler system is located beneath the obstructions in order to extinguish floor based fires. In a few areas, the sprinklers are also located at the ceiling. These sprinklers are part of a larger sprinkler system for the 587 ft. elevation of the Auxiliary Building which includes Fire Zones 5, 6M, 6N, 6S, 62A-C, 63A-C, 64A-B and 65A-B.

For Fire Zone 64A and 65A, A dry pilot preaction sprinkler system is provided for this fire zone. The pilot sprinklers are rated at 175°F and the water sprinklers are rated at 250°F. Manual release capability is provided on the 587 ft. elevation of the Auxiliary Building and at the valve station in the Turbine Building. These sprinklers are part of a larger sprinkler system for the 587 ft elevation of the Auxiliary Building which includes Fire Zones 5, 6M, 6N, 6S, 62A-C, 63A-C, 64A-B and 65A-B. The pilot line provided for the safety injection cubicles also provides coverage for the charging pump cubicles (Fire Zones 62A to 62C).

For Fire Zone 64B and 65B, A dry pilot preaction sprinkler system is provided for this fire zone. The pilot sprinklers are rated at 175°F and the water sprinklers are rated at 250°F. Manual release capability is provided on the 587 ft. elevation of the Auxiliary Building and at the valve station in the Turbine Building. These sprinklers are part of a larger sprinkler system for the 587 ft. elevation of the Auxiliary Building which includes Fire Zones 5, 6M, 6N, 6S, 62A-C, 63A-C, 64A-B and 65A-B. The pilot line provided for the safety injection cubicles also provides coverage for the charging pump cubicles (Fire Zones 63A to 63C).

For Fire Zone 6I, none provided.

### **3.1.6 Manual Suppression / Response Strategy**

For fire zones within AA5/6 equipped with automatic detection systems, a postulated fire will be identified by early detection using ionization type smoke detection, heat detection or by plant personnel using plant communication system to notify the control room. The automatic detection systems alarm in the control room. For fire zones within AA5/6 which are not equipped with automatic detection systems, a postulated fire will be identified by plant personnel using plant communication system to notify the control room. The Control Room operator will dispatch the fire brigade for initiation of manual fire fighting. A fire in this fire area will be contained by the construction features discussed in Section 3.1.1. Manual suppression is provided by the CNP Fire Brigade.



Fire extinguishers are available in Fire Zones 4, 5, 6M, 6N, 6S and 61.

Water hose reels are available in Fire Zones 5, 6N and 6S.

For Fire Zone 4, a water hose reel is located in adjacent Fire Zone 5.

Floor drains are available in Fire Zones 4, 5, 6A, 6M, 6N, 6S, 61, 64A, 64B, 65A and 65B.

For Fire Zone 6A, fire extinguishers are provided in adjacent Fire Zone 44N at the 609 ft. elevation. Two water hose reels, each with a second hose reel are also provided in Fire Zone 44N. The second hose reels are not connected to the standpipe system. Hoses must be taken through the floor hatches at the 609 ft. elevation in order to be used on the 601 ft. elevation of the pipe tunnel.

For Fire Zone 6M, water hose reels are located in adjacent Fire Zones 6N and 6S.

For Fire Zone 6N, water hose reels are located in this fire zone and in adjacent Fire Zone 12

For Fire Zone 6S, water hose reels are located in this fire zone and in adjacent Fire Zone 22.

For Fire Zone 61, a water hose reel is located in adjacent Fire Zone 5.

For Fire Zone 64A and 64B, fire extinguishers and a water hose reel is located in adjacent Fire Zone 6N. Floor drains are routed to a room sump that drains to the Auxiliary Building sump.

For Fire Zone 65A and 65B, fire extinguishers and a water hose reel is located in adjacent Fire Zone 6S. Floor drains are routed to a room sump that drains to the Auxiliary Building sump.

### 3.1.7 Ventilation

A fire in this area will be contained by the fire barriers. Smoke can be removed by portable fans and flexible ducting to other areas of the Auxiliary Building and outdoors if not contaminated. Contaminated smoke can be removed by portable fans and flexible ducting to other areas of the Auxiliary Building per the Fire Pre-Plans. The normal building ventilating systems in the Auxiliary Building will then exhaust the smoke via filtered monitored pathways.

For Fire Zone 4, fire dampers having a 1 1/2-hour rating are provided to adjacent Fire Zone 5. Fire dampers having a 3-hour rating is provided to adjacent Fire Zones 5 and 61.

For Fire Zone 5, there is an undampered duct penetration to the adjacent Fire Zone 6A. A fire area boundary evaluation was performed for an undampered ventilation duct to Fire Area AA3 - Fire Zones 32 and 36 (Engineering Equivalency Evaluations 9-37 and 9-34, respectively). Fire dampers having a 3-hour rating are provided to adjacent Fire Areas AA3, AA54 and AA55 - Fire Zones 3, 62C and 63C, respectively, and to adjacent Fire Zone 61. Fire dampers having a 1 1/2-hour rating are provided to adjacent Fire Zone 4. A fire damper having a 3-hour rating is provided to adjacent Fire Zone 4.

For Fire Zone 6A, there are no ventilation penetrations to adjacent fire areas. There is an undampered duct penetration to Fire Zone 5.

For Fire Zone 6M, there are no ventilation penetrations to adjacent fire areas.

For Fire Zone 6N, there is an undampered ventilation penetration to Fire Zone 64B. Fire dampers having a 3-hour rating are provided to adjacent Fire Area AA11 - Fire Zone 12. A fire damper exemption was granted for undampered ventilation ducts to Fire Area AA1 and AA36/42 - Fire Zone 1 and 44N (Engineering Equivalency Evaluation 11-45).

For Fire Zone 6S, there is an undampered ventilation penetration to Fire Zone 65B. Fire dampers having a 3-hour rating are provided to adjacent Fire Area AA27 - Fire Zone 22. A fire damper exemption was granted for undampered ventilation ducts to Fire Areas AA1 and AA36/42 - Fire Zone 1 and 44S (Engineering Equivalency Evaluation 11-45).

For Fire Zone 61, a fire damper having a 1 1/2-hour rating is provided to adjacent Fire Zone 4. A fire area boundary evaluation was performed for the unrated field fabricated fire dampers provided to adjacent Fire Area AA7 - Fire Zone 7. Fire Dampers 12-HV-PAS-FD-1 and 2 are field fabricated unrated fire dampers. The dampers are located in 3-inch diameter ventilation ducts (Engineering Equivalency Evaluation 9-40). Fire dampers having a 3-hour rating are provided to adjacent Fire Zone 5.

For Fire Zone 64A, there is an undampered ventilation penetration to the adjacent Fire Zone 64B. A fire area boundary evaluation was performed for an undampered ventilation duct to Fire Area AA11 - Fire Zone 12 (Engineering Equivalency Evaluation 9-4).

For Fire Zone 64B, there are undampered ventilation penetrations to the adjacent Fire Zones 6N and 64A.

There are no ventilation penetrations to adjacent fire areas.

For Fire Zone 65A, there is an undampered ventilation penetration to the adjacent Fire Zone 65B. A fire area boundary evaluation was performed for an undampered ventilation duct to Fire Area AA27 - Fire Zone 22 (Engineering Equivalency Evaluation 9-4).

For Fire Zone 65B, there are undampered ventilation penetrations to the adjacent Fire Zones 6S and 65A. There are no ventilation penetrations to adjacent fire areas.

### 3.1.8 Other Features

For Fire Zone 6A, access down to the 601 ft. elevation is by ladder, through an opening located in the "C" shaped walkway at elevation 609 ft. The pipe tunnel is open to adjacent Fire Zones 6N and 6S. This fire zone is also a high radiation area with locked access.

For Fire Zone 6M, and Electrical Raceway Fire Barrier System (ERFBS) with a rating of a 1-hour rating is provided, for raceway 8154G-2.

For Fire Zone 64A, six and eight inch high curbs are provided at the entrances to adjacent fire zones.

For Fire Zone 64B, an 8-inch high curb is provided at the entrance to adjacent Fire Zone 64A.

For Fire Zone 65A, six and eight inch high curbs are provided at the entrances to adjacent Fire Zones 6S and 65B.

For Fire Zone 65B, an 8-inch high curb is provided at the entrance to adjacent Fire Zone 65A.

In Fire Zone 5, a manual water spray system is provided for the spray additive tank charcoal filter unit (12-HV-SAT-FU) located on the 601 el. Landing. The system is a temperature regulating system and is not treated as a manual suppression system. Water is supplied to a pre-piped connection on the outside of the filter unit by a fire hose from the nearby hose station.

### 3.2 Fire Hazards Identification

The fire area contains both ignition sources and combustible fire hazards. The ignition sources consist of the waste evaporator feed pumps, the waste evaporator condensate pumps, the 15 GPM rad waste evaporator and panel, local shutdown indication panels, boric acid transfer pumps, motor control centers, valve control centers, the 250VDC train N battery distribution cabinet and the safety injection pumps.

The Boric Acid Transfer Pumps are located in their own remote section of the Fire Area which has walls on all sides, labyrinth entrances and is curbed. The pumps are physically separated from the other safety related and NSCA equipment within the adjacent zones.

The two (2) Safety Injection Pumps are provided for each unit, located in Fire Zones 64A and 64B, and 65A and 65B. Each pump is physically separated from the other and located within its own room with wall construction that exceeds a 3-hour fire rating with each room curbed.

Combustibles in the Fire Area include cellulose, rubber, plastics and Thermo-Lag. Fire Zones 5, 6S, and the SI Pump rooms also contain lube oil.

All fire zones within this fire area have a combustible loading classification of low.

### 3.3 NSCA Compliance Summary

Fire Area AA5/6, U1&U2 Aux Building (El. 587'), contains Unit 1 and Unit 2 Red and Green Train cables, conduits and raceways as well as Unit 1 and 2, local shutdown indication panels, Red and Green train 600V MCCs, Safety Injection system Pumps and MOVs, and other safe shutdown equipment.

Compliance with the nuclear safety performance criteria is achieved using the performance-based approach in accordance with NFPA 805, Section 4.2.4.2.

Safe and stable condition of Unit 1 will be accomplished using Steam Generators 2 and 3 via the Unit 1 East Motor Driven Auxiliary Feedwater Pump, Control Room Process Monitoring, Unit 1 Charging via the West or East pump, Unit 1 Component Cooling Water via the East or West Pump, Unit 1 ESW via the East Pump. The East ESW system remains available to support the Green Train EDG. Electrical power is supplied to either Red or Green Trains via offsite power with Green train Emergency Diesels also available.

Safe and stable condition of Unit 2 will be accomplished using Steam Generators 2 and 3 via the Unit 2 East Motor Driven Auxiliary Feedwater Pump, Control Room Process Monitoring, Unit 2 Charging via the crosstie to Unit 1 East or West Pump, Unit 1 Component Cooling Water via the East or West Pump supporting Unit 1 equipment cross-tied to Unit 2. The East or West ESW system remains available to support the Emergency Diesels however electrical power is supplied to either Red or Green Trains via offsite power with the Red train Emergency Diesel also available.

The Nuclear Safety Performance Criteria compliance strategy for AA5/6 is documented within the NSCA Report.

### 3.3.1 Variances

The variances identified for evaluation for this fire area are grouped as follows:

#### 3.3.1.1 VFDR No. AA5/6-001

12-HV-ESW-1, 12-HV-ESW-2, 12-HV-ESW-3 and 12-HV-12-ESW-4 - Unit 2 ESW HVAC Supply Fans are required to be operable to support Unit 2 ESW pump cooling. Failure of the supply fans could result in overheating of the ESW pumps causing them to fail. 12-HV-ESW-1 and 12-HV-ESW-2 may fail due to fire induced damage of cables 8048G-2, 8411G-2 and 9993G-2. 12-HV-ESW-3 and 12-HV-ESW-4 may fail due to fire induced damage of cables 8036R-2, 8048R-2, 8277R-2 and 8500R-2. This condition represents a variance from deterministic requirements of NFPA 805, Section 4.2.3. This is a separation issue.

This VFDR has been evaluated and it was determined that the risk, safety margin and defense-in-depth meet the acceptance criteria of NFPA 805 Section 4.2.4 with no further action required.

#### 3.3.1.2 VFDR No. AA5/6-002

12-HV-ESW-5, 12-HV-ESW-6, 12-HV-ESW-7 and 12-HV-12-ESW-8 - Unit 1 ESW HVAC Supply Fans are required to be operable to support Unit 1 ESW pump cooling. Failure of the supply fans could result in overheating of the ESW pumps causing them to fail. 12-HV-ESW-5 and 12-HV-ESW-6 may fail due to fire induced damage of cables 8036R-1, 8048R-1, 8277R-1 and 8500R-1. 12-HV-ESW-7 and 12-HV-ESW-8 may fail due to fire induced damage of cables 8030G-1, 8048G-1 and 8411G-1. This condition represents a variance from deterministic requirements of NFPA 805, Section 4.2.3. This is a separation issue.

This VFDR has been evaluated and it was determined that the risk, safety margin and defense-in-depth meet the acceptance criteria of NFPA 805 Section 4.2.4 with no further action required.

#### 3.3.1.3 VFDR No. AA5/6-003

1-FMO-222 and 1-FMO-232 - SG 2 and 3 AFW Supply Valves from East MDAFW Pump are required to be operable to support decay heat removal. Decay heat removal is required to be capable of removing sufficient heat from the reactor core such that the fuel is maintained in a safe and stable condition. The East MDAFW Pump is credit for a fire with Fire Area AA5/6 due fire induced damage of the West MDAFW Pump and TDAFW Pump. The East MDAFW Pump feeds SGs 2 and 3 through 1-FMO-222 and 1-FMO-232. 1-FMO-222 may fail due to fire induced damage of cable 9747G-1. 1-FMO-232 may fail due to fire induced damage of cable 9748G-1. The valves are required to be operable. These cable failures could render the valves inoperable. This condition represents a variance from the deterministic requirements of NFPA 805, Section 4.2.3. This is a separation issue.

This VFDR has been evaluated and it was determined that the risk, safety margin and defense-in-depth meet the acceptance criteria of NFPA 805 Section 4.2.4 with a recovery action credited.

**3.3.1.4 VFDR No. AA5/6-004**

1-WMO-754 - ESW Alternate Makeup to East MDAFW Pump is required to be open to support decay heat removal. 1-WMO-754 is required to be open to provide a secondary coolant source from the ESW system to the AFW system. The East MDAFW Pump is credited for decay heat removal due to a fire in Fire Area AA5/6. The secondary water source for AFW is not required until approximately 9 hours. 1-WMO-754 may fail due to fire induced damage of 600V VCC 1-ABV-D and cables 8036G-1, 8042G-1 and 9298G-1. This valve is normally closed. These failures could cause the valve to remain closed or spuriously close after it is opened. This condition represents a variance from the deterministic requirements of NFPA 805, Section 4.2.3. This is a separation issue.

This VFDR has been evaluated and it was determined that the risk, safety margin and defense-in-depth meet the acceptance criteria of NFPA 805 Section 4.2.4 with a recovery action credited.

**3.3.1.5 VFDR No. AA5/6-005**

1-QRV-251 - Charging Flow Control Valve is required to be open to support CVCS. This valve provides flow control for the Unit 1 charging system. CVCS is required to maintain inventory and pressure control. 1-QRV-251 may fail due to fire induced damage of cables 20141-1, 20142-1 and 6116-1. These failures could cause the valve to spuriously close. This condition represents a variance from the deterministic requirements of NFPA 805, Section 4.2.3. This is a separation issue.

This VFDR has been evaluated and it was determined that the risk, safety margin and defense-in-depth meet the acceptance criteria of NFPA 805 Section 4.2.4 with no further action required.

**3.3.1.6 VFDR No. AA5/6-006**

1-ICM-305 and 1-ICM-306 - Recirculation Sump to East and West RHR/CTS Valves are required to be closed to support Unit 1 CVCS and Unit 2 alternate CVCS. CVCS is required for maintain inventory and pressure control. The valves are required closed to prevent drawing air into the charging pumps suction lines and prevent the drain down of the RWST. 1-ICM-305 may fail due to fire induced damage of interlocked valve 1-IMO-310 and cables 8074G-1, 8077G-1, 8268G-1, 8363G-1 and 8383G-1. 1-ICM-306 may fail due to fire induced damage of interlocked valve 1-IMO-320 and cables 8074R-1, 8077R-1, 8268R-1, 8363R-1 and 8397R-1. These failures could cause the valves to spuriously open. This condition represents a variance from the deterministic requirements of NFPA 805, Section 4.2.3. This is a separation issue.

This VFDR has been evaluated and it was determined that the risk, safety margin and defense-in-depth meet the acceptance criteria of NFPA 805 Section 4.2.4 with a recovery action credited.

**3.3.1.7 VFDR No. AA5/6-007**

1-IMO-910 and 1-IMO-911 - RWST to Charging Pumps Isolation Valves are required to be open to support CVCS. These valves are required to be open to maintain charging pump suction from the RWST. CVCS is required to maintain inventory and pressure control. 1-IMO-910 and 1-IMO-911 are in parallel, requiring one of the valves to remain open to support CVCS. 1-IMO-910 may fail due to fire induced damage of cables 8026G-1 and 8031G-1. 1-IMO-911 may fail due to fire induced damage of 600V VCC 1-AZV-A and cables 8026R-1 and 8031R-1. These failures could spuriously close the valves. This condition represents a variance from the deterministic requirements of NFPA 805, Section 4.2.3. This is a separation issue.

This VFDR has been evaluated and it was determined that the risk, safety margin and defense-in-depth meet the acceptance criteria of NFPA 805 Section 4.2.4 with a defense-in-depth action credited.

**3.3.1.8 VFDR No. AA5/6-008**

1-QMO-225 and 1-QMO-226 - Unit 1 Charging Pumps Minimum Flow Valves are required to be open to support their respective Unit 1 charging pumps. One of the charging pumps is required to be operable to support CVCS. CVCS is required to maintain inventory and pressure control. 1-QMO-225 may fail due to fire induced damage of 600V VCC 1-ABV-D and cables 80179G-1, 8037G-1, 8039G-1, 8940G-1 and 9132G-1. 1-QMO-226 may fail due to fire induced damage of 600V VCC 1-ABV-A and cables 80179R-1, 8037R-1, 8039R-1, 8941R-1 and 9146R-1. These failures could spuriously close the valves. This condition represents a variance from the deterministic requirements of NFPA 805, Section 4.2.3. This is a separation issue.

This VFDR has been evaluated and it was determined that the risk, safety margin and defense-in-depth meet the acceptance criteria of NFPA 805 Section 4.2.4 with no further action required.

**3.3.1.9 VFDR No. AA5/6-009**

2-FMO-222 and 2-FMO-232 - SG 2 and 3 AFW Supply Valves from the East MDAFW Pump are required to be operable to support decay heat removal. Decay heat removal is required to be capable of removing sufficient heat from the reactor core such that the fuel is maintained in a safe and stable condition. The East MDAFW Pump is credited for a fire within AA5/6 due to fire induced damage to the West MDAFW Pump and the TDAFW Pump. 2-FMO-222 may fail due to fire induced damage of cable 9747G-2. 2-FMO-232 may fail due to fire induced damage of cable 9748G-2. These cable failures could spuriously close the valves. This condition represents a variance from the deterministic requirements of NFPA 805, Section 4.2.3. This is a separation issue.

This VFDR has been evaluated and it was determined that the risk, safety margin and defense-in-depth meet the acceptance criteria of NFPA 805 Section 4.2.4 with a recovery action credited.



**3.3.1.10 VFDR No. AA5/6-010**

2-WMO-754 - ESW Alternate Makeup to East MDAFW Pump is required to be open to support decay heat removal. 2-WMO-754 is required to be open to provide a secondary coolant source from the ESW system. The East MDAFW Pump is credited to provide decay heat removal due to a fire in Fire Area AA5/6 because to fire induced damage of the West MDAFW Pump and the TDAFW Pump. The secondary water source is not required until approximately 9 hours. 2-WMO-754 may fail due to fire induced damage of 600V VCC 2-ABV-D and cables 8036G-2, 8042G-2 and 9298G-2. This valve is normally closed. These failures could cause the valve to remain closed or spuriously close after it is opened. This condition represents a variance from the deterministic requirements of NFPA 805, Section 4.2.3. This is a separation issue.

This VFDR has been evaluated and it was determined that the risk, safety margin and defense-in-depth meet the acceptance criteria of NFPA 805 Section 4.2.4 with a recovery action credited.

**3.3.1.11 VFDR No. AA5/6-011**

2-PP-50E and 2-PP-50W - The Unit 2 East and West Charging Pumps are required to be operable to support CVCS. CVCS is required to support inventory, reactivity and pressure control. Both the Unit 2 charging pumps may fail due to a full area fire within Fire Area AA5/6 resulting in the need to use alternate CVCS and cross-tie to the Unit 1 Charging Pumps. 2-PP-50E and 2-PP-50W may fail due to fire induced failure of the Unit 2 CCW systems. This condition represents a variance from the deterministic requirements of NFPA 805, Section 4.2.3. This is a separation issue.

This VFDR has been evaluated and it was determined that the risk, safety margin and defense-in-depth meet the acceptance criteria of NFPA 805 Section 4.2.4 with a recovery action credited.

**3.3.1.12 VFDR No. AA5/6-012**

12-QFI-201 - Charging Cross Flow Indicator between Units is required to be operable to support Unit 2 alternate CVCS. CVCS is required to maintain inventory and pressure control. Unit 2 credits Unit 1 CVCS injecting through the Unit 2 BIT due to fire induced damage of the Unit 2 CCW. This requires the use of 12-QFI-201. 12-QFI-201 may fail due to fire induced damage of sense line 12-QFI-201-SL. This condition represents a variance from deterministic requirements of NFPA 805, Section 4.2.3. This is a separation issue.

This VFDR has been evaluated and it was determined that the risk, safety margin and defense-in-depth meet the acceptance criteria of NFPA 805 Section 4.2.4 with no further action required.

**3.3.1.13 VFDR No. AA5/6-013**

1-WMO-701, 1-WMO-702, 2-WMO-703 and 2-WMO-704 - The ESW Pump Discharge Valves are required to be open to support ESW. These valves are normally operable and fail as is on the loss of power. These valves may fail due to a loss of power due to a full area fire within Fire Area AA5/6. This could result in the loss of ESW. The Unit 1 and Unit 2 systems are normally cross-tied. 1-WMO-701 and 2-WMO-704 are required to be open to support Unit 1 East ESW and Unit 2 West ESW. 1-WMO-702 and 2-WMO-703 are required to be open to support Unit 1 West ESW and Unit 2 East ESW. 1-WMO-701 may fail due to fire induced damage of 600V MCC 1-PS-D. 1-WMO-702 may fail due to fire induced damage of 600V MCC 1-PS-A. 2-WMO-703 may fail due to fire induced damage of 600V MCC 2-PS-D. 2-WMO-704 may fail due to fire induced damage of 600V MCC 2-PS-A. This condition represents a variance from deterministic requirements of NFPA 805, Section 4.2.3. This is a separation issue.

This VFDR has been evaluated and it was determined that the risk, safety margin and defense-in-depth meet the acceptance criteria of NFPA 805 Section 4.2.4 with no further action required.

**3.3.1.14 VFDR No. AA5/6-014**

1-WMO-735 and 1-WMO-737 - The Inlet and Outlet CCW Valves for the Unit 1 West ESW system are required to be open to support Unit 1 ESW and are required to be closed to support Unit 2 ESW when the Unit 1 West ESW Pump is cross-tied to Unit 2. These valves are normally open and fail as is on the loss of power. 1-WMO-735 and 1-WMO-737 may fail due to fire induced damage of 600V VCC 1-AZV-A. This condition represents a variance from the deterministic requirements of NFPA 805, Section 4.2.3. This is a separation issue.

This VFDR has been evaluated and it was determined that the risk, safety margin and defense-in-depth meet the acceptance criteria of NFPA 805 Section 4.2.4 with no further action required.

**3.3.1.15 VFDR No. AA5/6-015**

2-WMO-736 and 2-WMO-738 - The Inlet and Outlet CCW Valves for the Unit 2 West ESW system are required to be open to support Unit 2 ESW and are required to be closed to support Unit 1 ESW when the Unit 2 West ESW Pump is cross-tied to Unit 1. These valves are normally open and fail as is on the loss of power. 2-WMO-736 and 2-WMO-738 may fail due to fire induced damage of 600V VCC 2-AZV-A. This condition represents a variance from the deterministic requirements of NFPA 805, Section 4.2.3. This is a separation issue.

This VFDR has been evaluated and it was determined that the risk, safety margin and defense-in-depth meet the acceptance criteria of NFPA 805 Section 4.2.4 with no further action required.



**3.3.1.16 VFDR No. AA5/6-016**

1-QMO-200, 1-QMO-201 and 1-QRV-200 - Charging System Isolation and Back pressure. At least one of these valves must be shut to maintain inventory, pressure and reactivity control. 1-QRV-200 may fail due to fire induced damage of cable 4505-1. 1-QMO-200 may fail due to fire induced damage of cables 8027G-1 and 8034G-1. 1-QMO-201 may fail due to fire induced damage of cables 8027R-1 and 8034R-1. These cable failures could spuriously open the valves. This condition represents a variance from deterministic requirements of NFPA 805, Section 4.2.3. This is a separation issue.

This VFDR has been evaluated and it was determined that the risk, safety margin and defense-in-depth meet the acceptance criteria of NFPA 805 Section 4.2.4 with no further action required.

**3.3.2 Recovery Actions Credited**

For each VFDR, a Fire Risk Evaluation has been performed to assess the acceptability of risk, defense-in-depth, and safety margin. This evaluation determined whether or not recovery actions are required to ensure that one success path necessary to achieve and maintain the nuclear safety performance criteria is maintained free of fire damage by a single fire. Table 3-3 identifies the credited recovery actions for this area. Actions retained for DID are identified as "DID Actions" within Table 3-3. Additional information for DID actions is contained within Section 3.8 of this report. Note that, for completeness, all VFDRs are contained within Table 3-3, even if the Fire Risk Evaluation has determined that a recovery action is not required. In those instances where a recovery action has been determined to not be required, the word "None" is provided in the "Action" column in the table.

<b>Table 3-3, Recovery Actions Credited</b>		
<b>VFDR</b>	<b>Component</b>	<b>Action</b>
AA5/6-001	12-HV-ESW-1 12-HV-ESW-2 12-HV-ESW-3 12-HV-ESW-4	None
AA5/6-002	12-HV-ESW-5 12-HV-ESW-6 12-HV-ESW-7 12-HV-ESW-8	None
AA5/6-003	1-FMO-222 1-FMO-232	1-FMO-222-OPERATE (De-energize and manually operate 1-FMO-222)  1-FMO-232-OPERATE (De-energize and manually operate 1-FMO-232)
AA5/6-004	1-WMO-754	1-WMO-754-OPEN (De-energize and manually open 1- WMO-754)
AA5/6-005	1-QRV-251	None

Table 3-3, Recovery Actions Credited		
VFDR	Component	Action
AA5/6-006	1-ICM-305 1-ICM-306	1-CS-302-CLOSE (Close manual valve 1-CS-302)  1-CS-534-OPEN (Open manual valve 1-CS-534)  2-CS-536-OPEN (Open manual valve 2-CS-536)
AA5/6-007	1-IMO-910 1-IMO-911	DID ACTION 1-IMO-910-OPEN (De-energize and manually open 1-IMO-910)
AA5/6-008	1-QMO-225 1-QMO-226	None
AA5/6-009	2-FMO-222 2-FMO-232	2-FMO-222-OPERATE (De-energize and manually open 2-FMO-222)  2-FMO-232-OPERATE (De-energize and manually open 2-FMO-232)
AA5/6-010	2-WMO-754	2-WMO-754-OPERATE (De-energize and manually open 2-WMO-754)
AA5/6-011	2-PP-50E 2-PP-50W	1-CS-536-OPEN (Open manual valve 1-CS-536)  2-CS-302-CLOSE (Close manual valve 2-CS-302)  2-CS-534-OPEN (Open manual valve 2-CS-534)
AA5/6-012	12-QFI-201	None
AA5/6-013	1-WMO-701 1-WMO-702 2-WMO-703 2-WMO-704	None
AA5/6-014	1-WMO-735 1-WMO-737	None
AA5/6-015	2-WMO-736 2-WMO-738	None
AA5/6-016	1-QRV-200	None

### 3.4 Non-Power Operational Modes Compliance Summary

A review of CNP for the potential effects of a fire in this Fire Area while in non-power modes of

operation (NPO) was conducted. This review was conducted using the guidance provided in NEI 04-02 and FAQ 07-0040, "Non-Power Operations Clarifications".

The review determined that there are potential failures that affect certain Key Safety Functions (KSF) as a result of the fire in this area, and the fire could result in the loss of one or more KSF paths. Compensatory measures are required during high risk evolution periods to provide reasonable assurance a fire will not adversely affect key safety functions and the NFPA 805 performance goal for NPO is therefore satisfied. The results of the NPO analysis are contained within Technical Evaluation R1900-005-001, Non-Power Operation Modes Transition Review Report.

### 3.5 Radioactive Release Compliance Summary

The NFPA 805 radiological release goal is to provide reasonable assurance that a fire will not result in a radiological release that adversely affects the public, plant personnel or the environment. The NFPA 805 requirement is to ensure a radiation release to any unrestricted area due to the direct effects of fire suppression activities (but not involving fuel damage) shall be as low as reasonably achievable and shall not exceed applicable plant Technical Specification limits.

AA5/6 is within the Radiological Controlled Area (RCA) and has been identified as a potential fire area for radioactive release due to fire fighting activities. In accordance with NFPA 805 FAQ 09-0056, this potential has been reviewed to ensure that engineering controls, fire pre-plans, and fire brigade training materials are provided for containment and monitoring of gaseous and liquid effluents associated with fire suppression agents and products of combustion.

The review concludes that the steps to limit radiation release to other areas due to the direct effects of fire suppression activities, in addition to compliance with NFPA 805, Chapter 4, ensure that any radioactive release will be as low as reasonably achievable and will not exceed limits designated in the CNP Technical Specifications.

The review of this fire area, with respect to radioactive release, is documented in the NFPPM.

### 3.6 Probabilistic Risk Assessment-Summary of Results

A Fire PRA (FPRA) quantification of Fire Area AA5/6 was performed and is documented in PRA-NB-FIRE-FQ, Fire PRA Model Quantification Notebook. The fire risk quantification for Fire Area AA5/6 is analyzed using detailed fire modeling to consider risk of fire scenarios of ignition sources. PRA-NB-FIRE-FQ includes a summary of all potentially risk-significant fire scenarios (i.e., CDF > 1.0E-7 or LERF > 1.0E-8). Bounding CDF / LERF per calendar year values are reported that are based on the risk values documented in PRA-NB-FIRE-FSS, Fire PRA Fire Scenario Selection.

Fire Protection features credited in the Fire PRA are documented in R1900-0411-AA5-6, Detailed Fire Modeling Report: Fire Compartment: AA5/6 Auxiliary Building (EL 587 FT). PRA-NB-FIRE-FSS documents the revision level of the fire modeling reports used in the most recent Fire PRA quantification.

### **3.7 Risk-Informed, Performance-Based Evaluations**

Fire Risk Evaluations (FREs) have been performed to ensure that variances from the NFPA 805 deterministic requirements are acceptable. The evaluation process consists of an integrated assessment of the acceptability of risk, defense-in-depth, and safety margins.

#### **3.7.1 Transition Risk-Informed, Performance-Based Evaluations**

The ‘changes’ associated with NFPA 805 transition were those variances from the deterministic requirements of NFPA 805 or with the existing fire protection licensing basis that were brought into compliance with the NFPA 805 performance based approach. The change identified for evaluation for Fire Area AA5/6 is as follows:

- Separation Issues

The Fire Risk Evaluation has determined that the change is acceptable based upon:

- The measured change in CDF and LERF.
- Adequate defense-in-depth and safety margins being maintained.

Refer to Attachment 2 for a summary of results associated with the Fire Risk Evaluations.

### 3.8 Defense-in-Depth

A comprehensive risk-informed, performance-based analysis includes consideration of defense-in-depth (DID) as part of an integrated evaluation of risk considerations. In general, defense-in-depth involves consideration of the extent to which fire protection systems and features are provided within the three echelons of fire-protection:

- Preventing fires from starting,
- Rapidly detecting fires and controlling and extinguishing promptly those fires that do occur, thereby limiting fire damage,
- Providing an adequate level of fire protection for structures, systems, and components important to safety, so that a fire that is not promptly extinguished will not prevent the nuclear safety performance criteria from being met.

Each VFDR was evaluated for DID. The following recovery actions have been retained for DID.

VFDR No. AA5/6-007: 1-IMO-910 and 1-IMO-911 - RWST to Charging Pumps Isolation Valves are required to be open to support CVCS. These valves are required to be open to maintain charging pump suction from the RWST. RWST to Charging Pumps Isolation Valves could spuriously close due to cable failures caused by a full area fire within Fire Area AA5/6. These failures can be mitigated by de-energizing and manually opening either 1-IMO-910 or 1-IMO-911. This recovery action is being retained for DID to CVCS is maintained.

VFDR No. AA5/6-016: 1-QMO-200, 1-QMO-201 and 1-QRV-200 - Charging System Isolation and Back pressure. At least one of these valves must be shut to maintain inventory, pressure and reactivity control. These failures can be mitigated by de-energizing 1-QRV-200 at CRID II. This recovery action is being retained for DID to ensure charging isolation and pressure are maintained.

Based on the assessment in support of the Fire Risk Evaluation, defense-in-depth is maintained for fire area AA5/6. Refer to Attachment 2 for details associated with the Fire Risk Evaluation.

### 3.9 Monitoring Program Input

A Monitoring Program will be developed in accordance with FAQ 10-0059, Rev. 1. Methods to monitor availability, reliability, and performance of fire protection program structures, systems, and components (SSCs), as well as programmatic elements will be provided. Additionally, effectiveness measures are established to review program related performance and trends. For AA5/6 the following systems and features are candidates for inclusion in the CNP Fire Protection Monitoring Program:

- Fire Area boundary barriers discussed in Section 3.1
- Fire Detection System
- Fire Suppression System
- Cable tray covers
- Diking around Fire Zones 64A, 64B, 65A and 65B

### 4.0 CONCLUSION

The nuclear safety and radioactive release performance criteria of NFPA 805 are met for a fire in Fire Area AA5/6. This Fire Risk Evaluation for Fire Area AA5/6 has demonstrated that

- The change in core damage frequency (delta CDF) is acceptable, and
- The change in large early release frequency (delta LERF) is acceptable, and

- Defense-in-depth and safety margins are maintained.

This is confirmation that a success path effectively remains free of fire damage and that the performance-based approach is acceptable per Section 4.2.4.2 of NFPA 805.

## 5.0 REFERENCES

- 5.1 Calculation PRA-FIRE-NB-CRE, Fire PRA Cumulative Risk Evaluations
- 5.2 CNP Fire Pre-Plans, Volumes I, II, and III, Revisions 17, 14, and 18 respectively
- 5.3 Fire Hazards Analysis
- 5.4 NFPA 805, Performance-Based Standard for Fire Protection for Light Water Reactor Electric Generating Plants
- 5.5 NFPPM, NFPA 805 Fire Protection Program Manual (NFPPM)
- 5.6 Nuclear Energy Institute (NEI) 04-02, Guidance for Implementing a Risk-Informed, Performance-Based Fire Protection Program under 10 CFR 50.48(c), Rev. 2
- 5.7 Nuclear Safety Capability Assessment Report
- 5.8 PRA-NB-FIRE-FQ, Fire PRA Model Quantification Notebook
- 5.9 PRA-NB-FIRE-FSS, Fire PRA Fire Scenario Selection
- 5.10 R1900-0411-AA5-6, AA5-6 - Detailed Fire Modeling Report
- 5.11 Regulatory Guide 1.205, Risk-Informed, Performance-Based Fire Protection for Existing Light-Water Nuclear Power Plants, Rev. Revision 1
- 5.12 Technical Evaluation R1900-005-001, Non-Power Operation Modes Transition Review

**Fire Area AA5/6 – Attachment 1 - Table B-3 - Fire Area Transition**

<u>Unit</u>	<u>Fire Area</u>	<u>Description</u>
1, 2	AA5/6	Auxiliary Building (El. 587 ft.)

**Fire Zone   Description**

4	Sampling Room, Auxiliary Building - El. 587 ft. 0 in.
5	Auxiliary Building - El. 587 ft. 0 in. (East End) - Both Units
6A	Auxiliary Building Pipe Tunnel – El. 601 ft. 0 in. and El. 609 ft. 0 in. – Both Units
6M	Auxiliary Building - El. 587 ft. 0 in. (Middle Section of the West End) - Both Units
6N	Auxiliary Building - El. 587 ft. 0 in. (North Section of West End) - Unit 1
6S	Auxiliary Building - El. 587 ft. 0 in. (South Section of the West End) - Unit 2
61	Spray Additive Tank Room - El. 587 ft. 0 in. - Both Units
64A	Safety Injection Pump North - El. 587 ft. 0 in. - Unit 1
64B	Safety Injection Pump South - El. 587 ft. 0 in. - Unit 1
65A	Safety Injection Pump South - El. 587 ft. 0 in. - Unit 2
65B	Safety Injection Pump North - El. 587 ft. 0 in. 0 - Unit 2

**Regulatory Basis**

4.2.4.2 - Performance-Based Approach - Fire Risk Evaluation with simplifying deterministic assumptions

<b>Performance Goal</b>	<b>Method of Accomplishment</b>	<b>Comments</b>
<b>Reactivity Control</b>	Unit 1 - Trip the reactor from the Control Room. Borate using Unit 1 East or West Charging Pump from the RWST. Use source range monitoring for indication.  Unit 2 - Trip the reactor from the Control Room. Borate using Unit 1 East or West Charging Pumps supplied from the Unit 1 RWST. Use source range monitoring for indication.	None
<b>Inventory and Pressure Control</b>	Unit 1 - Control inventory using Unit 1 East or West Charging Pump. Control pressure using Unit 1 Pressurizer Safety Relief Valves.  Unit 2 - Control inventory using Unit 1 East or West Charging Pump aligned through the Unit 2 BIT. Control pressure using Unit 2 Pressurizer Safety Relief Valves.	VFDRs identified for Unit 1 and Unit 2 CVCS.

**Fire Area AA5/6 – Attachment 1 - Table B-3 - Fire Area Transition**

<u>Unit</u>	<u>Fire Area</u>	<u>Description</u>
1, 2	AA5/6	Auxiliary Building (El. 587 ft.)
Decay Heat Removal		<p>Unit 1 - Feed SGs 2 &amp; 3 with Unit 1 East MDAFW Pump. The DHR function also requires MS isolation with a steam release path through the Safety Relief Valves.</p> <p>Unit 2 - Feed SGs 2 &amp; 3 with Unit 2 East MDAFW Pump. The DHR function also requires MS isolation with a steam release path through the Safety Relief Valves.</p>
Process Monitoring		<p>Unit 1 Process Monitoring - Use Unit 1 process monitoring in the Control Room for the following: Pressurizer level, RCS pressure and temperature, and S/G level and Pressure.</p> <p>Unit 1 Source Range Monitoring - Use Unit 1 source range monitoring in the Control Room.</p> <p>Unit 2 Process Monitoring - Use Unit 2 process monitoring in the Control Room for the following: Pressurizer level, RCS pressure and temperature, and S/G level and Pressure.</p> <p>Unit 2 Source Range Monitoring - Use Unit 2 source range monitoring in the Control Room.</p>
Vital Auxiliaries		<p>Unit 1 Electrical - Control Unit 1 Green (CD) Train Electrical Distribution with Unit 1 Green (CD) Train Offsite Power or Unit 1 Green (CD) DG. Control Unit 1 Red (AB) Train Electrical Distribution with Unit 1 Red (AB) Train Offsite Power.</p> <p>Unit 1 ESW - Operate Unit 1 East or West ESW or Unit 2 East or West ESW aligned to Unit 1.</p> <p>Unit 1 CCW - Operate Unit 1 East or West CCW</p> <p>Unit 1 HVAC - Operate Unit 1 Control Room HVAC. Operate Unit 1 Auxiliary Building HVAC. Operate Unit 1 Green (CD) DG HVAC. Operate Unit 1 Switchgear HVAC. Unit 1 East AFW Pump Room HVAC system is not available. Unit 1 ESW HVAC system requires temporary ventilation.</p> <p>Unit 2 Electrical - Control Unit 2 Red (AB) Train Electrical Distribution with Unit 2 Red (AB) Train Offsite Power or Unit 2 Red (AB) DG. Control Unit 2 Green (CD) Train Electrical Distribution with Unit 2 Green (CD) Train Offsite Power.</p> <p>Unit 2 ESW - Operate Unit 2 East or West ESW or operate Unit 1 East or</p>



**Fire Area AA5/6 – Attachment 1 - Table B-3 - Fire Area Transition**

<u>Unit</u>	<u>Fire Area</u>	<u>Description</u>
1, 2	AA5/6	Auxiliary Building (El. 587 ft.)
<p>West ESW aligned to Unit 2</p> <p>Unit 2 CCW - Operate Unit 1 East or West CCW to support alternate CVCS for Unit 2.</p> <p>Unit 2 HVAC - Operate Unit 2 Control Room HVAC. Operate Unit 2 Auxiliary Building HVAC. Operate Unit 2 Red (AB) DG HVAC. Operate Unit 2 Switchgear HVAC. Unit 2 East AFW Pump Room HVAC system is not available. Unit 2 ESW HVAC system requires temporary ventilation.</p>		

**Reference Documents**

Genesis Solution Suite, EDISON / SAFE-PB, DC Cook V 3.4.0

Nuclear Safety Capability Assessment Report

**Licensing Actions**

None

**Existing Engineering Equivalency Evaluations (EEEE)**

**EEEE Title** Engineering Equivalency Evaluation 9-4 - Auxiliary Building Vertical Air Shafts Evaluation: Fire Zones 12 (Fire Area AA11) and 22 (Fire Area AA27)

**Summary** The purpose of this engineering equivalency evaluation is to document the acceptability of two vertical air shafts, located in the Auxiliary Building (Fire Areas AA11 and AA27), that extend from the 573 ft. elevation to just below the 650 ft. elevation with dampered and undampered ventilation openings.

Reasonable assurance is provided that a fire in any of the adjoining fire areas to the Auxiliary Building air shafts with undampered or unrated duct penetrations or a fire in either air shaft will not adversely impact on safe shutdown capabilities of CNP. In addition, this engineering equivalency evaluation does not adversely impact other engineering equivalency evaluations.

The air shafts were evaluated and found to be acceptable based on the fire hazards, fire protection systems and construction features within the evaluated areas.

**Fire Area AA5/6 – Attachment 1 - Table B-3 - Fire Area Transition**

<b><u>Unit</u></b>	<b><u>Fire Area</u></b>	<b><u>Description</u></b>
1, 2	AA5/6	Auxiliary Building (El. 587 ft.)

<b><u>EEEE Title</u></b>	<b>Engineering Equivalency Evaluation 9-33 - Fire Zone 6A (Fire Area AA5/6) to 138B (Fire Area AA1) Boundary Evaluations</b>
<b><u>Summary</u></b>	<p>The purpose of this engineering equivalency evaluation is to document the acceptability of a vertical shaft connecting the 601 ft. Pipe Tunnel in Fire Zone 6A (Fire Area AA5/6) and the CVCS Hold Up Tank Room B in Fire Zone 138B (Fire Area AA1).</p> <p>Reasonable assurance is provided that a fire on the 573 or 562 ft. elevations of the Auxiliary Building will not spread up the shaft in Fire Zone 138B to Fire Zone 6A and spread from there so as to impair redundant safe shutdown capabilities. This engineering equivalency evaluation does not impact other engineering equivalency evaluations.</p> <p>The undampered vertical shaft connecting Fire Zone 6A and Fire Zone 138B was evaluated and found to be acceptable based on the fire hazards and fire protection systems within the evaluated areas. Also, one of the fire zones being evaluated does not contain</p>
<b><u>EEEE Title</u></b>	<b>Engineering Equivalency Evaluation 9-34 - Fire Zone 36 (Fire Area AA3) to Fire Zone 5 (Fire Area AA5/6) Boundary Evaluation</b>
<b><u>Summary</u></b>	<p>The purpose of this engineering equivalency evaluation is to document the acceptability of an undampered duct penetrating the barrier separating Fire Zone 36 (Fire Area AA3) from Fire Zone 5 (Fire Area AA5/6).</p> <p>Reasonable assurance is provided that the undampered ventilation duct passing through the barrier separating Fire Zones 5 and 36 will not impact either safe shutdown capability or other engineering equivalency evaluations or exemptions.</p> <p>The duct was evaluated and found to be acceptable based on the fire hazards and fire protection systems within the evaluated areas.</p>
<b><u>EEEE Title</u></b>	<b>Engineering Equivalency Evaluation 9-37 - Fire Zones 5 (Fire Area AA5/6) and 32 (Fire Area AA3) Boundary Evaluations</b>
<b><u>Summary</u></b>	<p>The purpose of this engineering equivalency evaluation is to document the acceptability of: (1) an undampered duct; (2) unrated construction including an unrated door; and (3) several minor unsealed penetrations in the wall and ceiling of a stairway enclosure separating Fire Zone 5 (Fire Area AA5/6) from Fire Zone 32 (Fire Area AA3).</p> <p>Reasonable assurance is provided that the undampered ventilation duct, unrated door, unrated construction, and unsealed penetrations through the barriers separating Fire Zones 5 and 32 will not impact the redundant safe shutdown capability for either fire zone. This engineering equivalency evaluation does not adversely impact other engineering equivalency evaluations or exemption requests and is limited in scope to those items stated above.</p> <p>The duct, door and penetrations were evaluated and found to be acceptable based on the fire hazards, fire protection systems and construction features within the evaluated areas.</p>

**Fire Area AA5/6 – Attachment 1 - Table B-3 - Fire Area Transition**

<b><u>Unit</u></b>	<b><u>Fire Area</u></b>	<b><u>Description</u></b>
1, 2	AA5/6	Auxiliary Building (El. 587 ft.)

<b><u>EEEE Title</u></b>	<b>Engineering Equivalency Evaluation 9-40 - Fire Zone 7 (Fire Area AA7) to Fire Zone 61 (Fire Area AA5/6) Boundary Elevation</b>
<b><u>Summary</u></b>	<p>The purpose of this engineering equivalency evaluation is to document the acceptability of two unrated field fabricated fusible link actuated guillotine type dampers presently located between the Unit 1 Quadrant 1 Cable Tunnel in Fire Zone 7 (Fire Area AA7) and the Spray Additive Tank Room in Fire Zone 61 (Fire Area AA5/6).</p> <p>The existing field fabricated fusible link actuated guillotine type dampers located between Fire Zone 7 and Fire Zone 61 is an acceptable device for maintaining the rating of the fire area boundary. This engineering equivalency evaluation verifies that there is no adverse impact to other engineering equivalency evaluations.</p> <p>The fusible link actuated guillotine type dampers were evaluated and found to be acceptable based on the fire hazards, fire protection systems and construction features within the evaluated areas.</p>
<b><u>EEEE Title</u></b>	<b>Engineering Equivalency Evaluation 11-1 - Auxiliary Building Elevation 587 ft. to Spent Fuel Heat Exchanger Pit Pump Room Hatch Boundary Evaluation Fire Zone 5 (Fire Area AA5/6) and Fire Zone 36 (Fire Area AA3) Hatch Evaluation</b>
<b><u>Summary</u></b>	<p>The purpose of this engineering equivalency evaluation is to document the acceptability of an unrated steel plate floor hatch located between the east end of the Auxiliary Building in Fire Zone 5 (Fire Area AA5/6) at elevation 587 ft. and the spent fuel heat exchanger pit pump room in Fire Zone 36 (Fire Area AA3) at elevation 609 ft. A 3-hr fire-rated hatch assembly is not commercially available for use in this location.</p> <p>Reasonable assurance is provided that the unrated steel plate hatch passing through the barrier separating Fire Zones 5 and 36 will not impact redundant safe shutdown capability. This engineering equivalency evaluation does not adversely impact other engineering equivalency evaluations.</p> <p>The unrated steel plate floor hatch was evaluated and found to be acceptable based on the fire hazards, fire protection systems and construction features within the areas.</p>

**Fire Area AA5/6 – Attachment 1 - Table B-3 - Fire Area Transition**

<u>Unit</u>	<u>Fire Area</u>	<u>Description</u>
1, 2	AA5/6	Auxiliary Building (El. 587 ft.)
<b><u>EEEE Title</u></b>	<b>Engineering Equivalency Evaluation 11-7 - Fire Zone 5 (Fire Area AA5/6) to Unit 1 Fire Zones 62A, 62B and 62C (Fire Area AA54) and Unit 2 Fire Zones 63A, 63B and 63C (Fire Area AA5) Removable Block Walls</b>	
<b><u>Summary</u></b>	<p>The purpose of this engineering equivalency evaluation is to document the acceptability of unrated fire area boundaries between the common Unit 1 and Unit 2 east end of the Auxiliary Building at elevation 587 ft. (Fire Zone 5), and the Unit 1 charging pump cubicles (Fire Zones 62A, 62B and 62C) and the Unit 2 charging pump cubicles (Fire Zones 63A, 63B and 63C) for their impact on preventing the spread of fire.</p> <p>Reasonable assurance is provided that a fire developing in either the Unit 1 charging pump cubicles (Fire Zones 62A, 629 and 62C), the Unit 2 charging pump cubicles (Fire Zones 63A, 63B and 63C) or the east end of the Auxiliary Building at elevation 587 ft. (Fire Zone 5) will not impair the safe shutdown capabilities of Unit 1 or Unit 2. In addition, this engineering equivalency evaluation does not adversely impact other engineering equivalency evaluations.</p> <p>The boundaries were evaluated and found to be acceptable based on the fire hazards, fire protection systems and construction features within the evaluated areas.</p>	
<b><u>EEEE Title</u></b>	<b>Engineering Equivalency Evaluation 11-9 - Turbine, Auxiliary and Containment Buildings Boundary Evaluation</b>	
<b><u>Summary</u></b>	<p>The purpose of this engineering equivalency evaluation is to describe in general, the approach and existence of evaluations performed to determine and reconcile fire area boundaries having components or designs with less than a 3-hr fire rating on preventing the spread of fire. This engineering equivalency evaluation also specifically evaluates the impact of unrated door assemblies on the spread of fire.</p> <p>Reasonable assurance is provided that the fire area boundaries having components or design less than a 3-hr fire rating will not increase the spread of fire or impair the safe shutdown capabilities of Units 1 or 2. In addition, this engineering equivalency evaluation does not adversely impact on other engineering equivalency evaluations or exemption requests.</p> <p>This evaluation supports additional evaluations credited in this fire area.</p>	

**Fire Area AA5/6 – Attachment 1 - Table B-3 - Fire Area Transition**

<u>Unit</u>	<u>Fire Area</u>	<u>Description</u>
1, 2	AA5/6	Auxiliary Building (El. 587 ft.)
<hr/>		
<b><u>EEEE Title</u></b>	<b>Engineering Equivalency Evaluation 11-12 - Stairwells and Elevator Construction and Boundary Evaluation (Fire Analysis Areas AA 1, AA2, AA3, AA5/6, AA3 6 and AA42)</b>	
<b><u>Summary</u></b>	<p>The purpose of this engineering equivalency evaluation is to document the acceptability of the rated and unrated fire barriers of the stairwells and elevators located in the Turbine and Auxiliary Buildings for their impact on preventing the spread of fire in Fire Areas AA1, AA2, AA3, AA5/6, and AA36/42.</p> <p>Reasonable assurance is provided that the open stairwells and elevators of the Turbine and Auxiliary Buildings will not result in an increased potential for the spread of fire or potential impairment of the safe shutdown capabilities of Unit 1 or Unit 2. This engineering equivalency evaluation does not impact other engineering equivalency evaluations.</p> <p>The stairwells and elevator boundaries were evaluated and found to be acceptable based on the fire hazards, fire protection systems and construction features within the areas.</p>	
<b><u>EEEE Title</u></b>	<b>Engineering Equivalency Evaluation 11-18 - Fire Zones 3, 31, 32, and 35 (Fire Area AA3) Boundary Evaluation</b>	
<b><u>Summary</u></b>	<p>The purpose of this engineering equivalency evaluation is to document the acceptability of the unrated construction features of the radwaste area boundaries in Fire Area AA3 for their impact on the spread of fire.</p> <p>Reasonable assurance is provided that the unrated construction features of the radwaste area boundaries will not result in an increased potential for the spread of fire or potential impairment of the safe shutdown capabilities of Units 1 and Unit 2. This engineering equivalency evaluation does not impact other engineering equivalency evaluations.</p> <p>The unrated boundary construction features were evaluated and found to be acceptable based on the fire hazards and the fire protection systems and features within the evaluated areas.</p>	

**Fire Area AA5/6 – Attachment 1 - Table B-3 - Fire Area Transition**

<u>Unit</u>	<u>Fire Area</u>	<u>Description</u>
1, 2	AA5/6	Auxiliary Building (El. 587 ft.)
<hr/>		
<b><u>EEEE Title</u></b>	<b>Engineering Equivalency Evaluation 11-45 - Auxiliary Building HVAC Duct Penetrations Boundary Evaluation Fire Analysis Areas AA1, AA3, AA5/6 and AA36/42</b>	
<b><u>Summary</u></b>	<p>The purpose of this engineering equivalency evaluation is to document the acceptability of not installing fire dampers in the ventilation system duct penetrations that communicate between fire areas vertically from elevation to elevation in Fire Areas AA1, AA3, AA5/6, and AA36/42. The ventilation ducts associated with the 22 penetrations were located on HVAC drawings showing the entire flow path of each duct. Penetrations into fire zones/areas equipped with rated fire dampers were eliminated and what remained is discussed in this engineering equivalency evaluation.</p> <p>This analysis verifies that the safe shutdown system requirements relative to the guidelines of NFPA 805 are being met, and the exclusion of fire dampers in the ventilation ducts is justified.</p> <p>The ventilation ducts were evaluated and found to be acceptable based on the fire hazards, fire protection systems and construction features within the evaluated areas.</p>	

**Fire Suppression Effects on Nuclear Safety Performance Criteria**

The CNP fire brigade is trained to discharge water in a judicious manner and instructed to direct hose streams and portable extinguishers at the base of the fire to limit the amount of overspray beyond the immediate fire zone. For this reason, fire brigade activities are not expected to fail components which are not immediately involved in the fire scenario. It has been concluded that water impingement on cables is not a concern. Electrical cabinets are provided with a seal at the conduit interface to prevent water intrusion. Per visual inspection any side vents for this equipment are pointed downward to prevent water intrusion. Therefore, in the event of discharge, the pre-action system will not adversely effect the other equipment operating within the fire zone. The drainage features of the fire area mitigate the potential for flooding damage due to fire suppression, such that the standing water would not affect credited equipment.

Since it is shown that suppression effects will not impact the nuclear safety performance criteria, the fire area configuration is deemed acceptable.

**References:**

Technical Evaluation 12.1, "Fire Suppression Effects Study"

Technical Evaluation 12.1, "Supplemental Information to Fire Suppression Effects Study – Supplement 1"

**Fire Area Comments**

None

## Fire Area AA5/6 – Attachment 2 - Fire Risk Evaluation Results Summary

### A2.1 Introduction

The ‘changes’ associated with NFPA 805 transition were those variances from the deterministic requirements of NFPA 805. The changes identified for evaluation for fire area AA5/6 are grouped as follows:

- Separation Issues

This attachment is a summary of the Fire Risk Evaluation for the fire area. The complete results and methodology are contained in the Cumulative Fire Risk Evaluation, PRA-FIRE-NB-CRE. (FPCE 2017-0009)

### A2.2 Inputs/Assumptions

Fire modeling processes and inputs provided in NUREG/CR-6850 are appropriate for use in a risk-informed, performance-based evaluation. The complete list of assumptions used in the fire modeling methodology for this fire area is contained in Detailed Fire Modeling Technical Evaluation R1900-0411-AA5-6.

### A2.3 Fire Modeling Methodology

Fire PRA fire modeling results are used as the initial input into this Fire Risk Evaluation. The process consists of conservative bounding analyses using NUREG/CR-6850 methods. As needed, refinements are made to utilize more realistic parameters. The complete fire modeling methodology for this fire area is contained in Detailed Fire Modeling Technical Evaluation R1900-0411-AA5-6.

### A2.4 Scenario Descriptions and Model Results

Fire Area AA5/6 was evaluated for the impact of fires originating from both fixed and transient ignition sources. Complete descriptions of each fire scenario is contained within the Detailed Fire Modeling Technical Evaluation R1900-0411-AA5/6.

For Fire Zones 64A, 64B, 65A and 65B, One scenario was developed for 64A/B and one scenario was developed for 65A/B. This scenario represented the 100% lube oil spill and the transient scenarios.

#### A2.4.1 Ignition Sources

Fire Area AA5/6 contains the nuclear sampling control panels, waste evaporator bottoms storage tank control panel, various motor control and valve control centers, heat trace distribution panels, waste evaporator condensate and feed pumps, boric acid transfer pumps, reactor coolant system local shutdown indication cabinets, the boric acid evaporator subpanel, data acquisition panels, the containment hydrogen monitoring system subpanels for train A and B as well as the operability relay cabinet and the fire signal and alarm panels.

Per discussion with plant personnel, the heat release rates for all switchgear, load centers, and MCC electrical cabinets have been characterized as qualified cable because items of this nature are generally constructed on-site. For other electrical cabinet types, where the internal cable qualification was unknown, the heat release rates have been assumed as non-qualified. As a screening approach, all ignition sources with the were modeled using a 98th heat release rate percentile fire scenario.

Ignition sources 12-DRP, Waste Evaporator-Unit 2, Cabinet C408, 12-ERA-7500 and the Boron Gas Recycling Cabinet were refined and modeled using a 75th heat release rate percentile fire scenario. The

## **Fire Area AA5/6 – Attachment 2 - Fire Risk Evaluation Results Summary**

Boric Acid Transfer pumps located in Fire Zone 6M were refined and modeled using a 10% oil spill pump analysis.

For all fire zones in Fire Area AA5/6 the 98th percentile HRR was used for all transient fires. The 98th percentile HRR bounds the possible transient ignition sources expected for this fire area, which were fire tested and identified in NUREG/CR-6850, Appendix G, Table G-7.

### **A2.4.2 Scenario Results**

A delta risk calculation has been performed to quantify the risk associated with the VFDRs in the fire area.

### **A2.5 Fire Risk Evaluation Results**

PRA-FIRE-NB-CRE documents scenarios and corresponding impacted VFDRs that were evaluated for delta risk during the transition to NFPA 805 and also all changes to the Fire Protection Program that are currently incorporated into the Fire PRA model. The acceptability of the Cumulative Fire Risk Evaluations was based on calculated delta risk meeting the thresholds of NEI 04-02, RG 1.205 and RG 1.174. (FPCE 2017-0009)



## Fire Area AA5/6 – Attachment 2 - Fire Risk Evaluation Results Summary

### A-2.6 Impact of VFDR on Defense-in-Depth

Defense-in-Depth has been evaluated for this fire area. The impacts of this evaluation are summarized in the table below:

Defense-in-Depth Impact Review for AA5/6			
Method of Providing DID	Required to Support Deterministic Analysis or Fire PRA?	Changes or Improvements Necessary for DID?	Basis/Justification
Echelon 1: Prevent fires from starting			
Combustible Control is implemented in accordance with Procedure PMP-2270-CCM-001, Control of Combustible Materials.	Yes	No	• This element is strengthened to off set potential over-reliance on another echelon of defense-in-depth.
Hot Work Control is implemented in accordance with Procedure PMP-2270-WBG-001, Welding, Burning and Grinding Activities.	Yes	No	
Echelon 2: Rapidly detect, control and extinguish promptly those fires that do occur thereby limiting fire damage			
Fire Detection System	Yes	No	• Although fire fighting activities may be challenging, suppression and detection are provided throughout the fire area and therefore no changes or improvements to Echelon 2 attributes are necessary to maintain defense-in-depth.
Fixed Fire Suppression	Yes	No	
Portable Fire Extinguishers	Yes	No	
Hose stations and hydrants	Yes	No	
Pre-Fire Plan	Yes	Yes	
Echelon 3: Provide adequate level of fire protection for systems and structures so that a fire will not prevent essential safety functions from being performed			
Walls, floors ceilings and structural elements are rated or have been evaluated as adequate for the hazard.	Yes	No	• There are significant modeling differences between the Fire PRA and nuclear safety capability assessment (i.e., due to different success criteria, end states, etc.) and therefore a recovery action for VFDR AA5/6-007 has been credited to ensure that defense-in-depth is maintained.  • Where a variance can possibly be affected in a potentially high risk scenario, based on a detailed review, the VFDR is either not the cause for the high risk of the scenario or the mitigating recovery action is credited; therefore no changes or improvements to Echelon 3 attributes are necessary to maintain defense-in-depth.
Penetrations in the fire area barrier are rated or have been evaluated as adequate for the hazard.	Yes	No	
Supplemental barriers (e.g., ERFBS, cable tray covers, etc.)	Yes	No	
Guidance provided to operations personnel detailing the required success path(s) including recovery actions to achieve nuclear safety performance criteria.	Yes	Yes	
			• Cable tray covers are credited in the detailed fire modeling to reduce fire spread and target damage, and, are therefore, credited for defense-in-depth.

## Fire Area AA5/6 – Attachment 2 - Fire Risk Evaluation Results Summary

### A-2.7 Safety Margin Considerations

In accordance with NEI 04-02, the maintenance of adequate Safety Margin is assessed by the consideration categories of analyses utilized by this Fire Risk Evaluation.

Safety margins are considered to be maintained if:

- Codes and Standards or their alternatives accepted for use by the NRC are met.

AND

- Safety analyses acceptance criteria in the licensing basis (e.g., FSAR, supporting analyses) are met, or provides sufficient margin to account for analysis and data uncertainty.

The following summarizes the bases for ensuring the maintenance of safety margins:

- The risk-informed, performance based processes utilized are based upon NFPA 805, 2001 edition, endorsed by the NRC in 10 CFR 50.48(c).
- The Fire Risk Evaluation process is in accordance with NEI 04-02, Revision 2, which is endorsed by the NRC in Regulatory Guide 1.205, Revision 1.
- The Fire PRA is developed in accordance with NUREG/CR-6850, which was developed jointly between the NRC and EPRI.
- The Fire PRA has undergone an industry peer review, in order to ensure the Fire PRA meets the appropriate quality standards of ASME/ANS RA-Sa-2009, "Standard for Level 1/Large Early Release Frequency Probabilistic Risk Assessment for Nuclear Power Plant Applications," Dated February 2, 2009
- The "combined analysis approach" is used during transition (NEI 04-02, Section 5.3.4.3); therefore, MEFS/LFS is not analyzed separately from the Fire PRA results.
- The CNP internal events PRA model received two formal industry peer reviews conducted in accordance with applicable NEI guidelines. The initial peer review was performed in 2001, while a subsequent focused scope (i.e., limited scope) peer review was conducted in 2009. The initial, full-scope WOG peer review covered all aspects of the CNP PRA model and the administrative processes used to maintain and update the model. The CNP PRA model has been revised to address all significant issues (i.e., Category A and B Facts & Observations) identified during the initial peer review. None of the findings from the focused-scope peer review were judged to reach the significance level of a Category A or B Fact & Observation; as a result, no changes to the PRA model have yet been made to include resolutions for these latter issues.
- Fire protection systems and features determined to be required by NFPA 805 Chapter 4 have been confirmed to meet the requirements of NFPA 805 Chapter 3 and their associated referenced codes and listings, or provided with acceptable alternatives using processes accepted for use by the NRC (i.e., FAQ 06-0008, FAQ 06-0004, 07-0033).
- Fire modeling performed in support of the transition has been performed within the Fire PRA utilizing codes and standards developed by industry and NRC staff which have been verified and validated in authoritative publications, such as NUREG 1824, "Verification and Validation of Selected Fire Models for Nuclear Power Plant Applications". In general, the fire modeling performed in support of the Fire Risk Evaluations has been performed using conservative methods and input parameters that are based upon

## **Fire Area AA5/6 – Attachment 2 - Fire Risk Evaluation Results Summary**

NUREG/CR-6850 as documented in the AA5/6 Detailed Fire Modeling Report, section 7.2. While this is generally not ideal in the context of best estimate probabilistic risk analysis, it is a pragmatic approach given the current state of knowledge regarding the uncertainties related to the application of the fire modeling tools and associated input parameters for specific plant configurations.

- In accordance with the requirements of 10 CFR 50.48(c)(2)(iii), the Fire PRA results, including cutsets for the scenarios of concern, have been reviewed and it was verified that the results presented above do not rely solely on feed and bleed as the fire-protected safe shutdown path for maintaining reactor coolant inventory, pressure control, and decay heat removal capability for this fire area.

### **A-2.8 Transition Risk Evaluation Conclusions**

The transition change evaluation determined that these changes:

- Are acceptable based upon the measured change in CDF and LERF
- Maintained adequate defense-in-depth and safety margins

The results of this evaluation meet the requirements of NFPA 805 Risk Evaluation; therefore, the use of the performance based analysis approach is acceptable.

D. C. Cook Nuclear Plant  
Fire Safety Analysis

Fire Area: AA7

Unit 1 Quadrant 1 Cable Tunnel (El. 596 ft.)

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Attachments

Fire Area AA7 – Attachment 1 - Table B-3 - Fire Area Transition

Fire Area AA7 – Attachment 2 - Fire Risk Evaluation Results Summary

## 1.0 PURPOSE

This report documents the Fire Safety Analysis (FSA) for Cook Nuclear Plant (CNP) Fire Area AA7, Unit 1 Quadrant 1 Cable Tunnel (El. 596 ft.) which comprises fire zone(s) 7. The purpose of this analysis is to demonstrate the achievement of the nuclear safety and radioactive release performance criteria of NFPA 805 as required by 10 CFR 50.48(c). The Fire Safety Analysis is a key part of compliance with Section 2.7.1.2 Fire Protection Program Design Basis Document of NFPA 805.

## 2.0 ANALYSIS METHODOLOGY

The FSA is the design basis document as described in NFPA 805 Section 2.7.1.2. The following steps are performed to develop the FSA on a fire area basis:

- Identify significant fire hazards in the fire area. This is based on NFPA 805 approach to analyze the plant from an ignition source and fuel package perspective.
- Summarize Nuclear Safety Capability Analysis (NSCA) compliance strategies. This is the result of the NEI 04-02 B-3 Table review of the Safe Shutdown Analysis.
- Summarize Non-Power Operations Modes compliance strategies.
- Summarize Radioactive Release compliance strategies. The transition review process required per NEI 04-02 is used to develop these results.
- Provide Fire Probabilistic Risk Assessment summary of results. This is based on the results from the plant Fire PRA.
- Perform risk informed, performance based evaluations if needed for the performance based approach.
- Summarize Defense-in-Depth strategy for each fire area.
- Determine key analysis assumptions which are candidates to be included in the NFPA 805 monitoring program.
- Provide conclusions relative to NFPA 805 compliance.

### **3.0 ANALYSIS**

#### **3.1 Classical Fire Protection**

##### **3.1.1 Construction**

Walls, floors and ceilings to adjacent fire areas are reinforced concrete in excess of a 3-hour rating.

A fire area boundary evaluation was performed for a damper and penetration seal in this area which has a fire resistance rating of less than 3 hours.

Applicable Engineering Equivalency Evaluations are documented in Attachment 1.

##### **3.1.2 Doors and Access Openings**

Fire doors having a 3-hour rating are provided to adjacent Fire Areas AA8 and AA37 - Fire Zones 8 and 38, respectively.

##### **3.1.3 Penetrations**

Note: Statements regarding fire resistance rating of penetration seals are not applicable to seals in barriers to Analysis Area YD.

Penetrations in fire barriers between this fire zone and adjacent fire areas are provided with fire seals except as noted below.

A fire area boundary evaluation was performed for the 8-inch thick unrated silicone foam fire seals installed between Fire Area AA7 and Fire Area AA37 - Fire Zone 38 (Engineering Equivalency Evaluation 11-2).

Fire Area engineering equivalency evaluations were prepared to evaluate fire seal designs between Fire Zones 7 and 8 and Fire Zones 7 and 38. (Engineering Equivalency Evaluations 11-28 and 11-33).

The seismic gaps are sealed with a glass fiber reinforced silicone sheeting.

Seismic gap exemption was granted for Fire Zone 7 interface with Fire Areas AA8, AA11 and AA3 - Fire Zones 8, 12, and 49, 69, respectively (Engineering Equivalency Evaluation 11-46).

### 3.1.4 Detection

The table below outlines the fire detection system(s) provided in the Fire Area:

Table 3-1, Fire Area AA7 Detection Systems								
Fire Zone	Type of System	Local (L) / Remote (R)	Detection Actuates Suppression?	Required System?				
				S	L	E	R	D
7	Infrared	L/R	N	N	N	Y	N	N
7	Ionization	L/R	N	N	N	Y	N	N

**Table 3-1 Legend:**

Table Field: "Required System?"	
S	- Required for Chapter 4 Separation Criteria
L	- Required for NRC Approved Licensing Action
E	- Required for Engineering Equivalency Evaluation
R	- Required for Risk Significance
D	- Required to maintain adequate balance of Defense-in-Depth in a Change Evaluation or Fire Risk Evaluation

Cross zoned ionization smoke detectors (4) and infra-red detectors (3) are provided which alarm in the Unit 1 Control Room.

### 3.1.5 Fixed Suppression

The table below outlines the fixed fire suppression system(s) provided in the Fire Area:

Table 3-2, Fire Area AA7 Suppression Systems							
Fire Zone	Type of System	Full (F) / Partial (P)	Required System?				
			S	L	E	R	D
7	Manual CO2	F	N	N	Y	Y	N

**Table 3-2 Legend:**

Table Field: "Required System?"	
S	- Required for Chapter 4 Separation Criteria
L	- Required for NRC Approved Licensing Action
E	- Required for Engineering Equivalency Evaluation
R	- Required for Risk Significance
D	- Required to maintain adequate balance of Defense-in-Depth in a Change Evaluation or Fire Risk Evaluation

Fire Area AA7 is not provided with automatic fire suppression.

### 3.1.6 Manual Suppression / Response Strategy

A postulated fire will be identified by early detection using ionization type smoke detection or by plant personnel using plant communication system to notify the control room. The automatic detection system alarms in the control room. The Control Room operator will dispatch the fire brigade for initiation of manual fire fighting. A fire in this fire area will be contained by the construction features discussed in Section 3.1.1. Manual suppression is provided by the CNP Fire

Brigade. A low pressure CO2 total flooding system supplied from the 17 ton tank is provided. This system is manually actuated. Operation of this system discharges CO2 into Fire Area AA7.

Fire extinguishers are located in Fire Area AA7 for the fire brigade's use.

Water hose reels are located within the fire area with additional hose reels located in the adjacent Fire Zones 8 and 9.

Floor drains are available in Fire Area AA7.

### 3.1.7 Ventilation

A fire in this area will be contained by the fire barriers. Smoke can be removed by portable fans and flexible ducting to other parts of the Auxiliary Building and outdoors if not contaminated. Contaminated smoke can be removed by portable fans and flexible ducting to other areas of the Auxiliary Building per the Fire Pre-Plans. The normal building ventilating systems in the Auxiliary Building will then exhaust the smoke via filtered monitored pathways. This fire area is listed as a non-controlled area in the Fire Pre Plans therefore there is reasonable assurance that products of combustion will not be contaminated.

For Fire Zone 7, A fire area boundary evaluation was performed for the unrated field fabricated fire dampers that are provided to adjacent Fire Area AA5/6 - Fire Zone 61. A fire damper having a 3-hour rating is provided to adjacent Fire Area AA8 - Fire Zone 8.

### 3.1.8 Other Features

No other fire protection features are provided for Fire Area AA7.

## 3.2 Fire Hazards Identification

The fire area contains both ignition sources and combustible fire hazards. The ignition sources consist of the neutron flux monitoring equipment, PAS waste collection pumps and BIT boric acid tank recirculating valves. Combustibles consist primarily of charcoal, cellulose and rubber/plastics.

The exterior wall penetrations of this Fire Area do not require a rating for protection. The spatial separation between the yard equipment and fire hazards to this Fire Area is sufficient to provide protection against heat damage. The impact of a fire in the yard on AA7 would be limited to radiant heat with no ceiling to contain the fire plume. Spatial separation as well as the reinforced concrete construction of the Fire Area is sufficient to prevent an exposure to credited equipment inside the plant through unrated exterior wall penetrations of this Fire Area.

The current fire loading classification is considered moderate.

## 3.3 NSCA Compliance Summary

Fire Area AA7, U1 Quadrant 1 Cable Tunnel, contains Red and Green Train cables, conduits, and raceways.

Compliance with the nuclear safety performance criteria is achieved using the performance-based approach in accordance with NFPA 805, Section 4.2.4.2.



Safe and stable condition of the affected Unit 1, will be accomplished using the Steam Generators 2 and 3 via the Unit 1 East Motor Driven Auxiliary Feedwater Pump, Control Room Process Monitoring, Unit 1 Charging via the East Pump, Unit 1 CCW via the East or West Pump and Unit 1 ESW via the East or West Pump. Power is credited to be available to the Red and Green train systems via offsite power with the EDGs available as well.

The Nuclear Safety Performance Criteria compliance strategy for AA7 is documented within the NSCA Report.

### 3.3.1 Variances

The variances identified for evaluation for this fire area are grouped as follows:

#### 3.3.1.1 VFDR No. AA07-001

1-NRV-151 and 1-NRV-152 - Pressurizer PORVs are required to be closed to support RCS integrity. RCS integrity is required to maintain positive control over RCS inventory and pressure. 1-NRV-151 may fail due to fire induced damage of cable 9705R-1. 1-NRV-152 may fail due to fire induced damage of cable 9706R-1. Failure of these cables could spuriously open the valves. This condition represents a variance from the deterministic requirements of NFPA 805, Section 4.2.3. This is a separation issue.

This VFDR has been evaluated and it was determined that the risk, safety margin and defense-in-depth meet the acceptance criteria of NFPA 805 Section 4.2.4 with a defense-in-depth action credited.

#### 3.3.1.2 VFDR No. AA07-002

1-NSO-023 and 1-NSO-024 - RX Head Vent Valves are required to be closed to support RCS Integrity. RCS integrity is required to maintain positive control over RCS inventory and pressure. 1-NSO-023 and 1-NSO-024 are in series requiring one of the valves to remain closed to provide RCS integrity. 1-NSO-023 may fail due to cable 9914PR-1. 1-NSO-024 may fail due to fire induce damage of cable 9920PR-1. Failure of these cables could spuriously open the valves. This condition represents a variance from the deterministic requirements of NFPA 805, Section 4.2.3. This is a separation issue.

This VFDR has been evaluated and it was determined that the risk, safety margin and defense-in-depth meet the acceptance criteria of NFPA 805 Section 4.2.4 with a defense-in-depth action credited.

#### 3.3.1.3 VFDR No. AA07-003

1-NSO-063 and 1-NSO-064 - Post Accident Vent Valves are required to be closed to support RCS integrity. RCS integrity is required to maintain positive control over RCS inventory and pressure. 1-NSO-063 and 1-NSO-064 are in series requiring one of the valves to remain closed to provide RCS integrity. 1-NSO-063 may fail due to fire induced damage of cable 9901PR-1. 1-NSO-064 may fail due to fire induced damage of cable 9907PR-1. Failure of these cables could spuriously open the valves. This condition represents a variance from the deterministic requirements of NFPA 805, Section 4.2.3. This is a separation issue.

This VFDR has been evaluated and it was determined that the risk, safety margin and defense-in-depth meet the acceptance criteria of NFPA 805 Section 4.2.4 with a defense-in-depth action credited.

**3.3.1.4 VFDR No. AA07-004**

1-QRV-10 and 1-QRV-40 - RCP Seal Water Return Isolation Valves are required to be open to support RCS integrity by maintaining the RCP seal. RCS integrity is required to maintain positive control over RCS inventory and pressure. 1-QRV-10 may fail due to fire induced damage of cable 4418PR-1. 1-QRV-40 may fail due to fire induced damage of cable 5002PR-1. These cables could cause spurious closure of these valves. This condition represents a variance from the deterministic requirements of NFPA 805, Section 4.2.3. This is a separation issue.

This VFDR has been evaluated and it was determined that the risk, safety margin and defense-in-depth meet the acceptance criteria of NFPA 805 Section 4.2.4 with a defense-in-depth action credited.

**3.3.2 Recovery Actions Credited**

For each VFDR, a Fire Risk Evaluation has been performed to assess the acceptability of risk, defense-in-depth, and safety margin. This evaluation determined whether or not recovery actions are required to ensure that one success path necessary to achieve and maintain the nuclear safety performance criteria is maintained free of fire damage by a single fire. Table 3-3 identifies the credited recovery actions for this area. Actions retained for DID are identified as “DID Actions” within Table 3-3. Additional information for DID actions is contained within Section 3.8 of this report. Note that, for completeness, all VFDRs are contained within Table 3-3, even if the Fire Risk Evaluation has determined that a recovery action is not required. In those instances where a recovery action has been determined to not be required, the word “None” is provided in the “Action” column in the table.

<b>Table 3-3, Recovery Actions Credited</b>		
<b>VFDR</b>	<b>Component</b>	<b>Action</b>
AA07-001	1-NRV-151 1-NRV-152	DID ACTION(S) 1-NRV-151-CLOSE 1-NRV-152-CLOSE (Remove fuses in MCR to fail closed PORVs 1-NRV-151 and 1-NRV-152)
AA07-002	1-NSO-023	DID ACTION(S) 1-NSO-023-CLOSE (Remove fuses in MCR to fail closed AOV 1-NSO-023)
AA07-003	1-NSO-063	DID ACTION(S) 1-NSO-063-CLOSE (Remove fuses in MCR to fail closed AOV 1-NSO-063)
AA07-004	1-QVR-10 1-QVR-40	DID ACTION(S) 1-QRV-10-OPEN 1-QRV-40-OPEN (Remove fuses in MCR to fail open AOVs 1-QRV-10 and 1-QRV-40)

### 3.4 Non-Power Operational Modes Compliance Summary

A review of CNP for the potential effects of a fire in this Fire Area while in non-power modes of operation (NPO) was conducted. This review was conducted using the guidance provided in NEI 04-02 and FAQ 07-0040, "Non-Power Operations Clarifications".

The review determined that there are potential failures that affect certain Key Safety Functions (KSF) as a result of the fire in this area, and the fire could result in the loss of one or more KSF paths. Compensatory measures are required during high risk evolution periods to provide reasonable assurance a fire will not adversely affect key safety functions and the NFPA 805 performance goal for NPO is therefore satisfied. The results of the NPO analysis are contained within Technical Evaluation R1900-005-001, Non-Power Operation Modes Transition Review Report.

### 3.5 Radioactive Release Compliance Summary

The NFPA 805 radiological release goal is to provide reasonable assurance that a fire will not result in a radiological release that adversely affects the public, plant personnel or the environment. The NFPA 805 requirement is to ensure a radiation release to any unrestricted area due to the direct effects of fire suppression activities (but not involving fuel damage) shall be as low as reasonably achievable and shall not exceed applicable plant Technical Specification limits.

AA7 is located outside the Radiological Controlled Area (RCA) and is not a storage location for contaminated materials, therefore there is reasonable assurance a fire in this area will not result in radiation release. The review of this fire area, with respect to radioactive release, is documented in the NFPPM.

### 3.6 Probabilistic Risk Assessment-Summary of Results

A Fire PRA (FPRA) quantification of Fire Area AA7 was performed and is documented in PRA-NB-FIRE-FQ, Fire PRA Model Quantification Notebook. The fire risk quantification for Fire Area AA7 is analyzed assuming whole room burnup. PRA-NB-FIRE-FQ includes a summary of all potentially risk-significant fire scenarios (i.e., CDF > 1.0E-7 or LERF > 1.0E-8). Bounding CDF / LERF per calendar year values are reported that are based on the risk values documented in PRA-NB-FIRE-FSS, Fire PRA Fire Scenario Selection.

### 3.7 Risk-Informed, Performance-Based Evaluations

Fire Risk Evaluations (FREs) have been performed to ensure that variances from the NFPA 805 deterministic requirements are acceptable. The evaluation process consists of an integrated assessment of the acceptability of risk, defense-in-depth, and safety margins.

#### 3.7.1 Transition Risk-Informed, Performance-Based Evaluations

The ‘changes’ associated with NFPA 805 transition were those variances from the deterministic requirements of NFPA 805 or with the existing fire protection licensing basis that were brought into compliance with the NFPA 805 performance based approach. The change identified for evaluation for Fire Area AA7 is as follows:

- Separation Issues

The Fire Risk Evaluation has determined that the change is acceptable based upon:

- The measured change in CDF and LERF.
- Adequate defense-in-depth and safety margins being maintained.

Refer to Attachment 2 for a summary of results associated with the Fire Risk Evaluations.

### 3.8 Defense-in-Depth

A comprehensive risk-informed, performance-based analysis includes consideration of defense-in-depth (DID) as part of an integrated evaluation of risk considerations. In general, defense-in-depth involves consideration of the extent to which fire protection systems and features are provided within the three echelons of fire-protection:

- Preventing fires from starting,
- Rapidly detecting fires and controlling and extinguishing promptly those fires that do occur, thereby limiting fire damage,
- Providing an adequate level of fire protection for structures, systems, and components important to safety, so that a fire that is not promptly extinguished will not prevent the nuclear safety performance criteria from being met.

Each VFDR was evaluated for DID. The following recovery actions have been retained for DID.

VFDR No. AA07-001: 1-NRV-151 and 1-NRV-152 - Pressurizer PORVs are required to be closed to support RCS integrity. RCS integrity is required to maintain positive control over RCS inventory and pressure. The spurious opening can be mitigated by de-energizing the valve to fail it closed. This recovery action is being retained for DID to ensure RCS pressure and inventory control is maintained.

VFDR No. AA07-002: 1-NSO-023 and 1-NSO-024 - RX Head Vent Valves are required to be closed to support

RCS Integrity. RCS integrity is required to maintain positive control over RCS inventory and pressure. 1-NSO-023 and 1-NSO-024 are in series requiring one of the valves to remain closed to provide RCS integrity. The spurious opening can be mitigated by de-energizing the valve to fail it closed. This recovery action is being retained for DID to ensure RCS pressure and inventory control is maintained.

VFDR No. AA07-003: 1-NSO-063 and 1-NSO-064 - Post Accident Vent Valves are required to be closed to support

RCS integrity. RCS integrity is required to maintain positive control over RCS inventory and pressure. 1-NSO-063 and 1-NSO-064 are in series requiring one of the valves to remain closed to provide RCS integrity. The spurious opening can be mitigated by de-energizing the valve to fail it closed. This recovery action is being retained for DID to ensure RCS pressure and inventory control is maintained.

VFDR No. AA07-004: 1-QVR-10 and 1-QVR-40 - RCP Seal Water Return Isolation Valves are required to be open to support RCS integrity by maintaining the RCP seal. RCS integrity is required to maintain positive control over RCS inventory and pressure. The spurious closing can be mitigated by de-energizing the valve to fail it open. This recovery action is being retained for DID to ensure RCS integrity is maintained.

Based on the assessment in support of the Fire Risk Evaluation, defense-in-depth is maintained for fire area AA7. Refer to Attachment 2 for details associated with the Fire Risk Evaluation.

### 3.9 Monitoring Program Input

A Monitoring Program will be developed in accordance with FAQ 10-0059, Rev. 1. Methods to monitor availability, reliability, and performance of fire protection program structures, systems, and components (SSCs), as well as programmatic elements will be provided. Additionally, effectiveness measures are established to review program related performance and trends. For AA7 the following

systems and features are candidates for inclusion in the CNP Fire Protection Monitoring Program:

- Fire Area boundary barriers discussed in Section 3.1

## 4.0 CONCLUSION

The nuclear safety and radioactive release performance criteria of NFPA 805 are met for a fire in Fire Area AA7. This Fire Risk Evaluation for Fire Area AA7 has demonstrated that

- The change in core damage frequency (delta CDF) is acceptable, and
- The change in large early release frequency (delta LERF) is acceptable, and
- Defense-in-depth and safety margins are maintained.

This is confirmation that a success path effectively remains free of fire damage and that the performance-based approach is acceptable per Section 4.2.4.2 of NFPA 805.

## 5.0 REFERENCES

- 5.1 Calculation PRA-FIRE-NB-CRE, Fire PRA Cumulative Risk Evaluations
- 5.2 CNP Fire Pre-Plans, Volumes I, II, and III, Revisions 17, 14, and 18 respectively
- 5.3 Fire Hazards Analysis
- 5.4 NFPA 805, Performance-Based Standard for Fire Protection for Light Water Reactor Electric Generating Plants
- 5.5 NFPPM, NFPA 805 Fire Protection Program Manual (NFPPM)
- 5.6 Nuclear Energy Institute (NEI) 04-02, Guidance for Implementing a Risk-Informed, Performance-Based Fire Protection Program under 10 CFR 50.48(c), Rev. 2
- 5.7 Nuclear Safety Capability Assessment Report
- 5.8 PRA-NB-FIRE-FQ, Fire PRA Model Quantification Notebook
- 5.9 PRA-NB-FIRE-FSS, Fire PRA Fire Scenario Selection
- 5.10 Regulatory Guide 1.205, Risk-Informed, Performance-Based Fire Protection for Existing Light-Water Nuclear Power Plants, Rev. Revision 1
- 5.11 Technical Evaluation R1900-005-001, Non-Power Operation Modes Transition Review

**Fire Area AA7 – Attachment 1 - Table B-3 - Fire Area Transition**

<u>Unit</u>	<u>Fire Area</u>	<u>Description</u>
1	AA7	Unit 1 Quadrant 1 Cable Tunnel (El. 596 ft.)

<u>Fire Zone</u>	<u>Description</u>
7	Quadrant 1 Cable Tunnel - El. 596 ft. 3-1/2 in. - Unit 1

**Regulatory Basis**

4.2.4.2 - Performance-Based Approach - Fire Risk Evaluation with simplifying deterministic assumptions

<b>Performance Goal</b>	<b>Method of Accomplishment</b>	<b>Comments</b>
Reactivity Control	Unit 1 - Trip the reactor from the Control Room. Borate using Unit 1 East Charging Pump supplied from the RWST. Use source range monitoring for indication for Unit 1.	None
Inventory and Pressure Control	Unit 1 - Control inventory using Unit 1 East Charging Pump. Control pressure using Unit 1 Pressurizer Safety Relief Valves.	VFDRs identified for Unit 1 and Unit 2 RX Head Vent Valves, Post Accident Vent Valves and RCP Seal Water Return Valves.
Decay Heat Removal	Unit 1 - Feed SGs 2 & 3 with Unit 1 East MDAFW Pump. The DHR function also requires MS isolation with a steam release path through the Safety Relief Valves.	None
Process Monitoring	Unit 1 Process Monitoring - Use Unit 1 process monitoring in the Control Room for the following: Pressurizer level, RCS pressure and temperature, and S/G level and Pressure. Unit 1 Source Range Monitoring - Use Unit 1 source range monitoring in the Control Room.	None
Vital Auxiliaries	Unit 1 Electrical - Control Unit 1 Red (AB) Train Electrical Distribution with Unit 1 Red (AB) Train Offsite Power or Unit 1 Red (AB) DG. Control Unit 1 Green (CD) Train Electrical Distribution with Unit 1 Green (CD) Train Offsite Power or Unit 1 Green (CD) DG. Unit 1 ESW - Operate Unit 1 East or West ESW. Unit 1 CCW - Operate Unit 1 East or West CCW Unit 1 Control Room - Operate Unit 1 Control Room HVAC. Operate Unit 1 Auxiliary Building HVAC. Operate Unit 1 Red (AB) and Green (CD) DG HVAC. Operate Unit 1 Switchgear HVAC. Operate Unit 1 East AFW Pump Room HVAC system. Operate the Unit 1 East and West ESW Pump HVAC	None

**Fire Area AA7 – Attachment 1 - Table B-3 - Fire Area Transition**

<u>Unit</u>	<u>Fire Area</u>	<u>Description</u>
1	AA7	Unit 1 Quadrant 1 Cable Tunnel (El. 596 ft.)

systems.

**Reference Documents**

Genesis Solution Suite, EDISON / SAFE-PB, DC Cook V 3.4.0

Nuclear Safety Capability Assessment Report

**Licensing Actions**

None

**Existing Engineering Equivalency Evaluations (EEEE)****EEEE Title Engineering Equivalency Evaluation 9-40 - Fire Zone 7 (Fire Area AA7) to Fire Zone 61 (Fire Area AA5/6) Boundary Elevation**

**Summary** The purpose of this engineering equivalency evaluation is to document the acceptability of two unrated field fabricated fusible link actuated guillotine type dampers presently located between the Unit 1 Quadrant 1 Cable Tunnel in Fire Zone 7 (Fire Area AA7) and the Spray Additive Tank Room in Fire Zone 61 (Fire Area AA5/6).

The existing field fabricated fusible link actuated guillotine type dampers located between Fire Zone 7 and Fire Zone 61 is an acceptable device for maintaining the rating of the fire area boundary. This engineering equivalency evaluation verifies that there is no adverse impact to other engineering equivalency evaluations.

The fusible link actuated guillotine type dampers were evaluated and found to be acceptable based on the fire hazards, fire protection systems and construction features within the evaluated areas.



**Fire Area AA7 – Attachment 1 - Table B-3 - Fire Area Transition**

<u>Unit</u>	<u>Fire Area</u>	<u>Description</u>
1	AA7	Unit 1 Quadrant 1 Cable Tunnel (El. 596 ft.)

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**EEEE Title** **Engineering Equivalency Evaluation 11-2 - Unit 1 Reactor Cable Tunnels Quadrant 1 to Quadrant 2 Boundary Evaluation Fire Zone 7 (Fire Area AA37) to Fire Zone 38 (Fire Area AA37)**

**Summary** The purpose of this engineering equivalency evaluation is to document the acceptability of the 8 in. thick silicone foam fire seals protecting the penetrations between the Quadrant 1 cable tunnel at elevation 596 ft. in Unit 1, Fire Zone 7 (Fire Area AA7) and the Quadrant 2 cable tunnel at elevation 612 ft. in Unit 1, Fire Zone 38 (Fire Area AA37).

The existing 8 in. silicone foam fire seals located within the penetrations between Fire Zone 7 and Fire Zone 38 are acceptable for maintaining the rating of the fire area boundary. This engineering equivalency evaluation does not impact other engineering equivalency evaluations.

The silicone foam seals were evaluated and found to be acceptable based on the fire hazards and fire protection systems within the evaluated areas.

**EEEE Title** **Engineering Equivalency Evaluation 11-9 - Turbine, Auxiliary and Containment Buildings Boundary Evaluation**

**Summary** The purpose of this engineering equivalency evaluation is to describe in general, the approach and existence of evaluations performed to determine and reconcile fire area boundaries having components or designs with less than a 3-hr fire rating on preventing the spread of fire. This engineering equivalency evaluation also specifically evaluates the impact of unrated door assemblies on the spread of fire.

Reasonable assurance is provided that the fire area boundaries having components or design less than a 3-hr fire rating will not increase the spread of fire or impair the safe shutdown capabilities of Units 1 or 2. In addition, this engineering equivalency evaluation does not adversely impact on other engineering equivalency evaluations or exemption requests.

This evaluation supports additional evaluations credited in this fire area.

**Fire Area AA7 – Attachment 1 - Table B-3 - Fire Area Transition**

<u>Unit</u>	<u>Fire Area</u>	<u>Description</u>
1	AA7	Unit 1 Quadrant 1 Cable Tunnel (El. 596 ft.)
<b><u>EEEE Title</u></b>	<b>Engineering Equivalency Evaluation 11-14 - Cable Spreading Room Construction Boundary Evaluation (Fire Areas AA3, AA7, AA8, AA9, AA10, AA29, AA30, AA31, AA34, AA35, AA36/42, AA37, AA38, AA48, AA50, AA51 and AA52)</b>	
<b><u>Summary</u></b>	<p>The purpose of this engineering equivalency evaluation is to document the acceptability of the construction features of the cable spreading rooms which have a fire resistance rating of less than 3 hours for their impact on the spread. In particular, fire dampers having a 1 1/2-hr fire rating were analyzed by this evaluation. Other unrated construction features have been previously analyzed under separate engineering equivalency evaluations. The applicable fire areas include: AA3, AA7, AA8, AA9, AA10, AA29, AA30, AA31, AA34, AA35, AA36/42, AA37, AA38, AA48, AA50, AA51 and AA52.</p> <p>Reasonable assurance is provided that the construction features of the cable spreading rooms which have a fire resistance rating of less than 3 hours will prevent the spread of fire and not impair the safe shutdown capabilities of Unit 1 and Unit 2. In addition, this engineering equivalency evaluation does not adversely impact other engineering equivalency evaluations.</p> <p>The construction features of the cable spreading room were evaluated and found to be acceptable based on the fire hazards, fire protection systems and construction features within the areas.</p>	
<b><u>EEEE Title</u></b>	<b>Engineering Equivalency Evaluation 11-24 - Fire Retention Capability of Nonconforming Fire Seals in Fire Zones having a Low Combustible Loading Classification</b>	
<b><u>Summary</u></b>	<p>The purpose of this engineering equivalency evaluation is to document the acceptability of fire seal designs which do not meet the requirements of the installation specification or fire test data in fire zones having a low combustible loading classification would have on preventing the spread of fire.</p> <p>Reasonable assurance is provided that fire seals which do not meet the requirements of the installation specification or fire test data in fire zones having a low combustible loading classification, will provide adequate fire retention capabilities and will not impair the safe shutdown capabilities of CNP or increase the spread of fire between fire zones. In addition, this engineering equivalency evaluation does not adversely impact other engineering equivalency evaluations or exemptions.</p> <p>Refer to Engineering Equivalency Evaluations 11.28 and 11.33.</p>	

**Fire Area AA7 – Attachment 1 - Table B-3 - Fire Area Transition**

<u>Unit</u>	<u>Fire Area</u>	<u>Description</u>
1	AA7	Unit 1 Quadrant 1 Cable Tunnel (El. 596 ft.)
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<b><u>EEEE Title</u></b>	<b>Engineering Equivalency Evaluation 11-28 - Generic Fire Seal Design 2 (Fire Areas AA7, AA8, AA39A, AA40, AA43, AA45A, AA45B, AA48 and AA52)</b>	
<b><u>Summary</u></b>	<p>The purpose of this engineering equivalency evaluation is to document the acceptability of deviations to Generic Fire Seal Design 2 on preventing the spread of fire. The applicable Fire Areas include AA7, AA8, AA39A, AA40, AA43, AA54A, AA54B, AA48 and AA52.</p> <p>Reasonable assurance is provided that deviations to Generic Fire Seal Design 2, Fire Seals W7109, W7952, F8150, F8152, F8162, F8184, F8859, F8861, F8863, F8887 and W9058, and the attributes discussed in the engineering equivalency evaluation do not impair the safe shutdown capabilities of CNP or increase the ability of fire to spread between fire zones. This engineering equivalency evaluation does not impact other engineering equivalency evaluations.</p> <p>Attribute Nos. 2, 7, 9 and the 11 fire seals of Generic Fire Seal Design 2 were evaluated and found to be acceptable based on the fire hazards and fire protection systems within the evaluated areas.</p>	
<b><u>EEEE Title</u></b>	<b>Engineering Equivalency Evaluation 11-33 - Generic Fire Seal Design 7 (Fire Areas AA7 and AA37)</b>	
<b><u>Summary</u></b>	<p>The purpose of this engineering equivalency evaluation is to document the acceptability of deviations to Generic Fire Seal Design 7 (in Fire Areas AA7 and AA37) on preventing the spread of fire.</p> <p>Reasonable assurance is provided that deviations to Generic Fire Seal Design 7, Fire Seal W9077, and the attributes discussed in this engineering equivalency evaluation will not impair the safe shutdown capabilities of CNP or increase the spread of fire between fire zones. This engineering equivalency evaluation does not impact other engineering equivalency evaluations.</p> <p>Generic Fire Seal Design 7 deviations from Attribute Numbers 2, 7, 9 and Fire Seal W9077 were evaluated and found to be acceptable based on the fire hazards and construction features within the evaluated areas.</p>	

**Fire Area AA7 – Attachment 1 - Table B-3 - Fire Area Transition**

<u>Unit</u>	<u>Fire Area</u>	<u>Description</u>
1	AA7	Unit 1 Quadrant 1 Cable Tunnel (El. 596 ft.)
<b><u>EEEE Title</u></b>	<b>Engineering Equivalency Evaluation 11-46 - Seismic Gaps between the Containment and Auxiliary Buildings Boundary Evaluation (Fire Areas AA2, AA3, AA7, AA8, AA9, AA10, AA11, AA27, AA29, AA30, AA31, AA34, AA35, AA37 and AA38)</b>	
<b><u>Summary</u></b>	<p>A seismic gap exists around the Containment Building of each unit that provides an opening of approximately 6 in. between the Containment Building and the walls, ceilings and floors of the structures immediately adjacent to containment. These Fire Areas include AA2, AA3, AA7, AA8, AA9, AA10, AA11, AA27, AA29, AA30, AA31, AA34, AA35, AA37 and AA38. This engineering equivalency evaluation has been performed to document the acceptability of these seismic gaps in the fire boundaries.</p> <p>This seismic gap evaluation shows the safe shutdown capability for CNP Unit 1 and Unit 2 has not been compromised as a result of seismic gaps. The analysis performed and the results presented in the tables indicate, on a system basis, the capability to safely shut down both units when considering fire damage to safe shutdown components and circuits contained in the seismic gap evaluation areas. The method of analysis is conservative when considering the fire hazards involved in the vicinity of the seismic gaps. That is, it is not anticipated that the evaluated areas would be affected to the extent that fire would propagate through the seismic gaps and cause damage throughout the evaluated area. This engineering equivalency evaluation has no impact on the exemption requests contained in other engineering equivalency evaluations.</p> <p>The seismic gaps were evaluated and found to be acceptable based on the fire hazards, fire protection systems and construction features within the evaluated areas.</p>	
<b><u>EEEE Title</u></b>	<b>Engineering Equivalency Evaluation 12-19 - CO2 Fire Suppression System Concentrations (Fire Areas AA7, AA8, AA9, AA10, AA29, AA30, AA31, AA37, AA38, AA39, AA40, AA41, AA43, AA44, AA45, AA48, AA49, AA50, AA51, AA52 and AA53)</b>	
<b><u>Summary</u></b>	<p>The purpose of this engineering equivalency evaluation is to document the acceptability of the CO2 fire suppression systems in fire zones containing concentrations of cable insulation and the potential for deep-seated fires. This engineering equivalency evaluation determines the CO2 system's impact on the spread of fire and previous engineering equivalency evaluations and exemption requests. Although there are other fire zones that use CO2 for fire suppression such as the DG Rooms, they are installed to suppress surface-type, combustible liquid fires and are not included in this analysis, because they do not contain significant concentrations of cable insulation capable of producing deep-seated fires.</p> <p>All of the CO2 systems included in this engineering equivalency evaluation are capable of performing their intended function, containing the fire until the Fire Brigade arrives, preventing fire spread to adjacent fire zones, and ensuring that safe shutdown of CNP can be achieved and maintained.</p> <p>The existing suppression systems were evaluated and found to be acceptable based on the fire hazards and fire protection systems within the evaluated areas.</p>	

**Fire Area AA7 – Attachment 1 - Table B-3 - Fire Area Transition**

<u>Unit</u>	<u>Fire Area</u>	<u>Description</u>
1	AA7	Unit 1 Quadrant 1 Cable Tunnel (El. 596 ft.)

**Fire Suppression Effects on Nuclear Safety Performance Criteria**

The CNP fire brigade is trained to discharge water in a judicious manner and instructed to direct hose streams and portable extinguishers at the base of the fire to limit the amount of overspray beyond the immediate fire zone. For this reason, fire brigade activities are not expected to fail components not already considered damaged. It has been concluded that water impingement on cables is not a concern. Electrical cabinets are provided with a seal at the conduit interface. Possible impacts to surrounding equipment due to manual fire fighting activities is bounded by the analysis approach of postulating whole room damage. The drainage features of the fire area mitigate the potential for flooding damage due to fire suppression, such that the standing water would not affect credited equipment.

In the event of discharge, any damage caused by the CO2 system to other equipment operating within the fire area which is not immediately involved in the originating fire is bounded by the analysis approach of postulating whole room damage. Since it is shown that suppression effects will not impact the nuclear safety performance criteria, the fire area configuration is deemed acceptable.

## References:

Technical Evaluation 12.1, "Fire Suppression Effects Study"

Technical Evaluation 12.1, "Supplemental Information to Fire Suppression Effects Study – Supplement 1"

**Fire Area Comments**

None

## Fire Area AA7 – Attachment 2 - Fire Risk Evaluation Results Summary

### A2.1 Introduction

The ‘changes’ associated with NFPA 805 transition were those variances from the deterministic requirements of NFPA 805. The changes identified for evaluation for fire area AA7 are grouped as follows:

- Separation Issues

This attachment is a summary of the Fire Risk Evaluation for the fire area. The complete results and methodology are contained in the Cumulative Fire Risk Evaluation, PRA-FIRE-NB-CRE. (FPCE 2017-0009)

### A2.2 Inputs/Assumptions

1. Assumptions from the Fire PRA apply to this calculation.
2. Detailed fire modeling was not performed for Fire Area AA7. A single whole room burnout scenario was assumed.

### A2.3 Fire Modeling Methodology

Detailed fire modeling was not performed for Fire Area AA7. This area was modeled considering whole room burnout.

### A2.4 Scenario Descriptions and Model Results

A single whole room burnout scenario was modeled for Fire Area AA7. All targets within the fire area were assumed damaged.

#### A2.4.1 Ignition Sources

The fixed ignition sources in Fire Area AA7 consist of the Nuclear Instrumentation Source Range Radiation Detector Amplifier, Signal Isolator, and Signal Processor, Containment Transmitter cabinets and an In-Core Thermocouple Cabinet. Additional detail regarding the ignition sources in this area is available in the Fire PRA Report. All fire scenarios, whether resulting from fixed or transient ignition sources, are assumed to damage all targets in the fire area.

#### A2.4.2 Scenario Results

The PRA analyzed the VFDRs and determined them to be risk insignificant, therefore, a quantitative delta risk calculation was not performed.

### A2.5 Fire Risk Evaluation Results

PRA-FIRE-NB-CRE documents scenarios and corresponding impacted VFDRs that were evaluated for delta risk during the transition to NFPA 805 and also all changes to the Fire Protection Program that are currently incorporated into the Fire PRA model. The acceptability of the Cumulative Fire Risk Evaluations was based on calculated delta risk meeting the thresholds of NEI 04-02, RG 1.205 and RG 1.174. (FPCE 2017-0009)

## Fire Area AA7 – Attachment 2 - Fire Risk Evaluation Results Summary

### A-2.6 Impact of VFDR on Defense-in-Depth

Defense-in-Depth has been evaluated for this fire area. The impacts of this evaluation are summarized in the table below:

Defense-in-Depth Impact Review for AA7			
Method of Providing DID	Required to Support Deterministic Analysis or Fire PRA?	Changes or Improvements Necessary for DID?	Basis/Justification
Echelon 1: Prevent fires from starting			
Combustible Control is implemented in accordance with Procedure PMP-2270-CCM-001, Control of Combustible Materials.	Yes	No	• This element is adequate based on no perceived weakness of, or over-reliance on, another echelon of defense-in-depth.
Hot Work Control is implemented in accordance with Procedure PMP-2270-WBG-001, Welding, Burning and Grinding Activities.	Yes	No	
Echelon 2: Rapidly detect, control and extinguish promptly those fires that do occur thereby limiting fire damage			
Fire Detection System	Yes	No	• Suppression and detection are already required and fire fighting activities are not expected to be challenging; therefore, no changes or improvements to Echelon 2 attributes are necessary to maintain defense-in-depth.
Fixed Fire Suppression	Yes	No	
Portable Fire Extinguishers	Yes	No	
Hose stations and hydrants	Yes	No	
Pre-Fire Plan	Yes	No	
Echelon 3: Provide adequate level of fire protection for systems and structures so that a fire will not prevent essential safety functions from being performed			
Walls, floors ceilings and structural elements are rated or have been evaluated as adequate for the hazard.	Yes	No	• Defense in Depth actions were credited to remove fuses or open breakers in the Control Room to prevent spurious equipment operation due to internal shorts.
Penetrations in the fire area barrier are rated or have been evaluated as adequate for the hazard.	Yes	No	
Supplemental barriers (e.g., ERFBS, cable tray covers, etc.)	No	No	
Guidance provided to operations personnel detailing the required success path(s) including recovery actions to achieve nuclear safety performance criteria.	Yes	No	

## Fire Area AA7 – Attachment 2 - Fire Risk Evaluation Results Summary

### A-2.7 Safety Margin Considerations

In accordance with NEI 04-02, the maintenance of adequate Safety Margin is assessed by the consideration categories of analyses utilized by this Fire Risk Evaluation.

Safety margins are considered to be maintained if:

- Codes and Standards or their alternatives accepted for use by the NRC are met.

AND

- Safety analyses acceptance criteria in the licensing basis (e.g., FSAR, supporting analyses) are met, or provides sufficient margin to account for analysis and data uncertainty.

The following summarizes the bases for ensuring the maintenance of safety margins:

- The risk-informed, performance based processes utilized are based upon NFPA 805, 2001 edition, endorsed by the NRC in 10 CFR 50.48(c).
- The Fire Risk Evaluation process is in accordance with NEI 04-02, Revision 2, which is endorsed by the NRC in Regulatory Guide 1.205, Revision 1.
- The Fire PRA is developed in accordance with NUREG/CR-6850, which was developed jointly between the NRC and EPRI.
- The Fire PRA has undergone an industry peer review, in order to ensure the Fire PRA meets the appropriate quality standards of ASME/ANS RA-Sa-2009, "Standard for Level 1/Large Early Release Frequency Probabilistic Risk Assessment for Nuclear Power Plant Applications," Dated February 2, 2009
- The "bounding risk assessment" is used during transition (NEI 04-02, Section 5.3.4.2). This approach conservatively assumes that target set damage occurs for postulated fire events which resulted in whole room burn up, and therefore, MEFS/LFS is not analyzed separately from the Fire PRA results.
- The CNP internal events PRA model received two formal industry peer reviews conducted in accordance with applicable NEI guidelines. The initial peer review was performed in 2001, while a subsequent focused scope (i.e., limited scope) peer review was conducted in 2009. The initial, full-scope WOG peer review covered all aspects of the CNP PRA model and the administrative processes used to maintain and update the model. The CNP PRA model has been revised to address all significant issues (i.e., Category A and B Facts & Observations) identified during the initial peer review. None of the findings from the focused-scope peer review were judged to reach the significance level of a Category A or B Fact & Observation; as a result, no changes to the PRA model have yet been made to include resolutions for these latter issues.
- Fire protection systems and features determined to be required by NFPA 805 Chapter 4 have been confirmed to meet the requirements of NFPA 805 Chapter 3 and their associated referenced codes and listings, or provided with acceptable alternatives using processes accepted for use by the NRC (i.e., FAQ 06-0008, FAQ 06-0004, 07-0033).
- Fire modeling has not been performed in support of the change evaluations and results are therefore, based on whole area burn up. As such, the results are considered very conservative.
- In accordance with the requirements of 10 CFR 50.48(c)(2)(iii), the Fire PRA results, including cutsets for



## **Fire Area AA7 – Attachment 2 - Fire Risk Evaluation Results Summary**

the scenarios of concern, have been reviewed and it was verified that the results presented above do not rely solely on feed and bleed as the fire-protected safe shutdown path for maintaining reactor coolant inventory, pressure control, and decay heat removal capability for this fire area.

### **A-2.8 Transition Risk Evaluation Conclusions**

The transition change evaluation determined that these changes:

- Are acceptable based upon the measured change in CDF and LERF
- Maintained adequate defense-in-depth and safety margins

The results of this evaluation meet the requirements of NFPA 805 Risk Evaluation; therefore, the use of the performance based analysis approach is acceptable.

## D. C. Cook Nuclear Plant Fire Safety Analysis

## Fire Area: AA8

Unit 1 Quadrant 4 Cable Tunnel (El. 596 ft.)

## Table of Contents

<b>Purpose</b> .....	Section 1.0
<b>Analysis Methodology</b> .....	Section 2.0
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<b>Conclusion</b> .....	Section 4.0
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## Attachments

Fire Area AA8 – Attachment 1 - Table B-3 - Fire Area Transition

## Fire Area AA8 – Attachment 2 - Fire Risk Evaluation Results Summary

## 1.0 PURPOSE

This report documents the Fire Safety Analysis (FSA) for Cook Nuclear Plant (CNP) Fire Area AA8, Unit 1 Quadrant 4 Cable Tunnel (El. 596 ft.) which comprises fire zone(s) 8. The purpose of this analysis is to demonstrate the achievement of the nuclear safety and radioactive release performance criteria of NFPA 805 as required by 10 CFR 50.48(c). The Fire Safety Analysis is a key part of compliance with Section 2.7.1.2 Fire Protection Program Design Basis Document of NFPA 805.

## 2.0 ANALYSIS METHODOLOGY

The FSA is the design basis document as described in NFPA 805 Section 2.7.1.2. The following steps are performed to develop the FSA on a fire area basis:

- Identify significant fire hazards in the fire area. This is based on NFPA 805 approach to analyze the plant from an ignition source and fuel package perspective.
- Summarize Nuclear Safety Capability Analysis (NSCA) compliance strategies. This is the result of the NEI 04-02 B-3 Table review of the Safe Shutdown Analysis.
- Summarize Non-Power Operations Modes compliance strategies.
- Summarize Radioactive Release compliance strategies. The transition review process required per NEI 04-02 is used to develop these results.
- Provide Fire Probabilistic Risk Assessment summary of results. This is based on the results from the plant Fire PRA.
- Perform risk informed, performance based evaluations if needed for the performance based approach.
- Summarize Defense-in-Depth strategy for each fire area.
- Determine key analysis assumptions which are candidates to be included in the NFPA 805 monitoring program.
- Provide conclusions relative to NFPA 805 compliance.

### **3.0 ANALYSIS**

#### **3.1 Classical Fire Protection**

##### **3.1.1 Construction**

Walls, floors and ceilings to adjacent fire areas are reinforced concrete in excess of a 3-hour rating.

A fire area boundary evaluation was performed for a damper and penetration seal in this area which has a fire resistance rating of less than 3 hours.

Applicable Engineering Equivalency Evaluations are documented in Attachment 1.

##### **3.1.2 Doors and Access Openings**

Fire doors having a 3-hour rating are provided to adjacent Fire Areas AA7 and AA9 - Fire Zones 7 and 9, respectively.

##### **3.1.3 Penetrations**

Penetrations in fire barriers between this fire zone and adjacent fire areas are provided with fire seals except as noted below.

A fire area engineering equivalency evaluation was prepared to evaluate a fire seal design between Fire Zones 7 and 8 (Engineering Equivalency Evaluation 11-28).

The seismic gaps are sealed with a glass fiber reinforced silicone sheeting.

Seismic gap exemption was granted for Fire Zone 8 interface with Fire Areas AA7, AA9 and AA34 - Fire Zones 7, 10 and 33A, respectively.

### 3.1.4 Detection

The table below outlines the fire detection system(s) provided in the Fire Area:

Table 3-1, Fire Area AA8 Detection Systems								
Fire Zone	Type of System	Local (L) / Remote (R)	Detection Actuates Suppression?	Required System?				
				S	L	E	R	D
8	Infrared	L/R	N	N	N	Y	N	N
8	Ionization	L/R	N	N	N	Y	N	N

**Table 3-1 Legend:**

Table Field: "Required System?"	
S	- Required for Chapter 4 Separation Criteria
L	- Required for NRC Approved Licensing Action
E	- Required for Engineering Equivalency Evaluation
R	- Required for Risk Significance
D	- Required to maintain adequate balance of Defense-in-Depth in a Change Evaluation or Fire Risk Evaluation

Cross zoned ionization smoke detectors (6) and infra-red detectors (5) are provided which alarm in the Unit 1 Control Room. No detection is provided in the two far east cubicles.

### 3.1.5 Fixed Suppression

The table below outlines the fixed fire suppression system(s) provided in the Fire Area:

Table 3-2, Fire Area AA8 Suppression Systems							
Fire Zone	Type of System	Full (F) / Partial (P)	Required System?				
			S	L	E	R	D
8	Manual CO2	P	N	N	Y	N	N
Table 3-2 Legend:							
Table Field: "Required System?"							
S	- Required for Chapter 4 Separation Criteria						
L	- Required for NRC Approved Licensing Action						
E	- Required for Engineering Equivalency Evaluation						
R	- Required for Risk Significance						
D	- Required to maintain adequate balance of Defense-in-Depth in a Change Evaluation or Fire Risk Evaluation						

Fire Area AA8 is not provided with automatic fire suppression.

### 3.1.6 Manual Suppression / Response Strategy

A postulated fire will be identified by early detection using ionization type smoke detection or by plant personnel using plant communication system to notify the control room. The automatic detection system alarms in the control room. The Control Room operator will dispatch the fire brigade for initiation of manual fire fighting. A fire in this fire area will be contained by the construction features discussed in Section 3.1.1. Manual suppression is provided by the CNP Fire

Brigade. A low pressure CO<sub>2</sub> total flooding system supplied from the 17 ton tank is provided. This system is manually actuated. Operation of this system discharges CO<sub>2</sub> into Fire Area AA8. No CO<sub>2</sub> suppression is provided in the two cubicles.

Fire extinguishers are located in Fire Area AA8 for the fire brigade's use.

Water hose reels are located within the fire area and in adjacent Fire Zone 9.

Floor drains are available in Fire Area AA8.

### 3.1.7 Ventilation

A fire in this area will be contained by the fire barriers. Smoke can be removed by portable fans and flexible ducting to other parts of the Auxiliary Building and outdoors if not contaminated. Contaminated smoke can be removed by portable fans and flexible ducting to other areas of the Auxiliary Building per the Fire Pre-Plans. The normal building ventilating systems in the Auxiliary Building will then exhaust the smoke via filtered monitored pathways. This fire area is listed as a non-controlled area in the Fire Pre Plans therefore there is reasonable assurance that products of combustion will not be contaminated.

There is a 1-1/2-hour fire damper on an interior wall in Fire Zone 8. Fire dampers having a 1-1/2-hour rating are provided to adjacent Fire Area AA9 - Fire Zones 9 and 10. Fire dampers having a 3-hour rating are provided to adjacent Fire Areas AA7 - Fire Zones 7, and Fire Area AA34 - Fire Zone 33. The fire dampers to Fire Zone 33 are installed beneath the grated opening in the ceiling.

### 3.1.8 Other Features

No other fire protection features are provided for Fire Area AA8.

## 3.2 Fire Hazards Identification

The fire area contains both ignition sources and combustible fire hazards. The ignition sources consist of motor control centers. Combustibles consist primarily of exposed electrical cables in trays, cellulose and rubber/plastics.

This Fire Area is below grade and any exterior wall penetrations need not be rated based on the protection provided by the ground covering the exterior walls.

The current fire loading classification is considered low.

## 3.3 NSCA Compliance Summary

Fire Area AA8 contains Red and Green Train cables, conduits, and raceways.

Compliance with the nuclear safety performance criteria is achieved using the performance-based approach in accordance with NFPA 805, Section 4.2.4.2.

Safe and stable of the affected Unit 1, will be accomplished using the Steam Generators 2 and 3 via Unit 1 East Motor Driven Auxiliary Feedwater Pump, Control Room Process Monitoring, Unit 1 Charging via the East Pump, Unit 1 CCW via the East or West Pump and Unit 1 ESW via the East or West Pump. Power is credited to be available to the Red and Green train systems via offsite

power with the EDGs available as well.

The Nuclear Safety Performance Criteria compliance strategy for AA8 is documented within the NSCA Report.

### 3.3.1 Variances

The variances identified for evaluation for this fire area are grouped as follows:

#### 3.3.1.1 VFDR No. AA08-001

1-MRV-213-P and 1-MRV-243-P - SG 1 & 4 PORVs are required to be closed to support main steam isolation. Main steam isolation is required to prevent uncontrolled cooldown through over steaming. 1-MRV-213-P may fail due to fire induced damage of cable 6841-1. 1-MRV-243-P may fail due to fire induced damage of cable 6842-1. Failure of these cables could spuriously open the valves. SGs 1 & 4 are not credited for decay heat removal due to a fire within this fire area. This condition represents a variance from deterministic requirements of NFPA 805, Section 4.2.3. This is a separation issue.

This VFDR has been evaluated and it was determined that the risk, safety margin and defense-in-depth meet the acceptance criteria of NFPA 805 Section 4.2.4 with a defense-in-depth action credited.

### 3.3.2 Recovery Actions Credited

For each VFDR, a Fire Risk Evaluation has been performed to assess the acceptability of risk, defense-in-depth, and safety margin. This evaluation determined whether or not recovery actions are required to ensure that one success path necessary to achieve and maintain the nuclear safety performance criteria is maintained free of fire damage by a single fire. Table 3-3 identifies the credited recovery actions for this area. Actions retained for DID are identified as “DID Actions” within Table 3-3. Additional information for DID actions is contained within Section 3.8 of this report. Note that, for completeness, all VFDRs are contained within Table 3-3, even if the Fire Risk Evaluation has determined that a recovery action is not required. In those instances where a recovery action has been determined to not be required, the word “None” is provided in the “Action” column in the table.

Table 3-3, Recovery Actions Credited		
VFDR	Component	Action
AA08-001	1-MRV-213 1-MRV-243	DID ACTION(S) 1-MRV-213-P-CLOSE 1-MRV-243-P-CLOSE (Remove power from SG PORVs at CRIDs to fail affected valves closed)

### 3.4 Non-Power Operational Modes Compliance Summary

A review of CNP for the potential effects of a fire in this Fire Area while in non-power modes of operation (NPO) was conducted. This review was conducted using the guidance provided in NEI 04-02 and FAQ 07-0040, “Non-Power Operations Clarifications”.

The review determined that there are potential failures that affect certain Key Safety Functions

(KSF) as a result of the fire in this area, and the fire could result in the loss of one or more KSF paths. Compensatory measures are required during high risk evolution periods to provide reasonable assurance a fire will not adversely affect key safety functions and the NFPA 805 performance goal for NPO is therefore satisfied. The results of the NPO analysis are contained within Technical Evaluation R1900-005-001, Non-Power Operation Modes Transition Review Report.

### 3.5 Radioactive Release Compliance Summary

The NFPA 805 radiological release goal is to provide reasonable assurance that a fire will not result in a radiological release that adversely affects the public, plant personnel or the environment. The NFPA 805 requirement is to ensure a radiation release to any unrestricted area due to the direct effects of fire suppression activities (but not involving fuel damage) shall be as low as reasonably achievable and shall not exceed applicable plant Technical Specification limits.

AA8 is located outside the Radiological Controlled Area (RCA) and is not a storage location for contaminated materials, therefore there is reasonable assurance a fire in this area will not result in radiation release. The review of this fire area, with respect to radioactive release, is documented in the NFPPM.

### 3.6 Probabilistic Risk Assessment-Summary of Results

A Fire PRA (FPRA) quantification of Fire Area AA8 was performed and is documented in PRA-NB-FIRE-FQ, Fire PRA Model Quantification Notebook. The fire risk quantification for Fire Area AA8 is analyzed using detailed fire modeling to consider risk of fire scenarios of ignition sources. PRA-NB-FIRE-FQ includes a summary of all potentially risk-significant fire scenarios (i.e., CDF > 1.0E-7 or LERF > 1.0E-8). Bounding CDF / LERF per calendar year values are reported that are based on the risk values documented in PRA-NB-FIRE-FSS, Fire PRA Fire Scenario Selection.

Fire Protection features credited in the Fire PRA are documented in R1900-0411-AA8, Detailed Fire Modeling Report: Fire Compartment: AA8 Unit 1 Quadrant 4 Cable Tunnel (EL. 596 FT). PRA-NB-FIRE-FSS documents the revision level of the fire modeling reports used in the most recent Fire PRA quantification.



### 3.7 Risk-Informed, Performance-Based Evaluations

Fire Risk Evaluations (FREs) have been performed to ensure that variances from the NFPA 805 deterministic requirements are acceptable. The evaluation process consists of an integrated assessment of the acceptability of risk, defense-in-depth, and safety margins.

#### 3.7.1 Transition Risk-Informed, Performance-Based Evaluations

The ‘changes’ associated with NFPA 805 transition were those variances from the deterministic requirements of NFPA 805 or with the existing fire protection licensing basis that were brought into compliance with the NFPA 805 performance based approach. The change identified for evaluation for Fire Area AA7 is as follows:

- Separation Issues

The Fire Risk Evaluation has determined that the change is acceptable based upon:

- The measured change in CDF and LERF.
- Adequate defense-in-depth and safety margins being maintained.

Refer to Attachment 2 for a summary of results associated with the Fire Risk Evaluations.

### 3.8 Defense-in-Depth

A comprehensive risk-informed, performance-based analysis includes consideration of defense-in-depth (DID) as part of an integrated evaluation of risk considerations. In general, defense-in-depth involves consideration of the extent to which fire protection systems and features are provided within the three echelons of fire-protection:

- Preventing fires from starting,
- Rapidly detecting fires and controlling and extinguishing promptly those fires that do occur, thereby limiting fire damage,
- Providing an adequate level of fire protection for structures, systems, and components important to safety, so that a fire that is not promptly extinguished will not prevent the nuclear safety performance criteria from being met.

Each VFDR was evaluated for DID. The following recovery actions have been retained for DID.

VFDR No. AA08-001: 1-MRV-213-P and 1-MRV-243-P - SG 1 & 4 PORVs are required to be closed to support main steam isolation. Main steam isolation is required to prevent uncontrolled cooldown through over steaming. SG 1 and 4 PORVs could spuriously open due cable failures cause by a full area fire within Fire Area AA08. These failures can be mitigated by locally venting air to close to the SG 1 and 4 PORVs. This manual action is being retained for DID to ensure main steam isolation is maintained.

Based on the assessment in support of the Fire Risk Evaluation, defense-in-depth is maintained for fire area AA8. Refer to Attachment 2 for details associated with the Fire Risk Evaluation.

### 3.9 Monitoring Program Input

A Monitoring Program will be developed in accordance with FAQ 10-0059, Rev. 1. Methods to monitor availability, reliability, and performance of fire protection program structures, systems, and components (SSCs), as well as programmatic elements will be provided. Additionally, effectiveness measures are established to review program related performance and trends. For AA8 the following systems and features are candidates for inclusion in the CNP Fire Protection Monitoring Program:

- Fire Area boundary barriers discussed in Section 3.1
- Fire Detection System
- Manual Fire Suppression System

### 4.0 CONCLUSION

The nuclear safety and radioactive release performance criteria of NFPA 805 are met for a fire in Fire Area AA8. This Fire Risk Evaluation for Fire Area AA8 has demonstrated that

- The change in core damage frequency (delta CDF) is acceptable, and
- The change in large early release frequency (delta LERF) is acceptable, and
- Defense-in-depth and safety margins are maintained.

This is confirmation that a success path effectively remains free of fire damage and that the performance-based approach is acceptable per Section 4.2.4.2 of NFPA 805.

## **5.0 REFERENCES**

- 5.1 Calculation PRA-FIRE-NB-CRE, Fire PRA Cumulative Risk Evaluations
- 5.2 CNP Fire Pre-Plans, Volumes I, II, and III, Revisions 17, 14, and 18 respectively
- 5.3 Fire Hazards Analysis
- 5.4 NFPA 805, Performance-Based Standard for Fire Protection for Light Water Reactor Electric Generating Plants
- 5.5 NFPPM, NFPA 805 Fire Protection Program Manual (NFPPM)
- 5.6 Nuclear Energy Institute (NEI) 04-02, Guidance for Implementing a Risk-Informed, Performance-Based Fire Protection Program under 10 CFR 50.48(c), Rev. 2
- 5.7 Nuclear Safety Capability Assessment Report
- 5.8 PRA-NB-FIRE-FQ, Fire PRA Model Quantification Notebook
- 5.9 PRA-NB-FIRE-FSS, Fire PRA Fire Scenario Selection
- 5.10 Regulatory Guide 1.205, Risk-Informed, Performance-Based Fire Protection for Existing Light-Water Nuclear Power Plants, Rev. Revision 1
- 5.11 Technical Evaluation R1900-005-001, Non-Power Operation Modes Transition Review

**Fire Area AA8 – Attachment 1 - Table B-3 - Fire Area Transition**

<u>Unit</u>	<u>Fire Area</u>	<u>Description</u>
1	AA8	Unit 1 Quadrant 4 Cable Tunnel (El. 596 ft.)

<u>Fire Zone</u>	<u>Description</u>
8	Quadrant 4 Cable Tunnel - El. 596 ft. 3-1/2 in. - Unit 1

**Regulatory Basis**

4.2.4.2 - Performance-Based Approach - Fire Risk Evaluation with simplifying deterministic assumptions

<b>Performance Goal</b>	<b>Method of Accomplishment</b>	<b>Comments</b>
Reactivity Control	Unit 1 - Trip the reactor from the Control Room. Borate using Unit 1 East Charging Pump supplied from the RWST. Use source range monitoring for indication for Unit 1.	None
Inventory and Pressure Control	Unit 1 - Control inventory using Unit 1 East Charging Pump. Control pressure using Unit 1 Pressurizer Safety Relief Valves.	None
Decay Heat Removal	Unit 1 - Feed SGs 2 & 3 with Unit 1 East MDAFW Pump. The DHR function also requires MS isolation with a steam release path through the Safety Relief Valves.	VFDR Identified for Main Steam Isolation.
Process Monitoring	Unit 1 Process Monitoring - Use Unit 1 process monitoring in the Control Room for the following: Pressurizer level, RCS pressure and temperature, and S/G level and Pressure. Unit 1 Source Range Monitoring - Use Unit 1 source range monitoring in the Control Room.	None
Vital Auxiliaries	Unit 1 Electrical - Control Unit 1 Red (AB) Train Electrical Distribution with Unit 1 Red (AB) Train Offsite Power or Unit Red (AB) DG. Control Unit 1 Green (CD) Train Electrical Distribution with Unit 1 Green (CD) Train Offsite Power or Unit 1 Green (CD) DG. Unit 1 ESW - Operate Unit 1 East or West ESW. Unit 1 CCW - Operate Unit 1 East or West CCW. Unit 1 HVAC - Operate Unit 1 Control Room HVAC. Operate Unit 1 Auxiliary Building HVAC. Operate Unit 1 Red (AB) and Green (CD) DG HVAC. Operate Unit 1 Switchgear HVAC. Operate Unit 1 East AFW Pump Room HVAC system. Operate the Unit 1 East and West ESW Pump HVAC systems.	None

**Fire Area AA8 – Attachment 1 - Table B-3 - Fire Area Transition**

<u>Unit</u>	<u>Fire Area</u>	<u>Description</u>
1	AA8	Unit 1 Quadrant 4 Cable Tunnel (El. 596 ft.)

**Reference Documents**

Genesis Solution Suite, EDISON / SAFE-PB, DC Cook V 3.4.0

Nuclear Safety Capability Assessment Report

**Licensing Actions**

None

**Existing Engineering Equivalency Evaluations (EEEE)****EEEE Title Engineering Equivalency Evaluation 11-9 - Turbine, Auxiliary and Containment Buildings Boundary Evaluation**

**Summary** The purpose of this engineering equivalency evaluation is to describe in general, the approach and existence of evaluations performed to determine and reconcile fire area boundaries having components or designs with less than a 3-hr fire rating on preventing the spread of fire. This engineering equivalency evaluation also specifically evaluates the impact of unrated door assemblies on the spread of fire.

Reasonable assurance is provided that the fire area boundaries having components or design less than a 3-hr fire rating will not increase the spread of fire or impair the safe shutdown capabilities of Units 1 or 2. In addition, this engineering equivalency evaluation does not adversely impact on other engineering equivalency evaluations or exemption requests.

This evaluation supports additional evaluations credited in this fire area.

**Fire Area AA8 – Attachment 1 - Table B-3 - Fire Area Transition**

<u>Unit</u>	<u>Fire Area</u>	<u>Description</u>
1	AA8	Unit 1 Quadrant 4 Cable Tunnel (El. 596 ft.)
<b><u>EEEE Title</u></b>	<b>Engineering Equivalency Evaluation 11-14 - Cable Spreading Room Construction Boundary Evaluation (Fire Areas AA3, AA7, AA8, AA9, AA10, AA29, AA30, AA31, AA34, AA35, AA36/42, AA37, AA38, AA48, AA50, AA51 and AA52)</b>	
<b><u>Summary</u></b>	<p>The purpose of this engineering equivalency evaluation is to document the acceptability of the construction features of the cable spreading rooms which have a fire resistance rating of less than 3 hours for their impact on the spread. In particular, fire dampers having a 1 1/2-hr fire rating were analyzed by this evaluation. Other unrated construction features have been previously analyzed under separate engineering equivalency evaluations. The applicable fire areas include: AA3, AA7, AA8, AA9, AA10, AA29, AA30, AA31, AA34, AA35, AA36/42, AA37, AA38, AA48, AA50, AA51 and AA52.</p> <p>Reasonable assurance is provided that the construction features of the cable spreading rooms which have a fire resistance rating of less than 3 hours will prevent the spread of fire and not impair the safe shutdown capabilities of Unit 1 and Unit 2. In addition, this engineering equivalency evaluation does not adversely impact other engineering equivalency evaluations.</p> <p>The construction features of the cable spreading room were evaluated and found to be acceptable based on the fire hazards, fire protection systems and construction features within the areas.</p>	
<b><u>EEEE Title</u></b>	<b>Engineering Equivalency Evaluation 11-24 - Fire Retention Capability of Nonconforming Fire Seals in Fire Zones having a Low Combustible Loading Classification</b>	
<b><u>Summary</u></b>	<p>The purpose of this engineering equivalency evaluation is to document the acceptability of fire seal designs which do not meet the requirements of the installation specification or fire test data in fire zones having a low combustible loading classification would have on preventing the spread of fire.</p> <p>Reasonable assurance is provided that fire seals which do not meet the requirements of the installation specification or fire test data in fire zones having a low combustible loading classification, will provide adequate fire retention capabilities and will not impair the safe shutdown capabilities of CNP or increase the spread of fire between fire zones. In addition, this engineering equivalency evaluation does not adversely impact other engineering equivalency evaluations or exemptions.</p> <p>Refer to Engineering Equivalency Evaluation 11.28.</p>	

**Fire Area AA8 – Attachment 1 - Table B-3 - Fire Area Transition**

<b><u>Unit</u></b>	<b><u>Fire Area</u></b>	<b><u>Description</u></b>
1	AA8	Unit 1 Quadrant 4 Cable Tunnel (El. 596 ft.)
<hr/>		
<b><u>EEEE Title</u></b>	<b>Engineering Equivalency Evaluation 11-28 - Generic Fire Seal Design 2 (Fire Areas AA7, AA8, AA39A, AA40, AA43, AA45A, AA45B, AA48 and AA52)</b>	
<b><u>Summary</u></b>	<p>The purpose of this engineering equivalency evaluation is to document the acceptability of deviations to Generic Fire Seal Design 2 on preventing the spread of fire. The applicable Fire Areas include AA7, AA8, AA39A, AA40, AA43, AA54A, AA54B, AA48 and AA52.</p> <p>Reasonable assurance is provided that deviations to Generic Fire Seal Design 2, Fire Seals W7109, W7952, F8150, F8152, F8162, F8184, F8859, F8861, F8863, F8887 and W9058, and the attributes discussed in the engineering equivalency evaluation do not impair the safe shutdown capabilities of CNP or increase the ability of fire to spread between fire zones. This engineering equivalency evaluation does not impact other engineering equivalency evaluations.</p> <p>Attribute Nos. 2, 7, 9 and the 11 fire seals of Generic Fire Seal Design 2 were evaluated and found to be acceptable based on the fire hazards and fire protection systems within the evaluated areas.</p>	
<b><u>EEEE Title</u></b>	<b>Engineering Equivalency Evaluation 11-46 - Seismic Gaps between the Containment and Auxiliary Buildings Boundary Evaluation (Fire Areas AA2, AA3, AA7, AA8, AA9, AA10, AA11, AA27, AA29, AA30, AA31, AA34, AA35, AA37 and AA38)</b>	
<b><u>Summary</u></b>	<p>A seismic gap exists around the Containment Building of each unit that provides an opening of approximately 6 in. between the Containment Building and the walls, ceilings and floors of the structures immediately adjacent to containment. These Fire Areas include AA2, AA3, AA7, AA8, AA9, AA10, AA11, AA27, AA29, AA30, AA31, AA34, AA35, AA37 and AA38. This engineering equivalency evaluation has been performed to document the acceptability of these seismic gaps in the fire boundaries.</p> <p>This seismic gap evaluation shows the safe shutdown capability for CNP Unit 1 and Unit 2 has not been compromised as a result of seismic gaps. The analysis performed and the results presented in the tables indicate, on a system basis, the capability to safely shut down both units when considering fire damage to safe shutdown components and circuits contained in the seismic gap evaluation areas. The method of analysis is conservative when considering the fire hazards involved in the vicinity of the seismic gaps. That is, it is not anticipated that the evaluated areas would be affected to the extent that fire would propagate through the seismic gaps and cause damage throughout the evaluated area. This engineering equivalency evaluation has no impact on the exemption requests contained in other engineering equivalency evaluations.</p> <p>The seismic gaps were evaluated and found to be acceptable based on the fire hazards, fire protection systems and construction features within the evaluated areas.</p>	

**Fire Area AA8 – Attachment 1 - Table B-3 - Fire Area Transition**

<u>Unit</u>	<u>Fire Area</u>	<u>Description</u>
1	AA8	Unit 1 Quadrant 4 Cable Tunnel (El. 596 ft.)
<hr/>		
<b><u>EEEE Title</u></b>	<b>Engineering Equivalency Evaluation 12-19 - CO2 Fire Suppression System Concentrations (Fire Areas AA7, AA8, AA9, AA10, AA29, AA30, AA31, AA37, AA38, AA39, AA40, AA41, AA43, AA44, AA45, AA48, AA49, AA50, AA51, AA52 and AA53)</b>	
<b><u>Summary</u></b>	<p>The purpose of this engineering equivalency evaluation is to document the acceptability of the CO2 fire suppression systems in fire zones containing concentrations of cable insulation and the potential for deep-seated fires. This engineering equivalency evaluation determines the CO2 system's impact on the spread of fire and previous engineering equivalency evaluations and exemption requests. Although there are other fire zones that use CO2 for fire suppression such as the DG Rooms, they are installed to suppress surface-type, combustible liquid fires and are not included in this analysis, because they do not contain significant concentrations of cable insulation capable of producing deep-seated fires.</p> <p>All of the CO2 systems included in this engineering equivalency evaluation are capable of performing their intended function, containing the fire until the Fire Brigade arrives, preventing fire spread to adjacent fire zones, and ensuring that safe shutdown of CNP can be achieved and maintained.</p> <p>The existing suppression systems were evaluated and found to be acceptable based on the fire hazards and fire protection systems within the evaluated areas.</p>	

**Fire Suppression Effects on Nuclear Safety Performance Criteria**

The CNP fire brigade is trained to discharge water in a judicious manner and instructed to direct hose streams and portable extinguishers at the base of the fire to limit the amount of overspray beyond the immediate fire zone. For this reason, fire brigade activities are not expected to fail components not already considered damaged. It has been concluded that water impingement on cables is not a concern. Electrical cabinets are provided with a seal at the conduit interface. Possible impacts to surrounding equipment due to manual fire fighting activities is bounded by the analysis approach of postulating whole room damage. The drainage features of the fire area mitigate the potential for flooding damage due to fire suppression, such that the standing water would not affect credited equipment.

In the event of discharge, any damage caused by the CO2 system to other equipment operating within the fire area which is not immediately involved in the originating fire is bounded by the analysis approach of postulating whole room damage. Since it is shown that suppression effects will not impact the nuclear safety performance criteria, the fire area configuration is deemed acceptable.

**References:**

Technical Evaluation 12.1, "Fire Suppression Effects Study"

Technical Evaluation 12.1, "Supplemental Information to Fire Suppression Effects Study – Supplement 1"



**Fire Area AA8 – Attachment 1 - Table B-3 - Fire Area Transition**

<u>Unit</u>	<u>Fire Area</u>	<u>Description</u>
1	AA8	Unit 1 Quadrant 4 Cable Tunnel (El. 596 ft.)

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**Fire Area Comments**

None

## Fire Area AA8 – Attachment 2 - Fire Risk Evaluation Results Summary

### A2.1 Introduction

The ‘changes’ associated with NFPA 805 transition were those variances from the deterministic requirements of NFPA 805. The changes identified for evaluation for fire area AA8 are grouped as follows:

- Separation Issues

This attachment is a summary of the Fire Risk Evaluation for the fire area. The complete results and methodology are contained in the Cumulative Fire Risk Evaluation, PRA-FIRE-NB-CRE. (FPCE 2017-0009)

### A2.2 Inputs/Assumptions

Fire modeling processes and inputs provided in NUREG/CR-6850 are appropriate for use in a risk-informed, performance-based evaluation. The complete list of assumptions used in the fire modeling methodology for this fire area is contained in Detailed Fire Modeling Technical Evaluation R1900-0411-AA8.

### A2.3 Fire Modeling Methodology

Fire PRA fire modeling results are used as the initial input into this Fire Risk Evaluation. The process consists of conservative bounding analyses using NUREG/CR-6850 methods. As needed, refinements are made to utilize more realistic parameters. The complete fire modeling methodology for this fire area is contained in Detailed Fire Modeling Technical Evaluation R1900-0411-AA8.

### A2.4 Scenario Descriptions and Model Results

Fire Area AA8 was evaluated for the impact of fires originating from both fixed and transient ignition sources. Complete descriptions of each fire scenario is contained within the Detailed Fire Modeling Technical Evaluation R1900-0411-AA8.

#### A2.4.1 Ignition Sources

The fixed ignition sources in Fire Area AA8 consist of the Containment Instrumentation Room Purge Exhaust Ventilation Unit Control Panel, 600V MCCs CT-BN and CT-CN, and Pressurizer Heater Emergency Feed 408V MCC.

In Fire Area AA34, the 98th percentile HRR was used for all transient fires. The 98th percentile HRR bounds the possible transient ignition sources expected for this fire area, which were fire tested and identified in NUREG/CR-6850, Appendix G, Table G-7.

#### A2.4.2 Scenario Results

The PRA analyzed the VFDRs and determined them to be risk insignificant, therefore, a quantitative delta risk calculation was not performed.

### A2.5 Fire Risk Evaluation Results

PRA-FIRE-NB-CRE documents scenarios and corresponding impacted VFDRs that were evaluated for delta risk during the transition to NFPA 805 and also all changes to the Fire Protection Program that are currently incorporated into the Fire PRA model. The acceptability of the Cumulative Fire Risk Evaluations was based on calculated delta risk meeting the thresholds of NEI 04-02, RG 1.205 and RG 1.174. (FPCE 2017-0009)

## Fire Area AA8 – Attachment 2 - Fire Risk Evaluation Results Summary

### A-2.6 Impact of VFDR on Defense-in-Depth

Defense-in-Depth has been evaluated for this fire area. The impacts of this evaluation are summarized in the table below:

Defense-in-Depth Impact Review for AA8			
Method of Providing DID	Required to Support Deterministic Analysis or Fire PRA?	Changes or Improvements Necessary for DID?	Basis/Justification
Echelon 1: Prevent fires from starting			
Combustible Control is implemented in accordance with Procedure PMP-2270-CCM-001, Control of Combustible Materials.	Yes	No	• This element is adequate based on no perceived weakness of, or over-reliance on, another echelon of defense-in-depth.
Hot Work Control is implemented in accordance with Procedure PMP-2270-WBG-001, Welding, Burning and Grinding Activities.	Yes	No	
Echelon 2: Rapidly detect, control and extinguish promptly those fires that do occur thereby limiting fire damage			
Fire Detection System	Yes	No	• Suppression and detection are already required and fire fighting activities are not expected to be challenging; therefore, no changes or improvements to Echelon 2 attributes are necessary to maintain defense-in-depth.
Fixed Fire Suppression	Yes	No	
Portable Fire Extinguishers	Yes	No	
Hose stations and hydrants	Yes	No	
Pre-Fire Plan	Yes	No	
Echelon 3: Provide adequate level of fire protection for systems and structures so that a fire will not prevent essential safety functions from being performed			
Walls, floors ceilings and structural elements are rated or have been evaluated as adequate for the hazard.	Yes	No	No recovery actions were credited for the VFDR in AA8. Defense in Depth actions were credited in the Control Room to isolate instrument loop cable failures to prevent spurious operation of the Steam Generator PORVs.
Penetrations in the fire area barrier are rated or have been evaluated as adequate for the hazard.	Yes	No	
Supplemental barriers (e.g., ERFBS, cable tray covers, etc.)	No	No	
Guidance provided to operations personnel detailing the required success path(s) including recovery actions to achieve nuclear safety performance criteria.	Yes	Yes	

## Fire Area AA8 – Attachment 2 - Fire Risk Evaluation Results Summary

### A-2.7 Safety Margin Considerations

In accordance with NEI 04-02, the maintenance of adequate Safety Margin is assessed by the consideration categories of analyses utilized by this Fire Risk Evaluation.

Safety margins are considered to be maintained if:

- Codes and Standards or their alternatives accepted for use by the NRC are met.

AND

- Safety analyses acceptance criteria in the licensing basis (e.g., FSAR, supporting analyses) are met, or provides sufficient margin to account for analysis and data uncertainty.

The following summarizes the bases for ensuring the maintenance of safety margins:

- The risk-informed, performance based processes utilized are based upon NFPA 805, 2001 edition, endorsed by the NRC in 10 CFR 50.48(c).
- The Fire Risk Evaluation process is in accordance with NEI 04-02, Revision 2, which is endorsed by the NRC in Regulatory Guide 1.205, Revision 1.
- The Fire PRA is developed in accordance with NUREG/CR-6850, which was developed jointly between the NRC and EPRI.
- The Fire PRA has undergone an industry peer review, in order to ensure the Fire PRA meets the appropriate quality standards of ASME/ANS RA-Sa-2009, "Standard for Level 1/Large Early Release Frequency Probabilistic Risk Assessment for Nuclear Power Plant Applications," Dated February 2, 2009
- The "combined analysis approach" is used during transition (NEI 04-02, Section 5.3.4.3); therefore, MEFS/LFS is not analyzed separately from the Fire PRA results.
- The CNP internal events PRA model received two formal industry peer reviews conducted in accordance with applicable NEI guidelines. The initial peer review was performed in 2001, while a subsequent focused scope (i.e., limited scope) peer review was conducted in 2009. The initial, full-scope WOG peer review covered all aspects of the CNP PRA model and the administrative processes used to maintain and update the model. The CNP PRA model has been revised to address all significant issues (i.e., Category A and B Facts & Observations) identified during the initial peer review. None of the findings from the focused-scope peer review were judged to reach the significance level of a Category A or B Fact & Observation; as a result, no changes to the PRA model have yet been made to include resolutions for these latter issues.
- Fire protection systems and features determined to be required by NFPA 805 Chapter 4 have been confirmed to meet the requirements of NFPA 805 Chapter 3 and their associated referenced codes and listings, or provided with acceptable alternatives using processes accepted for use by the NRC (i.e., FAQ 06-0008, FAQ 06-0004, 07-0033).
- Fire modeling performed in support of the transition has been performed within the Fire PRA utilizing codes and standards developed by industry and NRC staff which have been verified and validated in authoritative publications, such as NUREG 1824, "Verification and Validation of Selected Fire Models for Nuclear Power Plant Applications". In general, the fire modeling performed in support of the Fire Risk Evaluations has been performed using conservative methods and input parameters that are based upon

### Fire Area AA8 – Attachment 2 - Fire Risk Evaluation Results Summary

NUREG/CR-6850 as documented in the AA8 Detailed Fire Modeling Report, section 7.2. While this is generally not ideal in the context of best estimate probabilistic risk analysis, it is a pragmatic approach given the current state of knowledge regarding the uncertainties related to the application of the fire modeling tools and associated input parameters for specific plant configurations.

- In accordance with the requirements of 10 CFR 50.48©(2)(iii), the Fire PRA results, including cutsets for the scenarios of concern, have been reviewed and it was verified that the results presented above do not rely solely on feed and bleed as the fire-protected safe shutdown path for maintaining reactor coolant inventory, pressure control, and decay heat removal capability for this fire area.

#### A-2.8 Transition Risk Evaluation Conclusions

The transition change evaluation determined that these changes:

- Are acceptable based upon the measured change in CDF and LERF
- Maintained adequate defense-in-depth and safety margins

The results of this evaluation meet the requirements of NFPA 805 Risk Evaluation; therefore, the use of the performance based analysis approach is acceptable.

D. C. Cook Nuclear Plant  
Fire Safety Analysis

Fire Area: AA9

Unit 1 Quadrant 3M & 3N Cable Tunnel (El. 596 ft.)

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Attachments

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    Fire Area AA9 – Attachment 2 - Fire Risk Evaluation Results Summary

## 1.0 PURPOSE

This report documents the Fire Safety Analysis (FSA) for Cook Nuclear Plant (CNP) Fire Area AA9, Unit 1 Quadrant 3M & 3N Cable Tunnel (El. 596 ft.) which comprises fire zone(s) 9, 10, 116. The purpose of this analysis is to demonstrate the achievement of the nuclear safety and radioactive release performance criteria of NFPA 805 as required by 10 CFR 50.48(c). The Fire Safety Analysis is a key part of compliance with Section 2.7.1.2 Fire Protection Program Design Basis Document of NFPA 805. This analysis also documents results of risk-informed, performance-based Fire Risk Evaluations (FREs). These evaluations are associated with Variances from Deterministic Requirements (VFDRs) of NFPA 805 Chapter 4.

## 2.0 ANALYSIS METHODOLOGY

The FSA is the design basis document as described in NFPA 805 Section 2.7.1.2. The following steps are performed to develop the FSA on a fire area basis:

- Identify significant fire hazards in the fire area. This is based on NFPA 805 approach to analyze the plant from an ignition source and fuel package perspective.
- Summarize Nuclear Safety Capability Analysis (NSCA) compliance strategies. This is the result of the NEI 04-02 B-3 Table review of the Safe Shutdown Analysis.
- Summarize Non-Power Operations Modes compliance strategies.
- Summarize Radioactive Release compliance strategies. The transition review process required per NEI 04-02 is used to develop these results.
- Provide Fire Probabilistic Risk Assessment summary of results. This is based on the results from the plant Fire PRA.
- Perform risk informed, performance based evaluations if needed for the performance based approach.
- Summarize Defense-in-Depth strategy for each fire area.
- Determine key analysis assumptions which are candidates to be included in the NFPA 805 monitoring program.
- Provide conclusions relative to NFPA 805 compliance.

### 3.0 ANALYSIS

#### 3.1 Classical Fire Protection

##### 3.1.1 Construction

Walls, floors and ceilings to adjacent fire areas and fire zones are reinforced concrete in excess of a 3-hour rating.

A fire area boundary evaluation was performed for a damper and penetration seal in this area which has a fire resistance rating of less than 3 hours.

Applicable Engineering Equivalency Evaluations are documented in Attachment 1.

##### 3.1.2 Doors and Access Openings

For Fire Zone 9, fire doors having a 3-hour rating are provided to adjacent Fire Zone 10 and Fire Area AA8 - Fire Zone 8.

For Fire Zone 10, fire doors having a 3-hour rating is provided to adjacent Fire Zone 9 and Fire Area AA10 - Fire Zone 11 and Fire Area 2 - Fire Zone 79.

For Fire Zone 116, there are no door openings to adjacent fire areas. A fire area boundary evaluation was performed for open access penetrations from Fire Area AA11 - Fire Zone 12 and Fire Area AA34 - Fire Zone 33 (Engineering Equivalency Evaluation 9-23).

##### 3.1.3 Penetrations

Note: Statements regarding fire resistance rating of penetration seals are not applicable to seals in barriers to Analysis Area YD.

For Fire Zone 9, penetrations in fire barriers between this fire zone and adjacent fire areas and adjacent fire zones are provided with fire seals. The seismic expansion gap is sealed with a glass fiber reinforced silicone sheeting.

For Fire Zone 10, penetrations in fire barriers between this fire zone and adjacent fire areas and adjacent fire zones are provided with fire seals except as noted below. The seismic gaps are sealed with a glass fiber reinforced silicone sheeting. Seismic gap exemption was granted for Fire Zone 10 interface with Fire Areas AA8, AA10 and AA34 - Fire Zones 8, 11 and 33A, respectively (Engineering Equivalency Evaluation 11-46).

For Fire Zone 116, penetrations in fire barriers between this fire zone and adjacent fire areas are provided with fire seals. The seismic gaps are sealed with a glass fiber reinforced silicone sheeting.



### 3.1.4 Detection

The table below outlines the fire detection system(s) provided in the Fire Area:

Table 3-1, Fire Area AA9 Detection Systems								
Fire Zone	Type of System	Local (L) / Remote (R)	Detection Actuates Suppression?	Required System?				
				S	L	E	R	D
9	Infrared	L/R	N	N	N	Y	Y	N
9	Ionization	L/R	N	N	N	Y	Y	N
10	Infrared	L/R	N	N	N	Y	Y	N
10	Ionization	L/R	N	N	N	Y	Y	N
116	None	N/A	N/A	N/A	N/A	N/A	N/A	N/A

**Table 3-1 Legend:**

Table Field: "Required System?"	
S	- Required for Chapter 4 Separation Criteria
L	- Required for NRC Approved Licensing Action
E	- Required for Engineering Equivalency Evaluation
R	- Required for Risk Significance
D	- Required to maintain adequate balance of Defense-in-Depth in a Change Evaluation or Fire Risk Evaluation

For Fire Zone 9: Cross zoned ionization smoke detectors (4) and infra-red detectors (3) are provided which alarm in the Unit 1 Control Room.

For Fire Zone 10: Cross zoned ionization smoke detectors (4) and infra-red detectors (3) are provided which alarm in the Unit 1 Control Room.

Fire Zone 116 is not provided with an automatic detection system.

### 3.1.5 Fixed Suppression

The table below outlines the fixed fire suppression system(s) provided in the Fire Area:

Table 3-2, Fire Area AA9 Suppression Systems								
Fire Zone	Type of System	Full (F) / Partial (P)	Required System?					
			S	L	E	R	D	
9	Manual CO2	P	N	N	Y	Y	N	
10	Manual CO2	P	N	N	Y	N	N	
116	None	N/A	N/A	N/A	N/A	N/A	N/A	

Table 3-2 Legend:	
Table Field: "Required System?"	
S	- Required for Chapter 4 Separation Criteria
L	- Required for NRC Approved Licensing Action
E	- Required for Engineering Equivalency Evaluation
R	- Required for Risk Significance
D	- Required to maintain adequate balance of Defense-in-Depth in a Change Evaluation or Fire Risk Evaluation

Fire Area AA9 is not provided with automatic fire suppression.

### 3.1.6 Manual Suppression / Response Strategy

For fire zones within AA9 equipped with automatic detection systems, a postulated fire will be identified by early detection using ionization type smoke detection or by plant personnel using plant communication system to notify the control room. The automatic detection system alarms in the control room. For fire zones within AA9 which are not equipped with automatic detection systems, a postulated fire will be identified by plant personnel using plant communication system to notify the control room. The Control Room operator will dispatch the fire brigade for initiation of manual fire fighting. A fire in this fire area will be contained by the construction features discussed in Section 3.1.1. Manual suppression is provided by the CNP Fire Brigade. A low pressure CO2 total flooding system supplied from the 17 ton tank is provided in Fire Zones 9 and 10. This system is manually actuated. Operation of this system discharges CO2 into Fire Area AA9. No CO2 suppression is provided in the two cubicles furthest west.

Fire extinguishers are located in Fire Zones 9 and 10. For Fire Zone 116, fire extinguisher are located in adjacent Fire Zone 12, and additional extinguishers in adjacent Fire Zones 33 and 33A.

Water hose reels are located in Fire Zone 9. For Fire Zone 116, water hose reels are located in adjacent Fire Zone 12, with an additional water hose reel in adjacent Fire Zone 33A.

Floor drains are available in Fire Area AA9.

### 3.1.7 Ventilation

A fire in this area will be contained by the fire barriers. Smoke can be removed by portable fans and flexible ducting to other areas of the Auxiliary Building and outdoors if not contaminated. Contaminated smoke can be removed by portable fans and flexible ducting to other areas of the Auxiliary Building per the Fire Pre-Plans. The normal building ventilating systems in the

Auxiliary Building will then exhaust the smoke via filtered monitored pathways.

For Fire Zone 9, Fire dampers having a 1 1/2-hour rating are provided to adjacent Fire Area AA8 - Fire Zone 8. Fire damper having a 1 1/2-hour rating are provided to adjacent Fire Zone 10.

For Fire Zone 10, Fire dampers having a 1 1/2-hour rating are provided to adjacent Fire Areas AA8 and AA10 - Fire Zones 8 and 11, respectively. A fire damper having a 1 1/2-hour rating is provided to adjacent Fire Zone 9.

For Fire Zone 116, there are ventilation penetrations to adjacent fire areas. Access openings from Fire Area AA11 - Fire Zone 12 and Fire Area AA34 - Fire Zone 33 are also used for ventilation purposes.

### 3.1.8 Other Features

Some cable trays within Fire Area AA9 are provided with bottom covers and/or are fully enclosed.

## 3.2 Fire Hazards Identification

The fire area contains both ignition sources and combustible fire hazards. The ignition sources consist of the TC cabinet and various other fans less than 5 horsepower. Combustibles consist primarily of exposed electrical cables in trays and rubber/plastics.

The exterior fire hazards that are adjacent to exterior walls are the Start-up Transformers. However, water spray suppression systems are provided for the transformers. In addition, this Fire Area is mostly below grade and constructed of reinforced concrete. The missile barriers around each transformer also provide a measure of fire barrier protection, limiting radiant heat in the direction of the Fire Area.

The exterior wall penetrations of this Fire Area do not require a rating for protection. The ground surrounding the Fire Area protects most of the Fire Area from exterior fire hazards and the lack of surface area for direct heat impact, as well as the spatial separation between the yard equipment and fire hazards to this Fire Area is sufficient to provide protection against heat damage. The impact of a fire in the yard on AA9 would be limited to radiant heat with no ceiling to contain the fire plume. Spatial separation, fixed suppression as well as the reinforced concrete construction of the Fire Area is sufficient to prevent an exposure to credited equipment inside the plant through unrated exterior wall penetrations of this Fire Area.

The current fire loading classification of Fire Zones 9 and 10 is considered moderate.

The current fire loading classification of Fire Zone 116 is considered low.

## 3.3 NSCA Compliance Summary

Fire Area AA9 contains Red and Green Train cables, conduits, and raceways as well as safe shutdown Refueling Water Storage Tank and Condensate Storage Tank level indicators.

Compliance with the nuclear safety performance criteria is achieved using the performance-based approach in accordance with NFPA 805, Section 4.2.4.2.

Safe and stable condition of the affected Unit 1, will be accomplished using the Steam Generators 1 and 4 via the Unit 1 West Motor Driven Auxiliary Feedwater Pump, Unit 1 Charging via the East

Pump, Unit 1 Component Cooling Water via the East or West Pump, Unit 1 Essential Service Water via the East or West Pump and Process Monitoring in the Control Room. Local monitoring of CST is required. Power is credited to be available to the Red and Green train systems via offsite power with the EDGs available.

The Nuclear Safety Performance Criteria compliance strategy for AA9 is documented within the NSCA Report.

### 3.3.1 Variances

The variances identified for evaluation for this fire area are grouped as follows:

#### 3.3.1.1 VFDR No. AA9-001

1-MRV-213-P and 1-MRV-243-P - SG 1 and 4 PORVs are required to be closed to support main steam isolation. The valves are required closed to prevent uncontrolled cooldown through over-steaming. 1-MRV-213-P may fail due to fire induced damage of cables 6841-1 and 9050W-1. 1-MRV-243-P may fail due to fire induced damage of cables 6841-1 and 9050W-1. Failure of these cables could spuriously open the valves. SGs 1 and 4 are credited for decay heat removal due to a fire within Fire Area AA9. This condition represents a variance from deterministic requirements of NFPA 805, Section 4.2.3. This is a separation issue.

This VFDR has been evaluated and it was determined that the risk, safety margin and defense-in-depth meet the acceptance criteria of NFPA 805 Section 4.2.4 with a recovery action credited.

#### 3.3.1.2 VFDR No. AA9-002

1-CLI-113 and 1-CLI-114 - CST level indication is required to be operable to support AFW for decay heat removal. Decay heat removal is required to remove sufficient heat from the reactor core such that the fuel is maintained in a safe and stable condition. The CST level indicators provide Control Room indication of the initial water source for AFW. The level indicators may fail due to a full area fire within Fire Area AA9. 1-CLI-113 may fail due to fire induced damage of cable 20205-1. 1-CLI-114 may fail due to fire induced damage of cable 8202Y-1. This condition represents a variance from deterministic requirements of NFPA 805, Section 4.2.3. This is a separation issue.

This VFDR has been evaluated and it was determined that the risk, safety margin and defense-in-depth meet the acceptance criteria of NFPA 805 Section 4.2.4 with a defense-in-depth action credited.

**3.3.1.3 VFDR No. AA9-003**

1-ILS-950 and 1-ILS-951 - RWST level indication is required to support CVCS. CVCS is required to be operable to maintain inventory, pressure and reactivity control. The RWST is the primary credit borated water source for CVCS. The level indicators may fail due to a full area fire within Fire Area AA9. 1-ILS-950 may fail due to fire induced damage of cable 9738G-1. 1-ILS-951 may fail due to fire induced damage of cable 9738R-1. This condition represents a variance from deterministic requirements of NFPA 805, Section 4.2.3. This is a separation issue.

This VFDR has been evaluated and it was determined that the risk, safety margin and defense-in-depth meet the acceptance criteria of NFPA 805 Section 4.2.4 with no further action required.

**3.3.1.4 VFDR No. AA9-004**

1-DCR-310 and 1-DCR-340 - SG 1 and 4 Blowdown Isolation Valves are required to be closed to support main steam isolation. Main steam isolation is required to prevent uncontrolled cooldown through over-steaming. SG 1 and 4 Blowdown Isolation Valves may fail due to a full area fire within Fire Area AA10. 1-DCR-310 may fail due to fire induced damage of cable 8682G-1. 1-DCR-340 may fail due to fire induced damage of cable 8686G-1. These cable failures could spuriously open the valves. SGs 1 and 4 are credited for decay heat removal for a fire within Fire Area AA09. This condition represents a variance from the deterministic requirements of NFPA 805, Section 4.2.3. This is a separation issue.

This VFDR has been evaluated and it was determined that the risk, safety margin and defense-in-depth meet the acceptance criteria of NFPA 805 Section 4.2.4 with a defense-in-depth action credited.

**3.3.1.5 VFDR No. AA9-005**

1-NRV-153 - Pressurizer PORVs are required to be closed to support RCS integrity. RCS integrity is required to maintain positive control over RCS inventory and pressure. 1-NRV-153 may fail due to fire induced damage of cable 8757G-1. Failure of this cable could spuriously open the valve. This condition represents a variance from the deterministic requirements of NFPA 805, Section 4.2.3. This is a separation issue.

This VFDR has been evaluated and it was determined that the risk, safety margin and defense-in-depth meet the acceptance criteria of NFPA 805 Section 4.2.4 with a defense-in-depth action credited.

### 3.3.1.6 VFDR No. AA9-006

1-NSO-021 and 1-NSO-022 - RX Head Vent Valves are required to be closed to support RCS Integrity. RCS integrity is required to maintain positive control over RCS inventory and pressure. 1-NSO-021 and 1-NSO-022 are in series requiring one of the valves to remain closed to provide RCS integrity. 1-NSO-021 may fail due to cable 9914PG-1. 1-NSO-022 may fail due to fire induce damage of cable 9914PG-1. Failure of these cables could spuriously open the valves. This condition represents a variance from the deterministic requirements of NFPA 805, Section 4.2.3. This is a separation issue.

This VFDR has been evaluated and it was determined that the risk, safety margin and defense-in-depth meet the acceptance criteria of NFPA 805 Section 4.2.4 with a defense-in-depth action credited.

### 3.3.1.7 VFDR No. AA9-007

1-NSO-061 and 1-NSO-062 - Post Accident Vent Valves are required to be closed to support RCS integrity. RCS integrity is required to maintain positive control over RCS inventory and pressure. 1-NSO-061 and 1-NSO-062 are in series requiring one of the valves to remain closed to provide RCS integrity. 1-NSO-061 may fail due to fire induced damage of cable 9901PG-1. 1-NSO-062 may fail due to fire induced damage of cable 9907PG-1. Failure of these cables could spuriously open the valves. This condition represents a variance from the deterministic requirements of NFPA 805, Section 4.2.3. This is a separation issue.

This VFDR has been evaluated and it was determined that the risk, safety margin and defense-in-depth meet the acceptance criteria of NFPA 805 Section 4.2.4 with a defense-in-depth action credited.

### 3.3.1.8 VFDR No. AA9-008

1-QRV-20 and 1-QRV-30 - RCP Seal Water Return Isolation Valves are required to be open to support RCS integrity by maintaining the RCP seal. RCS integrity is required to maintain positive control over RCS inventory and pressure. 1-QRV-20 may fail due to fire induced damage of cable 4955PG-1. 1-QRV30 may fail due to fire induced damage of cable 5654PG-1. These cables could cause spurious closure of these valves. This condition represents a variance from the deterministic requirements of NFPA 805, Section 4.2.3. This is a separation issue.

This VFDR has been evaluated and it was determined that the risk, safety margin and defense-in-depth meet the acceptance criteria of NFPA 805 Section 4.2.4 with a defense-in-depth action credited.

## 3.3.2 Recovery Actions Credited

For each VFDR, a Fire Risk Evaluation has been performed to assess the acceptability of risk, defense-in-depth, and safety margin. This evaluation determined whether or not recovery actions are required to ensure that one success path necessary to achieve and maintain the nuclear safety performance criteria is maintained free of fire damage by a single fire. Table 3-3 identifies the credited recovery actions for this area. Actions retained for DID are identified as "DID Actions" within Table 3-3. Additional information for DID actions is contained within Section 3.8 of this report. Note that, for completeness, all VFDRs are contained within Table 3-3, even if the Fire Risk Evaluation has determined that a recovery action is not required. In those instances where a recovery action has been determined to not be required, the word "None" is provided in the

“Action” column in the table.

<b>Table 3-3, Recovery Actions Credited</b>		
<b>VFDR</b>	<b>Component</b>	<b>Action</b>
AA9-001	1-MRV-213-P 1-MRV-243-P	1-MRV-213-P-CLOSE (Place controller to manual mode in the control room and manually close 1-MRV-213)  1-MRV-243-P-CLOSE (Place controller to manual mode in the control room and manually close 1-MRV-243)
AA9-002	1-CLI-113 1-CLI-114	DID ACTION 1-CLI-113-LOCAL (Locally monitor CST level)
AA9-003	1-ILS-950 1-ILS-951	None
AA9-004	1-DCR-310 1-DCR-340	DID ACTION(S) 1-DCR-310-CLOSE 1-DCR-340-CLOSE (Remove fuses in MCR to fail closed AOVs 1-DCR-310 and 1-DCR-340)
AA9-005	1-NRV-153	DID ACTION(S) 1-NRV-153-CLOSE (Remove fuses in MCR to fail closed PORV 1-NRV-153)
AA9-006	1-NSO-021	DID ACTION(S) 1-NSO-021-CLOSE (Remove fuses in MCR to fail closed AOV 1-NSO-021)
AA9-007	1-NSO-061	DID ACTION(S) 1-NSO-061-CLOSE (Remove fuses in MCR to fail closed AOV 1-NSO-061)
AA9-008	1-QRV-20 1-QRV-30	DID ACTION(S) 1-QRV-20-OPEN 1-QRV-30-OPEN (Remove fuses in MCR to fail closed AOVs 1-QRV-20 and 1-QRV-30)

### 3.4 Non-Power Operational Modes Compliance Summary

A review of CNP for the potential effects of a fire in this Fire Area while in non-power modes of operation (NPO) was conducted. This review was conducted using the guidance provided in NEI 04-02 and FAQ 07-0040, “Non-Power Operations Clarifications”.

The review determined that there are potential failures that affect certain Key Safety Functions (KSF) as a result of the fire in this area, and the fire could result in the loss of one or more KSF paths. Compensatory measures are required during high risk evolution periods to provide reasonable assurance a fire will not adversely affect key safety functions and the NFPA 805 performance goal for NPO is therefore satisfied. The results of the NPO analysis are contained within Technical Evaluation R1900-005-001, Non-Power Operation Modes Transition Review Report.

### 3.5 Radioactive Release Compliance Summary

The NFPA 805 radiological release goal is to provide reasonable assurance that a fire will not result in a radiological release that adversely affects the public, plant personnel or the environment. The NFPA 805 requirement is to ensure a radiation release to any unrestricted area due to the direct effects of fire suppression activities (but not involving fuel damage) shall be as low as reasonably achievable and shall not exceed applicable plant Technical Specification limits.

AA9 is located outside the Radiological Controlled Area (RCA) and is not a storage location for contaminated materials, therefore there is reasonable assurance a fire in this area will not result in radiation release. The review of this fire area, with respect to radioactive release, is documented in the NFPPM.

### 3.6 Probabilistic Risk Assessment-Summary of Results

A Fire PRA (FPRA) quantification of Fire Area AA9 was performed and is documented in PRA-NB-FIRE-FQ, Fire PRA Model Quantification Notebook. The fire risk quantification for Fire Area AA9 is analyzed using detailed fire modeling to consider risk of fire scenarios of ignition sources. PRA-NB-FIRE-FQ includes a summary of all potentially risk-significant fire scenarios (i.e., CDF > 1.0E-7 or LERF > 1.0E-8). Bounding CDF / LERF per calendar year values are reported that are based on the risk values documented in PRA-NB-FIRE-FSS, Fire PRA Fire Scenario Selection.

Fire Protection features credited in the Fire PRA are documented in R1900-0411-AA9, Detailed Fire Modeling Report: Fire Compartment: AA9 Unit 1 Quadrant 1 Cable Tunnel (EL. 596 FT.). PRA-NB-FIRE-FSS documents the revision level of the fire modeling reports used in the most recent Fire PRA quantification.



### 3.7 Risk-Informed, Performance-Based Evaluations

Fire Risk Evaluations (FREs) have been performed to ensure that variances from the NFPA 805 deterministic requirements are acceptable. The evaluation process consists of an integrated assessment of the acceptability of risk, defense-in-depth, and safety margins.

#### 3.7.1 Transition Risk-Informed, Performance-Based Evaluations

The ‘changes’ associated with NFPA 805 transition were those variances from the deterministic requirements of NFPA 805 or with the existing fire protection licensing basis that were brought into compliance with the NFPA 805 performance based approach. The change identified for evaluation for Fire Area AA9 is as follows:

- Separation Issues

The Fire Risk Evaluation has determined that the change is acceptable based upon:

- The measured change in CDF and LERF.
- Adequate defense-in-depth and safety margins being maintained.

Refer to Attachment 2 for a summary of results associated with the Fire Risk Evaluations.

### 3.8 Defense-in-Depth

A comprehensive risk-informed, performance-based analysis includes consideration of defense-in-depth (DID) as part of an integrated evaluation of risk considerations. In general, defense-in-depth involves consideration of the extent to which fire protection systems and features are provided within the three echelons of fire-protection:

- Preventing fires from starting,
- Rapidly detecting fires and controlling and extinguishing promptly those fires that do occur, thereby limiting fire damage,
- Providing an adequate level of fire protection for structures, systems, and components important to safety, so that a fire that is not promptly extinguished will not prevent the nuclear safety performance criteria from being met.

Each VFDR was evaluated for DID. The following recovery actions have been retained for DID.

VFDR No. AA9-002: 1-CLI-113 and 1-CLI-114 - CST Control Room level indication is required to be operable to support AFW for decay heat removal. Decay heat removal is required to remove sufficient heat from the reactor core such that the fuel is maintained in a safe and stable condition. The CST level indicators provide Control Room indication of the initial water source for AFW. All of the Control Room CST level indicators may fail due to a full area fire within Fire Area AA9. Loss of CST indication can be mitigated by locally monitoring the CST level. This recovery action is being retained for DID to ensure CST level indication is maintained.

VFDR No. AA9-004: 1-DCR-310 and 1-DCR-340 - SG 1 and 4 Blowdown Isolation Valves are required to be closed to support main steam isolation. Main steam isolation is required to prevent uncontrolled cooldown through over-steaming. SG 1 and 4 Blowdown Isolation Valves may fail due to a full area fire within Fire Area AA9. Loss of Main Steam isolation can be mitigated by removing fuses to ensure valves fail shut. This recovery action is being retained for DID to ensure Main Steam isolation is maintained.

VFDR No. AA9-005: 1-NRV-153 - Pressurizer PORVs are required to be closed to support RCS integrity. RCS integrity is required to maintain positive control over RCS inventory and pressure. The spurious opening can be mitigated by de-energizing the valve to fail it closed. This recovery action is being retained for DID to ensure RCS pressure and inventory control is maintained.

VFDR No. AA9-006: 1-NSO-021 and 1-NSO-022 - RX Head Vent Valves are required to be closed to support RCS Integrity. RCS integrity is required to maintain positive control over RCS inventory and pressure. 1-NSO-021 and 1-NSO-022 are in series requiring one of the valves to remain closed to provide RCS integrity. The spurious opening can be mitigated by de-energizing the valve to fail it closed. This recovery action is being retained for DID to ensure RCS pressure and inventory control is maintained.

VFDR No. AA9-007: 1-NSO-061 and 1-NSO-062 - Post Accident Vent Valves are required to be closed to support RCS integrity. RCS integrity is required to maintain positive control over RCS inventory and pressure. 1-NSO-061 and 1-NSO-062 are in series requiring one of the valves to remain closed to provide RCS integrity. The spurious opening can be mitigated by de-energizing the valve to fail it closed. This recovery action is being retained for DID to ensure RCS pressure and inventory control is maintained.

VFDR No. AA09-008: 1-QVR-20 and 1-QVR-30 - RCP Seal Water Return Isolation Valves are required to be open to support RCS integrity by maintaining the RCP seal. RCS integrity is required to maintain positive control over RCS inventory and pressure. The spurious closing can be mitigated by de-energizing the valve to fail it open. This recovery action is being retained for DID to ensure RCS integrity is maintained.

Based on the assessment in support of the Fire Risk Evaluation, defense-in-depth is maintained for fire area AA9. Refer to Attachment 2 for details associated with the Fire Risk Evaluation.

### 3.9 Monitoring Program Input

A Monitoring Program will be developed in accordance with FAQ 10-0059, Rev. 1. Methods to monitor availability, reliability, and performance of fire protection program structures, systems, and components (SSCs), as well as programmatic elements will be provided. Additionally, effectiveness measures are established to review program related performance and trends. For AA36/42 the following systems and features are candidates for inclusion in the CNP Fire Protection Monitoring Program:

- Fire Area boundary barriers discussed in Section 3.1
- Fire Detection System (Infrared and Ionization)
- Fire Suppression System (Manual CO2)
- Cable tray covers

### 4.0 CONCLUSION

The nuclear safety and radioactive release performance criteria of NFPA 805 are met for a fire in Fire Area AA9. This Fire Risk Evaluation for Fire Area AA9 has demonstrated that

- The change in core damage frequency (delta CDF) is acceptable, and
- The change in large early release frequency (delta LERF) is acceptable, and
- Defense-in-depth and safety margins are maintained.

This is confirmation that a success path effectively remains free of fire damage and that the performance-based approach is acceptable per Section 4.2.4.2 of NFPA 805.

## **5.0 REFERENCES**

- 5.1 Calculation PRA-FIRE-NB-CRE, Fire PRA Cumulative Risk Evaluations
- 5.2 CNP Fire Pre-Plans, Volumes I, II, and III, Revisions 17, 14, and 18 respectively
- 5.3 Fire Hazards Analysis
- 5.4 NFPA 805, Performance-Based Standard for Fire Protection for Light Water Reactor Electric Generating Plants
- 5.5 NFPPM, NFPA 805 Fire Protection Program Manual (NFPPM)
- 5.6 Nuclear Energy Institute (NEI) 04-02, Guidance for Implementing a Risk-Informed, Performance-Based Fire Protection Program under 10 CFR 50.48(c), Rev. 2
- 5.7 Nuclear Safety Capability Assessment Report
- 5.8 PRA-NB-FIRE-FQ, Fire PRA Model Quantification Notebook
- 5.9 PRA-NB-FIRE-FSS, Fire PRA Fire Scenario Selection
- 5.10 R1900-0411-AA9, AA9 - Detailed Fire Modeling Report
- 5.11 Regulatory Guide 1.205, Risk-Informed, Performance-Based Fire Protection for Existing Light-Water Nuclear Power Plants, Rev. Revision 1
- 5.12 Technical Evaluation R1900-005-001, Non-Power Operation Modes Transition Review

**Fire Area AA9 – Attachment 1 - Table B-3 - Fire Area Transition**

<u>Unit</u>	<u>Fire Area</u>	<u>Description</u>
1	AA9	Unit 1 Quadrant 3M & 3N Cable Tunnel (El. 596 ft.)

<u>Fire Zone</u>	<u>Description</u>
9	Quadrant 3N Cable Tunnel - El. 596 ft. 3-1/2 in. - Unit 1
10	Quadrant 3M Cable Tunnel - El. 596 ft. 3-1/2 in. - Unit 1
116	RW, CS, PW Tank Area Pipe Tunnel - Unit 1 - El. 593 ft. 0 in.

**Regulatory Basis**

4.2.4.2 - Performance-Based Approach - Fire Risk Evaluation with simplifying deterministic assumptions

<b>Performance Goal</b>	<b>Method of Accomplishment</b>	<b>Comments</b>
Reactivity Control	Unit 1 - Trip the reactor from the Control Room. Borate using Unit 1 East Charging Pump supplied from the RWST. Use source range monitoring for indication for Unit 1.	None
Inventory and Pressure Control	Unit 1 - Control inventory using Unit 1 East Charging Pump. Control pressure using Unit 1 Pressurizer Safety Relief Valves.	VFDRs identified for RWST level indication and RCS Integrity.
Decay Heat Removal	Unit 1 - Feed SGs 1 & 4 with Unit 1 West MDAFW Pump. The DHR function also requires MS isolation with a steam release path through the Safety Relief Valves.	VFDRs identified for MS isolation and CST level indication.
Process Monitoring	Unit 1 Process Monitoring - Use Unit 1 process monitoring in the Control Room for the following: Pressurizer level, RCS pressure and temperature, and S/G level and Pressure. Unit 1 Source Range Monitoring - Use Unit 1 source range monitoring in the Control Room.	None
Vital Auxiliaries	Unit 1 Electrical - Control Unit 1 Red (AB) Train Electrical Distribution with Unit 1 Red (AB) Train Offsite Power or Unit 1 Red (AB) DG. Control Unit 1 Green (CD) Train Electrical Distribution with Unit 1 Green (CD) Train Offsite Power or Unit 1 Green (CD) DG. Unit 1 ESW - Operate Unit 1 East or West ESW. Unit 1 CCW - Operate Unit 1 East or West CCW. Unit 1 HVAC - Operate Unit 1 Control Room HVAC. Operate Unit 1 Auxiliary Building HVAC. Operate Unit 1 Red (AB) and Green (CD) DG HVAC. Operate Unit 1 Switchgear HVAC. Operate Unit 1 West AFW Pump Room	None

**Fire Area AA9 – Attachment 1 - Table B-3 - Fire Area Transition**

<u>Unit</u>	<u>Fire Area</u>	<u>Description</u>
1	AA9	Unit 1 Quadrant 3M & 3N Cable Tunnel (El. 596 ft.)
		HVAC system. Operate the Unit 1 East and West ESW Pump HVAC systems.

**Reference Documents**

Genesis Solution Suite, EDISON / SAFE-PB, DC Cook V 3.4.0

Nuclear Safety Capability Assessment Report

**Licensing Actions**

None

**Existing Engineering Equivalency Evaluations (EEEE)**

**EEEE Title** Engineering Equivalency Evaluation 9-23 - Fire Zone 116 (Fire Area AA9) Boundary Evaluation Adjacent to Fire Areas AA11 and AA34

**Summary** The purpose of this engineering equivalency evaluation is to document the acceptability of two manway openings connecting Fire Zone 116 (Fire Area AA9) with adjacent fire areas.

Reasonable assurance is provided that the two manway openings connecting Fire Zone 116 with Fire Zone 12 and Fire Zone 33 do not impair redundant safe shutdown capability. This engineering equivalency evaluation does not adversely impact other engineering equivalency evaluations.

The two manway openings were evaluated and found to be acceptable based on the fire hazards and construction features within the evaluated areas.

**Fire Area AA9 – Attachment 1 - Table B-3 - Fire Area Transition**

<u>Unit</u>	<u>Fire Area</u>	<u>Description</u>
1	AA9	Unit 1 Quadrant 3M & 3N Cable Tunnel (El. 596 ft.)

<b><u>EEEE Title</u></b>	<b>Engineering Equivalency Evaluation 11-9 - Turbine, Auxiliary and Containment Buildings Boundary Evaluation</b>
<b><u>Summary</u></b>	<p>The purpose of this engineering equivalency evaluation is to describe in general, the approach and existence of evaluations performed to determine and reconcile fire area boundaries having components or designs with less than a 3-hr fire rating on preventing the spread of fire. This engineering equivalency evaluation also specifically evaluates the impact of unrated door assemblies on the spread of fire.</p> <p>Reasonable assurance is provided that the fire area boundaries having components or design less than a 3-hr fire rating will not increase the spread of fire or impair the safe shutdown capabilities of Units 1 or 2. In addition, this engineering equivalency evaluation does not adversely impact on other engineering equivalency evaluations or exemption requests.</p> <p>This evaluation supports additional evaluations credited in this fire area.</p>
<b><u>EEEE Title</u></b>	<b>Engineering Equivalency Evaluation 11-14 - Cable Spreading Room Construction Boundary Evaluation (Fire Areas AA3, AA7, AA8, AA9, AA10, AA29, AA30, AA31, AA34, AA35, AA36/42, AA37, AA38, AA48, AA50, AA51 and AA52)</b>
<b><u>Summary</u></b>	<p>The purpose of this engineering equivalency evaluation is to document the acceptability of the construction features of the cable spreading rooms which have a fire resistance rating of less than 3 hours for their impact on the spread. In particular, fire dampers having a 1 1/2-hr fire rating were analyzed by this evaluation. Other unrated construction features have been previously analyzed under separate engineering equivalency evaluations. The applicable fire areas include: AA3, AA7, AA8, AA9, AA10, AA29, AA30, AA31, AA34, AA35, AA36/42, AA37, AA38, AA48, AA50, AA51 and AA52.</p> <p>Reasonable assurance is provided that the construction features of the cable spreading rooms which have a fire resistance rating of less than 3 hours will prevent the spread of fire and not impair the safe shutdown capabilities of Unit 1 and Unit 2. In addition, this engineering equivalency evaluation does not adversely impact other engineering equivalency evaluations.</p> <p>The construction features of the cable spreading room were evaluated and found to be acceptable based on the fire hazards, fire protection systems and construction features within the areas.</p>

**Fire Area AA9 – Attachment 1 - Table B-3 - Fire Area Transition**

<u>Unit</u>	<u>Fire Area</u>	<u>Description</u>
1	AA9	Unit 1 Quadrant 3M & 3N Cable Tunnel (El. 596 ft.)
<b><u>EEEE Title</u></b>	<b>Engineering Equivalency Evaluation 11-46 - Seismic Gaps between the Containment and Auxiliary Buildings Boundary Evaluation (Fire Areas AA2, AA3, AA7, AA8, AA9, AA10, AA11, AA27, AA29, AA30, AA31, AA34, AA35, AA37 and AA38)</b>	
<b><u>Summary</u></b>	<p>A seismic gap exists around the Containment Building of each unit that provides an opening of approximately 6 in. between the Containment Building and the walls, ceilings and floors of the structures immediately adjacent to containment. These Fire Areas include AA2, AA3, AA7, AA8, AA9, AA10, AA11, AA27, AA29, AA30, AA31, AA34, AA35, AA37 and AA38. This engineering equivalency evaluation has been performed to document the acceptability of these seismic gaps in the fire boundaries.</p> <p>This seismic gap evaluation shows the safe shutdown capability for CNP Unit 1 and Unit 2 has not been compromised as a result of seismic gaps. The analysis performed and the results presented in the tables indicate, on a system basis, the capability to safely shut down both units when considering fire damage to safe shutdown components and circuits contained in the seismic gap evaluation areas. The method of analysis is conservative when considering the fire hazards involved in the vicinity of the seismic gaps. That is, it is not anticipated that the evaluated areas would be affected to the extent that fire would propagate through the seismic gaps and cause damage throughout the evaluated area. This engineering equivalency evaluation has no impact on the exemption requests contained in other engineering equivalency evaluations.</p> <p>The seismic gaps were evaluated and found to be acceptable based on the fire hazards, fire protection systems and construction features within the evaluated areas.</p>	
<b><u>EEEE Title</u></b>	<b>Engineering Equivalency Evaluation 12-19 - CO2 Fire Suppression System Concentrations (Fire Areas AA7, AA8, AA9, AA10, AA29, AA30, AA31, AA37, AA38, AA39, AA40, AA41, AA43, AA44, AA45, AA48, AA49, AA50, AA51, AA52 and AA53)</b>	
<b><u>Summary</u></b>	<p>The purpose of this engineering equivalency evaluation is to document the acceptability of the CO2 fire suppression systems in fire zones containing concentrations of cable insulation and the potential for deep-seated fires. This engineering equivalency evaluation determines the CO2 system's impact on the spread of fire and previous engineering equivalency evaluations and exemption requests. Although there are other fire zones that use CO2 for fire suppression such as the DG Rooms, they are installed to suppress surface-type, combustible liquid fires and are not included in this analysis, because they do not contain significant concentrations of cable insulation capable of producing deep-seated fires.</p> <p>All of the CO2 systems included in this engineering equivalency evaluation are capable of performing their intended function, containing the fire until the Fire Brigade arrives, preventing fire spread to adjacent fire zones, and ensuring that safe shutdown of CNP can be achieved and maintained.</p> <p>The existing suppression systems were evaluated and found to be acceptable based on the fire hazards and fire protection systems within the evaluated areas.</p>	



**Fire Area AA9 – Attachment 1 - Table B-3 - Fire Area Transition**

<u>Unit</u>	<u>Fire Area</u>	<u>Description</u>
1	AA9	Unit 1 Quadrant 3M & 3N Cable Tunnel (El. 596 ft.)

**Fire Suppression Effects on Nuclear Safety Performance Criteria**

The CNP fire brigade is trained to discharge water in a judicious manner and instructed to direct hose streams and portable extinguishers at the base of the fire to limit the amount of overspray beyond the immediate fire zone. For this reason, fire brigade activities are not expected to fail components not already considered damaged by fire. It has been concluded that water impingement on cables is not a concern. Electrical cabinets are provided with a seal at the conduit interface. Per visual inspection any side vents for this equipment are pointed downward to prevent water intrusion. The drainage features of the fire area mitigate the potential for flooding damage due to fire suppression, such that the standing water would not affect credited equipment.

In the event of discharge, the CO2 system will not adversely affect the equipment operating within the fire area. Potential condensation developing on electrical components is a long term issue that would be eliminated by ventilating the fire area after actuation. Per visual inspection, all CO2 nozzles are located greater than 5 ft. away from any credited equipment and therefore, the possibility of thermal shock due to CO2 actuation has been deemed to be a non-issue in this fire area in accordance to EPRI NP-7253 "Effects of Fire Suppressants on Electrical Components in Nuclear Power Plants". Since it is shown that suppression effects will not impact the nuclear safety performance criteria, the fire area configuration is deemed acceptable.

**References:**

Technical Evaluation 12.1, "Fire Suppression Effects Study"

Technical Evaluation 12.1, "Supplemental Information to Fire Suppression Effects Study – Supplement 1"

**Fire Area Comments**

None

## Fire Area AA9 – Attachment 2 - Fire Risk Evaluation Results Summary

### A2.1 Introduction

The ‘changes’ associated with NFPA 805 transition were those variances from the deterministic requirements of NFPA 805. The changes identified for evaluation for fire area AA9 are grouped as follows:

- Separation Issues

This attachment is a summary of the Fire Risk Evaluation for the fire area. The complete results and methodology are contained in the Cumulative Fire Risk Evaluation, PRA-FIRE-NB-CRE. (FPCE 2017-0009)

### A2.2 Inputs/Assumptions

Fire modeling processes and inputs provided in NUREG/CR-6850 are appropriate for use in a risk-informed, performance-based evaluation. The complete list of assumptions used in the fire modeling methodology for this fire area is contained in Detailed Fire Modeling Technical Evaluation R1900-0411-AA9.

### A2.3 Fire Modeling Methodology

Fire PRA fire modeling results are used as the initial input into this Fire Risk Evaluation. The process consists of conservative bounding analyses using NUREG/CR-6850 methods. As needed, refinements are made to utilize more realistic parameters. The complete fire modeling methodology for this fire area is contained in Detailed Fire Modeling Technical Evaluation R1900-0411-AA9.

### A2.4 Scenario Descriptions and Model Results

Fire Area AA9 was evaluated for the impact of fires originating from both fixed and transient ignition sources. Complete descriptions of each fire scenario is contained within the Detailed Fire Modeling Technical Evaluation R1900-0411-AA9.

#### A2.4.1 Ignition Sources

Fire Area AA9 contains TC Cabinet B. Per discussion with plant personnel, the heat release rates for all switchgear, load centers, and MCC electrical cabinets have been characterized as qualified cable because items of this nature are generally constructed on-site. For other electrical cabinet types, where the internal cable qualification was unknown, the heat release rates have been assumed as non-qualified. Ignition sources in Fire Area AA9 were modeled using the 98th percentile fire as a screening approach. These scenarios were not risk significant enough to require further refinement.

In Fire Area AA9, the 98th percentile HRR was used for all transient fires. The 98th percentile HRR bounds the possible transient ignition sources expected for this fire area, which were fire tested and identified in NUREG/CR-6850, Appendix G, Table G-7.

#### A2.4.2 Scenario Results

A delta risk calculation has been performed to quantify the risk associated with the VFDRs in the fire area.

### A2.5 Fire Risk Evaluation Results

PRA-FIRE-NB-CRE documents scenarios and corresponding impacted VFDRs that were evaluated for delta risk during the transition to NFPA 805 and also all changes to the Fire Protection Program that are currently incorporated into the Fire PRA model. The acceptability of the Cumulative Fire Risk Evaluations

**Fire Area AA9 – Attachment 2 - Fire Risk Evaluation Results Summary**

was based on calculated delta risk meeting the thresholds of NEI 04-02, RG 1.205 and RG 1.174. (FPCE 2017-0009)

**Fire Area AA9 – Attachment 2 - Fire Risk Evaluation Results Summary****A-2.6 Impact of VFDR on Defense-in-Depth**

Defense-in-Depth has been evaluated for this fire area. The impacts of this evaluation are summarized in the table below:

Defense-in-Depth Impact Review for AA9			
Method of Providing DID	Required to Support Deterministic Analysis or Fire PRA?	Changes or Improvements Necessary for DID?	Basis/Justification
Echelon 1: Prevent fires from starting			
Combustible Control is implemented in accordance with Procedure PMP-2270-CCM-001, Control of Combustible Materials.	Yes	No	• This element is adequate based on no perceived weakness of, or over-reliance on, another echelon of defense-in-depth.
Hot Work Control is implemented in accordance with Procedure PMP-2270-WBG-001, Welding, Burning and Grinding Activities.	Yes	No	
Echelon 2: Rapidly detect, control and extinguish promptly those fires that do occur thereby limiting fire damage			
Fire Detection System	Yes	No	• Although a recovery action is required to maintain defense-in-depth, this action is not considered a time sensitive action, further, since fire fighting activities would not be challenging, no changes or improvements to Echelon 2 attributes are necessary to maintain defense-in-depth.
Fixed Fire Suppression	Yes	No	
Portable Fire Extinguishers	Yes	No	
Hose stations and hydrants	Yes	No	
Pre-Fire Plan	Yes	No	

**Fire Area AA9 – Attachment 2 - Fire Risk Evaluation Results Summary**

<b>Defense-in-Depth Impact Review for AA9</b>			
<b>Method of Providing DID</b>	<b>Required to Support Deterministic Analysis or Fire PRA?</b>	<b>Changes or Improvements Necessary for DID?</b>	<b>Basis/Justification</b>
<b>Echelon 3: Provide adequate level of fire protection for systems and structures so that a fire will not prevent essential safety functions from being performed</b>			
Walls, floors ceilings and structural elements are rated or have been evaluated as adequate for the hazard.	Yes	No	<ul style="list-style-type: none"> <li>• Since VFDR AA9-001 is required as a recovery action for Fire PRA no changes or improvements to Echelon 3 attributes are necessary to maintain defense-in-depth for this VFDR.</li> <li>• Although VFDR AA9-002 is not considered a significant contribution to core damage frequency, the variances are considered important enough to the NSCA to retain as a recovery action to ensure that defense-in-depth is maintained.</li> </ul>
Penetrations in the fire area barrier are rated or have been evaluated as adequate for the hazard.	Yes	No	<ul style="list-style-type: none"> <li>• Since VFDR AA9-003 is never affected in a potentially risk significant fire scenario, internal fire area separation is adequate, therefore implementing additional DID Echelon 3 attributes for these VFDRs is not required.</li> </ul>
Supplemental barriers (e.g., ERFBS, cable tray covers, etc.)	Yes	No	
Guidance provided to operations personnel detailing the required success path(s) including recovery actions to achieve nuclear safety performance criteria.	Yes	Yes	<ul style="list-style-type: none"> <li>• Defense in Depth actions were credited to remove fuses or open breakers in the Control Room to prevent spurious equipment operation due to internal shorts.</li> </ul>

## Fire Area AA9 – Attachment 2 - Fire Risk Evaluation Results Summary

### A-2.7 Safety Margin Considerations

In accordance with NEI 04-02, the maintenance of adequate Safety Margin is assessed by the consideration categories of analyses utilized by this Fire Risk Evaluation.

Safety margins are considered to be maintained if:

- Codes and Standards or their alternatives accepted for use by the NRC are met

AND

- Safety analyses acceptance criteria in the licensing basis (e.g., FSAR, supporting analyses) are met, or provides sufficient margin to account for analysis and data uncertainty.

The following summarizes the bases for ensuring the maintenance of safety margins:

- The risk-informed, performance based processes utilized are based upon NFPA 805, 2001 edition, endorsed by the NRC in 10 CFR 50.48(c).
- The Fire Risk Evaluation process is in accordance with NEI 04-02, Revision 2, which is endorsed by the NRC in Regulatory Guide 1.205, Revision 1.
- The Fire PRA is developed in accordance with NUREG/CR-6850, which was developed jointly between the NRC and EPRI.
- The Fire PRA has undergone an industry peer review, in order to ensure the Fire PRA meets the appropriate quality standards of ASME/ANS RA-Sa-2009, "Standard for Level 1/Large Early Release Frequency Probabilistic Risk Assessment for Nuclear Power Plant Applications," Dated February 2, 2009
- The "combined analysis approach" is used during transition (NEI 04-02, Section 5.3.4.3); therefore, MEFS/LFS is not analyzed separately from the Fire PRA results.
- The CNP internal events PRA model received two formal industry peer reviews conducted in accordance with applicable NEI guidelines. The initial peer review was performed in 2001, while a subsequent focused scope (i.e., limited scope) peer review was conducted in 2009. The initial, full-scope WOG peer review covered all aspects of the CNP PRA model and the administrative processes used to maintain and update the model. The CNP PRA model has been revised to address all significant issues (i.e., Category A and B Facts & Observations) identified during the initial peer review. None of the findings from the focused-scope peer review were judged to reach the significance level of a Category A or B Fact & Observation; as a result, no changes to the PRA model have yet been made to include resolutions for these latter issues.
- Fire protection systems and features determined to be required by NFPA 805 Chapter 4 have been confirmed to meet the requirements of NFPA 805 Chapter 3 and their associated referenced codes and listings, or provided with acceptable alternatives using processes accepted for use by the NRC (i.e., FAQ 06-0008, FAQ 06-0004, 07-0033).
- Fire modeling performed in support of the transition has been performed within the Fire PRA utilizing codes and standards developed by industry and NRC staff which have been verified and validated in authoritative publications, such as NUREG 1824, "Verification and Validation of Selected Fire Models for Nuclear Power Plant Applications". In general, the fire modeling performed in support of the Fire Risk Evaluations has been performed using conservative methods and input parameters that are based upon

### Fire Area AA9 – Attachment 2 - Fire Risk Evaluation Results Summary

NUREG/CR-6850 as documented in the AA9 Detailed Fire Modeling Report, section 7.2. While this is generally not ideal in the context of best estimate probabilistic risk analysis, it is a pragmatic approach given the current state of knowledge regarding the uncertainties related to the application of the fire modeling tools and associated input parameters for specific plant configurations.

- In accordance with the requirements of 10 CFR 50.48(c)(2)(iii), the Fire PRA results, including cutsets for the scenarios of concern, have been reviewed and it was verified that the results presented above do not rely solely on feed and bleed as the fire-protected safe shutdown path for maintaining reactor coolant inventory, pressure control, and decay heat removal capability for this fire area.

#### A-2.8 Transition Risk Evaluation Conclusions

The transition change evaluation determined that these changes:

- Are acceptable based upon the measured change in CDF and LERF
- Maintained adequate defense-in-depth and safety margins

The results of this evaluation meet the requirements of NFPA 805 Risk Evaluation; therefore, the use of the performance based analysis approach is acceptable.

# D. C. Cook Nuclear Plant Fire Safety Analysis

## Fire Area: AA10

Unit 1 Quadrant 3S Cable Tunnel (El. 596 ft.)

### Table of Contents

<b>Purpose</b> .....	Section 1.0
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#### Attachments

Fire Area AA10 – Attachment 1 - Table B-3 - Fire Area Transition

Fire Area AA10 – Attachment 2 - Fire Risk Evaluation Results Summary



## 1.0 PURPOSE

This report documents the Fire Safety Analysis (FSA) for Cook Nuclear Plant (CNP) Fire Area AA10, Unit 1 Quadrant 3S Cable Tunnel (El. 596 ft.) which comprises fire zone(s) 11. The purpose of this analysis is to demonstrate the achievement of the nuclear safety and radioactive release performance criteria of NFPA 805 as required by 10 CFR 50.48(c). The Fire Safety Analysis is a key part of compliance with Section 2.7.1.2 Fire Protection Program Design Basis Document of NFPA 805. This analysis also documents results of risk-informed, performance-based Fire Risk Evaluations (FREs). These evaluations are associated with Variances from Deterministic Requirements (VFDRs) of NFPA 805 Chapter 4.

## 2.0 ANALYSIS METHODOLOGY

The FSA is the design basis document as described in NFPA 805 Section 2.7.1.2. The following steps are performed to develop the FSA on a fire area basis:

- Identify significant fire hazards in the fire area. This is based on NFPA 805 approach to analyze the plant from an ignition source and fuel package perspective.
- Summarize Nuclear Safety Capability Analysis (NSCA) compliance strategies. This is the result of the NEI 04-02 B-3 Table review of the Safe Shutdown Analysis.
- Summarize Non-Power Operations Modes compliance strategies.
- Summarize Radioactive Release compliance strategies. The transition review process required per NEI 04-02 is used to develop these results.
- Provide Fire Probabilistic Risk Assessment summary of results. This is based on the results from the plant Fire PRA.
- Perform risk informed, performance based evaluations if needed for the performance based approach.
- Summarize Defense-in-Depth strategy for each fire area.
- Determine key analysis assumptions which are candidates to be included in the NFPA 805 monitoring program.
- Provide conclusions relative to NFPA 805 compliance.

### 3.0 ANALYSIS

#### 3.1 Classical Fire Protection

##### 3.1.1 Construction

Walls, floors and ceilings to adjacent fire areas are reinforced concrete in excess of a 3-hour rating.

A fire area boundary evaluation was performed for a damper and penetration seal in this area which has a fire resistance rating of less than 3 hours.

Applicable Engineering Equivalency Evaluations are documented in Attachment 1.

##### 3.1.2 Doors and Access Openings

A fire door having a 3-hour rating is provided to adjacent Fire Area AA9 - Fire Zone 10.

##### 3.1.3 Penetrations

Penetrations in fire barriers between this fire zone and adjacent fire areas are provided with fire seals except as noted below. The seismic gaps are sealed with a glass fiber reinforced silicone sheeting. Seismic gap exemption was granted for Fire Zone 11 interface with Fire Areas AA9, AA11 and AA34 - Fire Zones 10, 12 and 33A, respectively.

##### 3.1.4 Detection

The table below outlines the fire detection system(s) provided in the Fire Area:

Table 3-1, Fire Area AA10 Detection Systems								
Fire Zone	Type of System	Local (L) / Remote (R)	Detection Actuates Suppression?	Required System?				
				S	L	E	R	D
11	Infrared	L/R	N	N	N	Y	Y	N
11	Ionization	L/R	N	N	N	Y	Y	N

Table 3-1 Legend:	
Table Field: "Required System?"	
S	- Required for Chapter 4 Separation Criteria
L	- Required for NRC Approved Licensing Action
E	- Required for Engineering Equivalency Evaluation
R	- Required for Risk Significance
D	- Required to maintain adequate balance of Defense-in-Depth in a Change Evaluation or Fire Risk Evaluation

Cross zoned ionization smoke detectors (3) and infra-red detectors (3) are provided which alarm in the Unit 1 Control Room. No detectors are located in the corridor between quadrants 3M and 3S.

### 3.1.5 Fixed Suppression

The table below outlines the fixed fire suppression system(s) provided in the Fire Area:

Table 3-2, Fire Area AA10 Suppression Systems							
Fire Zone	Type of System	Full (F) / Partial (P)	Required System?				
			S	L	E	R	D
11	Manual CO2	P	N	N	Y	N	N

**Table 3-2 Legend:**

Table Field: "Required System?"	
S	- Required for Chapter 4 Separation Criteria
L	- Required for NRC Approved Licensing Action
E	- Required for Engineering Equivalency Evaluation
R	- Required for Risk Significance
D	- Required to maintain adequate balance of Defense-in-Depth in a Change Evaluation or Fire Risk Evaluation

Fire Area AA10 is not provided with an automatic fire suppression system.

### 3.1.6 Manual Suppression / Response Strategy

A postulated fire will be identified by early detection using ionization type smoke detection or by plant personnel using plant communication system to notify the control room. The automatic detection system alarms in the control room. The Control Room operator will dispatch the fire brigade for initiation of manual fire fighting. A fire in this fire area will be contained by the construction features discussed in Section 3.1.1. Manual suppression is provided by the CNP Fire Brigade. A low pressure CO2 total flooding system supplied from the 17 ton tank is provided. This system is manually actuated. Operation of this system discharges CO2 into Fire Area AA10. No CO2 suppression is provided in the two cubicles furthest east or in the corridor between quadrants 3M and 3S.

Fire extinguishers are located in Fire Area AA10 for the fire brigade's use.

Water hose reels are located in adjacent Fire Zone 9, and water hose reel located in diesel generator ramp/corridor adjacent Fire Zone 79.

Floor drains are available in Fire Area AA10.

### 3.1.7 Ventilation

A fire in this area will be contained by the fire barriers. Smoke can be removed by venting to the outdoors or to other parts of the Auxiliary Building. The normal building ventilating systems in the Auxiliary Building will then exhaust the smoke via filtered monitored pathways. This fire area is listed as a non-controlled area in the Fire Pre Plans and therefore there is reasonable assurance that products of combustion will not be contaminated.

There is a 1-1/2-hour fire damper in an interior wall of Fire Zone 11. Fire dampers having a 1-1/2-hour rating are provided to adjacent Fire Area AA9 - Fire Zone 10. A fire damper having a 3-hour rating is provided to adjacent Fire Area AA15 - Fire Zone 16.

### 3.1.8 Other Features

No other fire protection features provided for Fire Area AA10.

## 3.2 Fire Hazards Identification

The fire area contains both ignition sources and combustible fire hazards. The ignition sources consist of the motor control centers. Combustibles consist primarily of cable insulation, cellulose and rubber/plastics.

This Fire Area is below grade and any exterior wall penetrations need not be rated based on the protection provided by the ground covering the exterior walls.

The current fire loading classification is low.

## 3.3 NSCA Compliance Summary

Fire Area AA10 contains Red and Green Train cables, conduits, and raceways as well as safe shutdown equipment.

Compliance with the nuclear safety performance criteria is achieved using the performance-based approach in accordance with NFPA 805, Section 4.2.4.2.

Safe and stable condition of the affected Unit 1, will be accomplished using Steam Generators 1 and 4 via the Unit 1 West Motor Driven Auxiliary Feedwater Pump, Unit 1 Charging via the East or West Pump, Unit 1 Component Cooling Water via the East or West Pump, Unit 1 Essential Service Water via the East or West Pump and Process Monitoring from the Main Control Room. Local monitoring of CST is required. Power is credited to be available to the Red and Green train systems via offsite power with the Green Train EDG available as well.

The Nuclear Safety Performance Criteria compliance strategy for AA10 is documented within the NSCA Report.

### 3.3.1 Variances

The variances identified for evaluation for this fire area are grouped as follows:

#### 3.3.1.1 VFDR No. AA10-001

1-CLI-113 and 1-CLI-114 - CST Control Room level indication is required to be operable to support AFW for decay heat removal. Decay heat removal is required to remove sufficient heat from the reactor core such that the fuel is maintained in a safe and stable condition. The CST level indicators provide Control Room indication of the initial water source for AFW. All of the Control Room level indicators may fail due to a full area fire within Fire Area AA10. 1-CLI-113 may fail due to fire induced damage of cable 20205-1. 1-CLI-114 may fail due to fire induced damage of cable 8202Y-1. This condition represents a variance from deterministic requirements of NFPA 805, Section 4.2.3. This is a separation issue.

This VFDR has been evaluated and it was determined that the risk, safety margin and defense-in-depth meet the acceptance criteria of NFPA 805 Section 4.2.4 with a defense-in-depth action credited.

**3.3.1.2 VFDR No. AA10-002**

1-ILS-950 and 1-ILS-951 - RWST level indication is required to support CVCS. CVCS is required to be operable to maintain inventory, pressure and reactivity control. The RWST is the primary credit borated water source for CVCS. The RWST level indicators may fail due to a full area fire within Fire Area AA10. 1-ILS-950 may fail due to fire induced damage of cable 9738G-1. 1-ILS-951 may fail due to fire induced damage of cable 9738R-1. This condition represents a variance from deterministic requirements of NFPA 805, Section 4.2.3. This is a separation issue.

This VFDR has been evaluated and it was determined that the risk, safety margin and defense-in-depth meet the acceptance criteria of NFPA 805 Section 4.2.4 with no further action required.

**3.3.1.3 VFDR No. AA10-003**

1-DCR-310 and 1-DCR-340 - SG 1 and 4 Blowdown Isolation Valves are required to be closed to support main steam isolation. Main steam isolation is required to prevent uncontrolled cooldown through over-steaming. SG 1 and 4 Blowdown Isolation Valves may fail due to a full area fire within Fire Area AA10. 1-DCR-310 may fail due to fire induced damage of cable 8682G-1. 1-DCR-340 may fail due to fire induced damage of cable 8686G-1. These cable failures could spuriously open the valves. SGs 1 and 4 are credited for decay heat removal for a fire within Fire Area AA10. This condition represents a variance from the deterministic requirements of NFPA 805, Section 4.2.3. This is a separation issue.

This VFDR has been evaluated and it was determined that the risk, safety margin and defense-in-depth meet the acceptance criteria of NFPA 805 Section 4.2.4 with a defense-in-depth action credited.

**3.3.2 Recovery Actions Credited**

For each VFDR, a Fire Risk Evaluation has been performed to assess the acceptability of risk, defense-in-depth, and safety margin. This evaluation determined whether or not recovery actions are required to ensure that one success path necessary to achieve and maintain the nuclear safety performance criteria is maintained free of fire damage by a single fire. Table 3-3 identifies the credited recovery actions for this area. Actions retained for DID are identified as “DID Actions” within Table 3-3. Additional information for DID actions is contained within Section 3.8 of this report. Note that, for completeness, all VFDRs are contained within Table 3-3, even if the Fire Risk Evaluation has determined that a recovery action is not required. In those instances where a recovery action has been determined to not be required, the word “None” is provided in the “Action” column in the table.

<b>Table 3-3, Recovery Actions Credited</b>		
<b>VFDR</b>	<b>Component</b>	<b>Action</b>
AA10-001	1-CLI-113 1-CLI-114	DID ACTION 1-CLI-113-LOCAL (Locally monitor CST level)
AA10-002	1-ILS-950 1-ILS-951	None

Table 3-3, Recovery Actions Credited		
VFDR	Component	Action
AA10-003	1-DRC-310 1-DCR-340	DID ACTION(S) 1-DCR-310-CLOSE 1-DCR-340-CLOSE (Remove fuses in MCR to fail closed AOVs 1-DCR-310 and 1-DCR-340)

### 3.4 Non-Power Operational Modes Compliance Summary

A review of CNP for the potential effects of a fire in this Fire Area while in non-power modes of operation (NPO) was conducted. This review was conducted using the guidance provided in NEI 04-02 and FAQ 07-0040, "Non-Power Operations Clarifications", and the methodology as described in project procedure, Non-Power Operation Mode Review Procedure.

The review determined that there are potential failures that affect certain Key Safety Functions (KSF) as a result of the fire in this area, and the fire could result in the loss of one or more KSF paths. Compensatory measures are required during high risk evolution periods to provide reasonable assurance a fire will not adversely affect key safety functions and the NFPA 805 performance goal for NPO is therefore satisfied. The results of the NPO analysis are contained within Technical Evaluation R1900-005-001, Non-Power Operation Modes Transition Review Report.

### 3.5 Radioactive Release Compliance Summary

The NFPA 805 radiological release goal is to provide reasonable assurance that a fire will not result in a radiological release that adversely affects the public, plant personnel or the environment. The NFPA 805 requirement is to ensure a radiation release to any unrestricted area due to the direct effects of fire suppression activities (but not involving fuel damage) shall be as low as reasonably achievable and shall not exceed applicable plant Technical Specification limits.

AA10 is located outside the Radiological Controlled Area (RCA) and is not a storage location for contaminated materials, therefore there is reasonable assurance a fire in this area will not result in radiation release. The review of this fire area, with respect to radioactive release, is documented in the NFPPM.

### 3.6 Probabilistic Risk Assessment-Summary of Results

A Fire PRA (FPRA) quantification of Fire Area AA10 was performed and is documented in PRA-NB-FIRE-FQ, Fire PRA Model Quantification Notebook. The fire risk quantification for Fire Area AA10 is analyzed assuming whole room burnup. PRA-NB-FIRE-FQ includes a summary of all potentially risk-significant fire scenarios (i.e., CDF > 1.0E-7 or LERF > 1.0E-8). Bounding CDF / LERF per calendar year values are reported that are based on the risk values documented in PRA-NB-FIRE-FSS, Fire PRA Fire Scenario Selection.

### **3.7 Risk-Informed, Performance-Based Evaluations**

Fire Risk Evaluations (FREs) have been performed to ensure that variances from the NFPA 805 deterministic requirements are acceptable. The evaluation process consists of an integrated assessment of the acceptability of risk, defense-in-depth, and safety margins.

#### **3.7.1 Transition Risk-Informed, Performance-Based Evaluations**

The ‘changes’ associated with NFPA 805 transition were those variances from the deterministic requirements of NFPA 805 or with the existing fire protection licensing basis that were brought into compliance with the NFPA 805 performance based approach. The change identified for evaluation for Fire Area AA10 is as follows:

- Separation Issues

The Fire Risk Evaluation has determined that the change is acceptable based upon:

- The measured change in CDF and LERF.
- Adequate defense-in-depth and safety margins being maintained.

Refer to Attachment 2 for a summary of results associated with the Fire Risk Evaluations.

### 3.8 Defense-in-Depth

A comprehensive risk-informed, performance-based analysis includes consideration of defense-in-depth (DID) as part of an integrated evaluation of risk considerations. In general, defense-in-depth involves consideration of the extent to which fire protection systems and features are provided within the three echelons of fire-protection:

- Preventing fires from starting,
- Rapidly detecting fires and controlling and extinguishing promptly those fires that do occur, thereby limiting fire damage,
- Providing an adequate level of fire protection for structures, systems, and components important to safety, so that a fire that is not promptly extinguished will not prevent the nuclear safety performance criteria from being met.

Each VFDR was evaluated for DID. The following recovery actions have been retained for DID.

VFDR No. AA10-001: 1-CLI-113 and 1-CLI-114 - CST Control Room level indication is required to be operable to support AFW for decay heat removal. Decay heat removal is required to remove sufficient heat from the reactor core such that the fuel is maintained in a safe and stable condition. The CST level indicators provide Control Room indication of the initial water source for AFW. All of the Control Room CST level indicators may fail due to a full area fire within Fire Area AA10. Loss of CST indication can be mitigated by locally monitoring the CST level. This recovery action is being retained for DID to ensure CST level indication is maintained.

VFDR No. AA10-003: 1-DCR-310 and 1-DCR-340 - SG 1 and 4 Blowdown Isolation Valves are required to be closed to support main steam isolation. Main steam isolation is required to prevent uncontrolled cooldown through over-steaming. Loss of Main Steam isolation can be mitigated by removing fuses to ensure valves fail shut. This recovery action is being retained for DID to ensure Main Steam isolation is maintained.

Based on the assessment in support of the Fire Risk Evaluation, defense-in-depth is maintained for fire area AA10. Refer to Attachment 2 for details associated with the Fire Risk Evaluation.

### 3.9 Monitoring Program Input

A Monitoring Program will be developed in accordance with FAQ 10-0059, Rev. 1. Methods to monitor availability, reliability, and performance of fire protection program structures, systems, and components (SSCs), as well as programmatic elements will be provided. Additionally, effectiveness measures are established to review program related performance and trends. For AA10 the following systems and features are candidates for inclusion in the CNP Fire Protection Monitoring Program:

- Fire Area boundary barriers discussed in Section 3.1
- Fire Detection System
- Manual Fire Suppression System

### 4.0 CONCLUSION

The nuclear safety and radioactive release performance criteria of NFPA 805 are met for a fire in Fire Area AA10. This Fire Risk Evaluation for Fire Area AA10 has demonstrated that

- The change in core damage frequency (delta CDF) is acceptable, and
- The change in large early release frequency (delta LERF) is acceptable, and



- Defense-in-depth and safety margins are maintained.

This is confirmation that a success path effectively remains free of fire damage and that the performance-based approach is acceptable per Section 4.2.4.2 of NFPA 805.

## 5.0 REFERENCES

- 5.1 Calculation PRA-FIRE-NB-CRE, Fire PRA Cumulative Risk Evaluations
- 5.2 CNP Fire Pre-Plans, Volumes I, II, and III, Revisions 17, 14, and 18 respectively
- 5.3 Fire Hazards Analysis
- 5.4 NFPA 805, Performance-Based Standard for Fire Protection for Light Water Reactor Electric Generating Plants
- 5.5 NFPPM, NFPA 805 Fire Protection Program Manual (NFPPM)
- 5.6 Nuclear Energy Institute (NEI) 04-02, Guidance for Implementing a Risk-Informed, Performance-Based Fire Protection Program under 10 CFR 50.48(c), Rev. 2
- 5.7 Nuclear Safety Capability Assessment Report
- 5.8 PRA-NB-FIRE-FQ, Fire PRA Model Quantification Notebook
- 5.9 PRA-NB-FIRE-FSS, Fire PRA Fire Scenario Selection
- 5.10 Regulatory Guide 1.205, Risk-Informed, Performance-Based Fire Protection for Existing Light-Water Nuclear Power Plants, Rev. Revision 1
- 5.11 Technical Evaluation R1900-005-001, Non-Power Operation Modes Transition Review

**Fire Area AA10 – Attachment 1 - Table B-3 - Fire Area Transition**

<u>Unit</u>	<u>Fire Area</u>	<u>Description</u>
1	AA10	Unit 1 Quadrant 3S Cable Tunnel (El. 596 ft.)

<u>Fire Zone</u>	<u>Description</u>
11	Quadrant 3S Cable Tunnel - El. 596 ft. 3-1/2 in. - Unit 1

**Regulatory Basis**

4.2.4.2 - Performance-Based Approach - Fire Risk Evaluation with simplifying deterministic assumptions

<b>Performance Goal</b>	<b>Method of Accomplishment</b>	<b>Comments</b>
Reactivity Control	Unit 1 - Trip the reactor from the Control Room. Borate using Unit 1 East or West Charging Pump supplied from the RWST. Use source range monitoring for indication for Unit 1.	None
Inventory and Pressure Control	Unit 1 - Control inventory using Unit 1 East or West Charging Pump. Control pressure using Unit 1 Pressurizer Safety Relief Valves.	VFDR identified for RWST level indication.
Decay Heat Removal	Unit 1 - Feed SGs 1 & 4 with Unit 1 West MDAFP Pump. The DHR function also requires MS isolation with a steam release path through the Safety Relief Valves.	VFDRs identified for CST level indication and Main Steam Isolation.
Process Monitoring	Unit 1 Process Monitoring - Use Unit 1 process monitoring in the Control Room for the following: Pressurizer level, RCS pressure and temperature, and S/G level and Pressure. Unit 1 Source Range Monitoring - Use Unit 1 source range monitoring in the Control Room.	None
Vital Auxiliaries	Unit 1 Electrical - Control Unit 1 Red (AB) Train Electrical Distribution with Unit 1 Red (AB) Train Offsite Power. Control Unit 1 Green (CD) Train Electrical Distribution with Unit 1 Green (CD) Train Offsite Power or Unit 1 Green (CD) DG. Unit 1 ESW - Operate Unit 1 East or West ESW Unit 1 CCW - Operate Unit 1 East or West CCW Unit 1 HVAC - Operate Unit 1 Control Room HVAC. Operate Unit 1 Auxiliary Building HVAC. Operate Unit 1 Green (CD) DG HVAC. Operate Unit 1 Switchgear HVAC. Operate Unit 1 West AFW Pump Room HVAC system. Operate the Unit 1 East and West ESW Pump HVAC systems.	None

**Fire Area AA10 – Attachment 1 - Table B-3 - Fire Area Transition**

<u>Unit</u>	<u>Fire Area</u>	<u>Description</u>
1	AA10	Unit 1 Quadrant 3S Cable Tunnel (El. 596 ft.)

**Reference Documents**

Genesis Solution Suite, EDISON / SAFE-PB, DC Cook V 3.4.0

Nuclear Safety Capability Assessment Report

**Licensing Actions**

None

**Existing Engineering Equivalency Evaluations (EEEE)****EEEE Title Engineering Equivalency Evaluation 11-9 - Turbine, Auxiliary and Containment Buildings Boundary Evaluation**

**Summary** The purpose of this engineering equivalency evaluation is to describe in general, the approach and existence of evaluations performed to determine and reconcile fire area boundaries having components or designs with less than a 3-hr fire rating on preventing the spread of fire. This engineering equivalency evaluation also specifically evaluates the impact of unrated door assemblies on the spread of fire.

Reasonable assurance is provided that the fire area boundaries having components or design less than a 3-hr fire rating will not increase the spread of fire or impair the safe shutdown capabilities of Units 1 or 2. In addition, this engineering equivalency evaluation does not adversely impact on other engineering equivalency evaluations or exemption requests.

This evaluation supports additional evaluations credited in this fire area.

**Fire Area AA10 – Attachment 1 - Table B-3 - Fire Area Transition**

<u>Unit</u>	<u>Fire Area</u>	<u>Description</u>
1	AA10	Unit 1 Quadrant 3S Cable Tunnel (El. 596 ft.)
<b><u>EEEE Title</u></b>	<b>Engineering Equivalency Evaluation 11-14 - Cable Spreading Room Construction Boundary Evaluation (Fire Areas AA3, AA7, AA8, AA9, AA10, AA29, AA30, AA31, AA34, AA35, AA36/42, AA37, AA38, AA48, AA50, AA51 and AA52)</b>	
<b><u>Summary</u></b>	<p>The purpose of this engineering equivalency evaluation is to document the acceptability of the construction features of the cable spreading rooms which have a fire resistance rating of less than 3 hours for their impact on the spread. In particular, fire dampers having a 1 1/2-hr fire rating were analyzed by this evaluation. Other unrated construction features have been previously analyzed under separate engineering equivalency evaluations. The applicable fire areas include: AA3, AA7, AA8, AA9, AA10, AA29, AA30, AA31, AA34, AA35, AA36/42, AA37, AA38, AA48, AA50, AA51 and AA52.</p> <p>Reasonable assurance is provided that the construction features of the cable spreading rooms which have a fire resistance rating of less than 3 hours will prevent the spread of fire and not impair the safe shutdown capabilities of Unit 1 and Unit 2. In addition, this engineering equivalency evaluation does not adversely impact other engineering equivalency evaluations.</p> <p>The construction features of the cable spreading room were evaluated and found to be acceptable based on the fire hazards, fire protection systems and construction features within the areas.</p>	
<b><u>EEEE Title</u></b>	<b>Engineering Equivalency Evaluation 11-46 - Seismic Gaps between the Containment and Auxiliary Buildings Boundary Evaluation (Fire Areas AA2, AA3, AA7, AA8, AA9, AA10, AA11, AA27, AA29, AA30, AA31, AA34, AA35, AA37 and AA38)</b>	
<b><u>Summary</u></b>	<p>A seismic gap exists around the Containment Building of each unit that provides an opening of approximately 6 in. between the Containment Building and the walls, ceilings and floors of the structures immediately adjacent to containment. These Fire Areas include AA2, AA3, AA7, AA8, AA9, AA10, AA11, AA27, AA29, AA30, AA31, AA34, AA35, AA37 and AA38. This engineering equivalency evaluation has been performed to document the acceptability of these seismic gaps in the fire boundaries.</p> <p>This seismic gap evaluation shows the safe shutdown capability for CNP Unit 1 and Unit 2 has not been compromised as a result of seismic gaps. The analysis performed and the results presented in the tables indicate, on a system basis, the capability to safely shut down both units when considering fire damage to safe shutdown components and circuits contained in the seismic gap evaluation areas. The method of analysis is conservative when considering the fire hazards involved in the vicinity of the seismic gaps. That is, it is not anticipated that the evaluated areas would be affected to the extent that fire would propagate through the seismic gaps and cause damage throughout the evaluated area. This engineering equivalency evaluation has no impact on the exemption requests contained in other engineering equivalency evaluations.</p> <p>The seismic gaps were evaluated and found to be acceptable based on the fire hazards, fire protection systems and construction features within the evaluated areas.</p>	

**Fire Area AA10 – Attachment 1 - Table B-3 - Fire Area Transition**

<u>Unit</u>	<u>Fire Area</u>	<u>Description</u>
1	AA10	Unit 1 Quadrant 3S Cable Tunnel (El. 596 ft.)
<b><u>EEEE Title</u></b>	<b>Engineering Equivalency Evaluation 11-48 - Unit 1 and Unit 2 Diesel Generator AB/CD Pipe Penetration Seals - Fire Zones 11 (Fire Area AA10), 15 (Fire Area AA14), 16 (Fire Area AA15), 18 (Fire Area AA23), 19 (Fire Area AA24) and 23 (Fire Area AA29)</b>	
<b><u>Summary</u></b>	<p>The purpose of this engineering equivalency evaluation is to document the acceptability of fire-rated penetration seals W9142, W9143, W9171, W9172, W9192, W9193, W9959 and W9960. The seals are physically located in the east fire-rated walls of the DG Rooms floor elevation 587 ft., Fire Zones 15, 16, 18 and 19.</p> <p>The existing configuration for the subject fire-rated penetration is suitable to perform their design function, to provide an acceptable level of fire protection, therefore preventing fire propagation between to fire zones. As such, there is no impact on the stations ability to achieve and maintain safe shutdown.</p> <p>The fire rated penetration seals were evaluated and found to be acceptable based on the fire hazards and fire protection systems within the evaluated areas.</p>	
<b><u>EEEE Title</u></b>	<b>Engineering Equivalency Evaluation 12-19 - CO2 Fire Suppression System Concentrations (Fire Areas AA7, AA8, AA9, AA10, AA29, AA30, AA31, AA37, AA38, AA39, AA40, AA41, AA43, AA44, AA45, AA48, AA49, AA50, AA51, AA52 and AA53)</b>	
<b><u>Summary</u></b>	<p>The purpose of this engineering equivalency evaluation is to document the acceptability of the CO2 fire suppression systems in fire zones containing concentrations of cable insulation and the potential for deep-seated fires. This engineering equivalency evaluation determines the CO2 system's impact on the spread of fire and previous engineering equivalency evaluations and exemption requests. Although there are other fire zones that use CO2 for fire suppression such as the DG Rooms, they are installed to suppress surface-type, combustible liquid fires and are not included in this analysis, because they do not contain significant concentrations of cable insulation capable of producing deep-seated fires.</p> <p>All of the CO2 systems included in this engineering equivalency evaluation are capable of performing their intended function, containing the fire until the Fire Brigade arrives, preventing fire spread to adjacent fire zones, and ensuring that safe shutdown of CNP can be achieved and maintained.</p> <p>The existing suppression systems were evaluated and found to be acceptable based on the fire hazards and fire protection systems within the evaluated areas.</p>	

**Fire Area AA10 – Attachment 1 - Table B-3 - Fire Area Transition**

<u>Unit</u>	<u>Fire Area</u>	<u>Description</u>
1	AA10	Unit 1 Quadrant 3S Cable Tunnel (El. 596 ft.)

**Fire Suppression Effects on Nuclear Safety Performance Criteria**

The CNP fire brigade is trained to discharge water in a judicious manner and instructed to direct hose streams and portable extinguishers at the base of the fire to limit the amount of overspray beyond the immediate fire zone. For this reason, fire brigade activities are not expected to fail components not already considered damaged. It has been concluded that water impingement on cables is not a concern. Electrical cabinets are provided with a seal at the conduit interface. Possible impacts to surrounding equipment due to manual fire fighting activities is bounded by the analysis approach of postulating whole room damage. The drainage features of the fire area mitigate the potential for flooding damage due to fire suppression, such that the standing water would not affect credited equipment.

In the event of discharge, any damage caused by the CO2 system to other equipment operating within the fire area which is not immediately involved in the originating fire is bounded by the analysis approach of postulating whole room damage. Since it is shown that suppression effects will not impact the nuclear safety performance criteria, the fire area configuration is deemed acceptable.

## References:

Technical Evaluation 12.1, "Fire Suppression Effects Study"

Technical Evaluation 12.1, "Supplemental Information to Fire Suppression Effects Study – Supplement 1"

**Fire Area Comments**

None

## Fire Area AA10 – Attachment 2 - Fire Risk Evaluation Results Summary

### A2.1 Introduction

The ‘changes’ associated with NFPA 805 transition were those variances from the deterministic requirements of NFPA 805. The changes identified for evaluation for fire area AA30 are grouped as follows:

- Separation Issues

This attachment is a summary of the Fire Risk Evaluation for the fire area. The complete results and methodology are contained in the Cumulative Fire Risk Evaluation, PRA-FIRE-NB-CRE. (FPCE 2017-0009)

### A2.2 Inputs/Assumptions

1. Assumptions from the Fire PRA apply to this calculation.
2. Detailed fire modeling was not performed for Fire Area AA10. A single whole room burnout scenario was assumed.

### A2.3 Fire Modeling Methodology

Detailed fire modeling was not performed for Fire Area AA10. This area was modeled considering whole room burnout.

### A2.4 Scenario Descriptions and Model Results

A single whole room burnout scenario was modeled for Fire Area AA10. All targets within the fire area were assumed damaged.

#### A2.4.1 Ignition Sources

The fixed ignition sources in Fire Area AA10 consist of Motor Control Centers and various ventilation fans. Additional detail regarding the ignition sources in this area is available in the Fire PRA Report. All fire scenarios, whether resulting from credited fixed or transient ignition sources, are assumed to damage all targets in the fire area.

#### A2.4.2 Scenario Results

A delta risk calculation has been performed to quantify the risk associated with the VFDRs in the fire area.

### A2.5 Fire Risk Evaluation Results

PRA-FIRE-NB-CRE documents scenarios and corresponding impacted VFDRs that were evaluated for delta risk during the transition to NFPA 805 and also all changes to the Fire Protection Program that are currently incorporated into the Fire PRA model. The acceptability of the Cumulative Fire Risk Evaluations was based on calculated delta risk meeting the thresholds of NEI 04-02, RG 1.205 and RG 1.174. (FPCE 2017-0009)

## Fire Area AA10 – Attachment 2 - Fire Risk Evaluation Results Summary

### A-2.6 Impact of VFDR on Defense-in-Depth

Defense-in-Depth has been evaluated for this fire area. The impacts of this evaluation are summarized in the table below:

Defense-in-Depth Impact Review for AA10			
Method of Providing DID	Required to Support Deterministic Analysis or Fire PRA?	Changes or Improvements Necessary for DID?	Basis/Justification
Echelon 1: Prevent fires from starting			
Combustible Control is implemented in accordance with Procedure PMP-2270-CCM-001, Control of Combustible Materials.	Yes	No	• This element is adequate based on no perceived weakness of, or over-reliance on, another echelon of defense-in-depth.
Hot Work Control is implemented in accordance with Procedure PMP-2270-WBG-001, Welding, Burning and Grinding Activities.	Yes	No	
Echelon 2: Rapidly detect, control and extinguish promptly those fires that do occur thereby limiting fire damage			
Fire Detection System	Yes	No	• Suppression and detection are already required and fire fighting activities are not expected to be challenging; therefore, no changes or improvements to Echelon 2 attributes are necessary to maintain defense-in-depth.
Fixed Fire Suppression	Yes	No	
Portable Fire Extinguishers	Yes	No	
Hose stations and hydrants	Yes	No	
Pre-Fire Plan	Yes	No	
Echelon 3: Provide adequate level of fire protection for systems and structures so that a fire will not prevent essential safety functions from being performed			
Walls, floors ceilings and structural elements are rated or have been evaluated as adequate for the hazard.	Yes	No	• Although VFDR AA10-001 is not considered a significant contribution to core damage frequency, the variance is considered important enough to the NSCA to retain as a recovery action to ensure that defense-in-depth is maintained.
Penetrations in the fire area barrier are rated or have been evaluated as adequate for the hazard.	Yes	No	
Supplemental barriers (e.g., ERFBS, cable tray covers, etc.)	No	No	• Since VFDR AA10-002 is never affected in a potentially risk significant fire scenario, internal fire area separation is adequate, therefore implementing additional DID Echelon 3 attributes for these VFDRs is not required.
Guidance provided to operations personnel detailing the required success path(s) including recovery actions to achieve nuclear safety performance criteria.	No	Yes	
			• Defense in Depth actions were credited to open breakers in the Control Room to prevent spurious equipment operation due to internal shorts.



## Fire Area AA10 – Attachment 2 - Fire Risk Evaluation Results Summary

### A-2.7 Safety Margin Considerations

In accordance with NEI 04-02, the maintenance of adequate Safety Margin is assessed by the consideration categories of analyses utilized by this Fire Risk Evaluation.

Safety margins are considered to be maintained if:

- Codes and Standards or their alternatives accepted for use by the NRC are met.

AND

- Safety analyses acceptance criteria in the licensing basis (e.g., FSAR, supporting analyses) are met, or provides sufficient margin to account for analysis and data uncertainty.

The following summarizes the bases for ensuring the maintenance of safety margins:

- The risk-informed, performance based processes utilized are based upon NFPA 805, 2001 edition, endorsed by the NRC in 10 CFR 50.48(c).
- The Fire Risk Evaluation process is in accordance with NEI 04-02, Revision 2, which is endorsed by the NRC in Regulatory Guide 1.205, Revision 1.
- The Fire PRA is developed in accordance with NUREG/CR-6850, which was developed jointly between the NRC and EPRI.
- The Fire PRA has undergone an industry peer review, in order to ensure the Fire PRA meets the appropriate quality standards of ASME/ANS RA-Sa-2009, "Standard for Level 1/Large Early Release Frequency Probabilistic Risk Assessment for Nuclear Power Plant Applications," Dated February 2, 2009
- The "bounding risk assessment" is used during transition (NEI 04-02, Section 5.3.4.2). This approach conservatively assumes that target set damage occurs for postulated fire events which resulted in whole room burn up, and therefore, MEFS/LFS is not analyzed separately from the Fire PRA results.
- The CNP internal events PRA model received two formal industry peer reviews conducted in accordance with applicable NEI guidelines. The initial peer review was performed in 2001, while a subsequent focused scope (i.e., limited scope) peer review was conducted in 2009. The initial, full-scope WOG peer review covered all aspects of the CNP PRA model and the administrative processes used to maintain and update the model. The CNP PRA model has been revised to address all significant issues (i.e., Category A and B Facts & Observations) identified during the initial peer review. None of the findings from the focused-scope peer review were judged to reach the significance level of a Category A or B Fact & Observation; as a result, no changes to the PRA model have yet been made to include resolutions for these latter issues.
- Fire protection systems and features determined to be required by NFPA 805 Chapter 4 have been confirmed to meet the requirements of NFPA 805 Chapter 3 and their associated referenced codes and listings, or provided with acceptable alternatives using processes accepted for use by the NRC (i.e., FAQ 06-0008, FAQ 06-0004, 07-0033).
- Fire modeling has not been performed in support of the change evaluations and results are therefore, based on whole area burn up. As such, the results are considered very conservative.
- In accordance with the requirements of 10 CFR 50.48(c)(2)(iii), the Fire PRA results, including cutsets for

## **Fire Area AA10 – Attachment 2 - Fire Risk Evaluation Results Summary**

the scenarios of concern, have been reviewed and it was verified that the results presented above do not rely solely on feed and bleed as the fire-protected safe shutdown path for maintaining reactor coolant inventory, pressure control, and decay heat removal capability for this fire area.

### **A-2.8 Transition Risk Evaluation Conclusions**

The transition change evaluation determined that these changes:

- Are acceptable based upon the measured change in CDF and LERF
- Maintained adequate defense-in-depth and safety margins

The results of this evaluation meet the requirements of NFPA 805 Risk Evaluation; therefore, the use of the performance based analysis approach is acceptable.

D. C. Cook Nuclear Plant  
Fire Safety Analysis

Fire Area: AA11

Unit 1 Quadrant 2 Piping Tunnel (El. 591 ft.)

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Attachments

    Fire Area AA11 – Attachment 1 - Table B-3 - Fire Area Transition

    Fire Area AA11 – Attachment 2 - Fire Risk Evaluation Results Summary

## 1.0 PURPOSE

This report documents the Fire Safety Analysis (FSA) for Cook Nuclear Plant (CNP) Fire Area AA11, Unit 1 Quadrant 2 Piping Tunnel (El. 591 ft.) which comprises fire zone(s) 12. The purpose of this analysis is to demonstrate the achievement of the nuclear safety and radioactive release performance criteria of NFPA 805 as required by 10 CFR 50.48(c). The Fire Safety Analysis is a key part of compliance with Section 2.7.1.2 Fire Protection Program Design Basis Document of NFPA 805. This analysis also documents results of risk-informed, performance-based Fire Risk Evaluations (FREs). These evaluations are associated with Variances from Deterministic Requirements (VFDRs) of NFPA 805 Chapter 4.

## 2.0 ANALYSIS METHODOLOGY

The FSA is the design basis document as described in NFPA 805 Section 2.7.1.2. The following steps are performed to develop the FSA on a fire area basis:

- Identify significant fire hazards in the fire area. This is based on NFPA 805 approach to analyze the plant from an ignition source and fuel package perspective.
- Summarize Nuclear Safety Capability Analysis (NSCA) compliance strategies. This is the result of the NEI 04-02 B-3 Table review of the Safe Shutdown Analysis.
- Summarize Non-Power Operations Modes compliance strategies.
- Summarize Radioactive Release compliance strategies. The transition review process required per NEI 04-02 is used to develop these results.
- Provide Fire Probabilistic Risk Assessment summary of results. This is based on the results from the plant Fire PRA.
- Perform risk informed, performance based evaluations if needed for the performance based approach.
- Summarize Defense-in-Depth strategy for each fire area.
- Determine key analysis assumptions which are candidates to be included in the NFPA 805 monitoring program.
- Provide conclusions relative to NFPA 805 compliance.

### 3.0 ANALYSIS

#### 3.1 Classical Fire Protection

##### 3.1.1 Construction

Walls, floors and ceilings to adjacent fire areas are reinforced concrete in excess of a 3-hour rating.

Applicable Engineering Equivalency Evaluations are documented in Attachment 1.

##### 3.1.2 Doors and Access Openings

Fire doors having a 3-hour rating are provided to adjacent Fire Areas AA5/6 and AA37 - Fire Zones 6N and 38, respectively. The door in adjacent Fire Zone 38 provides access through the Boric Acid Injection Tank Room into the upper platform levels of Fire Zone 12.

A fire area boundary evaluation was performed for the manway opening to Fire Area AA9 - Fire Zone 116 (Engineering Equivalency Evaluation 9-23).

##### 3.1.3 Penetrations

Penetrations in fire barriers between this fire zone and adjacent fire areas are provided with fire seals except as noted below. The seismic gaps are sealed with a glass fiber reinforced silicone sheeting. Seismic gap exemption was granted for Fire Zone 12 interface with Fire Areas AA7, AA10, AA34 and AA37 - Fire Zones 7, 11, 33B and 38, respectively (Engineering Equivalency Evaluation 11-46).

##### 3.1.4 Detection

The table below outlines the fire detection system(s) provided in the Fire Area:

Table 3-1, Fire Area AA11 Detection Systems								
Fire Zone	Type of System	Local (L) / Remote (R)	Detection Actuates Suppression?	Required System?				
				S	L	E	R	D
12	None	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Table 3-1 Legend:	
Table Field: "Required System?"	
S	- Required for Chapter 4 Separation Criteria
L	- Required for NRC Approved Licensing Action
E	- Required for Engineering Equivalency Evaluation
R	- Required for Risk Significance
D	- Required to maintain adequate balance of Defense-in-Depth in a Change Evaluation or Fire Risk Evaluation

Fire Area AA11 is not provided with an automatic detection system.

### 3.1.5 Fixed Suppression

The table below outlines the fixed fire suppression system(s) provided in the Fire Area:

Table 3-2, Fire Area AA11 Suppression Systems							
Fire Zone	Type of System	Full (F) / Partial (P)	Required System?				
			S	L	E	R	D
12	None	N/A	N/A	N/A	N/A	N/A	N/A
Table 3-2 Legend:							
Table Field: "Required System?"							
S	- Required for Chapter 4 Separation Criteria						
L	- Required for NRC Approved Licensing Action						
E	- Required for Engineering Equivalency Evaluation						
R	- Required for Risk Significance						
D	- Required to maintain adequate balance of Defense-in-Depth in a Change Evaluation or Fire Risk Evaluation						

Fire Area AA11 is not provided with fixed fire suppression.

### 3.1.6 Manual Suppression / Response Strategy

A postulated fire will be identified by plant personnel using plant communication system to notify the control room. The Control Room operator will dispatch the fire brigade for initiation of manual fire fighting. A fire in this fire area will be contained by the construction features discussed in Section 3.1.1. Manual suppression is provided by the CNP Fire Brigade.

Fire extinguishers are located within the fire area with others located in the PHP valve pit, and outside the Boric Acid Injection Tank Room in adjacent Fire Area AA37 for upper level platforms.

Water hose reels are located within the fire area.

Floor drains are available in Fire Area AA11.

### 3.1.7 Ventilation

A fire in this area will be contained by the fire barriers. Smoke can be removed by portable fans and flexible ducting to other areas of the Auxiliary Building and outdoors if not contaminated. Contaminated smoke can be removed by portable fans and flexible ducting to other areas of the Auxiliary Building per the Fire Pre-Plans. The normal building ventilating systems in the Auxiliary Building will then exhaust the smoke via filtered monitored pathways.

Fire dampers having a 3-hour rating are provided to adjacent Fire Areas AA1, AA5/6 and AA54 - Fire Zones 1C and 1D, 6N and 62A-C. The manway opening to Fire Area AA9 - Fire Zone 116 is also used for ventilation purposes.

### 3.1.8 Other Features

No other fire protection features provided for Fire Area AA11.

## 3.2 Fire Hazards Identification

The fire area contains both ignition sources and combustible fire hazards. The hazards in the area include the blowdown demineralizer pump, radiation monitor, local shutdown indication panels and instrumentation and control cables. Combustibles consist primarily of cellulose and rubber/plastics. The current fire loading classification is low.

### 3.3 NSCA Compliance Summary

Fire Area AA11 contains Red and Green Train cables, conduits, and raceways as well as safe shutdown equipment.

Compliance with the nuclear safety performance criteria is achieved using the performance-based approach in accordance with NFPA 805, Section 4.2.4.2.

Safe and stable condition of the affected Unit 1, will be accomplished using Steam Generator 1 and 4 via the Unit 1 West Motor Driven Auxiliary Feedwater Pump, Unit 1 Charging via the East or West Pump, Unit 1 Component Cooling Water via the East or West Pump, Unit 1 Essential Service Water via the East or West Pump and Process Monitoring in the Control Room. Local monitoring of RWST and CST is required. Power is credited to be available to the Red and Green train systems via offsite power with the Red and Green Train EDGs available as well.

The Nuclear Safety Performance Criteria compliance strategy for AA11 is documented within the NSCA Report.

#### 3.3.1 Variances

The variances identified for evaluation for this fire area are grouped as follows:

##### 3.3.1.1 VFDR No. AA11-001

1-CLI-113 and 1-CLI-114 - CST Control Room level indication is required to be operable to support AFW for decay heat removal. Decay heat removal is required to remove sufficient heat from the reactor core such that the fuel is maintained in a safe and stable condition. The CST level indicators provide Control Room indication of the initial water source for AFW. All of the Control Room level indicators may fail due to a full area fire within Fire Area AA11. 1-CLI-113 may fail due to fire induced damage of cable 20205-1. 1-CLI-114 may fail due to fire induced damage of cable 8202Y-1. This condition represents a variance from deterministic requirements of NFPA 805, Section 4.2.3. This is a separation issue.

This VFDR has been evaluated and it was determined that the risk, safety margin and defense-in-depth meet the acceptance criteria of NFPA 805 Section 4.2.4 with a defense-in-depth action credited.

**3.3.1.2 VFDR No. AA11-002**

1-ILS-950 and 1-ILS-951 - RWST level indication is required to support CVCS. CVCS is required to be operable to maintain inventory, pressure and reactivity control. The RWST is the primary credit borated water source for CVCS. The level indicators may fail due to a full area fire within Fire Area AA11. 1-ILS-950 may fail due to fire induced damage of cable 9738G-1. 1-ILS-951 may fail due to fire induced damage of cable 9738R-1. This condition represents a variance from deterministic requirements of NFPA 805, Section 4.2.3. This is a separation issue.

This VFDR has been evaluated and it was determined that the risk, safety margin and defense-in-depth meet the acceptance criteria of NFPA 805 Section 4.2.4 with no further action required.

**3.3.1.3 VFDR No. AA11-003**

1-DCR-310, 1-DCR-320, 1-DCR-330 and 1-DCR-340 - SG 1 through 4 Blowdown Isolation Valves are required to be closed to support main steam isolation. Main steam isolation is required to prevent uncontrolled cooldown through over-steaming. All SG Blowdown Isolation Valves may fail due to a full area fire within Fire Area AA11. 1-DCR-310 may fail due to fire induced damage of cable(s) 8682G-1, 80282G-1 and 8683G-1. 1-DCR-320 may fail due to fire induced damage of cable(s) 8682R-1, 80282R-1, 80283R-1 and 8683R-1. 1-DCR-330 may fail due to fire induced damage of cable(s) 8686R-1, 80284R-1 and 8687R-1. 1-DCR-340 may fail due to fire induced damage of cable(s) 8686G-1, 80284G-1 and 8687G-1. These cable failures could spuriously open the valves. SGs 1 and 4 are credited for decay heat removal for a fire within Fire Area AA11. This condition represents a variance from the deterministic requirements of NFPA 805, Section 4.2.3. This is a separation issue.

This VFDR has been evaluated and it was determined that the risk, safety margin and defense-in-depth meet the acceptance criteria of NFPA 805 Section 4.2.4 with a defense-in-depth action credited.

**3.3.1.4 VFDR No. AA11-004**

1-QRV-251 - The Charging Flow Control Valve is required to be open to support CVCS. CVCS is required to be operable to maintain inventory, pressure and reactivity control. Loss of 1-QRV-251 will fail Unit 1 seal injection charging. 1-QRV-251 may fail due to fire induced damage of cable 6116-1. This cable failure could spuriously close the valve. This condition represents a variance from deterministic requirements of NFPA 805, Section 4.2.3. This is a separation issue.

This VFDR has been evaluated and it was determined that the risk, safety margin and defense-in-depth meet the acceptance criteria of NFPA 805 Section 4.2.4 with no further action required.

**3.3.2 Recovery Actions Credited**

For each VFDR, a Fire Risk Evaluation has been performed to assess the acceptability of risk, defense-in-depth, and safety margin. This evaluation determined whether or not recovery actions are required to ensure that one success path necessary to achieve and maintain the nuclear safety performance criteria is maintained free of fire damage by a single fire. Table 3-3 identifies the credited recovery actions for this area. Actions retained for DID are identified as "DID Actions" within Table 3-3. Additional information for DID actions is contained within Section 3.8 of this



report. Note that, for completeness, all VFDRs are contained within Table 3-3, even if the Fire Risk Evaluation has determined that a recovery action is not required. In those instances where a recovery action has been determined to not be required, the word “None” is provided in the “Action” column in the table.

<b>Table 3-3, Recovery Actions Credited</b>		
<b>VFDR</b>	<b>Component</b>	<b>Action</b>
AA11-001	1-CLI-113 1-CLI-114	DID ACTION 1-CLI-113-LOCAL (Locally monitor CST level)
AA11-002	1-ILS-950 1-ILS-951	None
AA11-003	1-DCR-310 1-DCR-320 1-DCR-330 1-DCR-340	DID ACTION(S) 1-DCR-310-CLOSE 1-DCR-320-CLOSE 1-DCR-330-CLOSE 1-DCR-340-CLOSE (Remove fuses in MCR to fail closed AOVs 1-DCR-310, 1-DCR-320, 1-DCR-330 and 1-DCR-340)
AA11-004	1-QRV-251	None

### 3.4 Non-Power Operational Modes Compliance Summary

A review of CNP for the potential effects of a fire in this Fire Area while in non-power modes of operation (NPO) was conducted. This review was conducted using the guidance provided in NEI 04-02 and FAQ 07-0040, “Non-Power Operations Clarifications”.

The review determined that there are potential failures that affect certain Key Safety Functions (KSF) as a result of the fire in this area, and the fire could result in the loss of one or more KSF paths. Compensatory measures are required during high risk evolution periods to provide reasonable assurance a fire will not adversely affect key safety functions and the NFPA 805 performance goal for NPO is therefore satisfied. The results of the NPO analysis are contained within Technical Evaluation R1900-005-001, Non-Power Operation Modes Transition Review Report.

### 3.5 Radioactive Release Compliance Summary

The NFPA 805 radiological release goal is to provide reasonable assurance that a fire will not result in a radiological release that adversely affects the public, plant personnel or the environment. The NFPA 805 requirement is to ensure a radiation release to any unrestricted area due to the direct effects of fire suppression activities (but not involving fuel damage) shall be as low as reasonably achievable and shall not exceed applicable plant Technical Specification limits.

AA11 is within the Radiological Controlled Area (RCA) and has been identified as a potential fire area for radioactive release due to fire fighting activities. In accordance with NFPA 805 FAQ 09-0056, this potential has been reviewed to ensure that engineering controls, fire pre-plans, and fire brigade training materials are provided for containment and monitoring of gaseous and liquid effluents associated with fire suppression agents and products of combustion.

The review concludes that the steps to limit radiation release to other areas due to the direct effects

of fire suppression activities, in addition to compliance with NFPA 805, Chapter 4, ensure that any radioactive release will be as low as reasonably achievable and will not exceed limits designated in the CNP Technical Specifications.

The review of this fire area, with respect to radioactive release, is documented in the NFPPM.

### **3.6 Probabilistic Risk Assessment-Summary of Results**

A Fire PRA (FPRA) quantification of Fire Area AA11 was performed and is documented in PRA-NB-FIRE-FQ, Fire PRA Model Quantification Notebook. The fire risk quantification for Fire Area AA11 is analyzed using detailed fire modeling to consider risk of fire scenarios of ignition sources. PRA-NB-FIRE-FQ includes a summary of all potentially risk-significant fire scenarios (i.e., CDF > 1.0E-7 or LERF > 1.0E-8). Bounding CDF / LERF per calendar year values are reported that are based on the risk values documented in PRA-NB-FIRE-FSS, Fire PRA Fire Scenario Selection.

Fire Protection features credited in the Fire PRA are documented in R1900-0411-AA11, Detailed Fire Modeling Report: Fire Compartment: AA11 Unit 1 Quadrant 2 Piping Tunnel (EL. 591 FT). PRA-NB-FIRE-FSS documents the revision level of the fire modeling reports used in the most recent Fire PRA quantification.

### **3.7 Risk-Informed, Performance-Based Evaluations**

Fire Risk Evaluations (FREs) have been performed to ensure that variances from the NFPA 805 deterministic requirements are acceptable. The evaluation process consists of an integrated assessment of the acceptability of risk, defense-in-depth, and safety margins.

#### **3.7.1 Transition Risk-Informed, Performance-Based Evaluations**

The 'changes' associated with NFPA 805 transition were those variances from the deterministic requirements of NFPA 805 or with the existing fire protection licensing basis that were brought into compliance with the NFPA 805 performance based approach. The change identified for evaluation for Fire Area AA11 is as follows:

- Separation Issues

The Fire Risk Evaluation has determined that the change is acceptable based upon:

- The measured change in CDF and LERF.
- Adequate defense-in-depth and safety margins being maintained.

Refer to Attachment 2 for a summary of results associated with the Fire Risk Evaluations.

### 3.8 Defense-in-Depth

A comprehensive risk-informed, performance-based analysis includes consideration of defense-in-depth (DID) as part of an integrated evaluation of risk considerations. In general, defense-in-depth involves consideration of the extent to which fire protection systems and features are provided within the three echelons of fire-protection:

- Preventing fires from starting,
- Rapidly detecting fires and controlling and extinguishing promptly those fires that do occur, thereby limiting fire damage,
- Providing an adequate level of fire protection for structures, systems, and components important to safety, so that a fire that is not promptly extinguished will not prevent the nuclear safety performance criteria from being met.

Each VFDR was evaluated for DID. The following recovery actions have been retained for DID.

VFDR No. AA11-001: 1-CLI-113 and 1-CLI-114 - CST Control Room level indication is required to be operable to support AFW for decay heat removal. Decay heat removal is required to remove sufficient heat from the reactor core such that the fuel is maintained in a safe and stable condition. The CST level indicators provide Control Room indication of the initial water source for AFW. All of the Control Room CST level indicators may fail due to a full area fire within Fire Area AA11. Loss of CST indication can be mitigated by locally monitoring the CST level. This recovery action is being retained for DID to ensure CST level indication is maintained.

VFDR No. AA11-003: 1-DCR-310, 1-DCR-320, 1-DCR-330 and 1-DCR-340 - SG 1 through 4 Blowdown Isolation Valves are required to be closed to support main steam isolation. Main steam isolation is required to prevent uncontrolled cooldown through over-steaming. Loss of Main Steam isolation can be mitigated by removing fuses to ensure valves fail shut. This recovery action is being retained for DID to ensure Main Steam isolation is maintained.

VFDR No. AA11-004: 1-QRV-251: The Charging Flow Control Valve is required to be open to support CVCS. CVCS is required to be operable to maintain inventory, pressure and reactivity control. Loss of 1-QRV-251 will fail Unit 1 seal injection charging. Loss of seal injection charging can be mitigated by removing fuses to fail the valve open. This recovery action is being retained for DID to ensure seal injection is maintained.

Based on the assessment in support of the Fire Risk Evaluation, defense-in-depth is maintained for fire area AA11. Refer to Attachment 2 for details associated with the Fire Risk Evaluation.

### 3.9 Monitoring Program Input

A Monitoring Program will be developed in accordance with FAQ 10-0059, Rev. 1. Methods to monitor availability, reliability, and performance of fire protection program structures, systems, and components (SSCs), as well as programmatic elements will be provided. Additionally, effectiveness measures are established to review program related performance and trends. For AA11 the following systems and features are candidates for inclusion in the CNP Fire Protection Monitoring Program:

- Fire Area boundary barriers discussed in Section 3.1

### 4.0 CONCLUSION

The nuclear safety and radioactive release performance criteria of NFPA 805 are met for a fire in

Fire Area AA11. This Fire Risk Evaluation for Fire Area AA11 has demonstrated that

- The change in core damage frequency (delta CDF) is acceptable, and
- The change in large early release frequency (delta LERF) is acceptable, and
- Defense-in-depth and safety margins are maintained.

This is confirmation that a success path effectively remains free of fire damage and that the performance-based approach is acceptable per Section 4.2.4.2 of NFPA 805.

## 5.0 REFERENCES

- 5.1 Calculation PRA-FIRE-NB-CRE, Fire PRA Cumulative Risk Evaluations
- 5.2 CNP Fire Pre-Plans, Volumes I, II, and III, Revisions 17, 14, and 18 respectively
- 5.3 Fire Hazards Analysis
- 5.4 NFPA 805, Performance-Based Standard for Fire Protection for Light Water Reactor Electric Generating Plants
- 5.5 NFPPM, NFPA 805 Fire Protection Program Manual (NFPPM)
- 5.6 Nuclear Energy Institute (NEI) 04-02, Guidance for Implementing a Risk-Informed, Performance-Based Fire Protection Program under 10 CFR 50.48(c), Rev. 2
- 5.7 Nuclear Safety Capability Assessment Report
- 5.8 PRA-NB-FIRE-FQ, Fire PRA Model Quantification Notebook
- 5.9 PRA-NB-FIRE-FSS, Fire PRA Fire Scenario Selection
- 5.10 Regulatory Guide 1.205, Risk-Informed, Performance-Based Fire Protection for Existing Light-Water Nuclear Power Plants, Rev. Revision 1
- 5.11 Technical Evaluation R1900-005-001, Non-Power Operation Modes Transition Review

**Fire Area AA11 – Attachment 1 - Table B-3 - Fire Area Transition**

<u>Unit</u>	<u>Fire Area</u>	<u>Description</u>
1	AA11	Unit 1 Quadrant 2 Piping Tunnel (El. 591 ft.)

<u>Fire Zone</u>	<u>Description</u>
12	Quadrant 2 Piping Tunnel - El. 591 ft. 0 in. - Unit 1

**Regulatory Basis**

4.2.4.2 - Performance-Based Approach - Fire Risk Evaluation with simplifying deterministic assumptions

<b>Performance Goal</b>	<b>Method of Accomplishment</b>	<b>Comments</b>
Reactivity Control	Unit 1 - Trip the reactor from the Control Room. Borate using Unit 1 East or West Charging Pump supplied from the RWST. Use source range monitoring for indication for Unit 1.	VFDR identified for charging flow control.
Inventory and Pressure Control	Unit 1 - Control inventory using Unit 1 East or West Charging Pump. Control pressure using Unit 1 Pressurizer Safety Relief Valves.	VFDRs identified for RWST level indication and charging flow control.
Decay Heat Removal	Unit 1 - Feed SGs 1 & 4 with Unit 1 West MDAFW Pump. The DHR function also requires MS isolation with a steam release path through the Safety Relief Valves.	VFDRs identified for CST level indication and Main Steam Isolation.
Process Monitoring	Unit 1 Process Monitoring - Use Unit 1 process monitoring in the Control Room for the following: Pressurizer level, RCS pressure and temperature, and S/G level and Pressure. Unit 1 Source Range Monitoring - Use Unit 1 source range monitoring in the Control Room.	None
Vital Auxiliaries	Unit 1 Electrical - Control Unit 1 Red (AB) Train Electrical Distribution with Unit 1 Red (AB) Train Offsite Power or Unit 1 Red (AB) DG. Control Unit 1 Green (CD) Train Electrical Distribution with Unit 1 Green (CD) Train Offsite Power or Unit 1 Green (CD) DG. Unit 1 ESW - Operate Unit 1 East or West ESW Unit 1 CCW - Operate Unit 1 East or West CCW Unit 1 HVAC - Operate Unit 1 Control Room HVAC. Operate Unit 1 Auxiliary Building HVAC. Operate Unit 1 Red (AB) and Green (CD) DG HVAC. Operate Unit 1 Switchgear HVAC. Operate Unit 1 West AFW Pump Room HVAC system. Operate the Unit 1 East and West ESW Pump HVAC systems.	None

**Fire Area AA11 – Attachment 1 - Table B-3 - Fire Area Transition**

<u>Unit</u>	<u>Fire Area</u>	<u>Description</u>
1	AA11	Unit 1 Quadrant 2 Piping Tunnel (El. 591 ft.)

**Reference Documents**

Genesis Solution Suite, EDISON / SAFE-PB, DC Cook V 3.4.0

Nuclear Safety Capability Assessment Report

**Licensing Actions**

None

**Existing Engineering Equivalency Evaluations (EEEE)**

**EEEE Title** Engineering Equivalency Evaluation 9-4 - Auxiliary Building Vertical Air Shafts Evaluation: Fire Zones 12 (Fire Area AA11) and 22 (Fire Area AA27)

**Summary** The purpose of this engineering equivalency evaluation is to document the acceptability of two vertical air shafts, located in the Auxiliary Building (Fire Areas AA11 and AA27), that extend from the 573 ft. elevation to just below the 650 ft. elevation with dampered and undampered ventilation openings.

Reasonable assurance is provided that a fire in any of the adjoining fire areas to the Auxiliary Building air shafts with undampered or unrated duct penetrations or a fire in either air shaft will not adversely impact on safe shutdown capabilities of CNP. In addition, this engineering equivalency evaluation does not adversely impact other engineering equivalency evaluations.

The air shafts were evaluated and found to be acceptable based on the fire hazards, fire protection systems and construction features within the evaluated areas.

**Fire Area AA11 – Attachment 1 - Table B-3 - Fire Area Transition**

<u>Unit</u>	<u>Fire Area</u>	<u>Description</u>
1	AA11	Unit 1 Quadrant 2 Piping Tunnel (El. 591 ft.)
<hr/>		
<b><u>EEEE Title</u></b>	<b>Engineering Equivalency Evaluation 9-23 - Fire Zone 116 (Fire Area AA9) Boundary Evaluation Adjacent to Fire Areas AA11 and AA34</b>	
<b><u>Summary</u></b>	<p>The purpose of this engineering equivalency evaluation is to document the acceptability of two manway openings connecting Fire Zone 116 (Fire Area AA9) with adjacent fire areas.</p> <p>Reasonable assurance is provided that the two manway openings connecting Fire Zone 116 with Fire Zone 12 and Fire Zone 33 do not impair redundant safe shutdown capability. This engineering equivalency evaluation does not adversely impact other engineering equivalency evaluations.</p> <p>The two manway openings were evaluated and found to be acceptable based on the fire hazards and construction features within the evaluated areas.</p>	
<b><u>EEEE Title</u></b>	<b>Engineering Equivalency Evaluation 11-9 - Turbine, Auxiliary and Containment Buildings Boundary Evaluation</b>	
<b><u>Summary</u></b>	<p>The purpose of this engineering equivalency evaluation is to describe in general, the approach and existence of evaluations performed to determine and reconcile fire area boundaries having components or designs with less than a 3-hr fire rating on preventing the spread of fire. This engineering equivalency evaluation also specifically evaluates the impact of unrated door assemblies on the spread of fire.</p> <p>Reasonable assurance is provided that the fire area boundaries having components or design less than a 3-hr fire rating will not increase the spread of fire or impair the safe shutdown capabilities of Units 1 or 2. In addition, this engineering equivalency evaluation does not adversely impact on other engineering equivalency evaluations or exemption requests.</p> <p>This evaluation supports additional evaluations credited in this fire area.</p>	

**Fire Area AA11 – Attachment 1 - Table B-3 - Fire Area Transition**

<u>Unit</u>	<u>Fire Area</u>	<u>Description</u>
1	AA11	Unit 1 Quadrant 2 Piping Tunnel (El. 591 ft.)
<b><u>EEEE Title</u></b>	<b>Engineering Equivalency Evaluation 11-46 - Seismic Gaps between the Containment and Auxiliary Buildings Boundary Evaluation (Fire Areas AA2, AA3, AA7, AA8, AA9, AA10, AA11, AA27, AA29, AA30, AA31, AA34, AA35, AA37 and AA38)</b>	
<b><u>Summary</u></b>	<p>A seismic gap exists around the Containment Building of each unit that provides an opening of approximately 6 in. between the Containment Building and the walls, ceilings and floors of the structures immediately adjacent to containment. These Fire Areas include AA2, AA3, AA7, AA8, AA9, AA10, AA11, AA27, AA29, AA30, AA31, AA34, AA35, AA37 and AA38. This engineering equivalency evaluation has been performed to document the acceptability of these seismic gaps in the fire boundaries.</p> <p>This seismic gap evaluation shows the safe shutdown capability for CNP Unit 1 and Unit 2 has not been compromised as a result of seismic gaps. The analysis performed and the results presented in the tables indicate, on a system basis, the capability to safely shut down both units when considering fire damage to safe shutdown components and circuits contained in the seismic gap evaluation areas. The method of analysis is conservative when considering the fire hazards involved in the vicinity of the seismic gaps. That is, it is not anticipated that the evaluated areas would be affected to the extent that fire would propagate through the seismic gaps and cause damage throughout the evaluated area. This engineering equivalency evaluation has no impact on the exemption requests contained in other engineering equivalency evaluations.</p> <p>The seismic gaps were evaluated and found to be acceptable based on the fire hazards, fire protection systems and construction features within the evaluated areas.</p>	

**Fire Suppression Effects on Nuclear Safety Performance Criteria**

The CNP fire brigade is trained to discharge water in a judicious manner and instructed to direct hose streams and portable extinguishers at the base of the fire to limit the amount of overspray beyond the immediate fire zone. For this reason, fire brigade activities are not expected to fail components not already considered damaged. It has been concluded that water impingement on cables is not a concern. Electrical cabinets are provided with a seal at the conduit interface. Possible impacts to surrounding equipment due to manual fire fighting activities is bounded by the analysis approach of postulating whole room damage. The drainage features of the fire area mitigate the potential for flooding damage due to fire suppression, such that the standing water would not affect credited equipment.

This fire area is not equipped with a fixed fire suppression system. Since it is shown that suppression effects will not impact the nuclear safety performance criteria, the fire area configuration is deemed acceptable.

**References:**

Technical Evaluation 12.1, "Fire Suppression Effects Study"

Technical Evaluation 12.1, "Supplemental Information to Fire Suppression Effects Study – Supplement 1"



**Fire Area AA11 – Attachment 1 - Table B-3 - Fire Area Transition**

<u>Unit</u>	<u>Fire Area</u>	<u>Description</u>
1	AA11	Unit 1 Quadrant 2 Piping Tunnel (El. 591 ft.)

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**Fire Area Comments**

None

## Fire Area AA11 – Attachment 2 - Fire Risk Evaluation Results Summary

### A2.1 Introduction

The ‘changes’ associated with NFPA 805 transition were those variances from the deterministic requirements of NFPA 805. The changes identified for evaluation for fire area AA11 are grouped as follows:

- Separation Issues

This attachment is a summary of the Fire Risk Evaluation for the fire area. The complete results and methodology are contained in the Cumulative Fire Risk Evaluation, PRA-FIRE-NB-CRE. (FPCE 2017-0009)

### A2.2 Inputs/Assumptions

Fire modeling processes and inputs provided in NUREG/CR-6850 are appropriate for use in a risk-informed, performance-based evaluation. The complete list of assumptions used in the fire modeling methodology for this fire area is contained in Detailed Fire Modeling Technical Evaluation R1900-0411-AA11.

### A2.3 Fire Modeling Methodology

Fire PRA fire modeling results are used as the initial input into this Fire Risk Evaluation. The process consists of conservative bounding analyses using NUREG/CR-6850 methods. As needed, refinements are made to utilize more realistic parameters. The complete fire modeling methodology for this fire area is contained in Detailed Fire Modeling Technical Evaluation R1900-0411-AA11.

### A2.4 Scenario Descriptions and Model Results

Fire Area AA11 was evaluated for the impact of fires originating from both fixed and transient ignition sources. Complete descriptions of each fire scenario is contained within the Detailed Fire Modeling Technical Evaluation R1900-0411-AA11.

#### A2.4.1 Ignition Sources

Fire Area AA11 contains SG Blowdown Pump. Ignition sources in Fire Area AA11 were modeled using the 98th percentile fire as a screening approach. These scenarios were not risk significant enough to require further refinement. The oil Ignition source was broken down into a 10% spill and 100% spill.

In Fire Area AA11, the 98th percentile HRR was used for all transient fires. The 98th percentile HRR bounds the possible transient ignition sources expected for this fire area, which were fire tested and identified in NUREG/CR-6850, Appendix G, Table G-7.

#### A2.4.2 Scenario Results

A delta risk calculation has been performed to quantify the risk associated with the VFDRs in the fire area.

### A2.5 Fire Risk Evaluation Results

PRA-FIRE-NB-CRE documents scenarios and corresponding impacted VFDRs that were evaluated for delta risk during the transition to NFPA 805 and also all changes to the Fire Protection Program that are currently incorporated into the Fire PRA model. The acceptability of the Cumulative Fire Risk Evaluations was based on calculated delta risk meeting the thresholds of NEI 04-02, RG 1.205 and RG 1.174. (FPCE 2017-0009)

## Fire Area AA11 – Attachment 2 - Fire Risk Evaluation Results Summary

### A-2.6 Impact of VFDR on Defense-in-Depth

Defense-in-Depth has been evaluated for this fire area. The impacts of this evaluation are summarized in the table below:

Defense-in-Depth Impact Review for AA11			
Method of Providing DID	Required to Support Deterministic Analysis or Fire PRA?	Changes or Improvements Necessary for DID?	Basis/Justification
Echelon 1: Prevent fires from starting			
Combustible Control is implemented in accordance with Procedure PMP-2270-CCM-001, Control of Combustible Materials.	Yes	No	• This element is adequate based on no perceived weakness of, or over-reliance on, another echelon of defense-in-depth.
Hot Work Control is implemented in accordance with Procedure PMP-2270-WBG-001, Welding, Burning and Grinding Activities.	Yes	No	
Echelon 2: Rapidly detect, control and extinguish promptly those fires that do occur thereby limiting fire damage			
Fire Detection System	No	No	• Although a recovery action is required to maintain defense-in-depth, this action is not considered a time sensitive action, further, since fire fighting activities would not be challenging, no changes or improvements to Echelon 2 attributes are necessary to maintain defense-in-depth.
Fixed Fire Suppression	No	No	
Portable Fire Extinguishers	Yes	No	
Hose stations and hydrants	Yes	No	
Pre-Fire Plan	Yes	No	
Echelon 3: Provide adequate level of fire protection for systems and structures so that a fire will not prevent essential safety functions from being performed			
Walls, floors ceilings and structural elements are rated or have been evaluated as adequate for the hazard.	Yes	No	• Although VFDR AA11-001 is not considered a significant contribution to core damage frequency, the variance is considered important enough to the NSCA to retain as a recovery action to ensure that defense-in-depth is maintained.
Penetrations in the fire area barrier are rated or have been evaluated as adequate for the hazard.	Yes	No	
Supplemental barriers (e.g., ERFBS, cable tray covers, etc.)	No	No	• Based on a detailed review, VFDR AA11-002 is not the cause for the risk of the scenario, therefore implementing additional DID Echelon 3 attributes for this VFDR would provide negligible risk improvement.
Guidance provided to operations personnel detailing the required success path(s) including recovery actions to achieve nuclear safety performance criteria.	No	Yes	
			• Defense in Depth actions were credited to remove fuses in the Control Room to prevent spurious equipment operation due to internal shorts.

## Fire Area AA11 – Attachment 2 - Fire Risk Evaluation Results Summary

### A-2.7 Safety Margin Considerations

In accordance with NEI 04-02, the maintenance of adequate Safety Margin is assessed by the consideration categories of analyses utilized by this Fire Risk Evaluation.

Safety margins are considered to be maintained if:

- Codes and Standards or their alternatives accepted for use by the NRC are met.

AND

- Safety analyses acceptance criteria in the licensing basis (e.g., FSAR, supporting analyses) are met, or provides sufficient margin to account for analysis and data uncertainty.

The following summarizes the bases for ensuring the maintenance of safety margins:

- The risk-informed, performance based processes utilized are based upon NFPA 805, 2001 edition, endorsed by the NRC in 10 CFR 50.48(c).
- The Fire Risk Evaluation process is in accordance with NEI 04-02, Revision 2, which is endorsed by the NRC in Regulatory Guide 1.205, Revision 1.
- The Fire PRA is developed in accordance with NUREG/CR-6850, which was developed jointly between the NRC and EPRI.
- The Fire PRA has undergone an industry peer review, in order to ensure the Fire PRA meets the appropriate quality standards of ASME/ANS RA-Sa-2009, "Standard for Level 1/Large Early Release Frequency Probabilistic Risk Assessment for Nuclear Power Plant Applications," Dated February 2, 2009
- The "bounding risk assessment" is used during transition (NEI 04-02, Section 5.3.4.2). This approach conservatively assumes that target set damage occurs for postulated fire events which resulted in whole room burn up, and therefore, MEFS/LFS is not analyzed separately from the Fire PRA results.
- The CNP internal events PRA model received two formal industry peer reviews conducted in accordance with applicable NEI guidelines. The initial peer review was performed in 2001, while a subsequent focused scope (i.e., limited scope) peer review was conducted in 2009. The initial, full-scope WOG peer review covered all aspects of the CNP PRA model and the administrative processes used to maintain and update the model. The CNP PRA model has been revised to address all significant issues (i.e., Category A and B Facts & Observations) identified during the initial peer review. None of the findings from the focused-scope peer review were judged to reach the significance level of a Category A or B Fact & Observation; as a result, no changes to the PRA model have yet been made to include resolutions for these latter issues.
- Fire protection systems and features determined to be required by NFPA 805 Chapter 4 have been confirmed to meet the requirements of NFPA 805 Chapter 3 and their associated referenced codes and listings, or provided with acceptable alternatives using processes accepted for use by the NRC (i.e., FAQ 06-0008, FAQ 06-0004, 07-0033).
- Fire modeling performed has been performed within the Fire PRA utilizing codes and standards developed by industry and NRC staff which have been verified and validated in authoritative publications, such as NUREG 1824, "Verification and Validation of Selected Fire Models for Nuclear Power Plant Applications". In general, the fire modeling performed in support of the Fire Risk Evaluations has been

## **Fire Area AA11 – Attachment 2 - Fire Risk Evaluation Results Summary**

performed using conservative methods and input parameters that are based upon NUREG/CR-6850 as documented in the AA11 Detailed Fire Modeling Report, section 7.2. While this is generally not ideal in the context of best estimate probabilistic risk analysis, it is a pragmatic approach given the current state of knowledge regarding the uncertainties related to the application of the fire modeling tools and associated input parameters for specific plant configurations.

- In accordance with the requirements of 10 CFR 50.48(c)(2)(iii), the Fire PRA results, including cutsets for the scenarios of concern, have been reviewed and it was verified that the results presented above do not rely solely on feed and bleed as the fire-protected safe shutdown path for maintaining reactor coolant inventory, pressure control, and decay heat removal capability for this fire area.

### **A-2.8 Transition Risk Evaluation Conclusions**

The transition change evaluation determined that these changes:

- Are acceptable based upon the measured change in CDF and LERF
- Maintained adequate defense-in-depth and safety margins

The results of this evaluation meet the requirements of NFPA 805 Risk Evaluation; therefore, the use of the performance based analysis approach is acceptable.

## D. C. Cook Nuclear Plant Fire Safety Analysis

## Fire Area: AA12

Unit 1 Diesel Generator Oil Pump Room (El. 587')

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## Attachments

Fire Area AA12 – Attachment 1 - Table B-3 - Fire Area Transition

## 1.0 PURPOSE

This report documents the Fire Safety Analysis (FSA) for Cook Nuclear Plant (CNP) Fire Area AA12, Unit 1 Diesel Generator Oil Pump Room (El. 587') which comprises fire zone(s) 13. The purpose of this analysis is to demonstrate the achievement of the nuclear safety and radioactive release performance criteria of NFPA 805 as required by 10 CFR 50.48(c). The Fire Safety Analysis is a key part of compliance with Section 2.7.1.2 Fire Protection Program Design Basis Document of NFPA 805.

## 2.0 ANALYSIS METHODOLOGY

The FSA is the design basis document as described in NFPA 805 Section 2.7.1.2. The following steps are performed to develop the FSA on a fire area basis:

- Identify significant fire hazards in the fire area. This is based on NFPA 805 approach to analyze the plant from an ignition source and fuel package perspective.
- Summarize Nuclear Safety Capability Analysis (NSCA) compliance strategies. This is the result of the NEI 04-02 B-3 Table review of the Safe Shutdown Analysis.
- Summarize Non-Power Operations Modes compliance strategies.
- Summarize Radioactive Release compliance strategies. The transition review process required per NEI 04-02 is used to develop these results.
- Provide Fire Probabilistic Risk Assessment summary of results. This is based on the results from the plant Fire PRA.
- Perform risk informed, performance based evaluations if needed for the performance based approach.
- Summarize Defense-in-Depth strategy for each fire area.
- Determine key analysis assumptions which are candidates to be included in the NFPA 805 monitoring program.
- Provide conclusions relative to NFPA 805 compliance.

### 3.0 ANALYSIS

#### 3.1 Classical Fire Protection

##### 3.1.1 Construction

Walls, floors and ceilings to adjacent fire areas are reinforced concrete in excess of a 3-hour rating.

Applicable Engineering Equivalency Evaluations are documented in Attachment 1.

##### 3.1.2 Doors and Access Openings

A fire door having a 3-hour rating is provided to the adjacent diesel generator room Fire Area AA14 - Fire Zone 15.

##### 3.1.3 Penetrations

Note: Statements regarding fire resistance rating of penetration seals are not applicable to seals in barriers to Analysis Area YD.

Penetrations in fire barriers between this fire zone and adjacent fire areas are provided with fire seals.

##### 3.1.4 Detection

The table below outlines the fire detection system(s) provided in the Fire Area:

Table 3-1, Fire Area AA12 Detection Systems								
Fire Zone	Type of System	Local (L) / Remote (R)	Detection Actuates Suppression?	Required System?				
				S	L	E	R	D
13	Thermal	L/R	Y	N	N	Y	N	N
Table 3-1 Legend:								
Table Field: "Required System?"								
S	- Required for Chapter 4 Separation Criteria							
L	- Required for NRC Approved Licensing Action							
E	- Required for Engineering Equivalency Evaluation							
R	- Required for Risk Significance							
D	- Required to maintain adequate balance of Defense-in-Depth in a Change Evaluation or Fire Risk Evaluation							

Fire Area AA12 is provided with one line type thermistor heat detector mounted at the ceiling.



### 3.1.5 Fixed Suppression

The table below outlines the fixed fire suppression system(s) provided in the Fire Area:

Table 3-2, Fire Area AA12 Suppression Systems							
Fire Zone	Type of System	Full (F) / Partial (P)	Required System?				
			S	L	E	R	D
13	Automatic CO2	F	N	N	N	N	N
Table 3-2 Legend:							
Table Field: "Required System?"							
S	- Required for Chapter 4 Separation Criteria						
L	- Required for NRC Approved Licensing Action						
E	- Required for Engineering Equivalency Evaluation						
R	- Required for Risk Significance						
D	- Required to maintain adequate balance of Defense-in-Depth in a Change Evaluation or Fire Risk Evaluation						

Fire Area AA12 is provided with a low pressure CO2 total flooding system supplied from the 17 ton tank. This system is actuated by operation of the thermistor detector. Operation of this system alarms in the Unit 1 Control Room.

### 3.1.6 Manual Suppression / Response Strategy

A postulated fire will be identified by the heat detector provided or plant personnel using plant communication system to notify the control room. The automatic detection system alarms in the control room. The Control Room operator will dispatch the fire brigade for initiation of manual fire fighting. A fire in this fire area will be contained by the construction features discussed in Section 3.1.1. Manual suppression is provided by the CNP Fire Brigade.

Fire Extinguishers are provided in Fire Area AA12.

A 25-gallon cart of foam liquid is provided and water hose reel are available in the Turbine Building Fire Zone 79. The water hose reel is located within the corridor outside of the diesel generator rooms.

Floor drains are available in Fire Area AA12.

### 3.1.7 Ventilation

A fire in this area will be contained by the fire barriers. Smoke can be removed by venting to the outdoors or to other parts of the turbine building. The normal building ventilating systems in the Turbine Building will then exhaust the smoke via filtered monitored pathways. This fire area is listed as a non-controlled area in the Fire Pre Plans and therefore there is reasonable assurance that products of combustion will not be contaminated.

A fire damper (1-HV-DOD-2) having a 3-hour rating, is provided to the adjacent yard area. An unrated damper, 1-HV-DOD-1, is located within the opening between fire zones 13 and 14 (Engineering Equivalency Evaluation 9-7).

### 3.1.8 Other Features

No other fire protection features provided for Fire Area AA12.

### 3.2 Fire Hazards Identification

The fire area contains both ignition sources and combustible fire hazards. The main ignition sources are the fuel oil transfer pumps. Combustibles consist primarily of rubber, plastics and 100 gallons of diesel fuel oil.

This Fire Area is below grade and any exterior wall penetrations need not be rated based on the protection provided by the ground covering the exterior walls.

The current fire loading classification is considered low.

### 3.3 NSCA Compliance Summary

Fire Area AA12, Unit 1 Diesel Generator Oil Pump Room (El. 587') contains Unit 1 and 2 Green Train cables, conduits and raceways as well as Unit 1 and Unit 2 Green Train EDG Fuel oil transfer equipment. Consequently, both Units are affected by the fire.

Compliance with the nuclear safety performance criteria is achieved using the deterministic approach in accordance with NFPA 805, Section 4.2.3.2.

Safe and stable condition of Unit 1 will be accomplished using Steam Generators 2 and 3 via Unit 1 East Motor Driven Auxiliary Feedwater Pump or Unit 1 Turbine Driven Auxiliary Feedwater Pump or Steam Generators 1 and 4 via the Unit 1 West Motor Driven Auxiliary Feedwater Pump, Control Room Process Monitoring, Unit 1 Charging via the West or East Pump, Unit 1 Component Cooling Water via the East or West Pump, Unit 1 ESW via the East or West Pump. Electrical power is supplied to either Red or Green Trains via offsite power with Red train Emergency Diesels also available.

Safe and stable condition of Unit 2 will be accomplished using Steam Generators 2 and 3 via Unit 2 East Motor Driven Auxiliary Feedwater Pump or Unit 2 Turbine Driven Auxiliary Feedwater Pump or Steam Generators 1 and 4 via the Unit 2 West Motor Driven Auxiliary Feedwater Pump, Control Room Process Monitoring, Unit 2 Charging via the West or East Pump, Unit 2 Component Cooling Water via the East or West Pump, Unit 2 ESW via the East or West Pump. Electrical power is supplied to either Red or Green Trains via offsite power with Red train Emergency Diesels also available.

The Nuclear Safety Performance Criteria compliance strategy for AA12 is documented within the NSCA Report.

#### 3.3.1 Variances

There are no variances for this fire area.

#### 3.3.2 Recovery Actions Credited

There are no recovery actions for this fire area.

### 3.4 Non-Power Operational Modes Compliance Summary

A review of CNP for the potential effects of a fire in this Fire Area while in non-power modes of operation (NPO) was conducted. This review was conducted using the guidance provided in NEI 04-02 and FAQ 07-0040, "Non-Power Operations Clarifications".

The review determined that there are no potential failures that affect required Key Safety Functions (KSF) as a result of the fire in this Fire Area. Therefore, the analysis has demonstrated there is reasonable assurance a fire in this fire area during NPO modes will not adversely affect key safety functions and the NFPA 805 performance goal for NPO is therefore satisfied. The results of the NPO analysis are contained within Technical Evaluation R1900-005-001, Non-Power Operation Modes Transition Review Report.

### **3.5 Radioactive Release Compliance Summary**

The NFPA 805 radiological release goal is to provide reasonable assurance that a fire will not result in a radiological release that adversely affects the public, plant personnel or the environment. The NFPA 805 requirement is to ensure a radiation release to any unrestricted area due to the direct effects of fire suppression activities (but not involving fuel damage) shall be as low as reasonably achievable and shall not exceed applicable plant Technical Specification limits.

AA12 is located outside the Radiological Controlled Area (RCA) and is not a storage location for contaminated materials, therefore there is reasonable assurance a fire in this area will not result in radiation release. The review of this fire area, with respect to radioactive release, is documented in the NFPPM.

### **3.6 Probabilistic Risk Assessment-Summary of Results**

A Fire PRA (FPRA) quantification of Fire Area AA12 was performed and is documented in PRA-NB-FIRE-FQ, Fire PRA Model Quantification Notebook. The fire risk quantification for Fire Area AA12 is analyzed assuming whole room burnup. PRA-NB-FIRE-FQ includes a summary of all potentially risk-significant fire scenarios (i.e., CDF > 1.0E-7 or LERF > 1.0E-8). Bounding CDF / LERF per calendar year values are reported that are based on the risk values documented in PRA-NB-FIRE-FSS, Fire PRA Fire Scenario Selection.

### **3.7 Risk-Informed, Performance-Based Evaluations**

There are no VFDRs for this fire area, and therefore, no Fire Risk Evaluations have been performed.

#### **3.7.1 Transition Risk-Informed, Performance-Based Evaluations**

There are no VFDRs for this fire area, and therefore this section is not applicable to Fire Area AA12.

### 3.8 Defense-in-Depth

Per NFPA 805, section 2.4.4.2, “Defense-in-Depth”: The deterministic approach for meeting the performance criteria shall be deemed to satisfy this defense-in-depth requirement.

### 3.9 Monitoring Program Input

A Monitoring Program will be developed in accordance with FAQ 10-0059, Rev. 1. Methods to monitor availability, reliability, and performance of fire protection program structures, systems, and components (SSCs), as well as programmatic elements will be provided. Additionally, effectiveness measures are established to review program related performance and trends. For AA12 the following systems and features are candidates for inclusion in the CNP Fire Protection Monitoring Program:

- Fire Area boundary barriers discussed in Section 3.1
- Fire Detection System (Thermistor Heat Detector)

## 4.0 CONCLUSION

The nuclear safety and radioactive release performance criteria of NFPA 805 are met for a fire in Fire Area AA12. This Fire Safety Analysis has demonstrated that for Fire Area AA12 a success path remains free of fire damage using the deterministic approach per Section 4.2.3 of NFPA 805.

## 5.0 REFERENCES

- 5.1 CNP Fire Pre-Plans, Volumes I, II, and III, Revisions 17, 14, and 18 respectively
- 5.2 Fire Hazards Analysis
- 5.3 NFPA 805, Performance-Based Standard for Fire Protection for Light Water Reactor Electric Generating Plants
- 5.4 NFPPM, NFPA 805 Fire Protection Program Manual (NFPPM)
- 5.5 Nuclear Energy Institute (NEI) 04-02, Guidance for Implementing a Risk-Informed, Performance-Based Fire Protection Program under 10 CFR 50.48(c), Rev. 2
- 5.6 Nuclear Safety Capability Assessment Report
- 5.7 PRA-NB-FIRE-FQ, Fire PRA Model Quantification Notebook
- 5.8 PRA-NB-FIRE-FSS, Fire PRA Fire Scenario Selection
- 5.9 Regulatory Guide 1.205, Risk-Informed, Performance-Based Fire Protection for Existing Light-Water Nuclear Power Plants, Rev. Revision 1
- 5.10 Technical Evaluation R1900-005-001, Non-Power Operation Modes Transition Review

**Fire Area AA12 – Attachment 1 - Table B-3 - Fire Area Transition**

<u>Unit</u>	<u>Fire Area</u>	<u>Description</u>
1, 2	AA12	Unit 1 Diesel Generator Oil Pump Room (El. 587')

<u>Fire Zone</u>	<u>Description</u>
13	Diesel Oil Pump Room - El. 587 ft. 0 in. - Unit 1

**Regulatory Basis**

4.2.3.2 - Deterministic Approach

<b>Performance Goal</b>	<b>Method of Accomplishment</b>	<b>Comments</b>
Reactivity Control	Unit 1 - Trip the reactor from the Control Room. Borate using Unit 1 East or West Charging Pump supplied from the RWST. Use source range monitoring for indication.	None
	Unit 2 - Trip the reactor from the Control Room. Borate using Unit 2 East or West Charging Pump supplied from the RWST. Using source range monitoring for indication.	
Inventory and Pressure Control	Unit 1 - Control inventory using Unit 1 East or West Charging Pump. Control pressure using Unit 1 Pressurizer Safety Relief Valves.	None
	Unit 2 - Control inventory using Unit 2 East or West Charging Pump. Control pressure using Unit 2 Pressurizer Safety Relief Valves.	
Decay Heat Removal	Unit 1 - Feed SGs 2 & 3 with Unit 1 East MDAFW Pump or Unit 1 TDAFW Pump or feed SGs 1 & 4 with Unit 1 West MDAFW Pump. The DHR function also requires MS isolation with a steam release path through the Safety Relief Valves.	None
	Unit 2 - Feed SGs 2 & 3 with Unit 2 East MDAFW Pump or Unit 2 TDAFW Pump or feed SGs 1 & 4 with Unit 2 West MDAFW Pump. The DHR function also requires MS isolation with a steam release path through the Safety Relief Valves.	
Process Monitoring	Unit 1 Process Monitoring - Use Unit 1 process monitoring in the Control Room for the following: Pressurizer level, RCS pressure and temperature, and S/G level and Pressure. Unit 1 Source Range Monitoring - Use Unit 1 source range monitoring in the	None

**Fire Area AA12 – Attachment 1 - Table B-3 - Fire Area Transition**

<u>Unit</u>	<u>Fire Area</u>	<u>Description</u>
1, 2	AA12	Unit 1 Diesel Generator Oil Pump Room (El. 587')
Vital Auxiliaries		Control room.
		Unit 2 Process Monitoring - Use Unit 2 process monitoring in the Control Room for the following: Pressurizer level, RCS pressure and temperature, and S/G level and Pressure. Unit 2 Source Range Monitoring - Use Unit 2 source range monitoring in the Control room.
Vital Auxiliaries		Unit 1 Electrical - Control Unit 1 Red (AB) Train Electrical Distribution with Unit 1 Red (AB) Train Offsite Power or Unit 1 Red (AB) DG. Control Unit 1 Green (CD) Train Electrical Distribution with Unit 1 Green (CD) Train Offsite Power Unit 1 ESW - Operate Unit 1 East or West ESW. Unit 1 CCW - Operate Unit 1 East or West CCW. Unit 1 HVAC - Operate Unit 1 Control Room HVAC. Operate Unit 1 Auxiliary Building HVAC. Operate Unit 1 Red (AB) DG HVAC. Operate Unit 1 Switchgear HVAC. Operate Unit 1 AFW Pump Room HVAC systems. Operate the Unit 1 East and West ESW Pump HVAC systems.
		Unit 2 Electrical - Control Unit 2 Red (AB) Train Electrical Distribution with Unit 2 Red (AB) Train Offsite Power or Unit 2 Red (AB) DG. Control Unit 2 Green (CD) Train Electrical Distribution with Unit 2 Green (CD) Train Offsite Power. Unit 2 ESW - Operate Unit 2 East or West ESW. Unit 2 CCW - Operate Unit 2 East or West CCW. Unit 2 HVAC - Operate Unit 2 Control Room HVAC. Operate Unit 2 Auxiliary Building HVAC. Operate Unit 2 Red (AB) DG HVAC. Operate Unit 2 Switchgear HVAC. Operate Unit 2 AFW Pump Room HVAC systems. Operate the Unit 2 East and West ESW Pump HVAC systems.

**Reference Documents**

Genesis Solution Suite, EDISON / SAFE-PB, DC Cook V 3.4.0

Nuclear Safety Capability Assessment Report

**Fire Area AA12 – Attachment 1 - Table B-3 - Fire Area Transition**

<u>Unit</u>	<u>Fire Area</u>	<u>Description</u>
1, 2	AA12	Unit 1 Diesel Generator Oil Pump Room (El. 587')

**Licensing Actions**

None

**Existing Engineering Equivalency Evaluations (EEEE)****EEEE Title Engineering Equivalency Evaluation 9-7 - Fire Zone 13 (Fire Area AA12) and Fire Zone 14 (Fire Area AA13) Boundary Evaluation**

**Summary** The purpose of this engineering equivalency evaluation is to document the acceptability of an unrated field fabricated fusible link guillotine type damper presently located between the Unit 1 Diesel Oil Pump Room in Fire Zone 13 (Fire Area AA12) and the Unit 1 Transformer Room in Fire Zone 14 (Fire Area AA13).

The existing CO2 actuated damper located between Fire Zones 13 and 14 is an acceptable device for maintaining the rating of the fire area boundary. This engineering equivalency evaluation does not adversely impact other engineering equivalency evaluations.

The unrated damper was evaluated and found to be acceptable based on the fire hazards and fire protection systems within the evaluated areas.

**EEEE Title Engineering Equivalency Evaluation 11-9 - Turbine, Auxiliary and Containment Buildings Boundary Evaluation**

**Summary** The purpose of this engineering equivalency evaluation is to describe in general, the approach and existence of evaluations performed to determine and reconcile fire area boundaries having components or designs with less than a 3-hr fire rating on preventing the spread of fire. This engineering equivalency evaluation also specifically evaluates the impact of unrated door assemblies on the spread of fire.

Reasonable assurance is provided that the fire area boundaries having components or design less than a 3-hr fire rating will not increase the spread of fire or impair the safe shutdown capabilities of Units 1 or 2. In addition, this engineering equivalency evaluation does not adversely impact on other engineering equivalency evaluations or exemption requests.

This evaluation supports additional evaluations credited in this fire area.

**Fire Area AA12 – Attachment 1 - Table B-3 - Fire Area Transition**

<u>Unit</u>	<u>Fire Area</u>	<u>Description</u>
1, 2	AA12	Unit 1 Diesel Generator Oil Pump Room (El. 587')

**Fire Suppression Effects on Nuclear Safety Performance Criteria**

The CNP fire brigade is trained to discharge water in a judicious manner and instructed to direct hose streams and portable extinguishers at the base of the fire to limit the amount of overspray beyond the immediate fire zone. For this reason, fire brigade activities are not expected to fail components not already considered damaged. It has been concluded that water impingement on cables is not a concern. Electrical cabinets are provided with a seal at the conduit interface. Possible impacts to surrounding equipment due to manual fire fighting activities is bounded by the analysis approach of postulating whole room damage. The drainage features of the fire area mitigate the potential for flooding damage due to fire suppression, such that the standing water would not affect credited equipment.

In the event of discharge, any damage caused by the CO2 system to other equipment operating within the fire area which is not immediately involved in the originating fire is bounded by the analysis approach of postulating whole room damage. Since it is shown that suppression effects will not impact the nuclear safety performance criteria, the fire area configuration is deemed acceptable.

## References:

Technical Evaluation 12.1, "Fire Suppression Effects Study"

Technical Evaluation 12.1, "Supplemental Information to Fire Suppression Effects Study – Supplement 1"

**Fire Area Comments**

None



## D. C. Cook Nuclear Plant Fire Safety Analysis

## Fire Area: AA13

Unit 1 Transformer Room (El. 591 ft.)

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## Attachments

Fire Area AA13 – Attachment 1 - Table B-3 - Fire Area Transition

## **1.0 PURPOSE**

This report documents the Fire Safety Analysis (FSA) for Cook Nuclear Plant (CNP) Fire Area AA13, Unit 1 Transformer Room (El. 591 ft.) which comprises fire zone(s) 14. The purpose of this analysis is to demonstrate the achievement of the nuclear safety and radioactive release performance criteria of NFPA 805 as required by 10 CFR 50.48(c). The Fire Safety Analysis is a key part of compliance with Section 2.7.1.2 Fire Protection Program Design Basis Document of NFPA 805.

## **2.0 ANALYSIS METHODOLOGY**

The FSA is the design basis document as described in NFPA 805 Section 2.7.1.2. The following steps are performed to develop the FSA on a fire area basis:

- Identify significant fire hazards in the fire area. This is based on NFPA 805 approach to analyze the plant from an ignition source and fuel package perspective.
- Summarize Nuclear Safety Capability Analysis (NSCA) compliance strategies. This is the result of the NEI 04-02 B-3 Table review of the Safe Shutdown Analysis.
- Summarize Non-Power Operations Modes compliance strategies.
- Summarize Radioactive Release compliance strategies. The transition review process required per NEI 04-02 is used to develop these results.
- Provide Fire Probabilistic Risk Assessment summary of results. This is based on the results from the plant Fire PRA.
- Perform risk informed, performance based evaluations if needed for the performance based approach.
- Summarize Defense-in-Depth strategy for each fire area.
- Determine key analysis assumptions which are candidates to be included in the NFPA 805 monitoring program.
- Provide conclusions relative to NFPA 805 compliance.

### 3.0 ANALYSIS

#### 3.1 Classical Fire Protection

##### 3.1.1 Construction

Walls, floors and ceilings to adjacent fire areas are reinforced concrete in excess of a 3-hour rating. A fire area boundary evaluation was performed for the construction features (i.e. fire doors, undampened ventilation and open penetrations) of the switchgear rooms that have a fire resistance rating of less than 3 hours. (Engineering Equivalency Evaluation 11-15).

Applicable Engineering Equivalency Evaluations are documented in Attachment 1.

##### 3.1.2 Doors and Access Openings

An unlabeled Class A (3-hour) roll-up fire door is provided to adjacent Fire Area AA2 - Fire Zone 79. This roll-up fire door is manufactured to Class A (3-hour) construction in accordance with UL Procedures. The alteration of the door does not affect the true fire rating of the door.

##### 3.1.3 Penetrations

Note: Statements regarding fire resistance rating of penetration seals are not applicable to seals in barriers to Analysis Area YD.

Penetrations in fire barriers between this fire zone and adjacent fire areas are provided with fire seals.

##### 3.1.4 Detection

The table below outlines the fire detection system(s) provided in the Fire Area:

Table 3-1, Fire Area AA13 Detection Systems								
Fire Zone	Type of System	Local (L) / Remote (R)	Detection Actuates Suppression?	Required System?				
				S	L	E	R	D
14	Ionization	L/R	No Auto Supp. (N/A)	N	N	Y	N	N
Table 3-1 Legend:								
Table Field: "Required System?"								
S	- Required for Chapter 4 Separation Criteria							
L	- Required for NRC Approved Licensing Action							
E	- Required for Engineering Equivalency Evaluation							
R	- Required for Risk Significance							
D	- Required to maintain adequate balance of Defense-in-Depth in a Change Evaluation or Fire Risk Evaluation							

Fire Area AA13 is provided with ionization detectors throughout the area which alarm in the Unit 1 Control Room.

### 3.1.5 Fixed Suppression

The table below outlines the fixed fire suppression system(s) provided in the Fire Area:

Table 3-2, Fire Area AA13 Suppression Systems							
Fire Zone	Type of System	Full (F) / Partial (P)	Required System?				
			S	L	E	R	D
14	None	N/A	N/A	N/A	N/A	N/A	N/A
Table 3-2 Legend:							
Table Field: "Required System?"							
S	- Required for Chapter 4 Separation Criteria						
L	- Required for NRC Approved Licensing Action						
E	- Required for Engineering Equivalency Evaluation						
R	- Required for Risk Significance						
D	- Required to maintain adequate balance of Defense-in-Depth in a Change Evaluation or Fire Risk Evaluation						

Fire Area AA13 is not provided with fixed fire suppression.

### 3.1.6 Manual Suppression / Response Strategy

A postulated fire will be identified by the ionization smoke detectors or plant personnel using plant communication system to notify the control room. The automatic detection system alarms in the control room. The Control Room operator will dispatch the fire brigade for initiation of manual fire fighting. A fire in this fire area will be contained by the construction features discussed in Section 3.1.1. Manual suppression is provided by the CNP Fire Brigade.

Fire extinguishers are located within Fire Area AA13.

A water hose reel is located in adjacent Fire Area AA2 - Fire Zone 79.

Fire Area AA13 is equipped with floor drains.

### 3.1.7 Ventilation

A fire in this area will be contained by the fire barriers. Smoke can be removed by venting to the outdoors or to other parts of the turbine building. The normal building ventilating systems in the Turbine Building will then exhaust the smoke via filtered monitored pathways. This fire area is listed as a non-controlled area in the Fire Pre Plans and therefore there is reasonable assurance that products of combustion will not be contaminated.

Fire dampers 1-HV-TX-FD-1 and 1-HV-TS-FD-1 having a 1 1/2-hour rating are provided to adjacent Fire Area AA2 - Fire Zone 79 (Engineering Equivalency Evaluation 9-6).

### 3.1.8 Other Features

No other fire protection features provided for Fire Area AA13.

## 3.2 Fire Hazards Identification

The fire area contains both ignition sources and combustible fire hazards. The ignition sources consist of the RWST area miscellaneous power supply phases 1&2 and 2&3, Bus 11BMC, Bus 11CMC and various other motor control centers. Combustibles consist primarily of cable insulation, rubber and plastics.

This Fire Area is below grade and any exterior wall penetrations need not be rated based on the protection provided by the ground covering the exterior walls.

The current fire loading classification is considered low.

### **3.3 NSCA Compliance Summary**

Fire Area AA13, U1 Transformer Room. (EL. 591') contains Unit 1 Red and Green Train cables, conduits and raceways.

Compliance with the nuclear safety performance criteria is achieved using the deterministic approach in accordance with NFPA 805, Section 4.2.3.2.

Safe and stable condition of Unit 1 will be accomplished using Steam Generators 2 and 3 via Unit 1 East Motor Driven Auxiliary Feedwater Pump or Unit 1 Turbine Driven Auxiliary Feedwater Pump or Steam Generators 1 and 4 via the Unit 1 West Motor Driven Auxiliary Feedwater Pump, Control Room Process Monitoring, Unit 1 Charging via the West or East Pump, Unit 1 Component Cooling Water via the East or West Pump, Unit 1 ESW via the East or West Pump. Electrical power is supplied to either Red or Green Trains via offsite power. Additionally Emergency Diesel Generator AB remains available.

The Nuclear Safety Performance Criteria compliance strategy for AA13 is documented within the NSCA Report.

#### **3.3.1 Variances**

There are no variances for this fire area.

#### **3.3.2 Recovery Actions Credited**

There are no recovery actions for this fire area.

### **3.4 Non-Power Operational Modes Compliance Summary**

A review of CNP for the potential effects of a fire in this Fire Area while in non-power modes of operation (NPO) was conducted. This review was conducted using the guidance provided in NEI 04-02 and FAQ 07-0040, "Non-Power Operations Clarifications".

The review determined that there are potential failures that affect certain Key Safety Functions (KSF) as a result of the fire in this area, and the fire could result in the loss of one or more KSF paths. Compensatory measures are required during high risk evolution periods to provide reasonable assurance a fire will not adversely affect key safety functions and the NFPA 805 performance goal for NPO is therefore satisfied. The results of the NPO analysis are contained within Technical Evaluation R1900-005-001, Non-Power Operation Modes Transition Review Report.

### **3.5 Radioactive Release Compliance Summary**

The NFPA 805 radiological release goal is to provide reasonable assurance that a fire will not result in a radiological release that adversely affects the public, plant personnel or the environment. The NFPA 805 requirement is to ensure a radiation release to any unrestricted area due to the direct effects of fire suppression activities (but not involving fuel damage) shall be as low as reasonably achievable and shall not exceed applicable plant Technical Specification limits.

AA13 is located outside the Radiological Controlled Area (RCA) and is not a storage location for contaminated materials, therefore there is reasonable assurance a fire in this area will not result in radiation release. The review of this fire area, with respect to radioactive release, is documented in the NFPPM.

### 3.6 Probabilistic Risk Assessment-Summary of Results

A Fire PRA (FPRA) quantification of Fire Area AA13 was performed and is documented in PRA-NB-FIRE-FQ, Fire PRA Model Quantification Notebook. The fire risk quantification for Fire Area AA13 is analyzed assuming whole room burnup. PRA-NB-FIRE-FQ includes a summary of all potentially risk-significant fire scenarios (i.e., CDF > 1.0E-7 or LERF > 1.0E-8). Bounding CDF / LERF per calendar year values are reported that are based on the risk values documented in PRA-NB-FIRE-FSS, Fire PRA Fire Scenario Selection.

### 3.7 Risk-Informed, Performance-Based Evaluations

There are no VFDRs for this fire area, and therefore, no Fire Risk Evaluations have been performed.

#### 3.7.1 Transition Risk-Informed, Performance-Based Evaluations

There are no VFDRs for this fire area, and therefore this section is not applicable to Fire Area AA13.

### 3.8 Defense-in-Depth

Per NFPA 805, section 2.4.4.2, "Defense-in-Depth": The deterministic approach for meeting the performance criteria shall be deemed to satisfy this defense-in-depth requirement.

### 3.9 Monitoring Program Input

A Monitoring Program will be developed in accordance with FAQ 10-0059, Rev. 1. Methods to monitor availability, reliability, and performance of fire protection program structures, systems, and components (SSCs), as well as programmatic elements will be provided. Additionally, effectiveness measures are established to review program related performance and trends. For AA13 the following systems and features are candidates for inclusion in the CNP Fire Protection Monitoring Program:

- Fire Area boundary barriers discussed in Section 3.1
- Fire Detection (Ionization)

## 4.0 CONCLUSION

The nuclear safety and radioactive release performance criteria of NFPA 805 are met for a fire in Fire Area AA13. This Fire Safety Analysis has demonstrated that for Fire Area AA13 a success path remains free of fire damage using the deterministic approach per Section 4.2.3 of NFPA 805.

## **5.0 REFERENCES**

- 5.1 CNP Fire Pre-Plans, Volumes I, II, and III, Revisions 17, 14, and 18 respectively
- 5.2 Fire Hazards Analysis
- 5.3 NFPA 805, Performance-Based Standard for Fire Protection for Light Water Reactor Electric Generating Plants
- 5.4 NFPPM, NFPA 805 Fire Protection Program Manual (NFPPM)
- 5.5 Nuclear Energy Institute (NEI) 04-02, Guidance for Implementing a Risk-Informed, Performance-Based Fire Protection Program under 10 CFR 50.48(c), Rev. 2
- 5.6 Nuclear Safety Capability Assessment Report
- 5.7 PRA-NB-FIRE-FQ, Fire PRA Model Quantification Notebook
- 5.8 PRA-NB-FIRE-FSS, Fire PRA Fire Scenario Selection
- 5.9 Regulatory Guide 1.205, Risk-Informed, Performance-Based Fire Protection for Existing Light-Water Nuclear Power Plants, Rev. Revision 1
- 5.10 Technical Evaluation R1900-005-001, Non-Power Operation Modes Transition Review

**Fire Area AA13 – Attachment 1 - Table B-3 - Fire Area Transition**

<u>Unit</u>	<u>Fire Area</u>	<u>Description</u>
1	AA13	Unit 1 Transformer Room (El. 591 ft.)

<u>Fire Zone</u>	<u>Description</u>
14	Transformer Room - El. 591 ft. 0 in. - Unit 1

**Regulatory Basis**

4.2.3.2 - Deterministic Approach

<b>Performance Goal</b>	<b>Method of Accomplishment</b>	<b>Comments</b>
Reactivity Control	Unit 1 - Trip the reactor from the Control Room. Borate using Unit 1 East or West Charging Pump supplied from the RWST. Use source range monitoring for indication from Unit 1.	None
Inventory and Pressure Control	Unit 1 - Control inventory using Unit 1 East or West Charging Pump. Control pressure using Unit 1 Pressurizer Safety Relief Valves.	None
Decay Heat Removal	Unit 1 - Feed SGs 2 & 3 with Unit 1 East MDAFW Pump or Unit 1 TDAFW Pump or feed SGs 1 & 4 with Unit 1 West MDAFW Pump. The DHR function also requires MS isolation with a steam release path through the Safety Relief Valves.	None
Process Monitoring	Unit 1 Process Monitoring - Use Unit 1 process monitoring in the Control Room for the following: Pressurizer level, RCS pressure and temperature, and S/G level and Pressure. Unit 1 Source Range Monitoring - Use Unit 1 source range monitoring in the Control Room.	None
Vital Auxiliaries	Unit 1 Electrical - Control Unit 1 Red (AB) Train Electrical Distribution with Unit 1 Red (AB) Train Offsite Power or Unit 1 Red (AB) DG. Control Unit 1 Green (CD) Train Electrical Distribution with Unit 1 Green (CD) Train Offsite Power. Unit 1 ESW - Operate Unit 1 East or West ESW. Unit 1 CCW - Operate Unit 1 East or West CCW. Unit 1 HVAC - Operate Unit 1 Control Room HVAC. Operate Unit 1 Auxiliary Building HVAC. Operate Unit 1 Red (AB) DG HVAC. Operate Unit 1 Switchgear HVAC. Operate Unit 1 AFW Pump Room HVAC systems. Operate the Unit 1 East and West ESW Pump HVAC systems.	None



**Fire Area AA13 – Attachment 1 - Table B-3 - Fire Area Transition**

<u>Unit</u>	<u>Fire Area</u>	<u>Description</u>
1	AA13	Unit 1 Transformer Room (El. 591 ft.)

**Reference Documents**

Genesis Solution Suite, EDISON / SAFE-PB, DC Cook V 3.4.0

Nuclear Safety Capability Assessment Report

**Licensing Actions**

None

**Existing Engineering Equivalency Evaluations (EEEE)****EEEE Title Engineering Equivalency Evaluation 9-7 - Fire Zone 13 (Fire Area AA12) and Fire Zone 14 (Fire Area AA13) Boundary Evaluation**

**Summary** The purpose of this engineering equivalency evaluation is to document the acceptability of an unrated field fabricated fusible link guillotine type damper presently located between the Unit 1 Diesel Oil Pump Room in Fire Zone 13 (Fire Area AA12) and the Unit 1 Transformer Room in Fire Zone 14 (Fire Area AA13).

The existing CO2 actuated damper located between Fire Zones 13 and 14 is an acceptable device for maintaining the rating of the fire area boundary. This engineering equivalency evaluation does not adversely impact other engineering equivalency evaluations.

The unrated damper was evaluated and found to be acceptable based on the fire hazards and fire protection systems within the evaluated areas.

**Fire Area AA13 – Attachment 1 - Table B-3 - Fire Area Transition**

<u>Unit</u>	<u>Fire Area</u>	<u>Description</u>
1	AA13	Unit 1 Transformer Room (El. 591 ft.)

**EEEE Title Engineering Equivalency Evaluation 11-9 - Turbine, Auxiliary and Containment Buildings Boundary Evaluation**

**Summary** The purpose of this engineering equivalency evaluation is to describe in general, the approach and existence of evaluations performed to determine and reconcile fire area boundaries having components or designs with less than a 3-hr fire rating on preventing the spread of fire. This engineering equivalency evaluation also specifically evaluates the impact of unrated door assemblies on the spread of fire.

Reasonable assurance is provided that the fire area boundaries having components or design less than a 3-hr fire rating will not increase the spread of fire or impair the safe shutdown capabilities of Units 1 or 2. In addition, this engineering equivalency evaluation does not adversely impact on other engineering equivalency evaluations or exemption requests.

This evaluation supports additional evaluations credited in this fire area.

**Fire Suppression Effects on Nuclear Safety Performance Criteria**

The CNP fire brigade is trained to discharge water in a judicious manner and instructed to direct hose streams and portable extinguishers at the base of the fire to limit the amount of overspray beyond the immediate fire zone. For this reason, fire brigade activities are not expected to fail components not already considered damaged. It has been concluded that water impingement on cables is not a concern. Electrical cabinets are provided with a seal at the conduit interface. Possible impacts to surrounding equipment due to manual fire fighting activities is bounded by the analysis approach of postulating whole room damage. The drainage features of the fire area mitigate the potential for flooding damage due to fire suppression, such that the standing water would not affect credited equipment.

This fire area is not equipped with a fixed fire suppression system. Since it is shown that suppression effects will not impact the nuclear safety performance criteria, the fire area configuration is deemed acceptable.

**References:**

Technical Evaluation 12.1, "Fire Suppression Effects Study"

Technical Evaluation 12.1, "Supplemental Information to Fire Suppression Effects Study – Supplement 1"

**Fire Area Comments**

None

## D. C. Cook Nuclear Plant Fire Safety Analysis

## Fire Area: AA14

Unit 1 CD Diesel Generator Room (El. 587 ft.)

## Table of Contents

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<b>Analysis Methodology</b> .....	Section 2.0
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## Attachments

Fire Area AA14 – Attachment 1 - Table B-3 - Fire Area Transition

## Fire Area AA14 – Attachment 2 - Fire Risk Evaluation Results Summary

## 1.0 PURPOSE

This report documents the Fire Safety Analysis (FSA) for Cook Nuclear Plant (CNP) Fire Area AA14, Unit 1 CD Diesel Generator Room (El. 587 ft.) which comprises fire zone(s) 15. The purpose of this analysis is to demonstrate the achievement of the nuclear safety and radioactive release performance criteria of NFPA 805 as required by 10 CFR 50.48(c). The Fire Safety Analysis is a key part of compliance with Section 2.7.1.2 Fire Protection Program Design Basis Document of NFPA 805. This analysis also documents results of risk-informed, performance-based Fire Risk Evaluations (FREs). These evaluations are associated with Variances from Deterministic Requirements (VFDRs) of NFPA 805 Chapter 4.

## 2.0 ANALYSIS METHODOLOGY

The FSA is the design basis document as described in NFPA 805 Section 2.7.1.2. The following steps are performed to develop the FSA on a fire area basis:

- Identify significant fire hazards in the fire area. This is based on NFPA 805 approach to analyze the plant from an ignition source and fuel package perspective.
- Summarize Nuclear Safety Capability Analysis (NSCA) compliance strategies. This is the result of the NEI 04-02 B-3 Table review of the Safe Shutdown Analysis.
- Summarize Non-Power Operations Modes compliance strategies.
- Summarize Radioactive Release compliance strategies. The transition review process required per NEI 04-02 is used to develop these results.
- Provide Fire Probabilistic Risk Assessment summary of results. This is based on the results from the plant Fire PRA.
- Perform risk informed, performance based evaluations if needed for the performance based approach.
- Summarize Defense-in-Depth strategy for each fire area.
- Determine key analysis assumptions which are candidates to be included in the NFPA 805 monitoring program.
- Provide conclusions relative to NFPA 805 compliance.

### 3.0 ANALYSIS

#### 3.1 Classical Fire Protection

##### 3.1.1 Construction

Walls, floors and ceilings to adjacent fire areas are reinforced concrete in excess of a 3-hour rating with two exceptions. These exceptions are the 3-hour rated 8-inch concrete block used to reduce the wall opening size for the exchange of a pair of doors to a single leaf door and the 4-hour rated 8-inch concrete block used in the west wall for equipment removal.

The fuel oil day tank room is constructed of 4-hour rated 8-inch concrete block to the underside of the ceiling slab with a cantilevered concrete floor located approximately 10'-8" above the Diesel Generator Room floor.

Applicable Engineering Equivalency Evaluations are documented in Attachment 1.

##### 3.1.2 Doors and Access Openings

Fire doors having a 3-hour rating are provided to adjacent Fire Areas AA12 and AA2 - Fire Zones 13 and 79, respectively, and to the fuel oil day tank room located within this fire zone.

##### 3.1.3 Penetrations

Note: Statements regarding fire resistance rating of penetration seals are not applicable to seals in barriers to Analysis Area YD.

Penetrations in fire barriers between this fire zone and adjacent fire areas are provided with fire seals. Additionally, the day tank within the fire zone is provided with fire seals.

In order to support NFPA 805 Chapter 3 requirements, a fire area boundary evaluation was performed for the grouted fire seals installed in penetrations separating the diesel generator diesel fuel oil tank rooms and their respective diesel generators (Engineering Equivalency Evaluation 11-17).

The seismic gaps are sealed with a glass fiber reinforced silicone sheeting.

### 3.1.4 Detection

The table below outlines the fire detection system(s) provided in the Fire Area:

Table 3-1, Fire Area AA14 Detection Systems								
Fire Zone	Type of System	Local (L) / Remote (R)	Detection Actuates Suppression?	Required System?				
				S	L	E	R	D
15	Thermal	L/R	Y	Y	N	Y	Y	N
Table 3-1 Legend:								
Table Field: "Required System?"								
S	- Required for Chapter 4 Separation Criteria							
L	- Required for NRC Approved Licensing Action							
E	- Required for Engineering Equivalency Evaluation							
R	- Required for Risk Significance							
D	- Required to maintain adequate balance of Defense-in-Depth in a Change Evaluation or Fire Risk Evaluation							

For Fire Zone 15, cross-zoned line type thermistor heat detectors (2) are provided at the ceiling. Each detection circuit utilizes a different alarm set point to assure that the CO2 will not be actuated until both set points are satisfied. This has been done to minimize spurious operations of the CO2.

### 3.1.5 Fixed Suppression

The table below outlines the fixed fire suppression system(s) provided in the Fire Area:

Table 3-2, Fire Area AA14 Suppression Systems							
Fire Zone	Type of System	Full (F) / Partial (P)	Required System?				
			S	L	E	R	D
15	Automatic CO2	F	Y	N	Y	Y	N
Table 3-2 Legend:							
Table Field: "Required System?"							
S	- Required for Chapter 4 Separation Criteria						
L	- Required for NRC Approved Licensing Action						
E	- Required for Engineering Equivalency Evaluation						
R	- Required for Risk Significance						
D	- Required to maintain adequate balance of Defense-in-Depth in a Change Evaluation or Fire Risk Evaluation						

A low pressure CO2 total flooding system supplied from 17 ton tank is provided. This system is actuated by operation of both of the above detection circuits. Operation of the CO2 system alarms in the Unit 1 Control Room.

### 3.1.6 Manual Suppression / Response Strategy

A postulated fire will be identified by automatic detection using the thermistor heat detectors described in Section 3.1.2 or by plant personnel using plant communication system to notify the

control room. The automatic detection system alarms in the control room. The Control Room operator will dispatch the fire brigade for initiation of manual fire fighting. A fire in this fire area will be contained by the construction features discussed in Section 3.1.1. Manual suppression is provided by the CNP Fire Brigade.

Fire extinguishers are provided in this fire area.

A water hose reel is located in adjacent Fire Area AA2 - Fire Zone 79.

Fire Area AA14 is equipped with floor drains.

### 3.1.7 Ventilation

A fire in this area will be contained by the fire barriers. Smoke can be removed by portable fans and flexible ducting to the Turbine Building and outdoors. The normal building ventilating systems in the Turbine Building will then exhaust the smoke. This fire area is listed as a non-controlled area in the Fire Pre Plans and therefore there is reasonable assurance that products of combustion will not be contaminated.

Ventilation openings to other fire areas are provided with 3-hour fire dampers.

### 3.1.8 Other Features

For Fire Zone 15, Electrical Raceway Fire Barrier Systems (ERFBS) with a rating of a 1-hour are provided, where required. Cables inside embedded conduits within a concrete pilaster are provided with an external layer of Thermo-Lag (Engineering Equivalency Evaluation 11-50).

## 3.2 Fire Hazards Identification

The fire area contains both ignition sources and combustible fire hazards. The ignition sources consist of the diesel generator, motor control centers, jacket water circulation pumps and the starting air compressors. Combustibles consist primarily of lube oil, diesel fuel oil and exposed electrical cables.

This Fire Area is below grade and any exterior wall penetrations need not be rated based on the protection provided by the ground covering the exterior walls.

The current fire loading classification is considered moderate.

## 3.3 NSCA Compliance Summary

Fire Area AA14 contains the Unit 1 Green Train Emergency Diesel Generator as well as associated Green Train EDG support components, 600V MCCs, and 120V power supplies. This fire area also contains both Red and Green train raceways and cables.

Compliance with the nuclear safety performance criteria is achieved using the performance-based approach in accordance with NFPA 805, Section 4.2.4.2.

Safe and stable condition of Unit 1 will be accomplished using Steam Generator 2 and 3 via the Unit 1 Turbine Driven Auxiliary Feedwater Pump, Unit 1 Charging via the West Pump, Process Monitoring/Indication from the Main Control Room, Unit 1 Component Cooling Water via the West Pump and Unit 1 Essential Service Water via the West Pump. Power is credited via the Red Train

from offsite, with Red Train EDG also available.

The Nuclear Safety Performance Criteria compliance strategy for AA14 is documented within the NSCA Report.

### 3.3.1 Variances

The variances identified for evaluation for this fire area are grouped as follows:

#### 3.3.1.1 VFDR No. AA14-001

1-11D-NORM - 600 Volt Bus 11D (normal) Power Supply is required to be operable in support of Unit 1 Electrical Distribution. Bus 11D may not be available due to fire induced damage of the Green (CD) Train buses resulting from DG output breaker failure and potential for spurious start of the DG (Multiple Spurious Operations concern). For the purposes of this VFDR, loss of Bus 11D impacts 250VDC battery charging and supply as well Control Room 120V CRIDs. As a result, Bus 11D is required to be transferred to its alternate power supply prior to battery depletion in approximately 4 hours in order to support Control Room RCS loop 2 & 3 temperature indication. The TDAFW pump is credited for a fire in this area. This condition represents a variance from deterministic requirements of NFPA 805, Section 4.2.3. This is a separation issue.

This VFDR has been evaluated and it was determined that the risk, safety margin and defense-in-depth meet the acceptance criteria of NFPA 805 Section 4.2.4 with a defense-in-depth action credited.

### 3.3.2 Recovery Actions Credited

For each VFDR, a Fire Risk Evaluation has been performed to assess the acceptability of risk, defense-in-depth, and safety margin. This evaluation determined whether or not recovery actions are required to ensure that one success path necessary to achieve and maintain the nuclear safety performance criteria is maintained free of fire damage by a single fire. Table 3-3 identifies the credited recovery actions for this area. Actions retained for DID are identified as “DID Actions” within Table 3-3. Additional information for DID actions is contained within Section 3.8 of this report. Note that, for completeness, all VFDRs are contained within Table 3-3, even if the Fire Risk Evaluation has determined that a recovery action is not required. In those instances where a recovery action has been determined to not be required, the word “None” is provided in the “Action” column in the table.

Table 3-3, Recovery Actions Credited		
VFDR	Component	Action
AA14-001	1-11D-NORM	DID ACTION 1-11D-XFER (Transfer to 1-11B via breaker 11BD)

### 3.4 Non-Power Operational Modes Compliance Summary

A review of CNP for the potential effects of a fire in this Fire Area while in non-power modes of operation (NPO) was conducted. This review was conducted using the guidance provided in NEI 04-02 and FAQ 07-0040, “Non-Power Operations Clarifications”.



The review determined that there are potential failures that affect certain Key Safety Functions (KSF) as a result of the fire in this area, and the fire could result in the loss of one or more KSF paths. Compensatory measures are required during high risk evolution periods to provide reasonable assurance a fire will not adversely affect key safety functions and the NFPA 805 performance goal for NPO is therefore satisfied. The results of the NPO analysis are contained within Technical Evaluation R1900-005-001, Non-Power Operation Modes Transition Review Report.

### 3.5 Radioactive Release Compliance Summary

The NFPA 805 radiological release goal is to provide reasonable assurance that a fire will not result in a radiological release that adversely affects the public, plant personnel or the environment. The NFPA 805 requirement is to ensure a radiation release to any unrestricted area due to the direct effects of fire suppression activities (but not involving fuel damage) shall be as low as reasonably achievable and shall not exceed applicable plant Technical Specification limits.

AA14 is located outside the Radiological Controlled Area (RCA) and is not a storage location for contaminated materials, therefore there is reasonable assurance a fire in this area will not result in radiation release. The review of this fire area, with respect to radioactive release, is documented in the NFPPM.

### 3.6 Probabilistic Risk Assessment-Summary of Results

A Fire PRA (FPRA) quantification of Fire Area AA14 was performed and is documented in PRA-NB-FIRE-FQ, Fire PRA Model Quantification Notebook. The fire risk quantification for Fire Area AA14 is analyzed assuming whole room burnup. PRA-NB-FIRE-FQ includes a summary of all potentially risk-significant fire scenarios (i.e., CDF > 1.0E-7 or LERF > 1.0E-8). Bounding CDF / LERF per calendar year values are reported that are based on the risk values documented in PRA-NB-FIRE-FSS, Fire PRA Fire Scenario Selection.

### 3.7 Risk-Informed, Performance-Based Evaluations

Fire Risk Evaluations (FREs) have been performed to ensure that variances from the NFPA 805 deterministic requirements are acceptable. The evaluation process consists of an integrated assessment of the acceptability of risk, defense-in-depth, and safety margins.

#### 3.7.1 Transition Risk-Informed, Performance-Based Evaluations

The 'changes' associated with NFPA 805 transition were those variances from the deterministic requirements of NFPA 805 or with the existing fire protection licensing basis that were brought into compliance with the NFPA 805 performance based approach. The change identified for evaluation for Fire Area AA14 is as follows:

- Separation Issues

The Fire Risk Evaluation has determined that the change is acceptable based upon:

- The measured change in CDF and LERF.
- Adequate defense-in-depth and safety margins being maintained.

Refer to Attachment 2 for a summary of results associated with the Fire Risk Evaluations.

### 3.8 Defense-in-Depth

A comprehensive risk-informed, performance-based analysis includes consideration of defense-in-depth (DID) as part of an integrated evaluation of risk considerations. In general, defense-in-depth involves consideration of the extent to which fire protection systems and features are provided within the three echelons of fire-protection:

- Preventing fires from starting,
- Rapidly detecting fires and controlling and extinguishing promptly those fires that do occur, thereby limiting fire damage,
- Providing an adequate level of fire protection for structures, systems, and components important to safety, so that a fire that is not promptly extinguished will not prevent the nuclear safety performance criteria from being met.

Each VFDR was evaluated for DID. The following recovery actions have been retained for DID.

VFDR No. AA14-001: 1-11D-NORM - 600 Volt Bus 11D (normal) Power Supply is required to be operable in support of Unit 1 Electrical Distribution. Bus 11D is not available due to the loss of power to the Green Train buses resulting from Emergency Diesel (EDG) output breaker failure and potential for spurious start of the EDG (Multiple Spurious Operations concern). For the purposes of this VFDR, loss of Bus 11D impacts 250VDC battery charging and supply as well Control Room 120V CRIDs. As a result, Bus 11D is required to be transferred to its alternate power supply prior to battery depletion in approximately 4 hours in order to support Control Room RCS loop 2 & 3 temperature indication. 1-11D-NORM transfer to alternate power supply is being retained for DID to ensure RCS loop 2 and 3 temperature indication is maintained.

Based on the assessment in support of the Fire Risk Evaluation, defense-in-depth is maintained for fire area AA14. Refer to Attachment 2 for details associated with the Fire Risk Evaluation.

### 3.9 Monitoring Program Input

A Monitoring Program will be developed in accordance with FAQ 10-0059, Rev. 1. Methods to monitor availability, reliability, and performance of fire protection program structures, systems, and components (SSCs), as well as programmatic elements will be provided. Additionally, effectiveness measures are established to review program related performance and trends. For AA14 the following systems and features are candidates for inclusion in the CNP Fire Protection Monitoring Program:

- Fire Area boundary barriers discussed in Section 3.1
- Fire Detection System (Thermal)
- Fire Suppression System (Automatic CO<sub>2</sub>)
- Electrical Raceway Fire Barrier Systems (ERFBS)

### 4.0 CONCLUSION

The nuclear safety and radioactive release performance criteria of NFPA 805 are met for a fire in Fire Area AA14. This Fire Risk Evaluation for Fire Area AA14 has demonstrated that

- The change in core damage frequency (delta CDF) is acceptable, and
- The change in large early release frequency (delta LERF) is acceptable, and
- Defense-in-depth and safety margins are maintained.

This is confirmation that a success path effectively remains free of fire damage and that the

performance-based approach is acceptable per Section 4.2.4.2 of NFPA 805.

## **5.0 REFERENCES**

- 5.1 Calculation PRA-FIRE-NB-CRE, Fire PRA Cumulative Risk Evaluations
- 5.2 CNP Fire Pre-Plans, Volumes I, II, and III, Revisions 17, 14, and 18 respectively
- 5.3 Fire Hazards Analysis
- 5.4 NFPA 805, Performance-Based Standard for Fire Protection for Light Water Reactor Electric Generating Plants
- 5.5 NFPPM, NFPA 805 Fire Protection Program Manual (NFPPM)
- 5.6 Nuclear Energy Institute (NEI) 04-02, Guidance for Implementing a Risk-Informed, Performance-Based Fire Protection Program under 10 CFR 50.48(c), Rev. 2
- 5.7 Nuclear Safety Capability Assessment Report
- 5.8 PRA-NB-FIRE-FQ, Fire PRA Model Quantification Notebook
- 5.9 PRA-NB-FIRE-FSS, Fire PRA Fire Scenario Selection
- 5.10 Regulatory Guide 1.205, Risk-Informed, Performance-Based Fire Protection for Existing Light-Water Nuclear Power Plants, Rev. Revision 1
- 5.11 Technical Evaluation R1900-005-001, Non-Power Operation Modes Transition Review

**Fire Area AA14 – Attachment 1 - Table B-3 - Fire Area Transition**

<u>Unit</u>	<u>Fire Area</u>	<u>Description</u>
1	AA14	Unit 1 CD Diesel Generator Room (El. 587 ft.)

<u>Fire Zone</u>	<u>Description</u>
15	1CD Diesel Generator Room - El. 587 ft. 0 in. - Unit 1

**Regulatory Basis**

4.2.4.2 - Performance-Based Approach - Fire Risk Evaluation with simplifying deterministic assumptions

<b>Performance Goal</b>	<b>Method of Accomplishment</b>	<b>Comments</b>
Reactivity Control	Unit 1 - Trip the reactor from the Control Room. Borate using Unit 1 West Charging Pump supplied from the RWST. Use source range monitoring for indication for Unit 1.	None
Inventory and Pressure Control	Unit 1 - Control inventory using Unit 1 West Charging Pump. Control pressure using Unit 1 Pressurizer Safety Relief Valves.	None
Decay Heat Removal	Unit 1 - Feed SGs 2 & 3 with Unit 1 TDAFW Pump. The DHR function also requires MS isolation with a steam release path through the Safety Relief Valves.	None
Process Monitoring	Unit 1 Process Monitoring - Use Unit 1 process monitoring in the Control Room for the following: Pressurizer level, RCS pressure and temperature, and S/G level and Pressure. Unit 1 Source Range Monitoring - Use Unit 1 source range monitoring in the Control Room.	None
Vital Auxiliaries	Unit 1 Electrical - Control Unit 1 Red (AB) Train Electrical Distribution with Unit 1 Red (AB) Train Offsite Power or Unit 1 Red (AB) DG. Unit 1 ESW - Operate Unit 1 West ESW. Unit 1 CCW - Operate Unit 1 West CCW. Unit 1 HVAC - Operate Unit 1 Control Room HVAC. Operate Unit 1 Auxiliary Building HVAC. Operate Unit 1 Red (AB) DG HVAC. Operate Unit 1 Red (AB) Switchgear HVAC. Operate Unit 1 TDAFW Pump Room HVAC system. Operate the Unit 1 West ESW Pump HVAC system.	VFDR indentified for electrical distribution.

**Fire Area AA14 – Attachment 1 - Table B-3 - Fire Area Transition**

<u>Unit</u>	<u>Fire Area</u>	<u>Description</u>
1	AA14	Unit 1 CD Diesel Generator Room (El. 587 ft.)

**Reference Documents**

Genesis Solution Suite, EDISON / SAFE-PB, DC Cook V 3.4.0

Nuclear Safety Capability Assessment Report

**Licensing Actions**

None

**Existing Engineering Equivalency Evaluations (EEEE)****EEEE Title Engineering Equivalency Evaluation 11-9 - Turbine, Auxiliary and Containment Buildings Boundary Evaluation**

**Summary** The purpose of this engineering equivalency evaluation is to describe in general, the approach and existence of evaluations performed to determine and reconcile fire area boundaries having components or designs with less than a 3-hr fire rating on preventing the spread of fire. This engineering equivalency evaluation also specifically evaluates the impact of unrated door assemblies on the spread of fire.

Reasonable assurance is provided that the fire area boundaries having components or design less than a 3-hr fire rating will not increase the spread of fire or impair the safe shutdown capabilities of Units 1 or 2. In addition, this engineering equivalency evaluation does not adversely impact on other engineering equivalency evaluations or exemption requests.

This evaluation supports additional evaluations credited in this fire area.

**Fire Area AA14 – Attachment 1 - Table B-3 - Fire Area Transition**

<u>Unit</u>	<u>Fire Area</u>	<u>Description</u>
1	AA14	Unit 1 CD Diesel Generator Room (El. 587 ft.)
<hr/>		
<b><u>EEEE Title</u></b>	<b>Engineering Equivalency Evaluation 11-17 - Diesel Generator Fuel Oil Day Tank Rooms Fire Zones 15 (Fire Area AA14), 16 (Fire Area AA15), 18 (Fire Area AA23) and 19 (Fire Area AA24) Boundary Evaluation</b>	
<b><u>Summary</u></b>	<p>The purpose of this engineering equivalency evaluation is to document the acceptability of the fire seals grouted to an unknown depth protecting the penetrations between the DG fuel oil day tank rooms and their respective DG rooms in Fire Zones 15 (Fire Area AA14), 16 (Fire Area AA15), 18 (Fire Area AA23) and 19 (Fire Area AA24) for their impact on preventing the spread.</p> <p>The existing fire seals grouted to an unknown depth located within the penetrations between the DG fuel oil day tank rooms and their respective DG rooms (Fire Zones 15, 16, 18 and 19) are acceptable for maintaining the rating of the fire boundary. This engineering equivalency evaluation does not impact other engineering equivalency evaluations.</p> <p>The fire seals were evaluated and found to be acceptable based on the fire hazards and fire protection systems within the areas.</p>	
<b><u>EEEE Title</u></b>	<b>Engineering Equivalency Evaluation 11-48 - Unit 1 and Unit 2 Diesel Generator AB/CD Pipe Penetration Seals - Fire Zones 11 (Fire Area AA10), 15 (Fire Area AA14), 16 (Fire Area AA15), 18 (Fire Area AA23), 19 (Fire Area AA24) and 23 (Fire Area AA29)</b>	
<b><u>Summary</u></b>	<p>The purpose of this engineering equivalency evaluation is to document the acceptability of fire-rated penetration seals W9142, W9143, W9171, W9172, W9192, W9193, W9959 and W9960. The seals are physically located in the east fire-rated walls of the DG Rooms floor elevation 587 ft., Fire Zones 15, 16, 18 and 19.</p> <p>The existing configuration for the subject fire-rated penetration is suitable to perform their design function, to provide an acceptable level of fire protection, therefore preventing fire propagation between to fire zones. As such, there is no impact on the stations ability to achieve and maintain safe shutdown.</p> <p>The fire rated penetration seals were evaluated and found to be acceptable based on the fire hazards and fire protection systems within the evaluated areas.</p>	

**Fire Area AA14 – Attachment 1 - Table B-3 - Fire Area Transition**

<u>Unit</u>	<u>Fire Area</u>	<u>Description</u>
1	AA14	Unit 1 CD Diesel Generator Room (El. 587 ft.)

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**EEEE Title**   **Engineering Equivalency Evaluation 11-50 - Embedded Conduit Fire Wrap Protection (Fire Areas AA14 and AA24)**

**Summary**   The purpose of this engineering equivalency evaluation is to document the acceptability of the fire boundary for the conduits that are embedded in a concrete pilaster and covered by an external fire wrap material in both the Unit 1 CD Diesel Generator Room (Fire Area AA14) and the Unit 2 AB Diesel Generator Room (Fire Area AA24).  
The fire wrap system over the concrete pilaster was originally installed to provide 3 hour protection for the embedded conduits for compliance with NFPA 805, Section 4.2.4.2. This engineering equivalency evaluation determined if the current barrier configuration in conjunction with the existing fire detection and fire suppression provides an adequate level of protection based upon the hazards in the area and the embedded conduit configuration for compliance with NFPA 805, Section 4.2.4.2. The engineering equivalency evaluation also determined if this engineering equivalency evaluation has any impact on other evaluations or exemptions.  
This engineering equivalency evaluation evaluated the ability of the existing concrete pilaster and external fire wrap system to provide adequate conduit protection against fire in the Unit 1 CD Diesel Generator Room and in the Unit 2 AB Diesel Generator Room.

Reasonable assurance is provided that the embedded conduits within the concrete pilaster will not impair the safe shutdown capability of CNP nor increase the potential for fire to spread to redundant safe shutdown systems. An equivalent level of protection is provided by the combination of concrete and fire wrap such that a minimum of 1-hr fire protection is reasonably achieved. This arrangement in combination with automatic detection and suppression in the area provide a degree of protection equivalent to that specified in NFPA 805 section 4.2.4.2.

The pilasters were evaluated and found to be acceptable based on the fire protection systems and construction features within the evaluated areas.

**Fire Area AA14 – Attachment 1 - Table B-3 - Fire Area Transition**

<u>Unit</u>	<u>Fire Area</u>	<u>Description</u>
1	AA14	Unit 1 CD Diesel Generator Room (El. 587 ft.)

**Fire Suppression Effects on Nuclear Safety Performance Criteria**

The CNP fire brigade is trained to discharge water in a judicious manner and instructed to direct hose streams and portable extinguishers at the base of the fire to limit the amount of overspray beyond the immediate fire zone. For this reason, fire brigade activities are not expected to fail components not already considered damaged. It has been concluded that water impingement on cables is not a concern. Electrical cabinets are provided with a seal at the conduit interface. Possible impacts to surrounding equipment due to manual fire fighting activities is bounded by the analysis approach of postulating whole room damage. The drainage features of the fire area mitigate the potential for flooding damage due to fire suppression, such that the standing water would not affect credited equipment.

In the event of discharge, any damage caused by the CO2 system to other equipment operating within the fire area which is not immediately involved in the originating fire is bounded by the analysis approach of postulating whole room damage. Since it is shown that suppression effects will not impact the nuclear safety performance criteria, the fire area configuration is deemed acceptable.

## References:

Technical Evaluation 12.1, "Fire Suppression Effects Study"

Technical Evaluation 12.1, "Supplemental Information to Fire Suppression Effects Study – Supplement 1"

**Fire Area Comments**

None



## Fire Area AA14 – Attachment 2 - Fire Risk Evaluation Results Summary

### A2.1 Introduction

The ‘changes’ associated with NFPA 805 transition were those variances from the deterministic requirements of NFPA 805. The changes identified for evaluation for fire area AA14 are grouped as follows:

- Separation Issues

This attachment is a summary of the Fire Risk Evaluation for the fire area. The complete results and methodology are contained in the Cumulative Fire Risk Evaluation, PRA-FIRE-NB-CRE. (FPCE 2017-0009)

### A2.2 Inputs/Assumptions

1. Assumptions from the Fire PRA apply to this calculation.
2. Detailed fire modeling was not performed for Fire Area AA14. A single whole room burnout scenario was assumed.

### A2.3 Fire Modeling Methodology

Detailed fire modeling was not performed for Fire Area AA14. This area was modeled considering whole room burnout.

### A2.4 Scenario Descriptions and Model Results

A single whole room burnout scenario was modeled for Fire Area AA14. All targets within the fire area were assumed damaged.

#### A2.4.1 Ignition Sources

The fixed ignition sources in Fire Area AA14 consist of the diesel generator, motor control centers and the jacket water circulation pumps. Additional detail regarding the ignition sources in this area is available in the Fire PRA Report. All fire scenarios, whether resulting from fixed or transient ignition sources, are assumed to damage all targets in the fire area.

#### A2.4.2 Scenario Results

The PRA analyzed the VFDRs and determined them to be risk insignificant, therefore, a quantitative delta risk calculation was not performed.

### A2.5 Fire Risk Evaluation Results

PRA-FIRE-NB-CRE documents scenarios and corresponding impacted VFDRs that were evaluated for delta risk during the transition to NFPA 805 and also all changes to the Fire Protection Program that are currently incorporated into the Fire PRA model. The acceptability of the Cumulative Fire Risk Evaluations was based on calculated delta risk meeting the thresholds of NEI 04-02, RG 1.205 and RG 1.174. (FPCE 2017-0009)

## Fire Area AA14 – Attachment 2 - Fire Risk Evaluation Results Summary

### A-2.6 Impact of VFDR on Defense-in-Depth

Defense-in-Depth has been evaluated for this fire area. The impacts of this evaluation are summarized in the table below:

Defense-in-Depth Impact Review for AA14			
Method of Providing DID	Required to Support Deterministic Analysis or Fire PRA?	Changes or Improvements Necessary for DID?	Basis/Justification
Echelon 1: Prevent fires from starting			
Combustible Control is implemented in accordance with Procedure PMP-2270-CCM-001, Control of Combustible Materials.	Yes	No	• This element is adequate based on no perceived weakness of, or over-reliance on, another echelon of defense-in-depth.
Hot Work Control is implemented in accordance with Procedure PMP-2270-WBG-001, Welding, Burning and Grinding Activities.	Yes	No	
Echelon 2: Rapidly detect, control and extinguish promptly those fires that do occur thereby limiting fire damage			
Fire Detection System	Yes	No	• Suppression and detection are required because fire fighting activities may be challenging. No changes or improvements to Echelon 2 attributes are necessary to maintain defense-in-depth.
Fixed Fire Suppression	Yes	No	
Portable Fire Extinguishers	Yes	No	
Hose stations and hydrants	Yes	No	
Pre-Fire Plan	Yes	No	
Echelon 3: Provide adequate level of fire protection for systems and structures so that a fire will not prevent essential safety functions from being performed			
Walls, floors ceilings and structural elements are rated or have been evaluated as adequate for the hazard.	Yes	No	• Although VFDR AA14-001 is not considered a significant contribution to core damage frequency, the variance is considered important enough to the NSCA to retain as a recovery action to ensure that defense-in-depth is maintained.
Penetrations in the fire area barrier are rated or have been evaluated as adequate for the hazard.	Yes	No	
Supplemental barriers (e.g., ERFBS, cable tray covers, etc.)	Yes	No	
Guidance provided to operations personnel detailing the required success path(s) including recovery actions to achieve nuclear safety performance criteria.	No	Yes	

## Fire Area AA14 – Attachment 2 - Fire Risk Evaluation Results Summary

### A-2.7 Safety Margin Considerations

In accordance with NEI 04-02, the maintenance of adequate Safety Margin is assessed by the consideration categories of analyses utilized by this Fire Risk Evaluation.

Safety margins are considered to be maintained if:

- Codes and Standards or their alternatives accepted for use by the NRC are met.

AND

- Safety analyses acceptance criteria in the licensing basis (e.g., FSAR, supporting analyses) are met, or provides sufficient margin to account for analysis and data uncertainty.

The following summarizes the bases for ensuring the maintenance of safety margins:

- The risk-informed, performance based processes utilized are based upon NFPA 805, 2001 edition, endorsed by the NRC in 10 CFR 50.48(c).
- The Fire Risk Evaluation process is in accordance with NEI 04-02, Revision 2, which is endorsed by the NRC in Regulatory Guide 1.205, Revision 1.
- The Fire PRA is developed in accordance with NUREG/CR-6850, which was developed jointly between the NRC and EPRI.
- The Fire PRA has undergone an industry peer review, in order to ensure the Fire PRA meets the appropriate quality standards of ASME/ANS RA-Sa-2009, "Standard for Level 1/Large Early Release Frequency Probabilistic Risk Assessment for Nuclear Power Plant Applications," Dated February 2, 2009
- The "bounding risk assessment" is used during transition (NEI 04-02, Section 5.3.4.2). This approach conservatively assumes that target set damage occurs for postulated fire events which resulted in whole room burn up, and therefore, MEFS/LFS is not analyzed separately from the Fire PRA results.
- The CNP internal events PRA model received two formal industry peer reviews conducted in accordance with applicable NEI guidelines. The initial peer review was performed in 2001, while a subsequent focused scope (i.e., limited scope) peer review was conducted in 2009. The initial, full-scope WOG peer review covered all aspects of the CNP PRA model and the administrative processes used to maintain and update the model. The CNP PRA model has been revised to address all significant issues (i.e., Category A and B Facts & Observations) identified during the initial peer review. None of the findings from the focused-scope peer review were judged to reach the significance level of a Category A or B Fact & Observation; as a result, no changes to the PRA model have yet been made to include resolutions for these latter issues.
- Fire protection systems and features determined to be required by NFPA 805 Chapter 4 have been confirmed to meet the requirements of NFPA 805 Chapter 3 and their associated referenced codes and listings, or provided with acceptable alternatives using processes accepted for use by the NRC (i.e., FAQ 06-0008, FAQ 06-0004, 07-0033).
- Fire modeling has not been performed in support of the change evaluations and results are therefore, based on whole area burn up. As such, the results are considered very conservative.
- In accordance with the requirements of 10 CFR 50.48(c)(2)(iii), the Fire PRA results, including cutsets for

## **Fire Area AA14 – Attachment 2 - Fire Risk Evaluation Results Summary**

the scenarios of concern, have been reviewed and it was verified that the results presented above do not rely solely on feed and bleed as the fire-protected safe shutdown path for maintaining reactor coolant inventory, pressure control, and decay heat removal capability for this fire area.

### **A-2.8 Transition Risk Evaluation Conclusions**

The transition change evaluation determined that these changes:

- Are acceptable based upon the measured change in CDF and LERF
- Maintained adequate defense-in-depth and safety margins

The results of this evaluation meet the requirements of NFPA 805 Risk Evaluation; therefore, the use of the performance based analysis approach is acceptable.

D. C. Cook Nuclear Plant  
Fire Safety Analysis

Fire Area: AA15

Unit 1 AB Diesel Generator Room (El. 587 ft.)

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Purpose ..... Section 1.0

Analysis Methodology ..... Section 2.0

Analysis ..... Section 3.0

Conclusion ..... Section 4.0

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Attachments

    Fire Area AA15 – Attachment 1 - Table B-3 - Fire Area Transition

    Fire Area AA15 – Attachment 2 - Fire Risk Evaluation Results Summary

## **1.0 PURPOSE**

This report documents the Fire Safety Analysis (FSA) for Cook Nuclear Plant (CNP) Fire Area AA15, Unit 1 AB Diesel Generator Room (El. 587 ft.) which comprises fire zone(s) 16. The purpose of this analysis is to demonstrate the achievement of the nuclear safety and radioactive release performance criteria of NFPA 805 as required by 10 CFR 50.48(c). The Fire Safety Analysis is a key part of compliance with Section 2.7.1.2 Fire Protection Program Design Basis Document of NFPA 805. This analysis also documents results of risk-informed, performance-based Fire Risk Evaluations (FREs). These evaluations are associated with Variances from Deterministic Requirements (VFDRs) of NFPA 805 Chapter 4.

## **2.0 ANALYSIS METHODOLOGY**

The FSA is the design basis document as described in NFPA 805 Section 2.7.1.2. The following steps are performed to develop the FSA on a fire area basis:

- Identify significant fire hazards in the fire area. This is based on NFPA 805 approach to analyze the plant from an ignition source and fuel package perspective.
- Summarize Nuclear Safety Capability Analysis (NSCA) compliance strategies. This is the result of the NEI 04-02 B-3 Table review of the Safe Shutdown Analysis.
- Summarize Non-Power Operations Modes compliance strategies.
- Summarize Radioactive Release compliance strategies. The transition review process required per NEI 04-02 is used to develop these results.
- Provide Fire Probabilistic Risk Assessment summary of results. This is based on the results from the plant Fire PRA.
- Perform risk informed, performance based evaluations if needed for the performance based approach.
- Summarize Defense-in-Depth strategy for each fire area.
- Determine key analysis assumptions which are candidates to be included in the NFPA 805 monitoring program.
- Provide conclusions relative to NFPA 805 compliance.

## 3.0 ANALYSIS

### 3.1 Classical Fire Protection

#### 3.1.1 Construction

Walls, floors and ceilings to adjacent fire areas are reinforced concrete in excess of a 3-hour rating with two exceptions. These exceptions are the 3-hour rated 8-inch concrete block used to reduce the wall opening size for the exchange of a pair of doors to a single leaf door and the 4-hour rated 8-inch concrete block and that has been covered on each side by a 3/8" structural steel plate (EC-0000054448/FPPR-2015-0027) used in the west wall for equipment removal.

The fuel oil day tank room is constructed of 4-hour rated 8-inch concrete block to the underside of the ceiling slab with a cantilevered concrete floor located approximately 10'-8" above the Diesel Generator Room floor.

Applicable Engineering Equivalency Evaluations are documented in Attachment 1.

#### 3.1.2 Doors and Access Openings

Fire doors having a 3-hour rating are provided to adjacent Fire Area AA2 - Fire Zones 79 and 114 and to the fuel oil day tank room located within this fire zone.

#### 3.1.3 Penetrations

Penetrations in fire barriers between this fire zone and adjacent fire areas are provided with fire seals. Additionally, the day tank room within this fire zone is provided with fire seals and dampers.

In order to support NFPA 805 Chapter 3 requirements, a fire area boundary evaluation was performed for the grouted fire seals installed in penetrations separating the diesel generator diesel fuel oil tank rooms and their respective diesel generators (Engineering Equivalency Evaluation 11-17).

A fire area engineering equivalency evaluation was prepared to evaluate a fire seal design between Fire Zones 16 and 80 (Engineering Equivalency Evaluation 11-29).

The seismic gaps are sealed with a glass fiber reinforced silicone sheeting.

### 3.1.4 Detection

The table below outlines the fire detection system(s) provided in the Fire Area:

Table 3-1, Fire Area AA15 Detection Systems								
Fire Zone	Type of System	Local (L) / Remote (R)	Detection Actuates Suppression?	Required System?				
				S	L	E	R	D
16	Thermal	L/R	Y	N	N	Y	Y	N
Table 3-1 Legend:								
Table Field: "Required System?"								
S	- Required for Chapter 4 Separation Criteria							
L	- Required for NRC Approved Licensing Action							
E	- Required for Engineering Equivalency Evaluation							
R	- Required for Risk Significance							
D	- Required to maintain adequate balance of Defense-in-Depth in a Change Evaluation or Fire Risk Evaluation							

For Fire Zone 16, cross-zoned line type thermistor heat detectors (2) are provided at the ceiling. Each detection circuit utilizes a different alarm set point to assure that the CO2 will not be actuated until both set points are satisfied. This has been done to minimize spurious operations of the CO2.

### 3.1.5 Fixed Suppression

The table below outlines the fixed fire suppression system(s) provided in the Fire Area:

Table 3-2, Fire Area AA15 Suppression Systems							
Fire Zone	Type of System	Full (F) / Partial (P)	Required System?				
			S	L	E	R	D
16	Automatic CO2	F	N	N	Y	Y	N
Table 3-2 Legend:							
Table Field: "Required System?"							
S	- Required for Chapter 4 Separation Criteria						
L	- Required for NRC Approved Licensing Action						
E	- Required for Engineering Equivalency Evaluation						
R	- Required for Risk Significance						
D	- Required to maintain adequate balance of Defense-in-Depth in a Change Evaluation or Fire Risk Evaluation						

A low pressure CO2 total flooding system supplied from 17 ton tank is provided. This system is actuated by operation of both of the above detection circuits. Operation of the CO2 system alarms in the Unit 1 Control Room.

### 3.1.6 Manual Suppression / Response Strategy

A postulated fire will be identified by automatic detection using the thermistor heat detectors described in Section 3.1.2 or by plant personnel using plant communication system to notify the



control room. The automatic detection system alarms in the control room. The Control Room operator will dispatch the fire brigade for initiation of manual fire fighting. A fire in this fire area will be contained by the construction features discussed in Section 3.1.1. Manual suppression is provided by the CNP Fire Brigade.

Fire extinguishers are provided in this fire area.

A water hose reel is located in adjacent Fire Area AA2 - Fire Zone 79.

Fire Area AA15 is equipped with floor drains.

### 3.1.7 Ventilation

A fire in this area will be contained by the fire barriers. Smoke can be removed by portable fans and flexible ducting to the Turbine Building and outdoors. The normal building ventilating systems in the Turbine Building will then exhaust the smoke. This fire area is listed as a non-controlled area in the Fire Pre Plans and therefore there is reasonable assurance that products of combustion will not be contaminated.

Ventilation openings to other fire areas are provided with 3-hour fire dampers.

### 3.1.8 Other Features

No other fire protection features provided for Fire Area AA15.

## 3.2 Fire Hazards Identification

The fire area contains both ignition sources and combustible fire hazards. The ignition sources consist of the diesel generator, motor control centers, jacket water circulation pumps and the starting air compressors. Combustibles consist primarily of lube oil, diesel fuel oil and exposed electrical cables.

This Fire Area is below grade and any exterior wall penetrations need not be rated based on the protection provided by the ground covering the exterior walls.

The current fire loading classification is considered moderate.

## 3.3 NSCA Compliance Summary

Fire Area AA15 contains the Unit 1 Red Train Emergency Diesel Generator as well as associated Red Train EDG support components, 600V MCCs, and 120V power supplies. This fire area also contains both Red and Green train raceways and cables.

Compliance with the nuclear safety performance criteria is achieved using the performance-based approach in accordance with NFPA 805, Section 4.2.4.2.

Safe and stable condition for Unit 1 will be accomplished using Stean Generator 2 and 3 via the Unit 1 East Motor Driven Auxiliary Feedwater Pump, Unit 1 Charging via the East Pump, Process Monitoring/Indication from the Main Control Room, Unit 1 Component Cooling Water via the East Pump and Essential Service Water via the East Pump. Power is credited via the Green Train from offsite, with Green Train EDG also available.

The Nuclear Safety Performance Criteria compliance strategy for AA15 is documented within the NSCA Report.

### 3.3.1 Variances

The variances identified for evaluation for this fire area are grouped as follows:

#### 3.3.1.1 VFDR No. AA15-001

1-ILS-950 and 1-ILS-951 - RWST level indication is required to be operable to support CVCS. RWST level indication will be available from the Control Room until battery 1-BATT-AB is depleted. Backup power can be provided to the battery charger with a manual action to transfer to backup power for 600V Bus 1-11A-NORM. Restoring 1-11A-NORM will also eliminate a spurious SI signal. If power is not restored local monitoring of the RWST level is required. 1-ILS-950 may fail due to fire induced damage of 120V Instrument Panel 1-CRID-III. 1-ILS-951 may fail due to fire induced damage of 120V Instrument Panel 1-CRID-IV. This condition represents a variance from the deterministic requirements of NFPA 805, Section 4.2.3. This is a separation issue.

This VFDR has been evaluated and it was determined that the risk, safety margin and defense-in-depth meet the acceptance criteria of NFPA 805 Section 4.2.4 with no further action required.

### 3.3.2 Recovery Actions Credited

For each VFDR, a Fire Risk Evaluation has been performed to assess the acceptability of risk, defense-in-depth, and safety margin. This evaluation determined whether or not recovery actions are required to ensure that one success path necessary to achieve and maintain the nuclear safety performance criteria is maintained free of fire damage by a single fire. Table 3-3 identifies the credited recovery actions for this area. Actions retained for DID are identified as “DID Actions” within Table 3-3. Additional information for DID actions is contained within Section 3.8 of this report. Note that, for completeness, all VFDRs are contained within Table 3-3, even if the Fire Risk Evaluation has determined that a recovery action is not required. In those instances where a recovery action has been determined to not be required, the word “None” is provided in the “Action” column in the table.

Table 3-3, Recovery Actions Credited		
VFDR	Component	Action
AA15-001	1-ILS-950	None
	1-ILS-951	

### 3.4 Non-Power Operational Modes Compliance Summary

A review of CNP for the potential effects of a fire in this Fire Area while in non-power modes of operation (NPO) was conducted. This review was conducted using the guidance provided in NEI 04-02 and FAQ 07-0040, “Non-Power Operations Clarifications”.

The review determined that there are potential failures that affect certain Key Safety Functions (KSF) as a result of the fire in this area, and the fire could result in the loss of one or more KSF paths. Compensatory measures are required during high risk evolution periods to provide reasonable assurance a fire will not adversely affect key safety functions and the NFPA 805 performance goal for NPO is therefore satisfied. The results of the NPO analysis are contained within Technical

Evaluation R1900-005-001, Non-Power Operation Modes Transition Review Report.

### 3.5 Radioactive Release Compliance Summary

The NFPA 805 radiological release goal is to provide reasonable assurance that a fire will not result in a radiological release that adversely affects the public, plant personnel or the environment. The NFPA 805 requirement is to ensure a radiation release to any unrestricted area due to the direct effects of fire suppression activities (but not involving fuel damage) shall be as low as reasonably achievable and shall not exceed applicable plant Technical Specification limits.

AA15 is located outside the Radiological Controlled Area (RCA) and is not a storage location for contaminated materials, therefore there is reasonable assurance a fire in this area will not result in radiation release. The review of this fire area, with respect to radioactive release, is documented in the NFPPM.

### 3.6 Probabilistic Risk Assessment-Summary of Results

A Fire PRA (FPRA) quantification of Fire Area AA15 was performed and is documented in PRA-NB-FIRE-FQ, Fire PRA Model Quantification Notebook. The fire risk quantification for Fire Area AA15 is analyzed assuming whole room burnup. PRA-NB-FIRE-FQ includes a summary of all potentially risk-significant fire scenarios (i.e., CDF > 1.0E-7 or LERF > 1.0E-8). Bounding CDF / LERF per calendar year values are reported that are based on the risk values documented in PRA-NB-FIRE-FSS, Fire PRA Fire Scenario Selection.

### 3.7 Risk-Informed, Performance-Based Evaluations

Fire Risk Evaluations (FREs) have been performed to ensure that variances from the NFPA 805 deterministic requirements are acceptable. The evaluation process consists of an integrated assessment of the acceptability of risk, defense-in-depth, and safety margins.

#### 3.7.1 Transition Risk-Informed, Performance-Based Evaluations

The 'changes' associated with NFPA 805 transition were those variances from the deterministic requirements of NFPA 805 or with the existing fire protection licensing basis that were brought into compliance with the NFPA 805 performance based approach. The change identified for evaluation for Fire Area AA15 is as follows:

- Separation Issues

The Fire Risk Evaluation has determined that the change is acceptable based upon:

- The measured change in CDF and LERF.
- Adequate defense-in-depth and safety margins being maintained.

Refer to Attachment 2 for a summary of results associated with the Fire Risk Evaluations.

### 3.8 Defense-in-Depth

A comprehensive risk-informed, performance-based analysis includes consideration of defense-in-depth (DID) as part of an integrated evaluation of risk considerations. In general, defense-in-depth involves consideration of the extent to which fire protection systems and features are provided within the three echelons of fire-protection:

- Preventing fires from starting,
- Rapidly detecting fires and controlling and extinguishing promptly those fires that do occur, thereby limiting fire damage,
- Providing an adequate level of fire protection for structures, systems, and components important to safety, so that a fire that is not promptly extinguished will not prevent the nuclear safety performance criteria from being met.

Each VFDR was evaluated for DID. No recovery actions have been retained for DID.

Based on the assessment in support of the Fire Risk Evaluation, defense-in-depth is maintained for fire area AA15. Refer to Attachment 2 for details associated with the Fire Risk Evaluation.

### 3.9 Monitoring Program Input

A Monitoring Program will be developed in accordance with FAQ 10-0059, Rev. 1. Methods to monitor availability, reliability, and performance of fire protection program structures, systems, and components (SSCs), as well as programmatic elements will be provided. Additionally, effectiveness measures are established to review program related performance and trends. For AA15 the following systems and features are candidates for inclusion in the CNP Fire Protection Monitoring Program:

- Fire Area boundary barriers discussed in Section 3.1
- Fire Detection System (Thermal)
- Fire Suppression System (Automatic CO2)

### 4.0 CONCLUSION

The nuclear safety and radioactive release performance criteria of NFPA 805 are met for a fire in Fire Area AA15. This Fire Risk Evaluation for Fire Area AA15 has demonstrated that

- The change in core damage frequency (delta CDF) is acceptable, and
- The change in large early release frequency (delta LERF) is acceptable, and
- Defense-in-depth and safety margins are maintained.

This is confirmation that a success path effectively remains free of fire damage and that the performance-based approach is acceptable per Section 4.2.4.2 of NFPA 805.

## **5.0 REFERENCES**

- 5.1 Calculation PRA-FIRE-NB-CRE, Fire PRA Cumulative Risk Evaluations
- 5.2 CNP Fire Pre-Plans, Volumes I, II, and III, Revisions 17, 14, and 18 respectively
- 5.3 Fire Hazards Analysis
- 5.4 NFPA 805, Performance-Based Standard for Fire Protection for Light Water Reactor Electric Generating Plants
- 5.5 NFPPM, NFPA 805 Fire Protection Program Manual (NFPPM)
- 5.6 Nuclear Energy Institute (NEI) 04-02, Guidance for Implementing a Risk-Informed, Performance-Based Fire Protection Program under 10 CFR 50.48(c), Rev. 2
- 5.7 Nuclear Safety Capability Assessment Report
- 5.8 PRA-NB-FIRE-FQ, Fire PRA Model Quantification Notebook
- 5.9 PRA-NB-FIRE-FSS, Fire PRA Fire Scenario Selection
- 5.10 Regulatory Guide 1.205, Risk-Informed, Performance-Based Fire Protection for Existing Light-Water Nuclear Power Plants, Rev. Revision 1
- 5.11 Technical Evaluation R1900-005-001, Non-Power Operation Modes Transition Review

**Fire Area AA15 – Attachment 1 - Table B-3 - Fire Area Transition**

<u>Unit</u>	<u>Fire Area</u>	<u>Description</u>
1	AA15	Unit 1 AB Diesel Generator Room (El. 587 ft.)

<u>Fire Zone</u>	<u>Description</u>
16	1AB Diesel Generator Room - El. 587 ft. 0 in. - Unit 1

**Regulatory Basis**

4.2.4.2 - Performance-Based Approach - Fire Risk Evaluation with simplifying deterministic assumptions

<b>Performance Goal</b>	<b>Method of Accomplishment</b>	<b>Comments</b>
Reactivity Control	Unit 1 - Trip the reactor from the Control Room. Borate using Unit 1 East Charging Pump supplied from the RWST. Use source range monitoring for indication for Unit 1.	None
Inventory and Pressure Control	Unit 1 - Control inventory using Unit 1 East Charging Pump. Control pressure using Unit 1 Pressurizer Safety Relief Valves.	VFDR identified for RWST level indication.
Decay Heat Removal	Unit 1 - Feed SGs 2 & 3 with Unit 1 East MDAFW Pump. The DHR function also requires MS isolation with a steam release path through the Safety Relief Valves.	None
Process Monitoring	Unit 1 Process Monitoring - Use Unit 1 process monitoring in the Control Room for the following: Pressurizer level, RCS pressure and temperature, and S/G level and Pressure. Unit 1 Source Range Monitoring - Use Unit 1 source range monitoring in the Control Room.	None
Vital Auxiliaries	Unit 1 Electrical - Control Unit 1 Green (CD) Train Electrical Distribution with Unit 1 Green (CD) Train Offsite Power or Unit 1 Green (CD) DG. Unit 1 ESW - Operate Unit 1 East ESW. Unit 1 CCW - Operate Unit 1 East CCW. Unit 1 HVAC - Operate Unit 1 Control Room HVAC. Operate Unit 1 Auxiliary Building HVAC. Operate Unit 1 Green (CD) DG HVAC. Operate Unit 1 Green (CD) Switchgear HVAC. Operate Unit 1 East MDAFW Pump Room HVAC system. Operate the Unit 1 ESW Pump HVAC system.	None

**Fire Area AA15 – Attachment 1 - Table B-3 - Fire Area Transition**

<u>Unit</u>	<u>Fire Area</u>	<u>Description</u>
1	AA15	Unit 1 AB Diesel Generator Room (El. 587 ft.)

**Reference Documents**

Genesis Solution Suite, EDISON / SAFE-PB, DC Cook V 3.4.0

Nuclear Safety Capability Assessment Report

**Licensing Actions**

None

**Existing Engineering Equivalency Evaluations (EEEE)****EEEE Title Engineering Equivalency Evaluation 11-9 - Turbine, Auxiliary and Containment Buildings Boundary Evaluation**

**Summary** The purpose of this engineering equivalency evaluation is to describe in general, the approach and existence of evaluations performed to determine and reconcile fire area boundaries having components or designs with less than a 3-hr fire rating on preventing the spread of fire. This engineering equivalency evaluation also specifically evaluates the impact of unrated door assemblies on the spread of fire.

Reasonable assurance is provided that the fire area boundaries having components or design less than a 3-hr fire rating will not increase the spread of fire or impair the safe shutdown capabilities of Units 1 or 2. In addition, this engineering equivalency evaluation does not adversely impact on other engineering equivalency evaluations or exemption requests.

This evaluation supports additional evaluations credited in this fire area.

**Fire Area AA15 – Attachment 1 - Table B-3 - Fire Area Transition**

<u>Unit</u>	<u>Fire Area</u>	<u>Description</u>
1	AA15	Unit 1 AB Diesel Generator Room (El. 587 ft.)
<hr/>		
<b><u>EEEE Title</u></b>	<b>Engineering Equivalency Evaluation 11-17 - Diesel Generator Fuel Oil Day Tank Rooms Fire Zones 15 (Fire Area AA14), 16 (Fire Area AA15), 18 (Fire Area AA23) and 19 (Fire Area AA24) Boundary Evaluation</b>	
<b><u>Summary</u></b>	<p>The purpose of this engineering equivalency evaluation is to document the acceptability of the fire seals grouted to an unknown depth protecting the penetrations between the DG fuel oil day tank rooms and their respective DG rooms in Fire Zones 15 (Fire Area AA14), 16 (Fire Area AA15), 18 (Fire Area AA23) and 19 (Fire Area AA24) for their impact on preventing the spread.</p> <p>The existing fire seals grouted to an unknown depth located within the penetrations between the DG fuel oil day tank rooms and their respective DG rooms (Fire Zones 15, 16, 18 and 19) are acceptable for maintaining the rating of the fire boundary. This engineering equivalency evaluation does not impact other engineering equivalency evaluations.</p> <p>The fire seals were evaluated and found to be acceptable based on the fire hazards and fire protection systems within the areas.</p>	
<b><u>EEEE Title</u></b>	<b>Engineering Equivalency Evaluation 11-48 - Unit 1 and Unit 2 Diesel Generator AB/CD Pipe Penetration Seals - Fire Zones 11 (Fire Area AA10), 15 (Fire Area AA14), 16 (Fire Area AA15), 18 (Fire Area AA23), 19 (Fire Area AA24) and 23 (Fire Area AA29)</b>	
<b><u>Summary</u></b>	<p>The purpose of this engineering equivalency evaluation is to document the acceptability of fire-rated penetration seals W9142, W9143, W9171, W9172, W9192, W9193, W9959 and W9960. The seals are physically located in the east fire-rated walls of the DG Rooms floor elevation 587 ft., Fire Zones 15, 16, 18 and 19.</p> <p>The existing configuration for the subject fire-rated penetration is suitable to perform their design function, to provide an acceptable level of fire protection, therefore preventing fire propagation between to fire zones. As such, there is no impact on the stations ability to achieve and maintain safe shutdown.</p> <p>The fire rated penetration seals were evaluated and found to be acceptable based on the fire hazards and fire protection systems within the evaluated areas.</p>	



**Fire Area AA15 – Attachment 1 - Table B-3 - Fire Area Transition**

<u>Unit</u>	<u>Fire Area</u>	<u>Description</u>
1	AA15	Unit 1 AB Diesel Generator Room (El. 587 ft.)

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**Fire Suppression Effects on Nuclear Safety Performance Criteria**

The CNP fire brigade is trained to discharge water in a judicious manner and instructed to direct hose streams and portable extinguishers at the base of the fire to limit the amount of overspray beyond the immediate fire zone. For this reason, fire brigade activities are not expected to fail components not already considered damaged. It has been concluded that water impingement on cables is not a concern. Electrical cabinets are provided with a seal at the conduit interface. Possible impacts to surrounding equipment due to manual fire fighting activities is bounded by the analysis approach of postulating whole room damage. The drainage features of the fire area mitigate the potential for flooding damage due to fire suppression, such that the standing water would not affect credited equipment.

In the event of discharge, any damage caused by the CO2 system to other equipment operating within the fire area which is not immediately involved in the originating fire is bounded by the analysis approach of postulating whole room damage. Since it is shown that suppression effects will not impact the nuclear safety performance criteria, the fire area configuration is deemed acceptable.

## References:

Technical Evaluation 12.1, "Fire Suppression Effects Study"

Technical Evaluation 12.1, "Supplemental Information to Fire Suppression Effects Study – Supplement 1"

**Fire Area Comments**

None

## Fire Area AA15 – Attachment 2 - Fire Risk Evaluation Results Summary

### A2.1 Introduction

The ‘changes’ associated with NFPA 805 transition were those variances from the deterministic requirements of NFPA 805. The changes identified for evaluation for fire area AA15 are grouped as follows:

- Separation Issues

This attachment is a summary of the Fire Risk Evaluation for the fire area. The complete results and methodology are contained in the Cumulative Fire Risk Evaluation, PRA-FIRE-NB-CRE. (FPCE 2017-0009)

### A2.2 Inputs/Assumptions

1. Assumptions from the Fire PRA apply to this calculation.
2. Detailed fire modeling was not performed for Fire Area AA15. A single whole room burnout scenario was assumed.

### A2.3 Fire Modeling Methodology

Detailed fire modeling was not performed for Fire Area AA15. This area was modeled considering whole room burnout.

### A2.4 Scenario Descriptions and Model Results

A single whole room burnout scenario was modeled for Fire Area AA15. All targets within the fire area were assumed damaged.

#### A2.4.1 Ignition Sources

The fixed ignition sources in Fire Area AA15 consist of the diesel generator, motor control centers and the jacket water circulation pumps. Additional detail regarding the ignition sources in this area is available in the Fire PRA Report. All fire scenarios, whether resulting from fixed or transient ignition sources, are assumed to damage all targets in the fire area.

#### A2.4.2 Scenario Results

The PRA analyzed the VFDRs and determined them to be risk insignificant, therefore, a quantitative delta risk calculation was not performed.

### A2.5 Fire Risk Evaluation Results

PRA-FIRE-NB-CRE documents scenarios and corresponding impacted VFDRs that were evaluated for delta risk during the transition to NFPA 805 and also all changes to the Fire Protection Program that are currently incorporated into the Fire PRA model. The acceptability of the Cumulative Fire Risk Evaluations was based on calculated delta risk meeting the thresholds of NEI 04-02, RG 1.205 and RG 1.174. (FPCE 2017-0009)

## Fire Area AA15 – Attachment 2 - Fire Risk Evaluation Results Summary

### A-2.6 Impact of VFDR on Defense-in-Depth

Defense-in-Depth has been evaluated for this fire area. The impacts of this evaluation are summarized in the table below:

Defense-in-Depth Impact Review for AA15			
Method of Providing DID	Required to Support Deterministic Analysis or Fire PRA?	Changes or Improvements Necessary for DID?	Basis/Justification
Echelon 1: Prevent fires from starting			
Combustible Control is implemented in accordance with Procedure PMP-2270-CCM-001, Control of Combustible Materials.	Yes	No	• This element is adequate based on no perceived weakness of, or over-reliance on, another echelon of defense-in-depth.
Hot Work Control is implemented in accordance with Procedure PMP-2270-WBG-001, Welding, Burning and Grinding Activities.	Yes	No	
Echelon 2: Rapidly detect, control and extinguish promptly those fires that do occur thereby limiting fire damage			
Fire Detection System	Yes	No	• Suppression and detection are required because fire fighting activities may be challenging. No changes or improvements to Echelon 2 attributes are necessary to maintain defense-in-depth.
Fixed Fire Suppression	Yes	No	
Portable Fire Extinguishers	Yes	No	
Hose stations and hydrants	Yes	No	
Pre-Fire Plan	Yes	No	
Echelon 3: Provide adequate level of fire protection for systems and structures so that a fire will not prevent essential safety functions from being performed			
Walls, floors ceilings and structural elements are rated or have been evaluated as adequate for the hazard.	Yes	No	• Although VFDR AA15-001 is affected in a potentially high risk scenario, based on a detailed review, the VFDR is not the cause for the high risk of the scenario, therefore implementing additional DID Echelon 3 attributes for this VFDR would provide negligible risk improvement.
Penetrations in the fire area barrier are rated or have been evaluated as adequate for the hazard.	Yes	No	
Supplemental barriers (e.g., ERFBS, cable tray covers, etc.)	No	No	
Guidance provided to operations personnel detailing the required success path(s) including recovery actions to achieve nuclear safety performance criteria.	No	No	

## Fire Area AA15 – Attachment 2 - Fire Risk Evaluation Results Summary

### A-2.7 Safety Margin Considerations

In accordance with NEI 04-02, the maintenance of adequate Safety Margin is assessed by the consideration categories of analyses utilized by this Fire Risk Evaluation.

Safety margins are considered to be maintained if:

- Codes and Standards or their alternatives accepted for use by the NRC are met.

AND

- Safety analyses acceptance criteria in the licensing basis (e.g., FSAR, supporting analyses) are met, or provides sufficient margin to account for analysis and data uncertainty.

The following summarizes the bases for ensuring the maintenance of safety margins:

- The risk-informed, performance based processes utilized are based upon NFPA 805, 2001 edition, endorsed by the NRC in 10 CFR 50.48(c).
- The Fire Risk Evaluation process is in accordance with NEI 04-02, Revision 2, which is endorsed by the NRC in Regulatory Guide 1.205, Revision 1.
- The Fire PRA is developed in accordance with NUREG/CR-6850, which was developed jointly between the NRC and EPRI.
- The Fire PRA has undergone an industry peer review, in order to ensure the Fire PRA meets the appropriate quality standards of ASME/ANS RA-Sa-2009, "Standard for Level 1/Large Early Release Frequency Probabilistic Risk Assessment for Nuclear Power Plant Applications," Dated February 2, 2009
- The "bounding risk assessment" is used during transition (NEI 04-02, Section 5.3.4.2). This approach conservatively assumes that target set damage occurs for postulated fire events which resulted in whole room burn up, and therefore, MEFS/LFS is not analyzed separately from the Fire PRA results.
- The CNP internal events PRA model received two formal industry peer reviews conducted in accordance with applicable NEI guidelines. The initial peer review was performed in 2001, while a subsequent focused scope (i.e., limited scope) peer review was conducted in 2009. The initial, full-scope WOG peer review covered all aspects of the CNP PRA model and the administrative processes used to maintain and update the model. The CNP PRA model has been revised to address all significant issues (i.e., Category A and B Facts & Observations) identified during the initial peer review. None of the findings from the focused-scope peer review were judged to reach the significance level of a Category A or B Fact & Observation; as a result, no changes to the PRA model have yet been made to include resolutions for these latter issues.
- Fire protection systems and features determined to be required by NFPA 805 Chapter 4 have been confirmed to meet the requirements of NFPA 805 Chapter 3 and their associated referenced codes and listings, or provided with acceptable alternatives using processes accepted for use by the NRC (i.e., FAQ 06-0008, FAQ 06-0004, 07-0033).
- Fire modeling has not been performed in support of the change evaluations and results are therefore, based on whole area burn up. As such, the results are considered very conservative.
- In accordance with the requirements of 10 CFR 50.48(c)(2)(iii), the Fire PRA results, including cutsets for

## **Fire Area AA15 – Attachment 2 - Fire Risk Evaluation Results Summary**

the scenarios of concern, have been reviewed and it was verified that the results presented above do not rely solely on feed and bleed as the fire-protected safe shutdown path for maintaining reactor coolant inventory, pressure control, and decay heat removal capability for this fire area.

### **A-2.8 Transition Risk Evaluation Conclusions**

The transition change evaluation determined that these changes:

- Are acceptable based upon the measured change in CDF and LERF
- Maintained adequate defense-in-depth and safety margins

The results of this evaluation meet the requirements of NFPA 805 Risk Evaluation; therefore, the use of the performance based analysis approach is acceptable.

D. C. Cook Nuclear Plant  
Fire Safety Analysis

Fire Area: AA16

Unit 1 West Motor Driven Auxiliary Feedwater Pump Room (El. 591 ft.)

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Purpose ..... Section 1.0

Analysis Methodology ..... Section 2.0

Analysis ..... Section 3.0

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Attachments

    Fire Area AA16 – Attachment 1 - Table B-3 - Fire Area Transition

## **1.0 PURPOSE**

This report documents the Fire Safety Analysis (FSA) for Cook Nuclear Plant (CNP) Fire Area AA16, Unit 1 West Motor Driven Auxiliary Feedwater Pump Room (El. 591 ft.) which comprises fire zone(s) 17A. The purpose of this analysis is to demonstrate the achievement of the nuclear safety and radioactive release performance criteria of NFPA 805 as required by 10 CFR 50.48(c). The Fire Safety Analysis is a key part of compliance with Section 2.7.1.2 Fire Protection Program Design Basis Document of NFPA 805.

## **2.0 ANALYSIS METHODOLOGY**

The FSA is the design basis document as described in NFPA 805 Section 2.7.1.2. The following steps are performed to develop the FSA on a fire area basis:

- Identify significant fire hazards in the fire area. This is based on NFPA 805 approach to analyze the plant from an ignition source and fuel package perspective.
- Summarize Nuclear Safety Capability Analysis (NSCA) compliance strategies. This is the result of the NEI 04-02 B-3 Table review of the Safe Shutdown Analysis.
- Summarize Non-Power Operations Modes compliance strategies.
- Summarize Radioactive Release compliance strategies. The transition review process required per NEI 04-02 is used to develop these results.
- Provide Fire Probabilistic Risk Assessment summary of results. This is based on the results from the plant Fire PRA.
- Perform risk informed, performance based evaluations if needed for the performance based approach.
- Summarize Defense-in-Depth strategy for each fire area.
- Determine key analysis assumptions which are candidates to be included in the NFPA 805 monitoring program.
- Provide conclusions relative to NFPA 805 compliance.

### 3.0 ANALYSIS

#### 3.1 Classical Fire Protection

##### 3.1.1 Construction

The north, south, and west walls to adjacent fire areas are constructed of 3/8-inch steel plate, inside and outside, on 10-inch steel columns. The ceiling is constructed of 3/8-inch steel plate inside and outside, on 10-inch steel joist. The walls and ceiling are each provided with a 2-inch coating of Pyrocrete Fireproofing (magnesium oxychloride) on the outside to give a 3-hour rating. A fire area engineering evaluation was performed to evaluate deviations to the 3-hour rating of the fireproofing material (Engineering Equivalency Evaluation 11-39).

The east wall and floor to the adjacent fire areas are constructed of reinforced concrete in excess of a 3-hour rating.

Applicable Engineering Equivalency Evaluations are documented in Attachment 1.

##### 3.1.2 Doors and Access Openings

A manual rolling fire door having a 3-hour rating is provided to adjacent Fire Area AA2 - Fire Zone 80. This fire door is manually operated for purposes of raising and lowering during normal plant activities. An unrated sliding door is provided for missile and jet impingement protection to adjacent Fire Area AA2 - Fire Zone 80. This unrated door is constructed of 3/8-inch steel plate, inside and outside, on 4-inch steel horizontal members.

##### 3.1.3 Penetrations

Penetrations in fire barriers between this fire zone and adjacent fire areas are provided with fire seals.

One of the fan penetrations is used to run water filled piping for ESW to the room cooler, as well as the power and control cables for the room cooler.

Two 2" diameter pipes are routed through two 4" diameter sleeves in this penetration. A 1" and a 1 1/2" rigid electrical conduit also pass through this opening through a 6" diameter sleeve. Also, piping between the cooler and pre-cooler is routed through a 4" diameter sleeve. These penetrating items are sealed using a silicone fire seal or with a site-approved, non-shrink, cementitious grout. Use of grout as a fire barrier material is acceptable. A 3/8" thick blank plate is installed inside and outside of this penetration restoring the wall around the penetrations for the pipes and rigid conduits. The outside plate is covered with a 3 hour coating of Pyrocrete.

The other fan penetration contains the room cooler, since a portion of the cooler is located in Fire Zone 80. Therefore, the cooler penetration has been evaluated within Engineering Equivalency Evaluation 11-39 as a non-rated opening. The revised evaluation concludes that the non-rated penetration is acceptable.

In addition, a penetration consisting of a 2" diameter Sch. 40-pipe sleeve exists in the south wall of the room below the fan penetration. A 1/2" diameter condensate drain line for the cooler is routed through this penetration. The penetration is closed with a fire seal or with a site-approved, non-shrink, cementitious grout.



### 3.1.4 Detection

The table below outlines the fire detection system(s) provided in the Fire Area:

Table 3-1, Fire Area AA16 Detection Systems								
Fire Zone	Type of System	Local (L) / Remote (R)	Detection Actuates Suppression?	Required System?				
				S	L	E	R	D
17A	None	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Table 3-1 Legend:								
Table Field: "Required System?"								
S	- Required for Chapter 4 Separation Criteria							
L	- Required for NRC Approved Licensing Action							
E	- Required for Engineering Equivalency Evaluation							
R	- Required for Risk Significance							
D	- Required to maintain adequate balance of Defense-in-Depth in a Change Evaluation or Fire Risk Evaluation							

Fire Area AA16 is not provided with an automatic detection system.

### 3.1.5 Fixed Suppression

The table below outlines the fixed fire suppression system(s) provided in the Fire Area:

Table 3-2, Fire Area AA16 Suppression Systems							
Fire Zone	Type of System	Full (F) / Partial (P)	Required System?				
			S	L	E	R	D
17A	None	N/A	N/A	N/A	N/A	N/A	N/A
Table 3-2 Legend:							
Table Field: "Required System?"							
S	- Required for Chapter 4 Separation Criteria						
L	- Required for NRC Approved Licensing Action						
E	- Required for Engineering Equivalency Evaluation						
R	- Required for Risk Significance						
D	- Required to maintain adequate balance of Defense-in-Depth in a Change Evaluation or Fire Risk Evaluation						

Fire Area AA16 is not provided with fixed fire suppression.

### 3.1.6 Manual Suppression / Response Strategy

A postulated fire will be identified by plant personnel using plant communication system to notify the control room. The Control Room operator will dispatch the fire brigade for initiation of manual fire fighting. A fire in this fire area will be contained by the construction features discussed in Section 3.1.1. Manual suppression is provided by the CNP Fire Brigade.

Fire extinguishers and water hose reels are located in adjacent Fire Area AA2 - Fire Zone 80.

A 25-gallon cart of foam liquid is located in adjacent Fire Area AA2 - Fire Zone 80.

Fire Area AA16 is equipped with floor drains.

### 3.1.7 Ventilation

A fire in this area will be contained by the fire barriers. Smoke can be removed by venting to the outdoors or to other parts of the turbine building. The normal building ventilating systems in the Turbine Building will then exhaust the smoke via filtered monitored pathways. This fire area is listed as a non-controlled area in the Fire Pre Plans and therefore there is reasonable assurance that products of combustion will not be contaminated.

Fire dampers having a 3-hour rating are provided to adjacent Fire Area AA2 - Fire Zone 80. The opening in the west wall that includes exiting fire damper 1-HV-AFP-FD-4B is a HELB vent path to Fire Zone 80 and has a non-rated blowout panel installed in series. The fire damper is 3-hour rated and is normally open to allow venting for a HELB condition. A fusible link is provided to close the damper in the event of fire. The two dampers (1-HV-AFP-FD-4A and 4C) in the other openings in the west wall are permanently closed and the penetrations are sealed using a plate on the opposite side of the wall from each fire damper. The new seal plates will not impact the existing fire damper function. Due to HELB temperature considerations, the fusible links for the fire dampers are rated for 350°F.

### 3.1.8 Other Features

No other fire protection features provided for Fire Area AA16.

## 3.2 Fire Hazards Identification

The fire area contains both ignition sources and combustible fire hazards. The main ignition source is the West AFW pump. Combustibles consist primarily of cable insulation, rubber and plastics. The current fire loading classification is considered low.

## 3.3 NSCA Compliance Summary

Fire Area AA16, U1 West Motor Driven Aux Feedpump Room (EL. 591') contains Unit 1 Red Train (West) Feedwater equipment, cables, conduits and raceways.

Compliance with the nuclear safety performance criteria is achieved using the deterministic approach in accordance with NFPA 805, Section 4.2.3.2.

Safe and stable condition of Unit 1 will be accomplished using Steam Generators 2 and 3 via Unit 1 East Motor Driven Auxiliary Feedwater Pump or Unit 1 Turbine Driven Auxiliary Feedwater Pump, Control Room Process Monitoring, Unit 1 Charging via the West or East pump, Unit 1 Component Cooling Water via the East or West Pump, Unit 1 ESW via the East or West Pump. Electrical power is supplied to either Red or Green Trains via offsite power with both Red and Green Train Emergency Diesels also available.

The Nuclear Safety Performance Criteria compliance strategy for AA16 is documented within the NSCA Report.

### 3.3.1 Variances

There are no variances for this fire area.

### 3.3.2 Recovery Actions Credited

There are no recovery actions for this fire area.

### 3.4 Non-Power Operational Modes Compliance Summary

A review of CNP for the potential effects of a fire in this Fire Area while in non-power modes of operation (NPO) was conducted. This review was conducted using the guidance provided in NEI 04-02 and FAQ 07-0040, "Non-Power Operations Clarifications".

The review determined that there are potential failures that affect certain Key Safety Functions (KSF) as a result of the fire in this area, and the fire could result in the loss of one or more KSF paths. Compensatory measures are required during high risk evolution periods to provide reasonable assurance a fire will not adversely affect key safety functions and the NFPA 805 performance goal for NPO is therefore satisfied. The results of the NPO analysis are contained within Technical Evaluation R1900-005-001, Non-Power Operation Modes Transition Review Report.

### 3.5 Radioactive Release Compliance Summary

The NFPA 805 radiological release goal is to provide reasonable assurance that a fire will not result in a radiological release that adversely affects the public, plant personnel or the environment. The NFPA 805 requirement is to ensure a radiation release to any unrestricted area due to the direct effects of fire suppression activities (but not involving fuel damage) shall be as low as reasonably achievable and shall not exceed applicable plant Technical Specification limits.

AA16 is located outside the Radiological Controlled Area (RCA) and is not a storage location for contaminated materials, therefore there is reasonable assurance a fire in this area will not result in radiation release. The review of this fire area, with respect to radioactive release, is documented in the NFPPM.

### 3.6 Probabilistic Risk Assessment-Summary of Results

A Fire PRA (FPRA) quantification of Fire Area AA16 was performed and is documented in PRA-NB-FIRE-FQ, Fire PRA Model Quantification Notebook. The fire risk quantification for Fire Area AA16 is analyzed assuming whole room burnup. PRA-NB-FIRE-FQ includes a summary of all potentially risk-significant fire scenarios (i.e., CDF > 1.0E-7 or LERF > 1.0E-8). Bounding CDF / LERF per calendar year values are reported that are based on the risk values documented in PRA-NB-FIRE-FSS, Fire PRA Fire Scenario Selection.

### 3.7 Risk-Informed, Performance-Based Evaluations

There are no VFDRs for this fire area, and therefore, no Fire Risk Evaluations have been performed.

#### 3.7.1 Transition Risk-Informed, Performance-Based Evaluations

There are no VFDRs for this fire area, and therefore this section is not applicable to Fire Area AA16.

### 3.8 Defense-in-Depth

Per NFPA 805, section 2.4.4.2, “Defense-in-Depth”: The deterministic approach for meeting the performance criteria shall be deemed to satisfy this defense-in-depth requirement.

### 3.9 Monitoring Program Input

A Monitoring Program will be developed in accordance with FAQ 10-0059, Rev. 1. Methods to monitor availability, reliability, and performance of fire protection program structures, systems, and components (SSCs), as well as programmatic elements will be provided. Additionally, effectiveness measures are established to review program related performance and trends. For AA16 the following systems and features are candidates for inclusion in the CNP Fire Protection Monitoring Program:

- Fire Area boundary barriers discussed in Section 3.1

## 4.0 CONCLUSION

The nuclear safety and radioactive release performance criteria of NFPA 805 are met for a fire in Fire Area AA16. This Fire Safety Analysis has demonstrated that for Fire Area AA16 a success path remains free of fire damage using the deterministic approach per Section 4.2.3 of NFPA 805.

## 5.0 REFERENCES

- 5.1 CNP Fire Pre-Plans, Volumes I, II, and III, Revisions 17, 14, and 18 respectively
- 5.2 Fire Hazards Analysis
- 5.3 NFPA 805, Performance-Based Standard for Fire Protection for Light Water Reactor Electric Generating Plants
- 5.4 NFPPM, NFPA 805 Fire Protection Program Manual (NFPPM)
- 5.5 Nuclear Energy Institute (NEI) 04-02, Guidance for Implementing a Risk-Informed, Performance-Based Fire Protection Program under 10 CFR 50.48(c), Rev. 2
- 5.6 Nuclear Safety Capability Assessment Report
- 5.7 PRA-NB-FIRE-FQ, Fire PRA Model Quantification Notebook
- 5.8 PRA-NB-FIRE-FSS, Fire PRA Fire Scenario Selection
- 5.9 Regulatory Guide 1.205, Risk-Informed, Performance-Based Fire Protection for Existing Light-Water Nuclear Power Plants, Rev. Revision 1
- 5.10 Technical Evaluation R1900-005-001, Non-Power Operation Modes Transition Review

**Fire Area AA16 – Attachment 1 - Table B-3 - Fire Area Transition**

<u>Unit</u>	<u>Fire Area</u>	<u>Description</u>
1	AA16	Unit 1 West Motor Driven Auxiliary Feedwater Pump Room (El. 591 ft.)

<u>Fire Zone</u>	<u>Description</u>
17A	West Aux. Feed Pump Room - El. 591 ft. 0 in. - Unit 1

**Regulatory Basis**

4.2.3.2 - Deterministic Approach

<b>Performance Goal</b>	<b>Method of Accomplishment</b>	<b>Comments</b>
Reactivity Control	Unit 1 - Trip the reactor from the Control Room. Borate using Unit 1 East or West Charging Pump supplied from the RWST. Use source range monitoring for indication for Unit 1.	None
Inventory and Pressure Control	Unit 1 - Control inventory using Unit 1 East or West Charging Pump. Control pressure using Unit 1 Pressurizer Safety Relief Valves.	None
Decay Heat Removal	Unit 1 - Feed SGs 2 & 3 with Unit 1 East MDAFW Pump or Unit 1 TDAFW Pump. The DHR function also requires MS isolation with a steam release path through the Safety Relief Valves.	None
Process Monitoring	Unit 1 Process Monitoring - Use Unit 1 process monitoring in the Control Room for the following: Pressurizer level, RCS pressure and temperature, and S/G level and Pressure. Unit 1 Source Range Monitoring - Use Unit 1 source range monitoring in the Control Room.	None
Vital Auxiliaries	Unit 1 - Control Unit 1 Red (AB) Train Electrical Distribution with Unit 1 Red (AB) Train Offsite Power or Unit 1 Red (AB) DG. Control Unit 1 Green (CD) Train Electrical Distribution with Unit 1 Green (CD) Train Offsite Power or Unit 1 Green (CD) DG. Unit 1 ESW - Operate Unit 1 East or West ESW. Unit 1 CCW - Operate Unit 1 East or West CCW. Unit 1 HVAC - Operate Unit 1 Control Room HVAC. Operate Unit 1 Auxiliary Building HVAC. Operate Unit 1 Red (AB) and Green (CD) DG HVAC. Operate Unit 1 Switchgear HVAC. Operate Unit 1 East MDAFW and TDAFW Pump Room HVAC systems. Operate the Unit 1 ESW Pump HVAC systems.	None

**Fire Area AA16 – Attachment 1 - Table B-3 - Fire Area Transition**

<u>Unit</u>	<u>Fire Area</u>	<u>Description</u>
1	AA16	Unit 1 West Motor Driven Auxiliary Feedwater Pump Room (El. 591 ft.)

**Reference Documents**

Genesis Solution Suite, EDISON / SAFE-PB, DC Cook V 3.4.0

Nuclear Safety Capability Assessment Report

**Licensing Actions**

None

**Existing Engineering Equivalency Evaluations (EEEE)****EEEE Title Engineering Equivalency Evaluation 11-9 - Turbine, Auxiliary and Containment Buildings Boundary Evaluation**

**Summary** The purpose of this engineering equivalency evaluation is to describe in general, the approach and existence of evaluations performed to determine and reconcile fire area boundaries having components or designs with less than a 3-hr fire rating on preventing the spread of fire. This engineering equivalency evaluation also specifically evaluates the impact of unrated door assemblies on the spread of fire.

Reasonable assurance is provided that the fire area boundaries having components or design less than a 3-hr fire rating will not increase the spread of fire or impair the safe shutdown capabilities of Units 1 or 2. In addition, this engineering equivalency evaluation does not adversely impact on other engineering equivalency evaluations or exemption requests.

This evaluation supports additional evaluations credited in this fire area.

**Fire Area AA16 – Attachment 1 - Table B-3 - Fire Area Transition**

<u>Unit</u>	<u>Fire Area</u>	<u>Description</u>
1	AA16	Unit 1 West Motor Driven Auxiliary Feedwater Pump Room (El. 591 ft.)
<b><u>EEEE Title</u></b>	<b>Engineering Equivalency Evaluation 11-39 - Fireproofing for the West Motor Driven Auxiliary Feedwater Pump Enclosures Fire Zones 17A (Fire Area AA16), 17B (Fire Area AA17), 80 (Fire Area AA2) and 84 (Fire Area AA2)</b>	
<b><u>Summary</u></b>	<p>The purpose of this engineering equivalency evaluation is to document the acceptability of the pyrocrete fireproofing installation for the for the Unit 1 and Unit 2 west motor driven auxiliary feedwater pump enclosures in Fire Areas AA16 and AA17 (Fire Zones 17A and 17B, respectively) on preventing the spread of fire. Pyrocrete fireproofing material has not and cannot be applied completely due to interferences which include a 9 in. wide by 48 in. high section between the HVAC security cage and the concrete wall, 4 in. wide HVAC overlap angles for fire dampers are unprotected along the top, bottom, and west perimeters, and a 11.5 in. wide by 48 in. high section between adjacent fire dampers.</p> <p>The engineering equivalency evaluation also addresses minor deficiencies including small areas between the 3-hr rated rollup fire door and opening in the structure, and where penetrations prevent the required thickness of fireproofing.</p> <p>The partially protected structural steel for Unit 1 and Unit 2 auxiliary feedwater pump enclosures (Fire Zones 17A and 17B) and the minor gaps associated with the 3-hr rated roll up door/sliding missile barrier or blowout panel will not impair the safe shutdown capabilities for CNP or increase the ability of fire to spread between fire zones based on combustible loadings, automatic suppression in Fire Zones 80 and 84, CNP layout, and fire test data.</p> <p>The pyrocrete fireproofing was evaluated and found to be acceptable based on the fire hazards, fire protection systems and construction features within the evaluated areas.</p>	

**Fire Suppression Effects on Nuclear Safety Performance Criteria**

The CNP fire brigade is trained to discharge water in a judicious manner and instructed to direct hose streams and portable extinguishers at the base of the fire to limit the amount of overspray beyond the immediate fire zone. For this reason, fire brigade activities are not expected to fail components not already considered damaged. It has been concluded that water impingement on cables is not a concern. Electrical cabinets are provided with a seal at the conduit interface. Possible impacts to surrounding equipment due to manual fire fighting activities is bounded by the analysis approach of postulating whole room damage. The drainage features of the fire area mitigate the potential for flooding damage due to fire suppression, such that the standing water would not affect credited equipment.

This fire area is not equipped with a fixed fire suppression system. Since it is shown that suppression effects will not impact the nuclear safety performance criteria, the fire area configuration is deemed acceptable.

**References:**

Technical Evaluation 12.1, "Fire Suppression Effects Study"

Technical Evaluation 12.1, "Supplemental Information to Fire Suppression Effects Study – Supplement 1"

**Fire Area AA16 – Attachment 1 - Table B-3 - Fire Area Transition**

<u>Unit</u>	<u>Fire Area</u>	<u>Description</u>
1	AA16	Unit 1 West Motor Driven Auxiliary Feedwater Pump Room (El. 591 ft.)

---

**Fire Area Comments**

None



## D. C. Cook Nuclear Plant Fire Safety Analysis

## Fire Area: AA17

## Unit 2 West Motor Driven Auxiliary Feedwater Pump Room (El. 591 ft.)

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## Attachments

Fire Area AA17 – Attachment 1 - Table B-3 - Fire Area Transition

## 1.0 PURPOSE

This report documents the Fire Safety Analysis (FSA) for Cook Nuclear Plant (CNP) Fire Area AA17, Unit 2 West Motor Driven Auxiliary Feedwater Pump Room (El. 591 ft.) which comprises fire zone(s) 17B. The purpose of this analysis is to demonstrate the achievement of the nuclear safety and radioactive release performance criteria of NFPA 805 as required by 10 CFR 50.48(c). The Fire Safety Analysis is a key part of compliance with Section 2.7.1.2 Fire Protection Program Design Basis Document of NFPA 805.

## 2.0 ANALYSIS METHODOLOGY

The FSA is the design basis document as described in NFPA 805 Section 2.7.1.2. The following steps are performed to develop the FSA on a fire area basis:

- Identify significant fire hazards in the fire area. This is based on NFPA 805 approach to analyze the plant from an ignition source and fuel package perspective.
- Summarize Nuclear Safety Capability Analysis (NSCA) compliance strategies. This is the result of the NEI 04-02 B-3 Table review of the Safe Shutdown Analysis.
- Summarize Non-Power Operations Modes compliance strategies.
- Summarize Radioactive Release compliance strategies. The transition review process required per NEI 04-02 is used to develop these results.
- Provide Fire Probabilistic Risk Assessment summary of results. This is based on the results from the plant Fire PRA.
- Perform risk informed, performance based evaluations if needed for the performance based approach.
- Summarize Defense-in-Depth strategy for each fire area.
- Determine key analysis assumptions which are candidates to be included in the NFPA 805 monitoring program.
- Provide conclusions relative to NFPA 805 compliance.

## 3.0 ANALYSIS

### 3.1 Classical Fire Protection

#### 3.1.1 Construction

The north, south and west walls to adjacent fire areas are constructed of 3/8-inch steel plate, inside and outside, on 10-inch steel columns. The ceiling is constructed of 3/8-inch steel plate inside and outside, on 10-inch steel joist. The walls and ceiling are each provided with a 2-inch coating of Pyrocrete Fireproofing (magnesium oxychloride) on the outside to give a 3-hour rating. A fire area engineering evaluation was performed to evaluate deviations to the 3-hour rating of the fireproofing material (Engineering Equivalency Evaluation 11-39).

The east wall and floor to the adjacent fire areas are constructed of reinforced concrete in excess of a 3-hour rating.

Applicable Engineering Equivalency Evaluations are documented in Attachment 1.

#### 3.1.2 Doors and Access Openings

A manual rolling fire door having a 3-hour rating is provided to adjacent Fire Area AA2 - Fire Zone 84. This fire door is manually operated for purposes of raising and lowering during normal plant activities.

An unrated sliding door is provided for missile and jet impingement protection to adjacent Fire Area AA2 - Fire Zone 84. This unrated door is constructed of 3/8-inch steel plate, inside and outside, on 4-inch steel horizontal members.

#### 3.1.3 Penetrations

Penetrations in fire barriers between this fire zone and adjacent fire areas are provided with fire seals.

One of the fan penetrations is used to run the water filled piping for ESW to the room cooler as well as the power and control cables for the room cooler. Two 2" diameter pipes are routed through two 4" diameter sleeves in this penetration. The penetration around the pipes is closed using a fire seal. Also, a 1" and a 1 1/2" rigid electrical conduit pass through this opening and are sealed using silicone grout. A 3/8" thick blank plate is installed inside and outside of this penetration restoring the wall around the penetrations for the pipes and rigid conduits. The outside plate is covered with a 3-hour coating of Pyrocrete.

In addition, a penetration consisting of a 2" diameter schedule 40 pipe sleeve exists in the north wall of the room below the fan penetration. A 1/2" diameter condensate drain line for the cooler is routed through this penetration. The penetration is closed with a fire seal.

### 3.1.4 Detection

The table below outlines the fire detection system(s) provided in the Fire Area:

Table 3-1, Fire Area AA17 Detection Systems								
Fire Zone	Type of System	Local (L) / Remote (R)	Detection Actuates Suppression?	Required System?				
				S	L	E	R	D
17B	None	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Table 3-1 Legend:								
Table Field: "Required System?"								
S	- Required for Chapter 4 Separation Criteria							
L	- Required for NRC Approved Licensing Action							
E	- Required for Engineering Equivalency Evaluation							
R	- Required for Risk Significance							
D	- Required to maintain adequate balance of Defense-in-Depth in a Change Evaluation or Fire Risk Evaluation							

Fire Area AA17 is not provided with an automatic detection system.

### 3.1.5 Fixed Suppression

The table below outlines the fixed fire suppression system(s) provided in the Fire Area:

Table 3-2, Fire Area AA17 Suppression Systems							
Fire Zone	Type of System	Full (F) / Partial (P)	Required System?				
			S	L	E	R	D
17B	None	N/A	N/A	N/A	N/A	N/A	N/A
Table 3-2 Legend:							
Table Field: "Required System?"							
S	- Required for Chapter 4 Separation Criteria						
L	- Required for NRC Approved Licensing Action						
E	- Required for Engineering Equivalency Evaluation						
R	- Required for Risk Significance						
D	- Required to maintain adequate balance of Defense-in-Depth in a Change Evaluation or Fire Risk Evaluation						

Fire Area AA17 is not provided with fixed fire suppression.

### 3.1.6 Manual Suppression / Response Strategy

A postulated fire will be identified by plant personnel using plant communication system to notify the control room. The Control Room operator will dispatch the fire brigade for initiation of manual fire fighting. A fire in this fire area will be contained by the construction features discussed in Section 3.1.1. Manual suppression is provided by the CNP Fire Brigade.

Fire extinguishers are located in adjacent Fire Area AA2 - Fire Zone 84.

Water hose reels are located in adjacent Fire Area AA2 - Fire Zone 84.

A 25-gallon cart of foam liquid is located in adjacent Fire Area AA2 - Fire Zone 84.

Fire Area AA17 is equipped with floor drains.

### 3.1.7 Ventilation

A fire in this area will be contained by the fire barriers. Smoke can be removed by venting to the outdoors or to other parts of the turbine building. The normal building ventilating systems in the Turbine Building will then exhaust the smoke via filtered monitored pathways. This fire area is listed as a non-controlled area in the Fire Pre Plans and therefore there is reasonable assurance that products of combustion will not be contaminated.

Fire dampers having a 3-hour rating are provided to adjacent Fire Area AA2 - Fire Zone 84.

The fire dampers in the three air intakes (2-HV-AFP-FD-4A, B, and C) help to assure the fire barrier is maintained. Two fire dampers (2-HV-AFP-FD-A and C) are maintained closed and the penetrations are sealed using a plate on the opposite side of the wall from the fire damper. The seal plates do not impact the existing fire damper function. The seal plate is 1/4" thick ASTM A36, sized as required to cover the opening. Silicone or approved equal at open gaps between the existing frame and the 1/4" plate. The 1/4" plate installed outside the pump room and the fire two dampers (2-HV-AFP-FD-4A, and C) are on the opposite side of the wall. Fire damper 2-HV-AFP-FD-4B is provided with a blowout panel on the outside of the opening to prevent a HELB in the turbine building from affecting the pump room. Due to HELB temperature considerations, the 160°F fusible links for the fire dampers are 350°F fusible links.

### 3.1.8 Other Features

No other fire protection features provided for Fire Area AA17.

## 3.2 Fire Hazards Identification

The fire area contains both ignition sources and combustible fire hazards. The main ignition source is the West AFW pump. Combustibles consist primarily of cable insulation, rubber and plastics. The current fire loading classification is considered low.

## 3.3 NSCA Compliance Summary

Fire Area AA17, U2 West Motor Driven Aux Feedpump Room (EL. 591') contains Unit 2 Red Train (West) Feedwater equipment, cables, conduits and raceways.

Compliance with the nuclear safety performance criteria is achieved using the deterministic approach in accordance with NFPA 805, Section 4.2.3.2.

Safe and stable condition of Unit 2 will be accomplished using Steam Generators 2 and 3 via Unit 2 East Motor Driven Auxiliary Feedwater Pump or Unit 2 Turbine Driven Auxiliary Feedwater Pump, Control Room Process Monitoring, Unit 2 Charging via the West or East pump, Unit 2 Component Cooling Water via the East or West Pump, Unit 2 ESW via the East or West Pump. Electrical power is supplied to either Red or Green Trains via offsite power with both Red and Green Train Emergency Diesels also available.

The Nuclear Safety Performance Criteria compliance strategy for AA17 is documented within the NSCA Report.

### **3.3.1 Variances**

There are no variances for this fire area.

### **3.3.2 Recovery Actions Credited**

There are no recovery actions for this fire area.

## **3.4 Non-Power Operational Modes Compliance Summary**

A review of CNP for the potential effects of a fire in this Fire Area while in non-power modes of operation (NPO) was conducted. This review was conducted using the guidance provided in NEI 04-02 and FAQ 07-0040, "Non-Power Operations Clarifications".

The review determined that there are potential failures that affect certain Key Safety Functions (KSF) as a result of the fire in this area, and the fire could result in the loss of one or more KSF paths. Compensatory measures are required during high risk evolution periods to provide reasonable assurance a fire will not adversely affect key safety functions and the NFPA 805 performance goal for NPO is therefore satisfied. The results of the NPO analysis are contained within Technical Evaluation R1900-005-001, Non-Power Operation Modes Transition Review Report.

## **3.5 Radioactive Release Compliance Summary**

The NFPA 805 radiological release goal is to provide reasonable assurance that a fire will not result in a radiological release that adversely affects the public, plant personnel or the environment. The NFPA 805 requirement is to ensure a radiation release to any unrestricted area due to the direct effects of fire suppression activities (but not involving fuel damage) shall be as low as reasonably achievable and shall not exceed applicable plant Technical Specification limits.

AA17 is located outside the Radiological Controlled Area (RCA) and is not a storage location for contaminated materials, therefore there is reasonable assurance a fire in this area will not result in radiation release. The review of this fire area, with respect to radioactive release, is documented in the NFPPM.

## **3.6 Probabilistic Risk Assessment-Summary of Results**

A Fire PRA (FPRA) quantification of Fire Area AA17 was performed and is documented in PRA-NB-FIRE-FQ, Fire PRA Model Quantification Notebook. The fire risk quantification for Fire Area AA17 is analyzed assuming whole room burnup. PRA-NB-FIRE-FQ includes a summary of all potentially risk-significant fire scenarios (i.e., CDF > 1.0E-7 or LERF > 1.0E-8). Bounding CDF / LERF per calendar year values are reported that are based on the risk values documented in PRA-NB-FIRE-FSS, Fire PRA Fire Scenario Selection.

### 3.7 Risk-Informed, Performance-Based Evaluations

There are no VFDRs for this fire area, and therefore, no Fire Risk Evaluations have been performed.

#### 3.7.1 Transition Risk-Informed, Performance-Based Evaluations

There are no VFDRs for this fire area, and therefore this section is not applicable to Fire Area AA17.

### 3.8 Defense-in-Depth

Per NFPA 805, section 2.4.4.2, “Defense-in-Depth”: The deterministic approach for meeting the performance criteria shall be deemed to satisfy this defense-in-depth requirement.

### 3.9 Monitoring Program Input

A Monitoring Program will be developed in accordance with FAQ 10-0059, Rev. 1. Methods to monitor availability, reliability, and performance of fire protection program structures, systems, and components (SSCs), as well as programmatic elements will be provided. Additionally, effectiveness measures are established to review program related performance and trends. For AA17 the following systems and features are candidates for inclusion in the CNP Fire Protection Monitoring Program:

- Fire Area boundary barriers discussed in Section 3.1

## 4.0 CONCLUSION

The nuclear safety and radioactive release performance criteria of NFPA 805 are met for a fire in Fire Area AA17. This Fire Safety Analysis has demonstrated that for Fire Area AA17 a success path remains free of fire damage using the deterministic approach per Section 4.2.3 of NFPA 805.

## 5.0 REFERENCES

- 5.1 CNP Fire Pre-Plans, Volumes I, II, and III, Revisions 17, 14, and 18 respectively
- 5.2 Fire Hazards Analysis
- 5.3 NFPA 805, Performance-Based Standard for Fire Protection for Light Water Reactor Electric Generating Plants
- 5.4 NFPPM, NFPA 805 Fire Protection Program Manual (NFPPM)
- 5.5 Nuclear Energy Institute (NEI) 04-02, Guidance for Implementing a Risk-Informed, Performance-Based Fire Protection Program under 10 CFR 50.48(c), Rev. 2
- 5.6 Nuclear Safety Capability Assessment Report
- 5.7 PRA-NB-FIRE-FQ, Fire PRA Model Quantification Notebook
- 5.8 PRA-NB-FIRE-FSS, Fire PRA Fire Scenario Selection
- 5.9 Regulatory Guide 1.205, Risk-Informed, Performance-Based Fire Protection for Existing Light-Water Nuclear Power Plants, Rev. Revision 1
- 5.10 Technical Evaluation R1900-005-001, Non-Power Operation Modes Transition Review

**Fire Area AA17 – Attachment 1 - Table B-3 - Fire Area Transition**

<u>Unit</u>	<u>Fire Area</u>	<u>Description</u>
2	AA17	Unit 2 West Motor Driven Auxiliary Feedwater Pump Room (El. 591 ft.)

<u>Fire Zone</u>	<u>Description</u>
17B	West Aux. Feed Pump Room - El. 591 ft. 0 in. - Unit 2

**Regulatory Basis**

4.2.3.2 - Deterministic Approach

<b>Performance Goal</b>	<b>Method of Accomplishment</b>	<b>Comments</b>
Reactivity Control	Unit 2 - Trip the reactor from the Control Room. Borate using Unit 2 East or West Charging Pump supplied from the RWST. Use source range monitoring for indication for Unit 2.	None
Inventory and Pressure Control	Unit 2 - Control inventory using Unit 2 East or West Charging Pump. Control pressure using Unit 2 Pressurizer Safety Relief Valves.	None
Decay Heat Removal	Unit 2 - Feed SGs 2 & 3 with Unit 2 East MDAFW Pump or Unit 2 TDAFW Pump. The DHR function also requires MS isolation with a steam release path through the Safety Relief Valves.	None
Process Monitoring	Unit 2 Process Monitoring - Use Unit 2 process monitoring in the Control Room for the following: Pressurizer level, RCS pressure and temperature, and S/G level and Pressure. Unit 2 Source Range Monitoring - Use Unit 2 source range monitoring in the Control Room.	None
Vital Auxiliaries	Unit 2 Electrical - Control Unit 2 Red (AB) Train Electrical Distribution with Unit 2 Red (AB) Train Offsite Power or Unit 2 Red (AB) DG. Control Unit 2 Green (CD) Train Electrical Distribution with Unit 2 Green (CD) Train Offsite Power or Unit 2 Green (CD) DG. Unit 2 ESW - Operate Unit 2 East or West ESW. Unit 2 CCW - Operate Unit 2 East or West CCW. Unit 2 HVAC - Operate Unit 2 Control Room HVAC. Operate Unit 2 Auxiliary Building HVAC. Operate Unit 2 Green (CD) and Unit 2 Red (AB) DG HVAC. Operate Unit 2 Switchgear HVAC. Operate Unit 2 East MDAFW and TDAFW Pump Room HVAC systems. Operate the Unit 2 East and West ESW Pump HVAC systems.	None



**Fire Area AA17 – Attachment 1 - Table B-3 - Fire Area Transition**

<u>Unit</u>	<u>Fire Area</u>	<u>Description</u>
2	AA17	Unit 2 West Motor Driven Auxiliary Feedwater Pump Room (El. 591 ft.)

**Reference Documents**

Genesis Solution Suite, EDISON / SAFE-PB, DC Cook V 3.4.0

Nuclear Safety Capability Assessment Report

**Licensing Actions**

None

**Existing Engineering Equivalency Evaluations (EEEE)****EEEE Title Engineering Equivalency Evaluation 11-9 - Turbine, Auxiliary and Containment Buildings Boundary Evaluation**

**Summary** The purpose of this engineering equivalency evaluation is to describe in general, the approach and existence of evaluations performed to determine and reconcile fire area boundaries having components or designs with less than a 3-hr fire rating on preventing the spread of fire. This engineering equivalency evaluation also specifically evaluates the impact of unrated door assemblies on the spread of fire.

Reasonable assurance is provided that the fire area boundaries having components or design less than a 3-hr fire rating will not increase the spread of fire or impair the safe shutdown capabilities of Units 1 or 2. In addition, this engineering equivalency evaluation does not adversely impact on other engineering equivalency evaluations or exemption requests.

This evaluation supports additional evaluations credited in this fire area.

**Fire Area AA17 – Attachment 1 - Table B-3 - Fire Area Transition**

<u>Unit</u>	<u>Fire Area</u>	<u>Description</u>
2	AA17	Unit 2 West Motor Driven Auxiliary Feedwater Pump Room (El. 591 ft.)

**EEEE Title** **Engineering Equivalency Evaluation 11-39 - Fireproofing for the West Motor Driven Auxiliary Feedwater Pump Enclosures Fire Zones 17A (Fire Area AA16), 17B (Fire Area AA17), 80 (Fire Area AA2) and 84 (Fire Area AA2)**

**Summary** The purpose of this engineering equivalency evaluation is to document the acceptability of the pyrocrete fireproofing installation for the for the Unit 1 and Unit 2 west motor driven auxiliary feedwater pump enclosures in Fire Areas AA16 and AA17 (Fire Zones 17A and 17B, respectively) on preventing the spread of fire. Pyrocrete fireproofing material has not and cannot be applied completely due to interferences which include a 9 in. wide by 48 in. high section between the HVAC security cage and the concrete wall, 4 in. wide HVAC overlap angles for fire dampers are unprotected along the top, bottom, and west perimeters, and a 11.5 in. wide by 48 in. high section between adjacent fire dampers.

The engineering equivalency evaluation also addresses minor deficiencies including small areas between the 3-hr rated rollup fire door and opening in the structure, and where penetrations prevent the required thickness of fireproofing.

The partially protected structural steel for Unit 1 and Unit 2 auxiliary feedwater pump enclosures (Fire Zones 17A and 17B) and the minor gaps associated with the 3-hr rated roll up door/sliding missile barrier or blowout panel will not impair the safe shutdown capabilities for CNP or increase the ability of fire to spread between fire zones based on combustible loadings, automatic suppression in Fire Zones 80 and 84, CNP layout, and fire test data.

The pyrocrete fireproofing was evaluated and found to be acceptable based on the fire hazards, fire protection systems and construction features within the evaluated areas.

**Fire Suppression Effects on Nuclear Safety Performance Criteria**

The CNP fire brigade is trained to discharge water in a judicious manner and instructed to direct hose streams and portable extinguishers at the base of the fire to limit the amount of overspray beyond the immediate fire zone. For this reason, fire brigade activities are not expected to fail components not already considered damaged. It has been concluded that water impingement on cables is not a concern. Electrical cabinets are provided with a seal at the conduit interface. Possible impacts to surrounding equipment due to manual fire fighting activities is bounded by the analysis approach of postulating whole room damage. The drainage features of the fire area mitigate the potential for flooding damage due to fire suppression, such that the standing water would not affect credited equipment.

This fire area is not equipped with a fixed fire suppression system. Since it is shown that suppression effects will not impact the nuclear safety performance criteria, the fire area configuration is deemed acceptable.

**References:**

Technical Evaluation 12.1, "Fire Suppression Effects Study"

Technical Evaluation 12.1, "Supplemental Information to Fire Suppression Effects Study – Supplement 1"

**Fire Area AA17 – Attachment 1 - Table B-3 - Fire Area Transition**

<u>Unit</u>	<u>Fire Area</u>	<u>Description</u>
2	AA17	Unit 2 West Motor Driven Auxiliary Feedwater Pump Room (El. 591 ft.)

---

**Fire Area Comments**

None

# D. C. Cook Nuclear Plant Fire Safety Analysis

## Fire Area: AA18

Auxiliary Feedwater Pump Corridor (El. 591 ft.)

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#### Attachments

Fire Area AA18 – Attachment 1 - Table B-3 - Fire Area Transition

Fire Area AA18 – Attachment 2 - Fire Risk Evaluation Results Summary

## 1.0 PURPOSE

This report documents the Fire Safety Analysis (FSA) for Cook Nuclear Plant (CNP) Fire Area AA18, Auxiliary Feedwater Pump Corridor (El. 591 ft.) which comprises fire zone(s) 17C, which has a dual unit effect. The purpose of this analysis is to demonstrate the achievement of the nuclear safety and radioactive release performance criteria of NFPA 805 as required by 10 CFR 50.48(c). The Fire Safety Analysis is a key part of compliance with Section 2.7.1.2 Fire Protection Program Design Basis Document of NFPA 805. This analysis also documents results of risk-informed, performance-based Fire Risk Evaluations (FREs). These evaluations are associated with Variances from Deterministic Requirements (VFDRs) of NFPA 805 Chapter 4.

## 2.0 ANALYSIS METHODOLOGY

The FSA is the design basis document as described in NFPA 805 Section 2.7.1.2. The following steps are performed to develop the FSA on a fire area basis:

- Identify significant fire hazards in the fire area. This is based on NFPA 805 approach to analyze the plant from an ignition source and fuel package perspective.
- Summarize Nuclear Safety Capability Analysis (NSCA) compliance strategies. This is the result of the NEI 04-02 B-3 Table review of the Safe Shutdown Analysis.
- Summarize Non-Power Operations Modes compliance strategies.
- Summarize Radioactive Release compliance strategies. The transition review process required per NEI 04-02 is used to develop these results.
- Provide Fire Probabilistic Risk Assessment summary of results. This is based on the results from the plant Fire PRA.
- Perform risk informed, performance based evaluations if needed for the performance based approach.
- Summarize Defense-in-Depth strategy for each fire area.
- Determine key analysis assumptions which are candidates to be included in the NFPA 805 monitoring program.
- Provide conclusions relative to NFPA 805 compliance.

### 3.0 ANALYSIS

#### 3.1 Classical Fire Protection

##### 3.1.1 Construction

Walls, floors and ceilings to adjacent fire areas are reinforced concrete in excess of a 3-hour rating.

Applicable Engineering Equivalency Evaluations are documented in Attachment 1.

##### 3.1.2 Doors and Access Openings

Fire doors having a 3-hour rating are provided to adjacent Fire Areas AA19, AA20, AA21, AA22 and AA2 - Fire Zones 17D, 17E, 17F, 17G, 80 and 84, respectively. The fire doors to Fire Zones 80 and 84 are held open by a 375°F fusible link in order to relieve pressure during a HELB of the steam piping in the TDAFW Pump Rooms, Fire Zones 17E and 17F. A fire area boundary evaluation was performed for installing a higher temperature fusible link than allowed by the UL Listing for fire doors. Due to HELB temperature considerations, the fusible links are set to 350°F.

##### 3.1.3 Penetrations

Penetrations in fire barriers between this fire zone and adjacent fire areas are provided with fire seals. The seismic gaps are provided with fire seals.

##### 3.1.4 Detection

The table below outlines the fire detection system(s) provided in the Fire Area:

Table 3-1, Fire Area AA18 Detection Systems								
Fire Zone	Type of System	Local (L) / Remote (R)	Detection Actuates Suppression?	Required System?				
				S	L	E	R	D
17C	Ionization	L/R	N	N	N	N	Y	N
Table 3-1 Legend:								
Table Field: "Required System?"								
S	- Required for Chapter 4 Separation Criteria							
L	- Required for NRC Approved Licensing Action							
E	- Required for Engineering Equivalency Evaluation							
R	- Required for Risk Significance							
D	- Required to maintain adequate balance of Defense-in-Depth in a Change Evaluation or Fire Risk Evaluation							

There are 2 ionization detectors which alarm in the Unit 1 Control Room.

### 3.1.5 Fixed Suppression

The table below outlines the fixed fire suppression system(s) provided in the Fire Area:

Table 3-2, Fire Area AA18 Suppression Systems							
Fire Zone	Type of System	Full (F) / Partial (P)	Required System?				
			S	L	E	R	D
17C	Wet Pipe	F	N	N	N	N	N
Table 3-2 Legend:							
Table Field: "Required System?"							
S	- Required for Chapter 4 Separation Criteria						
L	- Required for NRC Approved Licensing Action						
E	- Required for Engineering Equivalency Evaluation						
R	- Required for Risk Significance						
D	- Required to maintain adequate balance of Defense-in-Depth in a Change Evaluation or Fire Risk Evaluation						

A wet pipe sprinkler system with sprinklers rated at 250°F is provided which alarms in the Unit 1 Control Room. This system also protects the Unit 2 Turbine Driven Auxiliary Feed Water Pump Room, Fire Zone 17F.

### 3.1.6 Manual Suppression / Response Strategy

A postulated fire will be identified by the ionization smoke detectors or plant personnel using plant communication system to notify the control room. The automatic detection system alarms in the control room. The Control Room operator will dispatch the fire brigade for initiation of manual fire fighting. A fire in this fire area will be contained by the construction features discussed in Section 3.1.1. Manual suppression is provided by the CNP Fire Brigade.

Fire extinguishers are provided within this fire area.

Water hose reels are located in the adjacent Turbine Building Fire Zone 84, and in the adjacent Turbine Building Fire Zone 80.

Fire Area AA18 is equipped with floor drains.

### 3.1.7 Ventilation

A fire in this area will be contained by the fire barriers. Smoke can be removed by venting to the outdoors or to other parts of the turbine building. The normal building ventilating systems in the Turbine Building will then exhaust the smoke via filtered monitored pathways. This fire area is listed as a non-controlled area in the Fire Pre Plans and therefore there is reasonable assurance that products of combustion will not be contaminated.

A fire damper 1-HV-AFP-FD-2 having a 3-hour rating is provided to adjacent Fire Zone 17E. The near side of the damper is provided with a High Energy Line Break (HELB) Blowout Panel. The damper is provided with fusible link that is UL rated for 350°F so that the damper will close during a fire and remain open during a HELB in Fire Zone 17E.

### 3.1.8 Other Features

No other fire protection features provided for Fire Area AA18.

### 3.2 Fire Hazards Identification

The fire area does not contain fixed ignition sources. The main hazards are instrumentation and control elements. Combustibles consist primarily of cable insulation, cellulose, Thermo-Lag, rubber and plastics. The current fire loading classification is considered low.

### 3.3 NSCA Compliance Summary

Fire Area AA18, the AFP corridor (EL. 591') contains Unit 1 and 2 Feedwater equipment, as well as Red and Green train cables, conduits and raceways.

Compliance with the nuclear safety performance criteria is achieved using the performance-based approach in accordance with NFPA 805, Section 4.2.4.2.

Safe and stable condition of Unit 1 will be accomplished using Steam Generators 1 and 4 via the Unit 1 West Motor Driven Auxiliary Feedwater Pump, Control Room Process Monitoring, Unit 1 Charging via the West or East pump, Unit 1 Component Cooling Water via the East or West Pump, Unit 1 ESW via the East or West Pump. Electrical power is supplied to either Red or Green Trains via offsite power with both Red and Green train Emergency Diesels also available.

Safe and stable condition of Unit 2 will be accomplished using Steam Generators 1 and 4 via Unit 2 West Motor Driven Auxiliary Feedwater Pump, Control Room Process Monitoring, Unit 2 Charging via the West or East Pump, Unit 2 Component Cooling Water via the East or West Pump, Unit 2 ESW via the Unit 1 East or West Pump. Electrical power is supplied to either Red or Green Trains via offsite power with both Red and Green train Emergency Diesels also available.

The Nuclear Safety Performance Criteria compliance strategy for AA18 is documented within the NSCA Report.

#### 3.3.1 Variances

The variances identified for evaluation for this fire area are grouped as follows:

##### 3.3.1.1 VFDR No. AA18-001

1-FMO-212 and 1-FMO-242- SG 1 and 4 AFW Supply Valves are required to be operable to support decay heat removal for Unit 1. Decay heat removal shall be capable of removing heat from the reactor core such that the fuel is maintained in a safe and stable condition. Decay heat removal requires a set of 2 supply valves be operable with their corresponding AFW pump. The following sets of Unit 1 SG AFW supply valves may fail due to a full area fire within Fire Area AA18; 1-FMO-212 and 1-FMO-242, 1-FMO-222 and 1-FMO-232, 1-FMO-221 and 1-FMO-231. The West AFW Pump is credited to provide decay heat removal due to a fire within Fire Area AA18. This requires 1-FMO-212 and 1-FMO-242 be operable. 1-FMO-212 may fail due to fire induced damage of cables 9747R-1 and 9875R-1. 1-FMO-242 may fail due to fire induced damage cables 9748R-1 and 9874R-1. This condition represents a variance from the deterministic requirements of NFPA 805, Section 4.2.3. This is a separation issue.

This VFDR has been evaluated and it was determined that the risk, safety margin and defense-in-depth meet the acceptance criteria of NFPA 805 Section 4.2.4 with a recovery



action credited.

#### **3.3.1.2 VFDR No. AA18-002**

1HV-AFP-WAC – West MDAFW Pump Room Cooler is required to be operable to support the West MDAFW Pump for decay heat removal. Decay heat removal shall be capable of removing sufficient heat from the reactor core such that the fuel is maintained in a safe and stable condition. The West MDAFW Pump Room Cooler is required to be operable to maintain the room at the design basis temperature for the pump. The West MDAFW Pump is credited for providing decay heat removal for a fire in Fire Area AA18; therefore, 1HV-AFP-WAC is required to be operable. 1HV-AFP-WAC may fail due to fire induced damage of cable 9824R-1. This condition represents a variance from the deterministic requirements of NFPA 805, Section 4.2.3. This is a separation issue.

This VFDR has been evaluated and it was determined that the risk, safety margin and defense-in-depth meet the acceptance criteria of NFPA 805 Section 4.2.4 with a recovery action credited.

#### **3.3.1.3 VFDR No. AA18-003**

2-FMO-212 and 2-FMO-242- SG 1 and 4 AFW Supply Valves are required to be operable to support decay heat removal for Unit 2. Decay heat removal shall be capable of removing heat from the reactor core such that the fuel is maintained in a safe and stable condition. Decay heat removal requires a set of 2 supply valves be operable with their corresponding AFW pump. The following sets of Unit 1 SG AFW supply valves may fail due to a full area fire within Fire Area AA18; 2-FMO-212 and 2-FMO-242, 2-FMO-222 and 2-FMO-232, 2-FMO-221 and 2-FMO-231. The West AFW Pump is credited to provide decay heat removal due to a fire within AA18. This requires 2-FMO-212 and 2-FMO-242 be operable. 2-FMO-212 may fail due to fire induced damage of cables 8788R-2 and 9747R-2. 2-FMO-242 may fail due to fire induced damage of cables 8789R-2 and 9748R-2. This condition represents a variance from the deterministic requirements of NFPA 805, Section 4.2.3. This is a separation issue.

This VFDR has been evaluated and it was determined that the risk, safety margin and defense-in-depth meet the acceptance criteria of NFPA 805 Section 4.2.4 with a recovery action credited.

#### **3.3.1.4 VFDR No. AA18-004**

2HV-AFP-WAC – West MDAFW Pump Room Cooler is required to be operable to support the West MDAFW Pump for decay heat removal. Decay heat removal shall be capable of removing sufficient heat from the reactor core such that the fuel is maintained in a safe and stable condition. The West MDAFW Pump Room Cooler is required to be operable to maintain the room at the design basis temperature for the pump. The West MDAFW Pump is credited for providing decay heat removal for a fire in Fire Area AA18; therefore, 2HV-AFP-WAC is required to be operable. 2HV-AFP-WAC may fail due to fire induced damage of cable 8321R-2. This condition represents a variance from the deterministic requirements of NFPA 805, Section 4.2.3. This is a separation issue.

This VFDR has been evaluated and it was determined that the risk, safety margin and defense-in-depth meet the acceptance criteria of NFPA 805 Section 4.2.4 with a recovery action credited.

### 3.3.2 Recovery Actions Credited

For each VFDR, a Fire Risk Evaluation has been performed to assess the acceptability of risk, defense-in-depth, and safety margin. This evaluation determined whether or not recovery actions are required to ensure that one success path necessary to achieve and maintain the nuclear safety performance criteria is maintained free of fire damage by a single fire. Table 3-3 identifies the credited recovery actions for this area. Actions retained for DID are identified as “DID Actions” within Table 3-3. Additional information for DID actions is contained within Section 3.8 of this report. Note that, for completeness, all VFDRs are contained within Table 3-3, even if the Fire Risk Evaluation has determined that a recovery action is not required. In those instances where a recovery action has been determined to not be required, the word “None” is provided in the “Action” column in the table.

Table 3-3, Recovery Actions Credited		
VFDR	Component	Action
AA18-001	1-FMO-212	1-FMO-212-OPERATE (Manually operate 1-FMO-212)
	1-FMO-242	1-FMO-242-OPERATE (Manually operate 1-FMO-242)
AA18-002	1HV-AFP-WAC	1HV-AFP-WAC-VENT (Provide temporary ventilation for Unit 1 West AFW Pump)
AA18-003	2-FMO-212	2-FMO-212-OPERATE (Manually operate 2-FMO-212)
	2-FMO-242	2-FMO-242-OPERATE (Manually operate 2-FMO-242)
AA18-004	2HV-AFP-WAC	2HV-AFP-WAC-VENT (Provide temporary ventilation for Unit 2 West AFW Pump)

### 3.4 Non-Power Operational Modes Compliance Summary

A review of CNP for the potential effects of a fire in this Fire Area while in non-power modes of operation (NPO) was conducted. This review was conducted using the guidance provided in NEI 04-02 and FAQ 07-0040, “Non-Power Operations Clarifications”.

The review determined that there are no potential failures that affect required Key Safety Functions (KSF) as a result of the fire in this Fire Area. Therefore, the analysis has demonstrated there is reasonable assurance a fire in this fire area during NPO modes will not adversely affect key safety functions and the NFPA 805 performance goal for NPO is therefore satisfied. The results of the NPO analysis are contained within Technical Evaluation R1900-005-001, Non-Power Operation Modes Transition Review Report.

### 3.5 Radioactive Release Compliance Summary

The NFPA 805 radiological release goal is to provide reasonable assurance that a fire will not result in a radiological release that adversely affects the public, plant personnel or the environment. The NFPA 805 requirement is to ensure a radiation release to any unrestricted area due to the direct effects of fire suppression activities (but not involving fuel damage) shall be as low as reasonably

achievable and shall not exceed applicable plant Technical Specification limits.

AA18 is located outside the Radiological Controlled Area (RCA) and is not a storage location for contaminated materials, therefore there is reasonable assurance a fire in this area will not result in radiation release. The review of this fire area, with respect to radioactive release, is documented in the NFPPM.

### 3.6 Probabilistic Risk Assessment-Summary of Results

A Fire PRA (FPRA) quantification of Fire Area AA18 was performed and is documented in PRA-NB-FIRE-FQ, Fire PRA Model Quantification Notebook. The fire risk quantification for Fire Area AA18 is analyzed using detailed fire modeling to consider risk of fire scenarios of ignition sources. PRA-NB-FIRE-FQ includes a summary of all potentially risk-significant fire scenarios (i.e., CDF > 1.0E-7 or LERF > 1.0E-8). Bounding CDF / LERF per calendar year values are reported that are based on the risk values documented in PRA-NB-FIRE-FSS, Fire PRA Fire Scenario Selection.

Fire Protection features credited in the Fire PRA are documented in R1900-0411-AA18, Detailed Fire Modeling Report: Fire Compartment: AA18 Auxiliary Feedwater Pump Corridor (EL. 591 FT). PRA-NB-FIRE-FSS documents the revision level of the fire modeling reports used in the most recent Fire PRA quantification.

### 3.7 Risk-Informed, Performance-Based Evaluations

Fire Risk Evaluations (FREs) have been performed to ensure that variances from the NFPA 805 deterministic requirements are acceptable. The evaluation process consists of an integrated assessment of the acceptability of risk, defense-in-depth, and safety margins.

#### 3.7.1 Transition Risk-Informed, Performance-Based Evaluations

The 'changes' associated with NFPA 805 transition were those variances from the deterministic requirements of NFPA 805 or with the existing fire protection licensing basis that were brought into compliance with the NFPA 805 performance based approach. The change identified for evaluation for Fire Area AA18 is as follows:

- Separation Issues

The Fire Risk Evaluation has determined that the change is acceptable based upon:

- The measured change in CDF and LERF.
- Adequate defense-in-depth and safety margins being maintained.

Refer to Attachment 2 for a summary of results associated with the Fire Risk Evaluations.

### 3.8 Defense-in-Depth

A comprehensive risk-informed, performance-based analysis includes consideration of defense-in-depth (DID) as part of an integrated evaluation of risk considerations. In general, defense-in-depth involves consideration of the extent to which fire protection systems and features are provided within the three echelons of fire-protection:

- Preventing fires from starting,
- Rapidly detecting fires and controlling and extinguishing promptly those fires that do occur, thereby limiting fire damage,
- Providing an adequate level of fire protection for structures, systems, and components important to safety, so that a fire that is not promptly extinguished will not prevent the nuclear safety performance criteria from being met.

Each VFDR was evaluated for DID. No recovery actions have been retained for DID.

Based on the assessment in support of the Fire Risk Evaluation, defense-in-depth is maintained for fire area AA18. Refer to Attachment 2 for details associated with the Fire Risk Evaluation.

### 3.9 Monitoring Program Input

A Monitoring Program will be developed in accordance with FAQ 10-0059, Rev. 1. Methods to monitor availability, reliability, and performance of fire protection program structures, systems, and components (SSCs), as well as programmatic elements will be provided. Additionally, effectiveness measures are established to review program related performance and trends. For AA18 the following systems and features are candidates for inclusion in the CNP Fire Protection Monitoring Program:

- Fire Area boundary barriers discussed in Section 3.1
- Fire Detection System (ionization)
- Fire Suppression System (wet-pipe)

### 4.0 CONCLUSION

The nuclear safety and radioactive release performance criteria of NFPA 805 are met for a fire in Fire Area AA18. This Fire Risk Evaluation for Fire Area AA18 has demonstrated that

- The change in core damage frequency (delta CDF) is acceptable, and
- The change in large early release frequency (delta LERF) is acceptable, and
- Defense-in-depth and safety margins are maintained.

This is confirmation that a success path effectively remains free of fire damage and that the performance-based approach is acceptable per Section 4.2.4.2 of NFPA 805.

## **5.0 REFERENCES**

- 5.1 Calculation PRA-FIRE-NB-CRE, Fire PRA Cumulative Risk Evaluations
- 5.2 CNP Fire Pre-Plans, Volumes I, II, and III, Revisions 17, 14, and 18 respectively
- 5.3 Fire Hazards Analysis
- 5.4 NFPA 805, Performance-Based Standard for Fire Protection for Light Water Reactor Electric Generating Plants
- 5.5 NFPPM, NFPA 805 Fire Protection Program Manual (NFPPM)
- 5.6 Nuclear Energy Institute (NEI) 04-02, Guidance for Implementing a Risk-Informed, Performance-Based Fire Protection Program under 10 CFR 50.48(c), Rev. 2
- 5.7 Nuclear Safety Capability Assessment Report
- 5.8 PRA-NB-FIRE-FQ, Fire PRA Model Quantification Notebook
- 5.9 PRA-NB-FIRE-FSS, Fire PRA Fire Scenario Selection
- 5.10 R1900-0411-AA18, AA18 - Detailed Fire Modeling Report
- 5.11 Regulatory Guide 1.205, Risk-Informed, Performance-Based Fire Protection for Existing Light-Water Nuclear Power Plants, Rev. Revision 1
- 5.12 Technical Evaluation R1900-005-001, Non-Power Operation Modes Transition Review

**Fire Area AA18 – Attachment 1 - Table B-3 - Fire Area Transition**

<u>Unit</u>	<u>Fire Area</u>	<u>Description</u>
1, 2	AA18	Auxiliary Feedwater Pump Corridor (El. 591 ft.)

<u>Fire Zone</u>	<u>Description</u>
17C	Corridor to Aux. Feed Pump Rooms - El. 591 ft. 0 in. - Both Units

**Regulatory Basis**

4.2.4.2 - Performance-Based Approach - Fire Risk Evaluation with simplifying deterministic assumptions

<b>Performance Goal</b>	<b>Method of Accomplishment</b>	<b>Comments</b>
Reactivity Control	Unit 1 - Trip the reactor from the Control Room. Borate using Unit 1 East or West Charging Pump from the RWST. Use source range monitoring for indication.  Unit 2 - Trip the reactor from the Control Room. Borate using Unit 2 East or West Charging Pump supplied from the RWST. Use source range monitoring for indication.	None
Inventory and Pressure Control	Unit 1 - Control inventory using Unit 1 East or West Charging Pump. Control pressure using Unit 1 Pressurizer Safety Relief Valves.  Unit 2 - Control inventory using Unit 2 East or West Charging Pump. Control pressure using Unit 2 Pressurizer Safety Relief Valves.	None
Decay Heat Removal	Unit 1 - Feed SGs 1 & 4 with Unit 1 West MDAFW Pump. The DHR function also requires MS isolation with a steam release path through the Safety Relief Valves.  Unit 2 - Feed SGs 1 & 4 with Unit 2 West MDAFW Pump. The DHR function also requires MS isolation with a steam release path through the Safety Relief Valves.	VFDRs identified for Unit 1 and Unit 2 SG supply valves.
Process Monitoring	Unit 1 Process Monitoring - Use Unit 1 process monitoring in the Control Room for the following: Pressurizer level, RCS pressure and temperature, and S/G level and Pressure. Unit 1 Source Range Monitoring - Use Unit 1 source range monitoring in the Control Room.	None

**Fire Area AA18 – Attachment 1 - Table B-3 - Fire Area Transition**

<u>Unit</u>	<u>Fire Area</u>	<u>Description</u>
1, 2	AA18	Auxiliary Feedwater Pump Corridor (El. 591 ft.)
Vital Auxiliaries		<p>Unit 2 Process Monitoring - Use Unit 2 process monitoring in the Control Room for the following: Pressurizer level, RCS pressure and temperature, and S/G level and Pressure.</p> <p>Unit 2 Source Range Monitoring - Use Unit 2 source range monitoring in the Control Room.</p>
		<p>Unit 1 Electrical - Control Unit 1 Red (AB) Train Electrical Distribution with Unit 1 Red (AB) Train Offsite Power or Unit 1 Red (AB) DG. Control Unit 1 Green (CD) Train Electrical Distribution with Unit 1 Green (CD) Train Offsite Power or Unit 1 Green (CD) DG.</p> <p>Unit 1 ESW - Operate Unit 1 East or West ESW.</p> <p>Unit 1 CCW - Operate Unit 1 East or West CCW.</p> <p>Unit 1 HVAC - Operate Unit 1 Control Room HVAC. Operate Unit 1 Auxiliary Building HVAC. Operate Unit 1 Red (AB) and Green (CD) DG HVAC. Operate Unit 1 Switchgear HVAC. Unit 1 AFW Pump Room HVAC systems are not available. Operate the Unit 1 East and West ESW Pump HVAC systems.</p> <p>Unit 2 Electrical - Control Unit 2 Red (AB) Train Electrical Distribution with Unit 2 Red (AB) Train Offsite Power or Unit 2 Red (AB) DG. Control Unit 2 Green (CD) Train Electrical Distribution with Unit 2 Green (CD) Train Offsite Power or Unit 2 Green (CD) DG.</p> <p>Unit 2 ESW - Operate Unit 1 East or West ESW to support Unit 2 ESW systems. Unit 2 ESW pumps may not be available due to the loss of Unit 2 ESW ventilation.</p> <p>Unit 2 CCW - Operate Unit 2 East or West CCW.</p> <p>Unit 2 HVAC - Operate Unit 2 Control Room HVAC. Operate Unit 2 Auxiliary Building HVAC. Operate Unit 2 Red (AB) and Green (CD) DG HVAC. Operate Unit 2 Switchgear HVAC. Unit 2 AFW Pump Room HVAC systems are not available. Operate the Unit 1 East and West ESW Pump HVAC systems, Unit 2 ESW Pump HVAC systems are not available.</p>

VFDR identified for Unit 1 and Unit 2 West MDAFW Pump Room HVAC systems.

**Fire Area AA18 – Attachment 1 - Table B-3 - Fire Area Transition**

<u>Unit</u>	<u>Fire Area</u>	<u>Description</u>
1, 2	AA18	Auxiliary Feedwater Pump Corridor (El. 591 ft.)

**Reference Documents**

Genesis Solution Suite, EDISON / SAFE-PB, DC Cook V 3.4.0

Nuclear Safety Capability Assessment Report

**Licensing Actions**

None

**Existing Engineering Equivalency Evaluations (EEEE)**

None

**Fire Suppression Effects on Nuclear Safety Performance Criteria**

The CNP fire brigade is trained to discharge water in a judicious manner and instructed to direct hose streams and portable extinguishers at the base of the fire to limit the amount of overspray beyond the immediate fire zone. For this reason, fire brigade activities are not expected to fail components which are not immediately involved in the fire scenario. It has been concluded that water impingement on cables is not a concern. Electrical cabinets are provided with a seal at the conduit interface to prevent water intrusion. Per visual inspection any side vents for this equipment are pointed downward to prevent water intrusion. Therefore, in the event of discharge, the wet pipe system will not adversely effect the other equipment operating within the fire zone. The drainage features of the fire area mitigate the potential for flooding damage due to fire suppression, such that the standing water would not affect credited equipment.

Since it is shown that suppression effects will not impact the nuclear safety performance criteria, the fire area configuration is deemed acceptable.

**References:**

Technical Evaluation 12.1, "Fire Suppression Effects Study"

Technical Evaluation 12.1, "Supplemental Information to Fire Suppression Effects Study – Supplement 1"

**Fire Area Comments**

None



## Fire Area AA18 – Attachment 2 - Fire Risk Evaluation Results Summary

### A2.1 Introduction

The ‘changes’ associated with NFPA 805 transition were those variances from the deterministic requirements of NFPA 805. The changes identified for evaluation for fire area AA18 are grouped as follows:

- Separation Issues

This attachment is a summary of the Fire Risk Evaluation for the fire area. The complete results and methodology are contained in the Cumulative Fire Risk Evaluation, PRA-FIRE-NB-CRE. (FPCE 2017-0009)

### A2.2 Inputs/Assumptions

Fire modeling processes and inputs provided in NUREG/CR-6850 are appropriate for use in a risk-informed, performance-based evaluation. The complete list of assumptions used in the fire modeling methodology for this fire area is contained in Detailed Fire Modeling Technical Evaluation R1900-0411-AA18.

### A2.3 Fire Modeling Methodology

Fire PRA fire modeling results are used as the initial input into this Fire Risk Evaluation. The process consists of conservative bounding analyses using NUREG/CR-6850 methods. As needed, refinements are made to utilize more realistic parameters. The complete fire modeling methodology for this fire area is contained in Detailed Fire Modeling Technical Evaluation R1900-0411-AA18.

### A2.4 Scenario Descriptions and Model Results

Fire Area AA18 was evaluated for the impact of fires originating from transient ignition sources only. Complete descriptions of each fire scenario is contained within the Detailed Fire Modeling Technical Evaluation R1900-0411-AA18.

#### A2.4.1 Ignition Sources

Fire Area AA18 does not contain any fixed ignition sources. The 98th percentile HRR was used for all transient fires. The 98th percentile HRR bounds the possible transient ignition sources expected for this fire area, which were fire tested and identified in NUREG/CR-6850, Appendix G, Table G-7.

#### A2.4.2 Scenario Results

A delta risk calculation has been performed to quantify the risk associated with the VFDRs in the fire area.

### A2.5 Fire Risk Evaluation Results

PRA-FIRE-NB-CRE documents scenarios and corresponding impacted VFDRs that were evaluated for delta risk during the transition to NFPA 805 and also all changes to the Fire Protection Program that are currently incorporated into the Fire PRA model. The acceptability of the Cumulative Fire Risk Evaluations was based on calculated delta risk meeting the thresholds of NEI 04-02, RG 1.205 and RG 1.174. (FPCE 2017-0009)

## Fire Area AA18 – Attachment 2 - Fire Risk Evaluation Results Summary

### A-2.6 Impact of VFDR on Defense-in-Depth

Defense-in-Depth has been evaluated for this fire area. The impacts of this evaluation are summarized in the table below:

Defense-in-Depth Impact Review for AA18			
Method of Providing DID	Required to Support Deterministic Analysis or Fire PRA?	Changes or Improvements Necessary for DID?	Basis/Justification
Echelon 1: Prevent fires from starting			
Combustible Control is implemented in accordance with Procedure PMP-2270-CCM-001, Control of Combustible Materials.	Yes	No	• This element is adequate based on no perceived weakness of, or over-reliance on, another echelon of defense-in-depth.
Hot Work Control is implemented in accordance with Procedure PMP-2270-WBG-001, Welding, Burning and Grinding Activities.	Yes	No	
Echelon 2: Rapidly detect, control and extinguish promptly those fires that do occur thereby limiting fire damage			
Fire Detection System	Yes	No	• Detection is already required and fire fighting activities are not expected to be challenging, therefore, no changes or improvements to Echelon 2 attributes are necessary to maintain defense-in-depth.
Fixed Fire Suppression	No	No	
Portable Fire Extinguishers	Yes	No	
Hose stations and hydrants	Yes	No	
Pre-Fire Plan	Yes	No	
Echelon 3: Provide adequate level of fire protection for systems and structures so that a fire will not prevent essential safety functions from being performed			
Walls, floors ceilings and structural elements are rated or have been evaluated as adequate for the hazard.	Yes	No	• Based on a detailed review, the mitigating recovery action is credited for all variances; therefore no changes or improvements to Echelon 3 attributes are necessary to maintain defense-in-depth.
Penetrations in the fire area barrier are rated or have been evaluated as adequate for the hazard.	Yes	No	
Supplemental barriers (e.g., ERFBS, cable tray covers, etc.)	No	No	
Guidance provided to operations personnel detailing the required success path(s) including recovery actions to achieve nuclear safety performance criteria.	Yes	No	

## Fire Area AA18 – Attachment 2 - Fire Risk Evaluation Results Summary

### A-2.7 Safety Margin Considerations

In accordance with NEI 04-02, the maintenance of adequate Safety Margin is assessed by the consideration categories of analyses utilized by this Fire Risk Evaluation.

Safety margins are considered to be maintained if:

- Codes and Standards or their alternatives accepted for use by the NRC are met.

AND

- Safety analyses acceptance criteria in the licensing basis (e.g., FSAR, supporting analyses) are met, or provides sufficient margin to account for analysis and data uncertainty.

The following summarizes the bases for ensuring the maintenance of safety margins:

- The risk-informed, performance based processes utilized are based upon NFPA 805, 2001 edition, endorsed by the NRC in 10 CFR 50.48(c).
- The Fire Risk Evaluation process is in accordance with NEI 04-02, Revision 2, which is endorsed by the NRC in Regulatory Guide 1.205, Revision 1.
- The Fire PRA is developed in accordance with NUREG/CR-6850, which was developed jointly between the NRC and EPRI.
- The Fire PRA has undergone an industry peer review, in order to ensure the Fire PRA meets the appropriate quality standards of ASME/ANS RA-Sa-2009, "Standard for Level 1/Large Early Release Frequency Probabilistic Risk Assessment for Nuclear Power Plant Applications," Dated February 2, 2009
- The "combined analysis approach" is used during transition (NEI 04-02, Section 5.3.4.3); therefore, MEFS/LFS is not analyzed separately from the Fire PRA results.
- The CNP internal events PRA model received two formal industry peer reviews conducted in accordance with applicable NEI guidelines. The initial peer review was performed in 2001, while a subsequent focused scope (i.e., limited scope) peer review was conducted in 2009. The initial, full-scope WOG peer review covered all aspects of the CNP PRA model and the administrative processes used to maintain and update the model. The CNP PRA model has been revised to address all significant issues (i.e., Category A and B Facts & Observations) identified during the initial peer review. None of the findings from the focused-scope peer review were judged to reach the significance level of a Category A or B Fact & Observation; as a result, no changes to the PRA model have yet been made to include resolutions for these latter issues.
- Fire protection systems and features determined to be required by NFPA 805 Chapter 4 have been confirmed to meet the requirements of NFPA 805 Chapter 3 and their associated referenced codes and listings, or provided with acceptable alternatives using processes accepted for use by the NRC (i.e., FAQ 06-0008, FAQ 06-0004, 07-0033).
- Fire modeling performed in support of the transition has been performed within the Fire PRA utilizing codes and standards developed by industry and NRC staff which have been verified and validated in authoritative publications, such as NUREG 1824, "Verification and Validation of Selected Fire Models for Nuclear Power Plant Applications". In general, the fire modeling performed in support of the Fire Risk Evaluations has been performed using conservative methods and input parameters that are based upon

## **Fire Area AA18 – Attachment 2 - Fire Risk Evaluation Results Summary**

NUREG/CR-6850 as documented in the AA18 Detailed Fire Modeling Report, section 7.2. While this is generally not ideal in the context of best estimate probabilistic risk analysis, it is a pragmatic approach given the current state of knowledge regarding the uncertainties related to the application of the fire modeling tools and associated input parameters for specific plant configurations.

- In accordance with the requirements of 10 CFR 50.48(c)(2)(iii), the Fire PRA results, including cutsets for the scenarios of concern, have been reviewed and it was verified that the results presented above do not rely solely on feed and bleed as the fire-protected safe shutdown path for maintaining reactor coolant inventory, pressure control, and decay heat removal capability for this fire area.

### **A-2.8 Transition Risk Evaluation Conclusions**

The transition change evaluation determined that these changes:

- Are acceptable based upon the measured change in CDF and LERF
- Maintained adequate defense-in-depth and safety margins

The results of this evaluation meet the requirements of NFPA 805 Risk Evaluation; therefore, the use of the performance based analysis approach is acceptable.



## 1.0 PURPOSE

This report documents the Fire Safety Analysis (FSA) for Cook Nuclear Plant (CNP) Fire Area AA19, Unit 1 East Motor Driven Auxiliary Feedwater Pump Room (El. 591 ft.) which comprises fire zone(s) 17D. The purpose of this analysis is to demonstrate the achievement of the nuclear safety and radioactive release performance criteria of NFPA 805 as required by 10 CFR 50.48(c). The Fire Safety Analysis is a key part of compliance with Section 2.7.1.2 Fire Protection Program Design Basis Document of NFPA 805.

## 2.0 ANALYSIS METHODOLOGY

The FSA is the design basis document as described in NFPA 805 Section 2.7.1.2. The following steps are performed to develop the FSA on a fire area basis:

- Identify significant fire hazards in the fire area. This is based on NFPA 805 approach to analyze the plant from an ignition source and fuel package perspective.
- Summarize Nuclear Safety Capability Analysis (NSCA) compliance strategies. This is the result of the NEI 04-02 B-3 Table review of the Safe Shutdown Analysis.
- Summarize Non-Power Operations Modes compliance strategies.
- Summarize Radioactive Release compliance strategies. The transition review process required per NEI 04-02 is used to develop these results.
- Provide Fire Probabilistic Risk Assessment summary of results. This is based on the results from the plant Fire PRA.
- Perform risk informed, performance based evaluations if needed for the performance based approach.
- Summarize Defense-in-Depth strategy for each fire area.
- Determine key analysis assumptions which are candidates to be included in the NFPA 805 monitoring program.
- Provide conclusions relative to NFPA 805 compliance.

### 3.0 ANALYSIS

#### 3.1 Classical Fire Protection

##### 3.1.1 Construction

Walls, floors and ceilings to adjacent fire areas are reinforced concrete in excess of a 3-hour rating.

Applicable Engineering Equivalency Evaluations are documented in Attachment 1.

##### 3.1.2 Doors and Access Openings

A fire door having a 3-hour rating is provided to adjacent Fire Area AA18 - Fire Zone 17C.

##### 3.1.3 Penetrations

Penetrations in fire barriers between this fire zone and adjacent fire areas are provided with fire seals.

The seismic gaps are provided with fire seals. Refer to Engineering Equivalency Evaluation 11-26 for evaluation of the seismic gap to Fire Zone 17E as a HELB pressure boundary seal.

##### 3.1.4 Detection

The table below outlines the fire detection system(s) provided in the Fire Area:

Table 3-1, Fire Area AA19 Detection Systems								
Fire Zone	Type of System	Local (L) / Remote (R)	Detection Actuates Suppression?	Required System?				
				S	L	E	R	D
17D	None	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Table 3-1 Legend:								
Table Field: "Required System?"								
S	- Required for Chapter 4 Separation Criteria							
L	- Required for NRC Approved Licensing Action							
E	- Required for Engineering Equivalency Evaluation							
R	- Required for Risk Significance							
D	- Required to maintain adequate balance of Defense-in-Depth in a Change Evaluation or Fire Risk Evaluation							

Fire Area AA19 is not provided with an automatic fire detection system.

### 3.1.5 Fixed Suppression

The table below outlines the fixed fire suppression system(s) provided in the Fire Area:

Table 3-2, Fire Area AA19 Suppression Systems							
Fire Zone	Type of System	Full (F) / Partial (P)	Required System?				
			S	L	E	R	D
17D	None	N/A	N/A	N/A	N/A	N/A	N/A

**Table 3-2 Legend:**

Table Field: "Required System?"	
S	- Required for Chapter 4 Separation Criteria
L	- Required for NRC Approved Licensing Action
E	- Required for Engineering Equivalency Evaluation
R	- Required for Risk Significance
D	- Required to maintain adequate balance of Defense-in-Depth in a Change Evaluation or Fire Risk Evaluation

Fire Area AA19 is not provided with fixed fire suppression.

### 3.1.6 Manual Suppression / Response Strategy

A postulated fire will be identified by plant personnel using plant communication system to notify the control room. The Control Room operator will dispatch the fire brigade for initiation of manual fire fighting. A fire in this fire area will be contained by the construction features discussed in Section 3.1.1. Manual suppression is provided by the CNP Fire Brigade.

Fire extinguishers are located in adjacent Fire Area AA18 - Fire Zone 17C.

Water hose reels are located in the adjacent Turbine Building Fire Area AA2 - Fire Zone 80.

Fire Area AA19 is equipped with floor drains.

### 3.1.7 Ventilation

A fire in this area will be contained by the fire barriers. Smoke can be removed by venting to the outdoors or to other parts of the turbine building. The normal building ventilating systems in the Turbine Building will then exhaust the smoke via filtered monitored pathways. This fire area is listed as a non-controlled area in the Fire Pre Plans and therefore there is reasonable assurance that products of combustion will not be contaminated.

Fire dampers having a 3-hour rating are provided in penetrations to adjacent Fire Area AA2 - Fire Zone 80. The fire zone is cooled by an internal room cooler.

The fire dampers (1-HV-AFP-FD-1A and 1-HV-AFP-FD-1B) in the two fan penetrations assure the fire barrier is maintained. Fire damper 1-HV-AFP-FD-1A is maintained closed. The penetration is sealed using a plate on the opposite side of the wall from the fire damper. The seal plates do not impact the fire damper function. The steel plate is ¼" thick ASTM A36, sized as required to cover the opening. D.C. 96-081 RTV silicone adhesive/sealant or approved equal is installed at open gaps between the frame and the ¼" plate (Sealant provides an air seal). The ¼"



plate is installed inside the pump room and the fire damper is on the opposite side of the wall. Fire Damper 1-HV-AFP-FD-1B is provided with a blowout panel and a security barrier. This blowout panel and security barrier do not impact the function of the fire damper. An 8"-diameter penetration (No. TPS-111) in the west wall to Fire Zone 17A is used to route the 2"-diameter ESW return line from cooler 1-HV-AFP-EAC. The penetration is sealed with a site-approved, non-shrink, cementitious grout to achieve a 3-hr rating. Use of grout as a fire barrier material is acceptable.

### 3.1.8 Other Features

No other fire protection features provided for Fire Area AA19.

## 3.2 Fire Hazards Identification

The fire area contains both ignition sources and combustible fire hazards. The main ignition sources are the East AFW pump and the room cooler. Combustibles consist primarily of rubber and plastics. The current fire loading classification is considered low.

## 3.3 NSCA Compliance Summary

U1 East Motor Driven Aux Feedpump Room (EL. 591') contains Unit 1 Green Train (East) Feedwater and room cooler equipment, Red and Green train cables, conduits, raceways and the room cooler.

Compliance with the nuclear safety performance criteria is achieved using the deterministic approach in accordance with NFPA 805, Section 4.2.3.2.

Safe and stable condition of Unit 1 will be accomplished using Steam Generators 2 and 3 via Unit 1 Turbine Driven Auxiliary Feedwater Pump, Control Room Process Monitoring, Unit 1 Charging via the West or East pump, Unit 1 Component Cooling Water via the East or West Pump, Unit 1 Essential Service Water via the East or West Pump. Electrical power is supplied to either Red or Green Trains via offsite power with both Red and Green Train Emergency Diesels also available.

The Nuclear Safety Performance Criteria compliance strategy for AA19 is documented within the NSCA Report.

### 3.3.1 Variances

There are no variances for this fire area.

### 3.3.2 Recovery Actions Credited

There are no recovery actions for this fire area.

## 3.4 Non-Power Operational Modes Compliance Summary

A review of CNP for the potential effects of a fire in this Fire Area while in non-power modes of operation (NPO) was conducted. This review was conducted using the guidance provided in NEI 04-02 and FAQ 07-0040, "Non-Power Operations Clarifications".

The review determined that there are potential failures that affect certain Key Safety Functions (KSF) as a result of the fire in this area, and the fire could result in the loss of one or more KSF paths. Compensatory measures are required during high risk evolution periods to provide reasonable

assurance a fire will not adversely affect key safety functions and the NFPA 805 performance goal for NPO is therefore satisfied. The results of the NPO analysis are contained within Technical Evaluation R1900-005-001, Non-Power Operation Modes Transition Review Report.

### **3.5 Radioactive Release Compliance Summary**

The NFPA 805 radiological release goal is to provide reasonable assurance that a fire will not result in a radiological release that adversely affects the public, plant personnel or the environment. The NFPA 805 requirement is to ensure a radiation release to any unrestricted area due to the direct effects of fire suppression activities (but not involving fuel damage) shall be as low as reasonably achievable and shall not exceed applicable plant Technical Specification limits.

AA19 is located outside the Radiological Controlled Area (RCA) and is not a storage location for contaminated materials, therefore there is reasonable assurance a fire in this area will not result in radiation release. The review of this fire area, with respect to radioactive release, is documented in the NFPPM.

### **3.6 Probabilistic Risk Assessment-Summary of Results**

A Fire PRA (FPRA) quantification of Fire Area AA19 was performed and is documented in PRA-NB-FIRE-FQ, Fire PRA Model Quantification Notebook. The fire risk quantification for Fire Area AA19 is analyzed assuming whole room burnup. PRA-NB-FIRE-FQ includes a summary of all potentially risk-significant fire scenarios (i.e., CDF > 1.0E-7 or LERF > 1.0E-8). Bounding CDF / LERF per calendar year values are reported that are based on the risk values documented in PRA-NB-FIRE-FSS, Fire PRA Fire Scenario Selection.

### **3.7 Risk-Informed, Performance-Based Evaluations**

There are no VFDRs for this fire area, and therefore, no Fire Risk Evaluations have been performed.

#### **3.7.1 Transition Risk-Informed, Performance-Based Evaluations**

There are no VFDRs for this fire area, and therefore this section is not applicable to Fire Area AA19.

### 3.8 Defense-in-Depth

Per NFPA 805, section 2.4.4.2, “Defense-in-Depth”: The deterministic approach for meeting the performance criteria shall be deemed to satisfy this defense-in-depth requirement.

### 3.9 Monitoring Program Input

A Monitoring Program will be developed in accordance with FAQ 10-0059, Rev. 1. Methods to monitor availability, reliability, and performance of fire protection program structures, systems, and components (SSCs), as well as programmatic elements will be provided. Additionally, effectiveness measures are established to review program related performance and trends. For AA19 the following systems and features are candidates for inclusion in the CNP Fire Protection Monitoring Program:

- Fire Area boundary barriers discussed in Section 3.1

## 4.0 CONCLUSION

The nuclear safety and radioactive release performance criteria of NFPA 805 are met for a fire in Fire Area AA19. This Fire Safety Analysis has demonstrated that for Fire Area AA19 a success path remains free of fire damage using the deterministic approach per Section 4.2.3 of NFPA 805.

## 5.0 REFERENCES

- 5.1 CNP Fire Pre-Plans, Volumes I, II, and III, Revisions 17, 14, and 18 respectively
- 5.2 Fire Hazards Analysis
- 5.3 NFPA 805, Performance-Based Standard for Fire Protection for Light Water Reactor Electric Generating Plants
- 5.4 NFPPM, NFPA 805 Fire Protection Program Manual (NFPPM)
- 5.5 Nuclear Energy Institute (NEI) 04-02, Guidance for Implementing a Risk-Informed, Performance-Based Fire Protection Program under 10 CFR 50.48(c), Rev. 2
- 5.6 Nuclear Safety Capability Assessment Report
- 5.7 PRA-NB-FIRE-FQ, Fire PRA Model Quantification Notebook
- 5.8 PRA-NB-FIRE-FSS, Fire PRA Fire Scenario Selection
- 5.9 Regulatory Guide 1.205, Risk-Informed, Performance-Based Fire Protection for Existing Light-Water Nuclear Power Plants, Rev. Revision 1
- 5.10 Technical Evaluation R1900-005-001, Non-Power Operation Modes Transition Review

**Fire Area AA19 – Attachment 1 - Table B-3 - Fire Area Transition**

<u>Unit</u>	<u>Fire Area</u>	<u>Description</u>
1	AA19	Unit 1 East Motor Driven Auxiliary Feedwater Pump Room (El. 591 ft.)

<u>Fire Zone</u>	<u>Description</u>
17D	East Aux. Feed Pump Room - El. 591 ft. 0 in. - Unit 1

**Regulatory Basis**

4.2.3.2 - Deterministic Approach

<b>Performance Goal</b>	<b>Method of Accomplishment</b>	<b>Comments</b>
Reactivity Control	Unit 1 - Trip the reactor from the Control Room. Borate using Unit 1 East or West Charging Pump supplied from the RWST. Use source range monitoring for indication for Unit 1.	None
Inventory and Pressure Control	Unit 1 - Control inventory using Unit 1 East or West Charging Pump. Control pressure using Unit 1 Pressurizer Safety Relief Valves.	None
Decay Heat Removal	Unit 1 - Feed SGs 2 & 3 with Unit 1 TDAFW Pump. The DHR function also requires MS isolation with a steam release path through the Safety Relief Valves.	None
Process Monitoring	Unit 1 Process Monitoring - Use Unit 1 process monitoring in the Control Room for the following: Pressurizer level, RCS pressure and temperature, and S/G level and Pressure. Unit 1 Source Range Monitoring - Use Unit 1 source range monitoring in the Control Room.	None
Vital Auxiliaries	Unit 1 Electrical - Control Unit 1 Red (AB) Train Electrical Distribution with Unit 1 Red (AB) Train Offsite Power or Unit 1 Red (AB) DG. Control Unit 1 Green (CD) Train Electrical Distribution with Unit 1 Green (CD) Train Offsite Power or Unit 1 Green (CD) DG. Unit 1 ESW - Operate Unit 1 East or West ESW. Unit 1 CCW - Operate Unit 1 East or West CCW. Unit 1 HVAC - Operate Unit 1 Control Room HVAC. Operate Unit 1 Auxiliary Building HVAC. Operate Unit 1 Red (AB) DG and Green (CD) DG HVAC. Operate Unit 1 Switchgear HVAC. Operate Unit 1 TDAFW Pump Room HVAC system. Operate the Unit 1 East and West ESW Pump HVAC systems.	None

**Fire Area AA19 – Attachment 1 - Table B-3 - Fire Area Transition**

<u>Unit</u>	<u>Fire Area</u>	<u>Description</u>
1	AA19	Unit 1 East Motor Driven Auxiliary Feedwater Pump Room (El. 591 ft.)

**Reference Documents**

Genesis Solution Suite, EDISON / SAFE-PB, DC Cook V 3.4.0

Nuclear Safety Capability Assessment Report

**Licensing Actions**

None

**Existing Engineering Equivalency Evaluations (EEEE)****EEEE Title Engineering Equivalency Evaluation 11-9 - Turbine, Auxiliary and Containment Buildings Boundary Evaluation**

**Summary** The purpose of this engineering equivalency evaluation is to describe in general, the approach and existence of evaluations performed to determine and reconcile fire area boundaries having components or designs with less than a 3-hr fire rating on preventing the spread of fire. This engineering equivalency evaluation also specifically evaluates the impact of unrated door assemblies on the spread of fire.

Reasonable assurance is provided that the fire area boundaries having components or design less than a 3-hr fire rating will not increase the spread of fire or impair the safe shutdown capabilities of Units 1 or 2. In addition, this engineering equivalency evaluation does not adversely impact on other engineering equivalency evaluations or exemption requests.

This evaluation supports additional evaluations credited in this fire area.

**Fire Area AA19 – Attachment 1 - Table B-3 - Fire Area Transition**

<u>Unit</u>	<u>Fire Area</u>	<u>Description</u>
1	AA19	Unit 1 East Motor Driven Auxiliary Feedwater Pump Room (El. 591 ft.)

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**EEEE Title** **Engineering Equivalency Evaluation 11-26 - Fire Seal Evaluation Study Fire Retention Capability of a HELB Pressure Boundary Seal**

**Summary** The purpose of this engineering equivalency evaluation is to document the acceptability of the fire retention capability of a HELB seal on preventing the spread of fire in Fire Areas AA19, AA20, AA21 and AA22.

Reasonable assurance is provided that the HELB pressure boundary seals located between the east motor driven and turbine driven auxiliary feedwater pump rooms will provide adequate fire retention capabilities and will not impair the safe shutdown capabilities of CNP or increase the ability of fire to spread between fire zones. This engineering equivalency evaluation does not impact other engineering equivalency evaluations.

The fire seal designs were evaluated and found to be acceptable based on the fire hazards and the construction features within the evaluated areas.

**Fire Suppression Effects on Nuclear Safety Performance Criteria**

The CNP fire brigade is trained to discharge water in a judicious manner and instructed to direct hose streams and portable extinguishers at the base of the fire to limit the amount of overspray beyond the immediate fire zone. For this reason, fire brigade activities are not expected to fail components not already considered damaged. It has been concluded that water impingement on cables is not a concern. Electrical cabinets are provided with a seal at the conduit interface. Possible impacts to surrounding equipment due to manual fire fighting activities is bounded by the analysis approach of postulating whole room damage. The drainage features of the fire area mitigate the potential for flooding damage due to fire suppression, such that the standing water would not affect credited equipment.

This fire area is not equipped with a fixed fire suppression system. Since it is shown that suppression effects will not impact the nuclear safety performance criteria, the fire area configuration is deemed acceptable.

**References:**

Technical Evaluation 12.1, "Fire Suppression Effects Study"

Technical Evaluation 12.1, "Supplemental Information to Fire Suppression Effects Study – Supplement 1"

**Fire Area Comments**

None

## D. C. Cook Nuclear Plant Fire Safety Analysis

## Fire Area: AA20

## Unit 1 Turbine Driven Auxiliary Feedwater Pump Room (El. 591 ft.)

## Table of Contents

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## Attachments

Fire Area AA20 – Attachment 1 - Table B-3 - Fire Area Transition

## 1.0 PURPOSE

This report documents the Fire Safety Analysis (FSA) for Cook Nuclear Plant (CNP) Fire Area AA20, Unit 1 Turbine Driven Auxiliary Feedwater Pump Room (El. 591 ft.) which comprises fire zone(s) 17E. The purpose of this analysis is to demonstrate the achievement of the nuclear safety and radioactive release performance criteria of NFPA 805 as required by 10 CFR 50.48(c). The Fire Safety Analysis is a key part of compliance with Section 2.7.1.2 Fire Protection Program Design Basis Document of NFPA 805.

## 2.0 ANALYSIS METHODOLOGY

The FSA is the design basis document as described in NFPA 805 Section 2.7.1.2. The following steps are performed to develop the FSA on a fire area basis:

- Identify significant fire hazards in the fire area. This is based on NFPA 805 approach to analyze the plant from an ignition source and fuel package perspective.
- Summarize Nuclear Safety Capability Analysis (NSCA) compliance strategies. This is the result of the NEI 04-02 B-3 Table review of the Safe Shutdown Analysis.
- Summarize Non-Power Operations Modes compliance strategies.
- Summarize Radioactive Release compliance strategies. The transition review process required per NEI 04-02 is used to develop these results.
- Provide Fire Probabilistic Risk Assessment summary of results. This is based on the results from the plant Fire PRA.
- Perform risk informed, performance based evaluations if needed for the performance based approach.
- Summarize Defense-in-Depth strategy for each fire area.
- Determine key analysis assumptions which are candidates to be included in the NFPA 805 monitoring program.
- Provide conclusions relative to NFPA 805 compliance.



### 3.0 ANALYSIS

#### 3.1 Classical Fire Protection

##### 3.1.1 Construction

Walls, floors and ceilings to adjacent fire areas are reinforced concrete in excess of a 3-hour rating.

Applicable Engineering Equivalency Evaluations are documented in Attachment 1.

##### 3.1.2 Doors and Access Openings

A fire door having a 3-hour rating is provided to adjacent Fire Area AA18 - Fire Zone 17C.

##### 3.1.3 Penetrations

Penetrations in fire barriers between this fire zone and adjacent fire areas are provided with fire seals. The seismic gaps are provided with fire seals. Refer to Engineering Equivalency Evaluation 11-26 for evaluation of the seismic gap to 17D as a HELB pressure boundary seal.

A penetration exists in the wall between Fire Zone 17E and Fire Zone 17D for the 2" diameter ESW piping. The piping is grouted in place to the full depth of the wall using concrete or non-shrink grout to achieve a 3-hr rating. An 8"-diameter penetration (No. TPS-113) in the west wall to Fire Zone 17A is used to route the 2"-diameter ESW return from cooler 1-HV-AFP-T2AC and the 2"-diameter ESW supply line to cooler. Also, a 6"-diameter penetration in the west wall (No. TPS-115) is used to route the 2"-diameter return line from cooler. The penetrations are sealed with a non-shrink grout to achieve a 3-hr rating.

##### 3.1.4 Detection

The table below outlines the fire detection system(s) provided in the Fire Area:

Table 3-1, Fire Area AA20 Detection Systems								
Fire Zone	Type of System	Local (L) / Remote (R)	Detection Actuates Suppression?	Required System?				
				S	L	E	R	D
17E	None	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Table 3-1 Legend:								
Table Field: "Required System?"								
S	- Required for Chapter 4 Separation Criteria							
L	- Required for NRC Approved Licensing Action							
E	- Required for Engineering Equivalency Evaluation							
R	- Required for Risk Significance							
D	- Required to maintain adequate balance of Defense-in-Depth in a Change Evaluation or Fire Risk Evaluation							

Fire Area AA20 is not provided with an automatic fire detection system.

### 3.1.5 Fixed Suppression

The table below outlines the fixed fire suppression system(s) provided in the Fire Area:

Table 3-2, Fire Area AA20 Suppression Systems							
Fire Zone	Type of System	Full (F) / Partial (P)	Required System?				
			S	L	E	R	D
17E	Wet Pipe	F	N	N	N	N	N
Table 3-2 Legend:							
Table Field: "Required System?"							
S	- Required for Chapter 4 Separation Criteria						
L	- Required for NRC Approved Licensing Action						
E	- Required for Engineering Equivalency Evaluation						
R	- Required for Risk Significance						
D	- Required to maintain adequate balance of Defense-in-Depth in a Change Evaluation or Fire Risk Evaluation						

Fire Area AA20 is provided with a wet pipe sprinkler system. Sprinklers are rated at 175°F and the system alarms in the Unit 1 Control Room.

### 3.1.6 Manual Suppression / Response Strategy

A postulated fire will be identified by the wet pipe sprinkler system actuating in the main control room or by plant personnel using plant communication system to notify the control room. The Control Room operator will dispatch the fire brigade for initiation of manual fire fighting. A fire in this fire area will be contained by the construction features discussed in Section 3.1.1. Manual suppression is provided by the CNP Fire Brigade.

Fire extinguishers are located in adjacent Fire Area AA18 - Fire Zone 17C.

Water hose reels are located in the adjacent Turbine Building Fire Area AA2 - Fire Zone 80.

Fire Area AA20 is equipped with floor drains.

### 3.1.7 Ventilation

A fire in this area will be contained by the fire barriers. Smoke can be removed by venting to the outdoors or to other parts of the turbine building. The normal building ventilating systems in the Turbine Building will then exhaust the smoke via filtered monitored pathways. This fire area is listed as a non-controlled area in the Fire Pre Plans and therefore there is reasonable assurance that products of combustion will not be contaminated.

Fire dampers having a 3-hour rating are provided to adjacent Fire Areas AA18 and AA2- Fire Zones 17C and 80, respectively.

Blowout panels and a security barrier are placed over the penetration with fire damper 1-HV-AFP-FD-1D. The blowout panel and security barrier are installed so as not to impact the function of the fire damper. The fire damper will remain normally open. The set point for the fire damper is 350°F for HELB considerations. Fire damper 1-HV-AFP-FD-1C is closed and the penetration is sealed

using a plate which does not impact the fire damper function. The steel plate is 1/4" thick ASTM A36, sized as required to cover the opening with DC.96-081 RTV silicone adhesive/sealant or approved equal at open gaps between the frame and the 1/4" plate.

A blow out panel is installed in fire damper 1-HV-AFP-FD-2 and a security barrier is placed in/over this penetration. The blowout panel and security barrier are installed so that they will not impact the function of the fire damper. The set point for the fire damper is 350°F for HELB considerations.

### 3.1.8 Other Features

No other fire protection features provided for Fire Area AA20.

## 3.2 Fire Hazards Identification

The fire area contains both ignition sources and combustible fire hazards. The main ignition sources are the TDAFW pump, the room coolers and the TDAFW pump subpanel. Combustibles consist primarily of rubber and plastics. The current fire loading classification is considered low.

## 3.3 NSCA Compliance Summary

Fire Area 20, U1 Turbine Driven Aux Feedpump Room (EL. 591') contains Unit 1 Turbine Driven Feedwater equipment, CST Level indication, Red and Green train cables, conduits, raceways and the room cooler.

Compliance with the nuclear safety performance criteria is achieved using the deterministic approach in accordance with NFPA 805, Section 4.2.3.2.

Safe and stable condition of Unit 1 will be accomplished using Steam Generators 2 and 3 via Unit 1 East Motor Driven Auxiliary Feedwater Pump or Steam Generators 1 and 4 via the Unit 1 West Motor Driven Auxiliary Feedwater Pump, Control Room Process Monitoring, Unit 1 Charging via the West or East Pump, Unit 1 Component Cooling Water via the East or West Pump, Unit 1 Essential Service Water via the East or West Pump. Electrical power is supplied to either Red or Green Trains via offsite power with both Red and Green Train Emergency Diesels also available.

The Nuclear Safety Performance Criteria compliance strategy for AA20 is documented within the NSCA Report.

### 3.3.1 Variances

There are no variances for this fire area.

### 3.3.2 Recovery Actions Credited

There are no recovery actions for this fire area.

## 3.4 Non-Power Operational Modes Compliance Summary

A review of CNP for the potential effects of a fire in this Fire Area while in non-power modes of operation (NPO) was conducted. This review was conducted using the guidance provided in NEI 04-02 and FAQ 07-0040, "Non-Power Operations Clarifications".

The review determined that there are no potential failures that affect required Key Safety Functions

(KSF) as a result of the fire in this Fire Area. Therefore, the analysis has demonstrated there is reasonable assurance a fire in this fire area during NPO modes will not adversely affect key safety functions and the NFPA 805 performance goal for NPO is therefore satisfied. The results of the NPO analysis are contained within Technical Evaluation R1900-005-001, Non-Power Operation Modes Transition Review Report.

### **3.5 Radioactive Release Compliance Summary**

The NFPA 805 radiological release goal is to provide reasonable assurance that a fire will not result in a radiological release that adversely affects the public, plant personnel or the environment. The NFPA 805 requirement is to ensure a radiation release to any unrestricted area due to the direct effects of fire suppression activities (but not involving fuel damage) shall be as low as reasonably achievable and shall not exceed applicable plant Technical Specification limits.

AA20 is located outside the Radiological Controlled Area (RCA) and is not a storage location for contaminated materials, therefore there is reasonable assurance a fire in this area will not result in radiation release. The review of this fire area, with respect to radioactive release, is documented in the NFPPM.

### **3.6 Probabilistic Risk Assessment-Summary of Results**

A Fire PRA (FPRA) quantification of Fire Area AA20 was performed and is documented in PRA-NB-FIRE-FQ, Fire PRA Model Quantification Notebook. The fire risk quantification for Fire Area AA20 is analyzed assuming whole room burnup. PRA-NB-FIRE-FQ includes a summary of all potentially risk-significant fire scenarios (i.e., CDF > 1.0E-7 or LERF > 1.0E-8). Bounding CDF / LERF per calendar year values are reported that are based on the risk values documented in PRA-NB-FIRE-FSS, Fire PRA Fire Scenario Selection.

### **3.7 Risk-Informed, Performance-Based Evaluations**

There are no VFDRs for this fire area, and therefore, no Fire Risk Evaluations have been performed.

#### **3.7.1 Transition Risk-Informed, Performance-Based Evaluations**

There are no VFDRs for this fire area, and therefore this section is not applicable to Fire Area AA20.

### 3.8 Defense-in-Depth

Per NFPA 805, section 2.4.4.2, “Defense-in-Depth”: The deterministic approach for meeting the performance criteria shall be deemed to satisfy this defense-in-depth requirement.

### 3.9 Monitoring Program Input

A Monitoring Program will be developed in accordance with FAQ 10-0059, Rev. 1. Methods to monitor availability, reliability, and performance of fire protection program structures, systems, and components (SSCs), as well as programmatic elements will be provided. Additionally, effectiveness measures are established to review program related performance and trends. For AA20 the following systems and features are candidates for inclusion in the CNP Fire Protection Monitoring Program:

- Fire Area boundary barriers discussed in Section 3.1

## 4.0 CONCLUSION

The nuclear safety and radioactive release performance criteria of NFPA 805 are met for a fire in Fire Area AA20. This Fire Safety Analysis has demonstrated that for Fire Area AA20 a success path remains free of fire damage using the deterministic approach per Section 4.2.3 of NFPA 805.

## 5.0 REFERENCES

- 5.1 CNP Fire Pre-Plans, Volumes I, II, and III, Revisions 17, 14, and 18 respectively
- 5.2 Fire Hazards Analysis
- 5.3 NFPA 805, Performance-Based Standard for Fire Protection for Light Water Reactor Electric Generating Plants
- 5.4 NFPPM, NFPA 805 Fire Protection Program Manual (NFPPM)
- 5.5 Nuclear Energy Institute (NEI) 04-02, Guidance for Implementing a Risk-Informed, Performance-Based Fire Protection Program under 10 CFR 50.48(c), Rev. 2
- 5.6 Nuclear Safety Capability Assessment Report
- 5.7 PRA-NB-FIRE-FQ, Fire PRA Model Quantification Notebook
- 5.8 PRA-NB-FIRE-FSS, Fire PRA Fire Scenario Selection
- 5.9 Regulatory Guide 1.205, Risk-Informed, Performance-Based Fire Protection for Existing Light-Water Nuclear Power Plants, Rev. Revision 1
- 5.10 Technical Evaluation R1900-005-001, Non-Power Operation Modes Transition Review

**Fire Area AA20 – Attachment 1 - Table B-3 - Fire Area Transition**

<u>Unit</u>	<u>Fire Area</u>	<u>Description</u>
1	AA20	Unit 1 Turbine Driven Auxiliary Feedwater Pump Room (El. 591 ft.)

<u>Fire Zone</u>	<u>Description</u>
17E	Turbine Aux. Feed Pump Room - El. 591 ft. 0 in. - Unit 1

**Regulatory Basis**

4.2.3.2 - Deterministic Approach

<b>Performance Goal</b>	<b>Method of Accomplishment</b>	<b>Comments</b>
Reactivity Control	Unit 1 - Trip the reactor from the Control Room. Borate using Unit 1 East or West Charging Pump supplied from the RWST Use source range monitoring for indication for Unit 1.	None
Inventory and Pressure Control	Unit 1 - Control inventory using Unit 1 East or West Charging Pump. Control pressure using Unit 1 Pressurizer Safety Relief Valves.	None
Decay Heat Removal	Unit 1 - Feed SGs 2 & 3 with Unit 1 East MDAFW Pump or feed SGs 1 & 4 with Unit 1 West MDAFW Pump. The DHR function also requires MS isolation with a steam release path through the Safety Relief Valves.	None
Process Monitoring	Unit 1 Process Monitoring - Use Unit 1 process monitoring in the Control Room for the following: Pressurizer level, RCS pressure and temperature, and S/G level and Pressure. Unit 1 Source Range Monitoring - Use Unit 1 source range monitoring in the Control Room.	None
Vital Auxiliaries	Unit 1 Electrical - Control Unit 1 Red (AB) Train Electrical Distribution with Unit 1 Red (AB) Train Offsite Power or Unit 1 Red (AB) DG. Control Unit 1 Green (CD) Train Electrical Distribution with Unit 1 Green (CD) Train Offsite Power or Unit 1 Green (CD) DG. Unit 1 ESW - Operate Unit 1 East or West ESW. Unit 1 CCW - Operate Unit 1 East or West CCW. Unit 1 HVAC - Operate Unit 1 Control Room HVAC. Operate Unit 1 Auxiliary Building HVAC. Operate Unit 1 Red (AB) and Green (CD) DG HVAC. Operate Unit 1 Switchgear HVAC. Operate Unit 1 East and West MDAFW Pump Room HVAC systems. Operate the Unit 1 East and West ESW Pump HVAC systems.	None

**Fire Area AA20 – Attachment 1 - Table B-3 - Fire Area Transition**

<u>Unit</u>	<u>Fire Area</u>	<u>Description</u>
1	AA20	Unit 1 Turbine Driven Auxiliary Feedwater Pump Room (El. 591 ft.)

**Reference Documents**

Genesis Solution Suite, EDISON / SAFE-PB, DC Cook V 3.4.0

Nuclear Safety Capability Assessment Report

**Licensing Actions**

None

**Existing Engineering Equivalency Evaluations (EEEE)****EEEE Title Engineering Equivalency Evaluation 11-9 - Turbine, Auxiliary and Containment Buildings Boundary Evaluation**

**Summary** The purpose of this engineering equivalency evaluation is to describe in general, the approach and existence of evaluations performed to determine and reconcile fire area boundaries having components or designs with less than a 3-hr fire rating on preventing the spread of fire. This engineering equivalency evaluation also specifically evaluates the impact of unrated door assemblies on the spread of fire.

Reasonable assurance is provided that the fire area boundaries having components or design less than a 3-hr fire rating will not increase the spread of fire or impair the safe shutdown capabilities of Units 1 or 2. In addition, this engineering equivalency evaluation does not adversely impact on other engineering equivalency evaluations or exemption requests.

This evaluation supports additional evaluations credited in this fire area.

**Fire Area AA20 – Attachment 1 - Table B-3 - Fire Area Transition**

<u>Unit</u>	<u>Fire Area</u>	<u>Description</u>
1	AA20	Unit 1 Turbine Driven Auxiliary Feedwater Pump Room (El. 591 ft.)

---

**EEEE Title** **Engineering Equivalency Evaluation 11-26 - Fire Seal Evaluation Study Fire Retention Capability of a HELB Pressure Boundary Seal**

**Summary** The purpose of this engineering equivalency evaluation is to document the acceptability of the fire retention capability of a HELB seal on preventing the spread of fire in Fire Areas AA19, AA20, AA21 and AA22.

Reasonable assurance is provided that the HELB pressure boundary seals located between the east motor driven and turbine driven auxiliary feedwater pump rooms will provide adequate fire retention capabilities and will not impair the safe shutdown capabilities of CNP or increase the ability of fire to spread between fire zones. This engineering equivalency evaluation does not impact other engineering equivalency evaluations.

The fire seal designs were evaluated and found to be acceptable based on the fire hazards and the construction features within the evaluated areas.

**Fire Suppression Effects on Nuclear Safety Performance Criteria**

The CNP fire brigade is trained to discharge water in a judicious manner and instructed to direct hose streams and portable extinguishers at the base of the fire to limit the amount of overspray beyond the immediate fire zone. For this reason, fire brigade activities are not expected to fail components not already considered damaged. It has been concluded that water impingement on cables is not a concern. Electrical cabinets are provided with a seal at the conduit interface. Possible impacts to surrounding equipment due to manual fire fighting activities or the wet pipe system is bounded by the analysis approach of postulating whole room damage. The drainage features of the fire area mitigate the potential for flooding damage due to fire suppression, such that the standing water would not affect credited equipment.

Since it is shown that suppression effects will not impact the nuclear safety performance criteria, the fire area configuration is deemed acceptable.

**References:**

Technical Evaluation 12.1, "Fire Suppression Effects Study"

Technical Evaluation 12.1, "Supplemental Information to Fire Suppression Effects Study – Supplement 1"

**Fire Area Comments**

None



# D. C. Cook Nuclear Plant Fire Safety Analysis

## Fire Area: AA21

Unit 2 Turbine Driven Auxiliary Feedwater Pump Room (El. 591 ft.)

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#### Attachments

Fire Area AA21 – Attachment 1 - Table B-3 - Fire Area Transition

## 1.0 PURPOSE

This report documents the Fire Safety Analysis (FSA) for Cook Nuclear Plant (CNP) Fire Area AA21, Unit 2 Turbine Driven Auxiliary Feedwater Pump Room (El. 591 ft.) which comprises fire zone(s) 17F. The purpose of this analysis is to demonstrate the achievement of the nuclear safety and radioactive release performance criteria of NFPA 805 as required by 10 CFR 50.48(c). The Fire Safety Analysis is a key part of compliance with Section 2.7.1.2 Fire Protection Program Design Basis Document of NFPA 805.

## 2.0 ANALYSIS METHODOLOGY

The FSA is the design basis document as described in NFPA 805 Section 2.7.1.2. The following steps are performed to develop the FSA on a fire area basis:

- Identify significant fire hazards in the fire area. This is based on NFPA 805 approach to analyze the plant from an ignition source and fuel package perspective.
- Summarize Nuclear Safety Capability Analysis (NSCA) compliance strategies. This is the result of the NEI 04-02 B-3 Table review of the Safe Shutdown Analysis.
- Summarize Non-Power Operations Modes compliance strategies.
- Summarize Radioactive Release compliance strategies. The transition review process required per NEI 04-02 is used to develop these results.
- Provide Fire Probabilistic Risk Assessment summary of results. This is based on the results from the plant Fire PRA.
- Perform risk informed, performance based evaluations if needed for the performance based approach.
- Summarize Defense-in-Depth strategy for each fire area.
- Determine key analysis assumptions which are candidates to be included in the NFPA 805 monitoring program.
- Provide conclusions relative to NFPA 805 compliance.

### 3.0 ANALYSIS

#### 3.1 Classical Fire Protection

##### 3.1.1 Construction

Walls, floors and ceilings to adjacent fire areas are reinforced concrete in excess of a 3-hour rating.

Applicable Engineering Equivalency Evaluations are documented in Attachment 1.

##### 3.1.2 Doors and Access Openings

A fire door having a 3-hour rating is provided to adjacent Fire Area AA18 - Fire Zone 17C.

##### 3.1.3 Penetrations

Penetrations in fire barriers between this fire zone and adjacent fire areas are provided with fire seals.

The seismic gaps are provided with fire seals. Refer to Engineering Equivalency Evaluation 11-26 for evaluation of the seismic gap to Fire Zone 17G as a HELB pressure boundary seal.

There are a total of four (4) penetrations to the walls in Fire Zone 17F for the 2" diameter ESW piping. Three between Fire Zone 17F and Fire Zone 84 and one between Fire Zone 17F and Fire Zone 17G. This piping is grouted in place to the full depth of the wall using concrete or non-shrink grout.

##### 3.1.4 Detection

The table below outlines the fire detection system(s) provided in the Fire Area:

Table 3-1, Fire Area AA21 Detection Systems								
Fire Zone	Type of System	Local (L) / Remote (R)	Detection Actuates Suppression?	Required System?				
				S	L	E	R	D
17F	None	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Table 3-1 Legend:								
Table Field: "Required System?"								
S	- Required for Chapter 4 Separation Criteria							
L	- Required for NRC Approved Licensing Action							
E	- Required for Engineering Equivalency Evaluation							
R	- Required for Risk Significance							
D	- Required to maintain adequate balance of Defense-in-Depth in a Change Evaluation or Fire Risk Evaluation							

Fire Area AA21 is not provided with an automatic fire detection system.

### 3.1.5 Fixed Suppression

The table below outlines the fixed fire suppression system(s) provided in the Fire Area:

Table 3-2, Fire Area AA21 Suppression Systems							
Fire Zone	Type of System	Full (F) / Partial (P)	Required System?				
			S	L	E	R	D
17F	Wet Pipe	F	N	N	N	N	N

Table 3-2 Legend:	
Table Field: "Required System?"	
S	- Required for Chapter 4 Separation Criteria
L	- Required for NRC Approved Licensing Action
E	- Required for Engineering Equivalency Evaluation
R	- Required for Risk Significance
D	- Required to maintain adequate balance of Defense-in-Depth in a Change Evaluation or Fire Risk Evaluation

Fire Area AA21 is provided with a wet pipe sprinkler system. Sprinklers are rated at 175°F and the system alarms in the Unit 1 Control Room. This system also protects the Unit 1 and 2 corridor to the Auxiliary Feed Pump Rooms, Fire Area AA18 - Fire Zone 17C.

### 3.1.6 Manual Suppression / Response Strategy

A postulated fire will be identified by the wet pipe sprinkler system actuating in the main control room or by plant personnel using plant communication system to notify the control room. The Control Room operator will dispatch the fire brigade for initiation of manual fire fighting. A fire in this fire area will be contained by the construction features discussed in Section 3.1.1. Manual suppression is provided by the CNP Fire Brigade.

Fire extinguishers are located in adjacent Fire Area AA18 - Fire Zone 17C.

Water hose reels are located in the adjacent Turbine Building Fire Area AA2 - Fire Zone 84.

Fire Area AA21 is equipped with floor drains.

### 3.1.7 Ventilation

A fire in this area will be contained by the fire barriers. Smoke can be removed by venting to the outdoors or to other parts of the turbine building. The normal building ventilating systems in the Turbine Building will then exhaust the smoke via filtered monitored pathways. This fire area is listed as a non-controlled area in the Fire Pre Plans and therefore there is reasonable assurance that products of combustion will not be contaminated.

Fire dampers having a 3-hour rating are provided to adjacent Fire Area AA2 - Fire Zones 2S and 84.

Blowout panels and security barriers are installed over fire dampers 2-HV-AFP-FD-1C and 2-HV-AFP-FD-1D. The blowout panels and security barrier do not impact the function of the fire damper. The set point for the fire dampers fusible links is 350°F for HELB considerations. There

is also a penetration in the floor of Fire Zone 17F that has a fire damper. This fire damper (2-HV-AFP-FD-3) is maintained closed and sealed with a plate which does not impact the fire damper function. The steal plate is 1/4" thick ASTM A36, sized as required to cover the opening.

### 3.1.8 Other Features

No other fire protection features provided for Fire Area AA21.

## 3.2 Fire Hazards Identification

The fire area contains both ignition sources and combustible fire hazards. The main ignition sources are the TDAFW pump, the room coolers and the TDAFW pump subpanel. Combustibles consist primarily of rubber and plastics. The current fire loading classification is considered low.

## 3.3 NSCA Compliance Summary

Fire Area 21, U2 Turbine Driven Aux Feedpump Room (EL. 591') contains Unit 2 Turbine Driven Feedwater equipment, CST Level indication, Red and Green train cables, conduits, raceways and the room cooler.

Compliance with the nuclear safety performance criteria is achieved using the deterministic approach in accordance with NFPA 805, Section 4.2.3.2.

Safe and stable condition of Unit 2 will be accomplished using Steam Generators 2 and 3 via Unit 2 East Motor Driven Auxiliary Feedwater Pump or Steam Generators 1 and 4 via the Unit 2 West Motor Driven Auxiliary Feedwater Pump, Control Room Process Monitoring, Unit 2 Charging via the West or East pump, Unit 2 Component Cooling Water via the East or West Pump, Unit 2 Essential Service Water via the East or West Pump. Electrical power is supplied to either Red or Green Trains via offsite power with both Red and Green Train Emergency Diesels also available.

The Nuclear Safety Performance Criteria compliance strategy for AA21 is documented within the NSCA Report.

### 3.3.1 Variances

There are no variances for this fire area.

### 3.3.2 Recovery Actions Credited

There are no recovery actions for this fire area.

## 3.4 Non-Power Operational Modes Compliance Summary

A review of CNP for the potential effects of a fire in this Fire Area while in non-power modes of operation (NPO) was conducted. This review was conducted using the guidance provided in NEI 04-02 and FAQ 07-0040, "Non-Power Operations Clarifications".

The review determined that there are no potential failures that affect required Key Safety Functions (KSF) as a result of the fire in this Fire Area. Therefore, the analysis has demonstrated there is reasonable assurance a fire in this fire area during NPO modes will not adversely affect key safety functions and the NFPA 805 performance goal for NPO is therefore satisfied. The results of the NPO analysis are contained within Technical Evaluation R1900-005-001, Non-Power Operation Modes Transition Review Report.

### 3.5 Radioactive Release Compliance Summary

The NFPA 805 radiological release goal is to provide reasonable assurance that a fire will not result in a radiological release that adversely affects the public, plant personnel or the environment. The NFPA 805 requirement is to ensure a radiation release to any unrestricted area due to the direct effects of fire suppression activities (but not involving fuel damage) shall be as low as reasonably achievable and shall not exceed applicable plant Technical Specification limits.

AA21 is located outside the Radiological Controlled Area (RCA) and is not a storage location for contaminated materials, therefore there is reasonable assurance a fire in this area will not result in radiation release. The review of this fire area, with respect to radioactive release, is documented in the NFPPM.

### 3.6 Probabilistic Risk Assessment-Summary of Results

A Fire PRA (FPRA) quantification of Fire Area AA21 was performed and is documented in PRA-NB-FIRE-FQ, Fire PRA Model Quantification Notebook. The fire risk quantification for Fire Area AA21 is analyzed assuming whole room burnup. PRA-NB-FIRE-FQ includes a summary of all potentially risk-significant fire scenarios (i.e., CDF > 1.0E-7 or LERF > 1.0E-8). Bounding CDF / LERF per calendar year values are reported that are based on the risk values documented in PRA-NB-FIRE-FSS, Fire PRA Fire Scenario Selection.

### 3.7 Risk-Informed, Performance-Based Evaluations

There are no VFDRs for this fire area, and therefore, no Fire Risk Evaluations have been performed.

#### 3.7.1 Transition Risk-Informed, Performance-Based Evaluations

There are no VFDRs for this fire area, and therefore this section is not applicable to Fire Area AA21.

### 3.8 Defense-in-Depth

Per NFPA 805, section 2.4.4.2, "Defense-in-Depth": The deterministic approach for meeting the performance criteria shall be deemed to satisfy this defense-in-depth requirement.

### 3.9 Monitoring Program Input

A Monitoring Program will be developed in accordance with FAQ 10-0059, Rev. 1. Methods to monitor availability, reliability, and performance of fire protection program structures, systems, and components (SSCs), as well as programmatic elements will be provided. Additionally, effectiveness measures are established to review program related performance and trends. For AA21 the following systems and features are candidates for inclusion in the CNP Fire Protection Monitoring Program:

- Fire Area boundary barriers discussed in Section 3.1

## 4.0 CONCLUSION

The nuclear safety and radioactive release performance criteria of NFPA 805 are met for a fire in Fire Area AA21. This Fire Safety Analysis has demonstrated that for Fire Area AA21 a success path remains free of fire damage using the deterministic approach per Section 4.2.3 of NFPA 805.

## **5.0 REFERENCES**

- 5.1 CNP Fire Pre-Plans, Volumes I, II, and III, Revisions 17, 14, and 18 respectively
- 5.2 Fire Hazards Analysis
- 5.3 NFPA 805, Performance-Based Standard for Fire Protection for Light Water Reactor Electric Generating Plants
- 5.4 NFPPM, NFPA 805 Fire Protection Program Manual (NFPPM)
- 5.5 Nuclear Energy Institute (NEI) 04-02, Guidance for Implementing a Risk-Informed, Performance-Based Fire Protection Program under 10 CFR 50.48(c), Rev. 2
- 5.6 Nuclear Safety Capability Assessment Report
- 5.7 PRA-NB-FIRE-FQ, Fire PRA Model Quantification Notebook
- 5.8 PRA-NB-FIRE-FSS, Fire PRA Fire Scenario Selection
- 5.9 Regulatory Guide 1.205, Risk-Informed, Performance-Based Fire Protection for Existing Light-Water Nuclear Power Plants, Rev. Revision 1
- 5.10 Technical Evaluation R1900-005-001, Non-Power Operation Modes Transition Review

**Fire Area AA21 – Attachment 1 - Table B-3 - Fire Area Transition**

<u>Unit</u>	<u>Fire Area</u>	<u>Description</u>
2	AA21	Unit 2 Turbine Driven Auxiliary Feedwater Pump Room (El. 591 ft.)

<u>Fire Zone</u>	<u>Description</u>
17F	Turbine Driven Auxiliary Feed Pump Room - El. 591 ft. 0 in. - Unit 2

**Regulatory Basis**

4.2.3.2 - Deterministic Approach

<b>Performance Goal</b>	<b>Method of Accomplishment</b>	<b>Comments</b>
Reactivity Control	Unit 2- Trip the reactor from the Control Room. Borate using Unit 2 East or West Charging Pump supplied from the RWST. Use source range monitoring for indication for Unit 2.	None
Inventory and Pressure Control	Unit 2 - Control inventory using Unit 2 East or West Charging Pump. Control pressure using Unit 2 Pressurizer Safety Relief Valves.	None
Decay Heat Removal	Unit 2 - Feed SGs 2 & 3 with Unit 2 East MDAFW Pump or feed SGs 1 & 4 with Unit 2 West MDAFW Pump. The DHR function also requires MS isolation with a steam release path through the Safety Relief Valves.	None
Process Monitoring	Unit 2 Process Monitoring - Use Unit 2 process monitoring in the Control Room for the following: Pressurizer level, RCS pressure and temperature, and S/G level and Pressure. Unit 2 Source Range Monitoring - Use Unit 2 source range monitoring in the Control Room.	None
Vital Auxiliaries	Unit 2 Electrical - Control Unit 2 Red (AB) Train Electrical Distribution with Unit 2 Red (AB) Train Offsite Power or Unit 2 Red (AB) DG. Control Unit 2 Green (CD) Train Electrical Distribution with Unit 2 Green (CD) Train Offsite Power or Unit 2 Green (CD) DG. Unit 2 ESW - Operate Unit 2 East or West ESW. Unit 2 CCW - Operate Unit 2 East or West CCW. Unit 2 HVAC - Operate Unit 2 Control Room HVAC. Operate Unit 2 Auxiliary Building HVAC. Operate Unit 2 Red (AB) and Green (CD) DG HVAC. Operate Unit 2 Switchgear HVAC. Operate Unit 2 East and West MDAFW Pump Room HVAC systems. Operate the Unit 2 East and West ESW Pump HVAC systems.	None



**Fire Area AA21 – Attachment 1 - Table B-3 - Fire Area Transition**

<u>Unit</u>	<u>Fire Area</u>	<u>Description</u>
2	AA21	Unit 2 Turbine Driven Auxiliary Feedwater Pump Room (El. 591 ft.)

**Reference Documents**

Genesis Solution Suite, EDISON / SAFE-PB, DC Cook V 3.4.0

Nuclear Safety Capability Assessment Report

**Licensing Actions**

None

**Existing Engineering Equivalency Evaluations (EEEE)****EEEE Title Engineering Equivalency Evaluation 11-9 - Turbine, Auxiliary and Containment Buildings Boundary Evaluation**

**Summary** The purpose of this engineering equivalency evaluation is to describe in general, the approach and existence of evaluations performed to determine and reconcile fire area boundaries having components or designs with less than a 3-hr fire rating on preventing the spread of fire. This engineering equivalency evaluation also specifically evaluates the impact of unrated door assemblies on the spread of fire.

Reasonable assurance is provided that the fire area boundaries having components or design less than a 3-hr fire rating will not increase the spread of fire or impair the safe shutdown capabilities of Units 1 or 2. In addition, this engineering equivalency evaluation does not adversely impact on other engineering equivalency evaluations or exemption requests.

This evaluation supports additional evaluations credited in this fire area.

**Fire Area AA21 – Attachment 1 - Table B-3 - Fire Area Transition**

<u>Unit</u>	<u>Fire Area</u>	<u>Description</u>
2	AA21	Unit 2 Turbine Driven Auxiliary Feedwater Pump Room (El. 591 ft.)

---

**EEEE Title** **Engineering Equivalency Evaluation 11-26 - Fire Seal Evaluation Study Fire Retention Capability of a HELB Pressure Boundary Seal**

**Summary** The purpose of this engineering equivalency evaluation is to document the acceptability of the fire retention capability of a HELB seal on preventing the spread of fire in Fire Areas AA19, AA20, AA21 and AA22.

Reasonable assurance is provided that the HELB pressure boundary seals located between the east motor driven and turbine driven auxiliary feedwater pump rooms will provide adequate fire retention capabilities and will not impair the safe shutdown capabilities of CNP or increase the ability of fire to spread between fire zones. This engineering equivalency evaluation does not impact other engineering equivalency evaluations.

The fire seal designs were evaluated and found to be acceptable based on the fire hazards and the construction features within the evaluated areas.

**Fire Suppression Effects on Nuclear Safety Performance Criteria**

The CNP fire brigade is trained to discharge water in a judicious manner and instructed to direct hose streams and portable extinguishers at the base of the fire to limit the amount of overspray beyond the immediate fire zone. For this reason, fire brigade activities are not expected to fail components not already considered damaged. It has been concluded that water impingement on cables is not a concern. Electrical cabinets are provided with a seal at the conduit interface. Possible impacts to surrounding equipment due to manual fire fighting activities or the wet pipe system is bounded by the analysis approach of postulating whole room damage. The drainage features of the fire area mitigate the potential for flooding damage due to fire suppression, such that the standing water would not affect credited equipment.

Since it is shown that suppression effects will not impact the nuclear safety performance criteria, the fire area configuration is deemed acceptable.

**References:**

Technical Evaluation 12.1, "Fire Suppression Effects Study"

Technical Evaluation 12.1, "Supplemental Information to Fire Suppression Effects Study – Supplement 1"

**Fire Area Comments**

None

## D. C. Cook Nuclear Plant Fire Safety Analysis

## Fire Area: AA22

Unit 2 East Motor Driven Auxiliary Feedwater Pump Room (El. 591 ft.)

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<b>Conclusion</b> .....	Section 4.0
<b>References</b> .....	Section 5.0

## Attachments

Fire Area AA22 – Attachment 1 - Table B-3 - Fire Area Transition

## 1.0 PURPOSE

This report documents the Fire Safety Analysis (FSA) for Cook Nuclear Plant (CNP) Fire Area AA22, Unit 2 East Motor Driven Auxiliary Feedwater Pump Room (El. 591 ft.) which comprises fire zone(s) 17G. The purpose of this analysis is to demonstrate the achievement of the nuclear safety and radioactive release performance criteria of NFPA 805 as required by 10 CFR 50.48(c). The Fire Safety Analysis is a key part of compliance with Section 2.7.1.2 Fire Protection Program Design Basis Document of NFPA 805.

## 2.0 ANALYSIS METHODOLOGY

The FSA is the design basis document as described in NFPA 805 Section 2.7.1.2. The following steps are performed to develop the FSA on a fire area basis:

- Identify significant fire hazards in the fire area. This is based on NFPA 805 approach to analyze the plant from an ignition source and fuel package perspective.
- Summarize Nuclear Safety Capability Analysis (NSCA) compliance strategies. This is the result of the NEI 04-02 B-3 Table review of the Safe Shutdown Analysis.
- Summarize Non-Power Operations Modes compliance strategies.
- Summarize Radioactive Release compliance strategies. The transition review process required per NEI 04-02 is used to develop these results.
- Provide Fire Probabilistic Risk Assessment summary of results. This is based on the results from the plant Fire PRA.
- Perform risk informed, performance based evaluations if needed for the performance based approach.
- Summarize Defense-in-Depth strategy for each fire area.
- Determine key analysis assumptions which are candidates to be included in the NFPA 805 monitoring program.
- Provide conclusions relative to NFPA 805 compliance.

### 3.0 ANALYSIS

#### 3.1 Classical Fire Protection

##### 3.1.1 Construction

Walls, floors and ceilings to adjacent fire areas are reinforced concrete in excess of a 3-hour rating.

Applicable Engineering Equivalency Evaluations are documented in Attachment 1.

##### 3.1.2 Doors and Access Openings

A fire door having a 3-hour rating is provided to adjacent Fire Area AA18 - Fire Zone 17C.

##### 3.1.3 Penetrations

Penetrations in fire barriers between this fire zone and adjacent fire areas are provided with fire seals.

The seismic gaps are provided with fire seals. Refer to Engineering Equivalency Evaluation 11-26 for evaluation of the seismic gap to Fire Zone 17F as a HELB pressure boundary seal.

##### 3.1.4 Detection

The table below outlines the fire detection system(s) provided in the Fire Area:

Table 3-1, Fire Area AA22 Detection Systems								
Fire Zone	Type of System	Local (L) / Remote (R)	Detection Actuates Suppression?	Required System?				
				S	L	E	R	D
17G	None	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Table 3-1 Legend:	
Table Field: "Required System?"	
S	- Required for Chapter 4 Separation Criteria
L	- Required for NRC Approved Licensing Action
E	- Required for Engineering Equivalency Evaluation
R	- Required for Risk Significance
D	- Required to maintain adequate balance of Defense-in-Depth in a Change Evaluation or Fire Risk Evaluation

Fire Area AA22 is not provided with an automatic fire detection system.

### 3.1.5 Fixed Suppression

The table below outlines the fixed fire suppression system(s) provided in the Fire Area:

Table 3-2, Fire Area AA22 Suppression Systems							
Fire Zone	Type of System	Full (F) / Partial (P)	Required System?				
			S	L	E	R	D
17G	None	N/A	N/A	N/A	N/A	N/A	N/A
Table 3-2 Legend:							
Table Field: "Required System?"							
S	- Required for Chapter 4 Separation Criteria						
L	- Required for NRC Approved Licensing Action						
E	- Required for Engineering Equivalency Evaluation						
R	- Required for Risk Significance						
D	- Required to maintain adequate balance of Defense-in-Depth in a Change Evaluation or Fire Risk Evaluation						

Fire Area AA22 is not provided with fixed fire suppression.

### 3.1.6 Manual Suppression / Response Strategy

A postulated fire will be identified by plant personnel using plant communication system to notify the control room. The Control Room operator will dispatch the fire brigade for initiation of manual fire fighting. A fire in this fire area will be contained by the construction features discussed in Section 3.1.1. Manual suppression is provided by the CNP Fire Brigade.

Fire extinguishers are located in adjacent Fire Area AA18 - Fire Zone 17C.

Water hose reels are located in the adjacent Turbine Building Fire Area AA2 - Fire Zone 84.

Fire Area AA22 is equipped with floor drains.

### 3.1.7 Ventilation

A fire in this area will be contained by the fire barriers. Smoke can be removed by venting to the outdoors or to other parts of the turbine building. The normal building ventilating systems in the Turbine Building will then exhaust the smoke via filtered monitored pathways. This fire area is listed as a non-controlled area in the Fire Pre Plans and therefore there is reasonable assurance that products of combustion will not be contaminated.

Fire dampers having a 3-hour rating are provided to adjacent Fire Area AA2 - Fire Zone 84.

Fire damper 2-HV-AFP-FD-1B is maintained closed and sealed with a plate on the opposite side of the wall from the fire damper. The seal plates do not impact the fire damper function. The seal plate is 1/4" thick ASTM A36, sized as required to cover the opening. D.C. 96-081 RTV silicone adhesive/sealant or approved equal is installed at open gaps between the frame and the 1/4" plate. The 1/4" plate is installed inside the pump room and the fire damper is on the opposite side of the wall.

A blowout panel and security barrier are placed in and over fire damper 2-HV-AFP-FD-1A. This blowout panel and security barrier are installed so that they will not impact the function of the fire damper.

### 3.1.8 Other Features

No other fire protection features provided for Fire Area AA22.

## 3.2 Fire Hazards Identification

The fire area contains both ignition sources and combustible fire hazards. The main ignition sources are the East AFW pump and the room cooler. Combustibles consist primarily of rubber and plastics. The current fire loading classification is considered low.

## 3.3 NSCA Compliance Summary

Fire Area 22, U2 East Motor Driven Aux Feedpump Room (EL. 591') contains Unit 2 Green Train (East) Feedwater equipment, Red and Green train cables, conduits, raceways and the room cooler.

Compliance with the nuclear safety performance criteria is achieved using the deterministic approach in accordance with NFPA 805, Section 4.2.3.2.

Safe and stable condition of Unit 2 will be accomplished using Steam Generators 2 and 3 via Unit 2 Turbine Driven Auxiliary Feedwater Pump, Control Room Process Monitoring, Unit 2 Charging via the West or East Pump, Unit 2 Component Cooling Water via the East or West Pump, Unit 2 Essential Service Water via the East or West Pump. Electrical power is supplied to either Red or Green Trains via offsite power with both Red and Green Train Emergency Diesels also available.

The Nuclear Safety Performance Criteria compliance strategy for AA22 is documented within the NSCA Report.

### 3.3.1 Variances

There are no variances for this fire area.

### 3.3.2 Recovery Actions Credited

There are no recovery actions for this fire area.

## 3.4 Non-Power Operational Modes Compliance Summary

A review of CNP for the potential effects of a fire in this Fire Area while in non-power modes of operation (NPO) was conducted. This review was conducted using the guidance provided in NEI 04-02 and FAQ 07-0040, "Non-Power Operations Clarifications".

The review determined that there are potential failures that affect certain Key Safety Functions (KSF) as a result of the fire in this area, and the fire could result in the loss of one or more KSF paths. Compensatory measures are required during high risk evolution periods to provide reasonable assurance a fire will not adversely affect key safety functions and the NFPA 805 performance goal for NPO is therefore satisfied. The results of the NPO analysis are contained within Technical Evaluation R1900-005-001, Non-Power Operation Modes Transition Review Report.

## 3.5 Radioactive Release Compliance Summary

The NFPA 805 radiological release goal is to provide reasonable assurance that a fire will not result in a radiological release that adversely affects the public, plant personnel or the environment. The NFPA 805 requirement is to ensure a radiation release to any unrestricted area due to the direct effects of fire suppression activities (but not involving fuel damage) shall be as low as reasonably achievable and shall not exceed applicable plant Technical Specification limits.

AA22 is located outside the Radiological Controlled Area (RCA) and is not a storage location for contaminated materials, therefore there is reasonable assurance a fire in this area will not result in radiation release. The review of this fire area, with respect to radioactive release, is documented in the NFPPM.

### 3.6 Probabilistic Risk Assessment-Summary of Results

A Fire PRA (FPRA) quantification of Fire Area AA22 was performed and is documented in PRA-NB-FIRE-FQ, Fire PRA Model Quantification Notebook. The fire risk quantification for Fire Area AA22 is analyzed assuming whole room burnup. PRA-NB-FIRE-FQ includes a summary of all potentially risk-significant fire scenarios (i.e., CDF > 1.0E-7 or LERF > 1.0E-8). Bounding CDF / LERF per calendar year values are reported that are based on the risk values documented in PRA-NB-FIRE-FSS, Fire PRA Fire Scenario Selection.

### 3.7 Risk-Informed, Performance-Based Evaluations

There are no VFDRs for this fire area, and therefore, no Fire Risk Evaluations have been performed.

#### 3.7.1 Transition Risk-Informed, Performance-Based Evaluations

There are no VFDRs for this fire area, and therefore this section is not applicable to Fire Area AA22.

### 3.8 Defense-in-Depth

Per NFPA 805, section 2.4.4.2, “Defense-in-Depth”: The deterministic approach for meeting the performance criteria shall be deemed to satisfy this defense-in-depth requirement.

### 3.9 Monitoring Program Input

A Monitoring Program will be developed in accordance with FAQ 10-0059, Rev. 1. Methods to monitor availability, reliability, and performance of fire protection program structures, systems, and components (SSCs), as well as programmatic elements will be provided. Additionally, effectiveness measures are established to review program related performance and trends. For AA22 the following systems and features are candidates for inclusion in the CNP Fire Protection Monitoring Program:

- Fire Area boundary barriers discussed in Section 3.1

## 4.0 CONCLUSION

The nuclear safety and radioactive release performance criteria of NFPA 805 are met for a fire in Fire Area AA22. This Fire Safety Analysis has demonstrated that for Fire Area AA22 a success path remains free of fire damage using the deterministic approach per Section 4.2.3 of NFPA 805.



## **5.0 REFERENCES**

- 5.1 CNP Fire Pre-Plans, Volumes I, II, and III, Revisions 17, 14, and 18 respectively
- 5.2 Fire Hazards Analysis
- 5.3 NFPA 805, Performance-Based Standard for Fire Protection for Light Water Reactor Electric Generating Plants
- 5.4 NFPPM, NFPA 805 Fire Protection Program Manual (NFPPM)
- 5.5 Nuclear Energy Institute (NEI) 04-02, Guidance for Implementing a Risk-Informed, Performance-Based Fire Protection Program under 10 CFR 50.48(c), Rev. 2
- 5.6 Nuclear Safety Capability Assessment Report
- 5.7 PRA-NB-FIRE-FQ, Fire PRA Model Quantification Notebook
- 5.8 PRA-NB-FIRE-FSS, Fire PRA Fire Scenario Selection
- 5.9 Regulatory Guide 1.205, Risk-Informed, Performance-Based Fire Protection for Existing Light-Water Nuclear Power Plants, Rev. Revision 1
- 5.10 Technical Evaluation R1900-005-001, Non-Power Operation Modes Transition Review

**Fire Area AA22 – Attachment 1 - Table B-3 - Fire Area Transition**

<u>Unit</u>	<u>Fire Area</u>	<u>Description</u>
2	AA22	Unit 2 East Motor Driven Auxiliary Feedwater Pump Room (El. 591 ft.)

<u>Fire Zone</u>	<u>Description</u>
17G	East Auxiliary Feed Pump Room - El. 591 ft. 0 in. - Unit 2

**Regulatory Basis**

4.2.3.2 - Deterministic Approach

<b>Performance Goal</b>	<b>Method of Accomplishment</b>	<b>Comments</b>
Reactivity Control	Unit 2 - Trip the reactor from the Control Room. Borate using Unit 2 East or West Charging Pump supplied from the RWST. Use source range monitoring for indication for Unit 2.	None
Inventory and Pressure Control	Unit 2 - Control inventory using Unit 2 East or West Charging Pump. Control pressure using Unit 2 Pressurizer Safety Relief Valves.	None
Decay Heat Removal	Unit 2 - Feed SGs 2 & 3 with Unit 2 TDAFW Pump. The DHR function also requires MS isolation with a steam release path through the Safety Relief Valves.	None
Process Monitoring	Unit 2 Process Monitoring - Use Unit 2 process monitoring in the Control Room for the following: Pressurizer level, RCS pressure and temperature, and S/G level and Pressure. Unit 2 Source Range Monitoring - Use Unit 2 source range monitoring in the Control Room.	None
Vital Auxiliaries	Unit 2 Electrical - Control Unit 2 Red (AB) Train Electrical Distribution with Unit 2 Red (AB) Train Offsite Power or Unit 2 Red (AB) DG. Control Unit 2 Green (CD) Train Electrical Distribution with Unit 2 Green (CD) Train Offsite Power or Unit 2 Green (CD) DG. Unit 2 ESW - Operate Unit 2 East or West ESW. Unit 2 CCW - Operate Unit 2 East or West CCW. Unit 2 HVAC - Operate Unit 2 Control Room HVAC. Operate Unit 2 Auxiliary Building HVAC. Operate Unit 2 Red (AB) and Green (CD) DG HVAC. Operate Unit 2 Switchgear HVAC. Operate Unit 2 TDAFW Pump Room HVAC system. Operate the Unit 2 East and West ESW Pump HVAC systems.	None

**Fire Area AA22 – Attachment 1 - Table B-3 - Fire Area Transition**

<u>Unit</u>	<u>Fire Area</u>	<u>Description</u>
2	AA22	Unit 2 East Motor Driven Auxiliary Feedwater Pump Room (El. 591 ft.)

**Reference Documents**

Genesis Solution Suite, EDISON / SAFE-PB, DC Cook V 3.4.0

Nuclear Safety Capability Assessment Report

**Licensing Actions**

None

**Existing Engineering Equivalency Evaluations (EEEE)****EEEE Title Engineering Equivalency Evaluation 11-9 - Turbine, Auxiliary and Containment Buildings Boundary Evaluation**

**Summary** The purpose of this engineering equivalency evaluation is to describe in general, the approach and existence of evaluations performed to determine and reconcile fire area boundaries having components or designs with less than a 3-hr fire rating on preventing the spread of fire. This engineering equivalency evaluation also specifically evaluates the impact of unrated door assemblies on the spread of fire.

Reasonable assurance is provided that the fire area boundaries having components or design less than a 3-hr fire rating will not increase the spread of fire or impair the safe shutdown capabilities of Units 1 or 2. In addition, this engineering equivalency evaluation does not adversely impact on other engineering equivalency evaluations or exemption requests.

This evaluation supports additional evaluations credited in this fire area.

**Fire Area AA22 – Attachment 1 - Table B-3 - Fire Area Transition**

<u>Unit</u>	<u>Fire Area</u>	<u>Description</u>
2	AA22	Unit 2 East Motor Driven Auxiliary Feedwater Pump Room (El. 591 ft.)

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**EEEE Title** **Engineering Equivalency Evaluation 11-26 - Fire Seal Evaluation Study Fire Retention Capability of a HELB Pressure Boundary Seal**

**Summary** The purpose of this engineering equivalency evaluation is to document the acceptability of the fire retention capability of a HELB seal on preventing the spread of fire in Fire Areas AA19, AA20, AA21 and AA22.

Reasonable assurance is provided that the HELB pressure boundary seals located between the east motor driven and turbine driven auxiliary feedwater pump rooms will provide adequate fire retention capabilities and will not impair the safe shutdown capabilities of CNP or increase the ability of fire to spread between fire zones. This engineering equivalency evaluation does not impact other engineering equivalency evaluations.

The fire seal designs were evaluated and found to be acceptable based on the fire hazards and the construction features within the evaluated areas.

**Fire Suppression Effects on Nuclear Safety Performance Criteria**

The CNP fire brigade is trained to discharge water in a judicious manner and instructed to direct hose streams and portable extinguishers at the base of the fire to limit the amount of overspray beyond the immediate fire zone. For this reason, fire brigade activities are not expected to fail components not already considered damaged. It has been concluded that water impingement on cables is not a concern. Electrical cabinets are provided with a seal at the conduit interface. Possible impacts to surrounding equipment due to manual fire fighting activities is bounded by the analysis approach of postulating whole room damage. The drainage features of the fire area mitigate the potential for flooding damage due to fire suppression, such that the standing water would not affect credited equipment.

This fire area is not equipped with a fixed fire suppression system. Since it is shown that suppression effects will not impact the nuclear safety performance criteria, the fire area configuration is deemed acceptable.

**References:**

Technical Evaluation 12.1, "Fire Suppression Effects Study"

Technical Evaluation 12.1, "Supplemental Information to Fire Suppression Effects Study – Supplement 1"

**Fire Area Comments**

None

D. C. Cook Nuclear Plant  
Fire Safety Analysis

Fire Area: AA23

Unit 2 CD Diesel Generator Room (El. 587 ft.)

Table of Contents

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Attachments

Fire Area AA23 – Attachment 1 - Table B-3 - Fire Area Transition

Fire Area AA23 – Attachment 2 - Fire Risk Evaluation Results Summary

## 1.0 PURPOSE

This report documents the Fire Safety Analysis (FSA) for Cook Nuclear Plant (CNP) Fire Area AA23, Unit 2 CD Diesel Generator Room (El. 587 ft.) which comprises fire zone(s) 18. The purpose of this analysis is to demonstrate the achievement of the nuclear safety and radioactive release performance criteria of NFPA 805 as required by 10 CFR 50.48(c). The Fire Safety Analysis is a key part of compliance with Section 2.7.1.2 Fire Protection Program Design Basis Document of NFPA 805. This analysis also documents results of risk-informed, performance-based Fire Risk Evaluations (FREs). These evaluations are associated with Variances from Deterministic Requirements (VFDRs) of NFPA 805 Chapter 4.

## 2.0 ANALYSIS METHODOLOGY

The FSA is the design basis document as described in NFPA 805 Section 2.7.1.2. The following steps are performed to develop the FSA on a fire area basis:

- Identify significant fire hazards in the fire area. This is based on NFPA 805 approach to analyze the plant from an ignition source and fuel package perspective.
- Summarize Nuclear Safety Capability Analysis (NSCA) compliance strategies. This is the result of the NEI 04-02 B-3 Table review of the Safe Shutdown Analysis.
- Summarize Non-Power Operations Modes compliance strategies.
- Summarize Radioactive Release compliance strategies. The transition review process required per NEI 04-02 is used to develop these results.
- Provide Fire Probabilistic Risk Assessment summary of results. This is based on the results from the plant Fire PRA.
- Perform risk informed, performance based evaluations if needed for the performance based approach.
- Summarize Defense-in-Depth strategy for each fire area.
- Determine key analysis assumptions which are candidates to be included in the NFPA 805 monitoring program.
- Provide conclusions relative to NFPA 805 compliance.

### 3.0 ANALYSIS

#### 3.1 Classical Fire Protection

##### 3.1.1 Construction

Walls, floors and ceilings to adjacent fire areas are reinforced concrete in excess of a 3-hour rating with two exceptions. These exceptions are the 3-hour 8-inch concrete block used to reduce the wall opening size for the exchange of a pair of doors to a single leaf door and the 4-hour 8-inch concrete block used in the west wall for equipment removal.

The fuel oil day tank room is constructed of 4-hour 8-inch concrete block to the underside of the ceiling slab with a cantilevered concrete floor located approximately 10'-8" above the Diesel Generator Room floor.

Applicable Engineering Equivalency Evaluations are documented in Attachment 1.

##### 3.1.2 Doors and Access Openings

Fire doors having a 3-hour rating are provided to adjacent Fire Area AA2 - Fire Zones 85 and 115, and to the fuel oil day tank room located within this fire zone.

##### 3.1.3 Penetrations

Penetrations in fire barriers between this fire zone and adjacent fire areas are provided with fire seals. Additionally, the day tank room within this fire zone is provided with fire seals and dampers.

In order to support NFPA 805 Chapter 3 requirements, a fire area boundary evaluation was performed for the grouted fire seals installed in penetrations separating the diesel generator diesel fuel oil tank rooms and their respective diesel generators (Engineering Equivalency Evaluation 11-17).

The seismic gaps are sealed with a glass fiber reinforced silicone sheeting.

### 3.1.4 Detection

The table below outlines the fire detection system(s) provided in the Fire Area:

Table 3-1, Fire Area AA23 Detection Systems								
Fire Zone	Type of System	Local (L) / Remote (R)	Detection Actuates Suppression?	Required System?				
				S	L	E	R	D
18	Thermal	L/R	Y	N	N	Y	Y	N
Table 3-1 Legend:								
Table Field: "Required System?"								
S	- Required for Chapter 4 Separation Criteria							
L	- Required for NRC Approved Licensing Action							
E	- Required for Engineering Equivalency Evaluation							
R	- Required for Risk Significance							
D	- Required to maintain adequate balance of Defense-in-Depth in a Change Evaluation or Fire Risk Evaluation							

Cross zoned line type thermistor heat detectors (2) are provided at the ceiling. Each detection circuit utilizes a different alarm set point to assure that the CO2 will not be actuated until both set points are satisfied. This has been done to minimize spurious operations of the CO2.

### 3.1.5 Fixed Suppression

The table below outlines the fixed fire suppression system(s) provided in the Fire Area:

Table 3-2, Fire Area AA23 Suppression Systems							
Fire Zone	Type of System	Full (F) / Partial (P)	Required System?				
			S	L	E	R	D
18	Automatic CO2	F	N	N	Y	Y	N
Table 3-2 Legend:							
Table Field: "Required System?"							
S	- Required for Chapter 4 Separation Criteria						
L	- Required for NRC Approved Licensing Action						
E	- Required for Engineering Equivalency Evaluation						
R	- Required for Risk Significance						
D	- Required to maintain adequate balance of Defense-in-Depth in a Change Evaluation or Fire Risk Evaluation						

A low pressure CO2 total flooding system supplied from 17-ton tank is provided. This system is actuated by operation of both of the above detection circuits. Operation of this system alarms in the Unit 2 Control Room.

### 3.1.6 Manual Suppression / Response Strategy

A postulated fire will be identified by automatic detection using the thermistor heat detectors described in Section 3.1.2 or by plant personnel using plant communication system to notify the control room. The automatic detection system alarms in the control room. The Control Room



operator will dispatch the fire brigade for initiation of manual fire fighting. A fire in this fire area will be contained by the construction features discussed in Section 3.1.1. Manual suppression is provided by the CNP Fire Brigade.

Fire extinguishers are provided in this fire area.

A water hose reel is located in adjacent Fire Area AA2 - Fire Zone 85.

Fire Area AA23 is equipped with floor drains.

### **3.1.7 Ventilation**

A fire in this area will be contained by the fire barriers. Smoke can be removed by portable fans and flexible ducting to the Turbine Building and outdoors. The normal building ventilating systems in the Turbine Building will then exhaust the smoke. This fire area is listed as a non-controlled area in the Fire Pre Plans and therefore there is reasonable assurance that products of combustion will not be contaminated.

Fire dampers having a 3-hour rating are provided to adjacent Fire Areas AA29 and AA2 - Fire Zones 23 and 85, respectively.

### **3.1.8 Other Features**

No other fire protection features provided for Fire Area AA23.

## **3.2 Fire Hazards Identification**

The fire area contains both ignition sources and combustible fire hazards. The ignition sources consist of the diesel generator, motor control centers, jacket water circulation pumps and the starting air compressors. Combustibles consist primarily of lube oil, diesel fuel oil and exposed electrical cables.

This Fire Area is below grade and any exterior wall penetrations need not be rated based on the protection provided by the ground covering the exterior walls.

The current fire loading classification is considered moderate.

## **3.3 NSCA Compliance Summary**

Fire Area AA23 contains the Unit 2 Green Train Emergency Diesel Generator as well as associated Green Train EDG support components, 600V MCCs, and 120V power supplies. This fire area also contains both Red and Green train raceways and cables.

Compliance with the nuclear safety performance criteria is achieved using the performance-based approach in accordance with NFPA 805, Section 4.2.4.2.

Safe and stable condition of Unit 2 will be accomplished using Steam Generators 2 and 3 via the Unit 2 Turbine Driven Auxiliary Feedwater Pump, Unit 2 Charging via the West Pump, Process Monitoring/Indication from the Main Control Room, Unit 2 Component Cooling Water via the West Pump and Unit 2 Essential Service Water via the West Pump. Power is credited via the Red Train from offsite, with Red Train EDG also available.

The Nuclear Safety Performance Criteria compliance strategy for AA23 is documented within the NSCA Report.

### 3.3.1 Variances

The variances identified for evaluation for this fire area are grouped as follows:

#### 3.3.1.1 VFDR No. AA23-001

2-21D-NORM - 600 Volt Bus 21D (normal) Power Supply is required to be operable in support of Unit 2 Electrical Distribution. Bus 21D may not be available due to the potential loss of power to the Green (CD) Train buses resulting from DG output breaker failure and potential for spurious start of the DG (Multiple Spurious Operations concern). For the purposes of this VFDR, loss of Bus 21D impacts 250VDC battery charging and supply as well Control Room 120V CRIDs. As a result, Bus 21D is required to be transferred to its alternate power supply prior to battery depletion in approximately 4 hours in order to support Control Room RCS loop temperature indication. The TDAFW pump is credited for a fire in this area. This condition represents a variance from deterministic requirements of NFPA 805, Section 4.2.3. This is a separation issue.

This VFDR has been evaluated and it was determined that the risk, safety margin and defense-in-depth meet the acceptance criteria of NFPA 805 Section 4.2.4 with a defense-in-depth action credited.

### 3.3.2 Recovery Actions Credited

For each VFDR, a Fire Risk Evaluation has been performed to assess the acceptability of risk, defense-in-depth, and safety margin. This evaluation determined whether or not recovery actions are required to ensure that one success path necessary to achieve and maintain the nuclear safety performance criteria is maintained free of fire damage by a single fire. Table 3-3 identifies the credited recovery actions for this area. Actions retained for DID are identified as “DID Actions” within Table 3-3. Additional information for DID actions is contained within Section 3.8 of this report. Note that, for completeness, all VFDRs are contained within Table 3-3, even if the Fire Risk Evaluation has determined that a recovery action is not required. In those instances where a recovery action has been determined to not be required, the word “None” is provided in the “Action” column in the table.

Table 3-3, Recovery Actions Credited		
VFDR	Component	Action
AA23-001	2-21D-NORM	DID ACTION 2-21D-XFER (Transfer Bus 21D to alternate source)

### 3.4 Non-Power Operational Modes Compliance Summary

A review of CNP for the potential effects of a fire in this Fire Area while in non-power modes of operation (NPO) was conducted. This review was conducted using the guidance provided in NEI 04-02 and FAQ 07-0040, “Non-Power Operations Clarifications”.

The review determined that there are potential failures that affect certain Key Safety Functions (KSF) as a result of the fire in this area, and the fire could result in the loss of one or more KSF

paths. Compensatory measures are required during high risk evolution periods to provide reasonable assurance a fire will not adversely affect key safety functions and the NFPA 805 performance goal for NPO is therefore satisfied. The results of the NPO analysis are contained within Technical Evaluation R1900-005-001, Non-Power Operation Modes Transition Review Report.

### 3.5 Radioactive Release Compliance Summary

The NFPA 805 radiological release goal is to provide reasonable assurance that a fire will not result in a radiological release that adversely affects the public, plant personnel or the environment. The NFPA 805 requirement is to ensure a radiation release to any unrestricted area due to the direct effects of fire suppression activities (but not involving fuel damage) shall be as low as reasonably achievable and shall not exceed applicable plant Technical Specification limits.

AA23 is located outside the Radiological Controlled Area (RCA) and is not a storage location for contaminated materials, therefore there is reasonable assurance a fire in this area will not result in radiation release. The review of this fire area, with respect to radioactive release, is documented in the NFPPM.

### 3.6 Probabilistic Risk Assessment-Summary of Results

A Fire PRA (FPRA) quantification of Fire Area AA23 was performed and is documented in PRA-NB-FIRE-FQ, Fire PRA Model Quantification Notebook. The fire risk quantification for Fire Area AA23 is analyzed assuming whole room burnup. PRA-NB-FIRE-FQ includes a summary of all potentially risk-significant fire scenarios (i.e., CDF > 1.0E-7 or LERF > 1.0E-8). Bounding CDF / LERF per calendar year values are reported that are based on the risk values documented in PRA-NB-FIRE-FSS, Fire PRA Fire Scenario Selection.

### 3.7 Risk-Informed, Performance-Based Evaluations

Fire Risk Evaluations (FREs) have been performed to ensure that variances from the NFPA 805 deterministic requirements are acceptable. The evaluation process consists of an integrated assessment of the acceptability of risk, defense-in-depth, and safety margins.

#### 3.7.1 Transition Risk-Informed, Performance-Based Evaluations

The 'changes' associated with NFPA 805 transition were those variances from the deterministic requirements of NFPA 805 or with the existing fire protection licensing basis that were brought into compliance with the NFPA 805 performance based approach. The change identified for evaluation for Fire Area AA23 is as follows:

- Separation Issues

The Fire Risk Evaluation has determined that the change is acceptable based upon:

- The measured change in CDF and LERF.
- Adequate defense-in-depth and safety margins being maintained.

Refer to Attachment 2 for a summary of results associated with the Fire Risk Evaluations.

### 3.8 Defense-in-Depth

A comprehensive risk-informed, performance-based analysis includes consideration of defense-in-depth (DID) as part of an integrated evaluation of risk considerations. In general, defense-in-depth involves consideration of the extent to which fire protection systems and features are provided within the three echelons of fire-protection:

- Preventing fires from starting,
- Rapidly detecting fires and controlling and extinguishing promptly those fires that do occur, thereby limiting fire damage,
- Providing an adequate level of fire protection for structures, systems, and components important to safety, so that a fire that is not promptly extinguished will not prevent the nuclear safety performance criteria from being met.

Each VFDR was evaluated for DID. The following recovery actions have been retained for DID.

VFDR No. AA23-001: 2-21D-NORM - 600 Volt Bus 21D (normal) Power Supply is required to be operable in support of Unit 2 Electrical Distribution. Bus 21D is not available due to the loss of power to the Green Train buses resulting from Emergency Diesel (EDG) output breaker failure and potential for spurious start of the EDG (Multiple Spurious Operations concern). For the purposes of this VFDR, loss of Bus 21D impacts 250VDC battery charging and supply as well Control Room 120V CRIDs. As a result, Bus 21D is required to be transferred to its alternate power supply prior to battery depletion in approximately 4 hours in order to support Control Room RCS loop 2 & 3 temperature indication. 2-21D-NORM transfer to alternate power supply is being retained for DID to ensure RCS loop 2 and 3 temperature indication is maintained.

Based on the assessment in support of the Fire Risk Evaluation, defense-in-depth is maintained for fire area AA23. Refer to Attachment 2 for details associated with the Fire Risk Evaluation.

### 3.9 Monitoring Program Input

A Monitoring Program will be developed in accordance with FAQ 10-0059, Rev. 1. Methods to monitor availability, reliability, and performance of fire protection program structures, systems, and components (SSCs), as well as programmatic elements will be provided. Additionally, effectiveness measures are established to review program related performance and trends. For AA23 the following systems and features are candidates for inclusion in the CNP Fire Protection Monitoring Program:

- Fire Area boundary barriers discussed in Section 3.1
- Fire Detection System (Thermal)
- Fire Suppression System (Automatic CO2)

## 4.0 CONCLUSION

The nuclear safety and radioactive release performance criteria of NFPA 805 are met for a fire in Fire Area AA23. This Fire Risk Evaluation for Fire Area AA23 has demonstrated that

- The change in core damage frequency (delta CDF) is acceptable, and
- The change in large early release frequency (delta LERF) is acceptable, and
- Defense-in-depth and safety margins are maintained.

This is confirmation that a success path effectively remains free of fire damage and that the performance-based approach is acceptable per Section 4.2.4.2 of NFPA 805.

## 5.0 REFERENCES

- 5.1 Calculation PRA-FIRE-NB-CRE, Fire PRA Cumulative Risk Evaluations
- 5.2 CNP Fire Pre-Plans, Volumes I, II, and III, Revisions 17, 14, and 18 respectively
- 5.3 Fire Hazards Analysis
- 5.4 NFPA 805, Performance-Based Standard for Fire Protection for Light Water Reactor Electric Generating Plants
- 5.5 NFPPM, NFPA 805 Fire Protection Program Manual (NFPPM)
- 5.6 Nuclear Energy Institute (NEI) 04-02, Guidance for Implementing a Risk-Informed, Performance-Based Fire Protection Program under 10 CFR 50.48(c), Rev. 2
- 5.7 Nuclear Safety Capability Assessment Report
- 5.8 PRA-NB-FIRE-FQ, Fire PRA Model Quantification Notebook
- 5.9 PRA-NB-FIRE-FSS, Fire PRA Fire Scenario Selection
- 5.10 Regulatory Guide 1.205, Risk-Informed, Performance-Based Fire Protection for Existing Light-Water Nuclear Power Plants, Rev. Revision 1
- 5.11 Technical Evaluation R1900-005-001, Non-Power Operation Modes Transition Review

**Fire Area AA23 – Attachment 1 - Table B-3 - Fire Area Transition**

<u>Unit</u>	<u>Fire Area</u>	<u>Description</u>
2	AA23	Unit 2 CD Diesel Generator Room (El. 587 ft.)

<u>Fire Zone</u>	<u>Description</u>
18	2CD Diesel Generator Room - El. 587 ft. 0 in. - Unit 2

**Regulatory Basis**

4.2.4.2 - Performance-Based Approach - Fire Risk Evaluation with simplifying deterministic assumptions

<b>Performance Goal</b>	<b>Method of Accomplishment</b>	<b>Comments</b>
Reactivity Control	Unit 2 - Trip the reactor from the Control Room. Borate using Unit 2 West Charging Pump supplied from the RWST. Use source range monitoring for indication for Unit 2.	None
Inventory and Pressure Control	Unit 2 - Control inventory using Unit 2 West Charging Pump. Control pressure using Unit 2 Pressurizer Safety Relief Valves.	None
Decay Heat Removal	Unit 2 - Feed SGs 2 & 3 with Unit 2 TDAFW Pump. The DHR function also requires MS isolation with a steam release path through the Safety Relief Valves.	None
Process Monitoring	Unit 2 Process Monitoring - Use Unit 2 process monitoring in the Control Room for the following: Pressurizer level, RCS pressure and temperature, and S/G level and Pressure. Unit 2 Source Range Monitoring - Use Unit 2 source range monitoring in the Control Room.	None
Vital Auxiliaries	Unit 2 Electrical - Control Unit 2 Red (AB) Train Electrical Distribution with Unit 2 Red (AB) Train Offsite Power or Unit 2 Red (AB) DG. Unit 2 ESW - Operate Unit 2 West ESW. Unit 2 CCW - Operate Unit 2 West CCW. Unit 2 HVAC - Operate Unit 2 Control Room HVAC. Operate Unit 2 Auxiliary Building HVAC. Operate Unit 2 Red (AB) DG HVAC. Operate Unit 2 Red (AB) Switchgear HVAC. Operate Unit 2 TDAFW Pump Room HVAC system. Operate Unit 2 West ESW Pump HVAC system.	VFDR indentified for electrical distribution.

**Fire Area AA23 – Attachment 1 - Table B-3 - Fire Area Transition**

<u>Unit</u>	<u>Fire Area</u>	<u>Description</u>
2	AA23	Unit 2 CD Diesel Generator Room (El. 587 ft.)

**Reference Documents**

Genesis Solution Suite, EDISON / SAFE-PB, DC Cook V 3.4.0

Nuclear Safety Capability Assessment Report

**Licensing Actions**

None

**Existing Engineering Equivalency Evaluations (EEEE)****EEEE Title Engineering Equivalency Evaluation 11-9 - Turbine, Auxiliary and Containment Buildings Boundary Evaluation**

**Summary** The purpose of this engineering equivalency evaluation is to describe in general, the approach and existence of evaluations performed to determine and reconcile fire area boundaries having components or designs with less than a 3-hr fire rating on preventing the spread of fire. This engineering equivalency evaluation also specifically evaluates the impact of unrated door assemblies on the spread of fire.

Reasonable assurance is provided that the fire area boundaries having components or design less than a 3-hr fire rating will not increase the spread of fire or impair the safe shutdown capabilities of Units 1 or 2. In addition, this engineering equivalency evaluation does not adversely impact on other engineering equivalency evaluations or exemption requests.

This evaluation supports additional evaluations credited in this fire area.

**Fire Area AA23 – Attachment 1 - Table B-3 - Fire Area Transition**

<u>Unit</u>	<u>Fire Area</u>	<u>Description</u>
2	AA23	Unit 2 CD Diesel Generator Room (El. 587 ft.)
<hr/>		
<b><u>EEEE Title</u></b>	<b>Engineering Equivalency Evaluation 11-17 - Diesel Generator Fuel Oil Day Tank Rooms Fire Zones 15 (Fire Area AA14), 16 (Fire Area AA15), 18 (Fire Area AA23) and 19 (Fire Area AA24) Boundary Evaluation</b>	
<b><u>Summary</u></b>	<p>The purpose of this engineering equivalency evaluation is to document the acceptability of the fire seals grouted to an unknown depth protecting the penetrations between the DG fuel oil day tank rooms and their respective DG rooms in Fire Zones 15 (Fire Area AA14), 16 (Fire Area AA15), 18 (Fire Area AA23) and 19 (Fire Area AA24) for their impact on preventing the spread.</p> <p>The existing fire seals grouted to an unknown depth located within the penetrations between the DG fuel oil day tank rooms and their respective DG rooms (Fire Zones 15, 16, 18 and 19) are acceptable for maintaining the rating of the fire boundary. This engineering equivalency evaluation does not impact other engineering equivalency evaluations.</p> <p>The fire seals were evaluated and found to be acceptable based on the fire hazards and fire protection systems within the areas.</p>	
<b><u>EEEE Title</u></b>	<b>Engineering Equivalency Evaluation 11-48 - Unit 1 and Unit 2 Diesel Generator AB/CD Pipe Penetration Seals - Fire Zones 11 (Fire Area AA10), 15 (Fire Area AA14), 16 (Fire Area AA15), 18 (Fire Area AA23), 19 (Fire Area AA24) and 23 (Fire Area AA29)</b>	
<b><u>Summary</u></b>	<p>The purpose of this engineering equivalency evaluation is to document the acceptability of fire-rated penetration seals W9142, W9143, W9171, W9172, W9192, W9193, W9959 and W9960. The seals are physically located in the east fire-rated walls of the DG Rooms floor elevation 587 ft., Fire Zones 15, 16, 18 and 19.</p> <p>The existing configuration for the subject fire-rated penetration is suitable to perform their design function, to provide an acceptable level of fire protection, therefore preventing fire propagation between to fire zones. As such, there is no impact on the stations ability to achieve and maintain safe shutdown.</p> <p>The fire rated penetration seals were evaluated and found to be acceptable based on the fire hazards and fire protection systems within the evaluated areas.</p>	



**Fire Area AA23 – Attachment 1 - Table B-3 - Fire Area Transition**

<u>Unit</u>	<u>Fire Area</u>	<u>Description</u>
2	AA23	Unit 2 CD Diesel Generator Room (El. 587 ft.)

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**Fire Suppression Effects on Nuclear Safety Performance Criteria**

The CNP fire brigade is trained to discharge water in a judicious manner and instructed to direct hose streams and portable extinguishers at the base of the fire to limit the amount of overspray beyond the immediate fire zone. For this reason, fire brigade activities are not expected to fail components not already considered damaged. It has been concluded that water impingement on cables is not a concern. Electrical cabinets are provided with a seal at the conduit interface. Possible impacts to surrounding equipment due to manual fire fighting activities is bounded by the analysis approach of postulating whole room damage. The drainage features of the fire area mitigate the potential for flooding damage due to fire suppression, such that the standing water would not affect credited equipment.

In the event of discharge, any damage caused by the CO2 system to other equipment operating within the fire area which is not immediately involved in the originating fire is bounded by the analysis approach of postulating whole room damage. Since it is shown that suppression effects will not impact the nuclear safety performance criteria, the fire area configuration is deemed acceptable.

## References:

Technical Evaluation 12.1, "Fire Suppression Effects Study"

Technical Evaluation 12.1, "Supplemental Information to Fire Suppression Effects Study – Supplement 1"

**Fire Area Comments**

None

## Fire Area AA23 – Attachment 2 - Fire Risk Evaluation Results Summary

### A2.1 Introduction

The ‘changes’ associated with NFPA 805 transition were those variances from the deterministic requirements of NFPA 805. The changes identified for evaluation for fire area AA23 are grouped as follows:

- Separation Issues

This attachment is a summary of the Fire Risk Evaluation for the fire area. The complete results and methodology are contained in the Cumulative Fire Risk Evaluation, PRA-FIRE-NB-CRE. (FPCE 2017-0009)

### A2.2 Inputs/Assumptions

1. Assumptions from the Fire PRA apply to this calculation.
2. Detailed fire modeling was not performed for Fire Area AA23. A single whole room burnout scenario was assumed.

### A2.3 Fire Modeling Methodology

Detailed fire modeling was not performed for Fire Area AA23. This area was modeled considering whole room burnout.

### A2.4 Scenario Descriptions and Model Results

A single whole room burnout scenario was modeled for Fire Area AA23. All targets within the fire area were assumed damaged.

#### A2.4.1 Ignition Sources

The fixed ignition sources in Fire Area AA23 consist of the diesel generator, motor control centers and the jacket water circulation pumps. Additional detail regarding the ignition sources in this area is available in the Fire PRA Report. All fire scenarios, whether resulting from fixed or transient ignition sources, are assumed to damage all targets in the fire area.

#### A2.4.2 Scenario Results

The PRA analyzed the VFDRs and determined them to be risk insignificant, therefore, a quantitative delta risk calculation was not performed.

### A2.5 Fire Risk Evaluation Results

PRA-FIRE-NB-CRE documents scenarios and corresponding impacted VFDRs that were evaluated for delta risk during the transition to NFPA 805 and also all changes to the Fire Protection Program that are currently incorporated into the Fire PRA model. The acceptability of the Cumulative Fire Risk Evaluations was based on calculated delta risk meeting the thresholds of NEI 04-02, RG 1.205 and RG 1.174. (FPCE 2017-0009)

## Fire Area AA23 – Attachment 2 - Fire Risk Evaluation Results Summary

### A-2.6 Impact of VFDR on Defense-in-Depth

Defense-in-Depth has been evaluated for this fire area. The impacts of this evaluation are summarized in the table below:

Defense-in-Depth Impact Review for AA23			
Method of Providing DID	Required to Support Deterministic Analysis or Fire PRA?	Changes or Improvements Necessary for DID?	Basis/Justification
Echelon 1: Prevent fires from starting			
Combustible Control is implemented in accordance with Procedure PMP-2270-CCM-001, Control of Combustible Materials.	Yes	No	• This element is adequate based on no perceived weakness of, or over-reliance on, another echelon of defense-in-depth.
Hot Work Control is implemented in accordance with Procedure PMP-2270-WBG-001, Welding, Burning and Grinding Activities.	Yes	No	
Echelon 2: Rapidly detect, control and extinguish promptly those fires that do occur thereby limiting fire damage			
Fire Detection System	Yes	No	• Suppression and detection are required because fire fighting activities may be challenging. No changes or improvements to Echelon 2 attributes are necessary to maintain defense-in-depth.
Fixed Fire Suppression	Yes	No	
Portable Fire Extinguishers	Yes	No	
Hose stations and hydrants	Yes	No	
Pre-Fire Plan	Yes	No	
Echelon 3: Provide adequate level of fire protection for systems and structures so that a fire will not prevent essential safety functions from being performed			
Walls, floors ceilings and structural elements are rated or have been evaluated as adequate for the hazard.	Yes	No	• Although VFDR AA23-001 is not considered a significant contribution to core damage frequency, the variance is considered important enough to the NSCA to retain as a recovery action to ensure that defense-in-depth is maintained.
Penetrations in the fire area barrier are rated or have been evaluated as adequate for the hazard.	Yes	No	
Supplemental barriers (e.g., ERFBS, cable tray covers, etc.)	No	No	
Guidance provided to operations personnel detailing the required success path(s) including recovery actions to achieve nuclear safety performance criteria.	No	Yes	

## Fire Area AA23 – Attachment 2 - Fire Risk Evaluation Results Summary

### A-2.7 Safety Margin Considerations

In accordance with NEI 04-02, the maintenance of adequate Safety Margin is assessed by the consideration categories of analyses utilized by this Fire Risk Evaluation.

Safety margins are considered to be maintained if:

- Codes and Standards or their alternatives accepted for use by the NRC are met.

AND

- Safety analyses acceptance criteria in the licensing basis (e.g., FSAR, supporting analyses) are met, or provides sufficient margin to account for analysis and data uncertainty.

The following summarizes the bases for ensuring the maintenance of safety margins:

- The risk-informed, performance based processes utilized are based upon NFPA 805, 2001 edition, endorsed by the NRC in 10 CFR 50.48(c).
- The Fire Risk Evaluation process is in accordance with NEI 04-02, Revision 2, which is endorsed by the NRC in Regulatory Guide 1.205, Revision 1.
- The Fire PRA is developed in accordance with NUREG/CR-6850, which was developed jointly between the NRC and EPRI.
- The Fire PRA has undergone an industry peer review, in order to ensure the Fire PRA meets the appropriate quality standards of ASME/ANS RA-Sa-2009, "Standard for Level 1/Large Early Release Frequency Probabilistic Risk Assessment for Nuclear Power Plant Applications," Dated February 2, 2009
- The "bounding risk assessment" is used during transition (NEI 04-02, Section 5.3.4.2). This approach conservatively assumes that target set damage occurs for postulated fire events which resulted in whole room burn up, and therefore, MEFS/LFS is not analyzed separately from the Fire PRA results.
- The CNP internal events PRA model received two formal industry peer reviews conducted in accordance with applicable NEI guidelines. The initial peer review was performed in 2001, while a subsequent focused scope (i.e., limited scope) peer review was conducted in 2009. The initial, full-scope WOG peer review covered all aspects of the CNP PRA model and the administrative processes used to maintain and update the model. The CNP PRA model has been revised to address all significant issues (i.e., Category A and B Facts & Observations) identified during the initial peer review. None of the findings from the focused-scope peer review were judged to reach the significance level of a Category A or B Fact & Observation; as a result, no changes to the PRA model have yet been made to include resolutions for these latter issues.
- Fire protection systems and features determined to be required by NFPA 805 Chapter 4 have been confirmed to meet the requirements of NFPA 805 Chapter 3 and their associated referenced codes and listings, or provided with acceptable alternatives using processes accepted for use by the NRC (i.e., FAQ 06-0008, FAQ 06-0004, 07-0033).
- Fire modeling has not been performed in support of the change evaluations and results are therefore, based on whole area burn up. As such, the results are considered very conservative.
- In accordance with the requirements of 10 CFR 50.48(c)(2)(iii), the Fire PRA results, including cutsets for

## **Fire Area AA23 – Attachment 2 - Fire Risk Evaluation Results Summary**

the scenarios of concern, have been reviewed and it was verified that the results presented above do not rely solely on feed and bleed as the fire-protected safe shutdown path for maintaining reactor coolant inventory, pressure control, and decay heat removal capability for this fire area.

### **A-2.8 Transition Risk Evaluation Conclusions**

The transition change evaluation determined that these changes:

- Are acceptable based upon the measured change in CDF and LERF
- Maintained adequate defense-in-depth and safety margins

The results of this evaluation meet the requirements of NFPA 805 Risk Evaluation; therefore, the use of the performance based analysis approach is acceptable.

## D. C. Cook Nuclear Plant Fire Safety Analysis

## Fire Area: AA24

Unit 2 AB Diesel Generator Room (El. 587 ft.)

## Table of Contents

<b>Purpose</b> .....	Section 1.0
<b>Analysis Methodology</b> .....	Section 2.0
<b>Analysis</b> .....	Section 3.0
<b>Conclusion</b> .....	Section 4.0
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## Attachments

Fire Area AA24 – Attachment 1 - Table B-3 - Fire Area Transition

## Fire Area AA24 – Attachment 2 - Fire Risk Evaluation Results Summary

## 1.0 PURPOSE

This report documents the Fire Safety Analysis (FSA) for Cook Nuclear Plant (CNP) Fire Area AA24, Unit 2 AB Diesel Generator Room (El. 587 ft.) which comprises fire zone(s) 19. The purpose of this analysis is to demonstrate the achievement of the nuclear safety and radioactive release performance criteria of NFPA 805 as required by 10 CFR 50.48(c). The Fire Safety Analysis is a key part of compliance with Section 2.7.1.2 Fire Protection Program Design Basis Document of NFPA 805. This analysis also documents results of risk-informed, performance-based Fire Risk Evaluations (FREs). These evaluations are associated with Variances from Deterministic Requirements (VFDRs) of NFPA 805 Chapter 4.

## 2.0 ANALYSIS METHODOLOGY

The FSA is the design basis document as described in NFPA 805 Section 2.7.1.2. The following steps are performed to develop the FSA on a fire area basis:

- Identify significant fire hazards in the fire area. This is based on NFPA 805 approach to analyze the plant from an ignition source and fuel package perspective.
- Summarize Nuclear Safety Capability Analysis (NSCA) compliance strategies. This is the result of the NEI 04-02 B-3 Table review of the Safe Shutdown Analysis.
- Summarize Non-Power Operations Modes compliance strategies.
- Summarize Radioactive Release compliance strategies. The transition review process required per NEI 04-02 is used to develop these results.
- Provide Fire Probabilistic Risk Assessment summary of results. This is based on the results from the plant Fire PRA.
- Perform risk informed, performance based evaluations if needed for the performance based approach.
- Summarize Defense-in-Depth strategy for each fire area.
- Determine key analysis assumptions which are candidates to be included in the NFPA 805 monitoring program.
- Provide conclusions relative to NFPA 805 compliance.

### 3.0 ANALYSIS

#### 3.1 Classical Fire Protection

##### 3.1.1 Construction

Walls, floors and ceilings to adjacent fire areas are reinforced concrete in excess of a 3-hour rating with two exceptions. These exceptions are the 3-hour, 8-inch concrete block used to reduce the wall opening size for the exchange of a pair of doors to a single leaf door and the 4-hour, 8-inch concrete block used in the west wall for equipment removal.

The fuel oil day tank room is constructed of 4-hour 8-inch concrete block to the underside of the ceiling slab with a cantilevered concrete floor located approximately 10 ft. 8-inches above the Diesel Generator Room floor.

Applicable Engineering Equivalency Evaluations are documented in Attachment 1.

##### 3.1.2 Doors and Access Openings

Fire doors having a 3-hour rating are provided to adjacent Fire Areas AA26 and AA2 - Fire Zones 21 and 85, respectively and to the fuel oil day tank room located within this fire zone.

##### 3.1.3 Penetrations

Note: Statements regarding fire resistance rating of penetration seals are not applicable to seals in barriers to Analysis Area YD.

Penetrations in fire barriers between this fire zone and adjacent fire areas are provided with fire seals. Additionally, the day tank room within this fire zone is provided with fire seals.

In order to support NFPA 805 Chapter 3 requirements, a fire area boundary evaluation was performed for the grouted fire seals installed in penetrations separating the diesel generator diesel fuel oil tank rooms and their respective diesel generators (Engineering Equivalency Evaluation 11-17).

The seismic gaps are sealed with a glass fiber reinforced silicone sheeting.



### 3.1.4 Detection

The table below outlines the fire detection system(s) provided in the Fire Area:

Table 3-1, Fire Area AA24 Detection Systems								
Fire Zone	Type of System	Local (L) / Remote (R)	Detection Actuates Suppression?	Required System?				
				S	L	E	R	D
19	Thermal	L/R	Y	Y	N	Y	Y	N
Table 3-1 Legend:								
Table Field: "Required System?"								
S	- Required for Chapter 4 Separation Criteria							
L	- Required for NRC Approved Licensing Action							
E	- Required for Engineering Equivalency Evaluation							
R	- Required for Risk Significance							
D	- Required to maintain adequate balance of Defense-in-Depth in a Change Evaluation or Fire Risk Evaluation							

Cross zoned line type thermistor heat detectors (2) are provided at the ceiling. Each detection circuit utilizes a different alarm set point to assure that the CO2 will not be actuated until both set points are satisfied. This has been done to minimize spurious operations of the CO2.

### 3.1.5 Fixed Suppression

The table below outlines the fixed fire suppression system(s) provided in the Fire Area:

Table 3-2, Fire Area AA24 Suppression Systems							
Fire Zone	Type of System	Full (F) / Partial (P)	Required System?				
			S	L	E	R	D
19	Automatic CO2	F	Y	N	Y	Y	N
Table 3-2 Legend:							
Table Field: "Required System?"							
S	- Required for Chapter 4 Separation Criteria						
L	- Required for NRC Approved Licensing Action						
E	- Required for Engineering Equivalency Evaluation						
R	- Required for Risk Significance						
D	- Required to maintain adequate balance of Defense-in-Depth in a Change Evaluation or Fire Risk Evaluation						

A low pressure CO2 total flooding system supplied from 17-ton tank is provided. This system is actuated by operation of both of the above detection circuits. Operation of the CO2 system provides alarm in the Unit 2 Control Room.

### 3.1.6 Manual Suppression / Response Strategy

A postulated fire will be identified by automatic detection using the thermistor heat detectors described in Section 3.1.2 or by plant personnel using plant communication system to notify the control room. The automatic detection system alarms in the control room. The Control Room

operator will dispatch the fire brigade for initiation of manual fire fighting. A fire in this fire area will be contained by the construction features discussed in Section 3.1.1. Manual suppression is provided by the CNP Fire Brigade.

Fire extinguishers are provided in this fire area.

A water hose reel is located in adjacent Fire Area AA2 - Fire Zone 85.

Fire Area AA24 is equipped with floor drains.

### 3.1.7 Ventilation

A fire in this area will be contained by the fire barriers. Smoke can be removed by portable fans and flexible ducting to the Turbine Building and outdoors. The normal building ventilating systems in the Turbine Building will then exhaust the smoke. This fire area is listed as a non-controlled area in the Fire Pre Plans and therefore there is reasonable assurance that products of combustion will not be contaminated.

Fire dampers having a 3-hour rating are provided to adjacent Fire Area AA2 - Fire Zone 85 and Yard. Additional 3-hour rated dampers are located within the fire zone between the diesel fuel day tank room and the remainder of the area.

### 3.1.8 Other Features

For Fire Zone 19, Electrical Raceway Fire Barrier Systems (ERFBS) with a rating of a 1-hour rating are provided, where required. Cables inside embedded conduits within a concrete pilaster are provided with an external layer of Thermo-Lag (Engineering Equivalency Evaluation 11-50).

## 3.2 Fire Hazards Identification

The fire area contains both ignition sources and combustible fire hazards. The ignition sources consist of the diesel generator, motor control centers, jacket water circulation pumps and the starting air compressors. Combustibles consist primarily of lube oil, diesel fuel oil and exposed electrical cables.

This Fire Area is below grade and any exterior wall penetrations need not be rated based on the protection provided by the ground covering the exterior walls.

The current fire loading classification is considered moderate.

## 3.3 NSCA Compliance Summary

Fire Area AA24 contains the Unit 2 Red Train Emergency Diesel Generator as well as associated Red Train EDG support components, 600V MCCs, and 120V power supplies. This fire area also contains both Red and Green train raceways and cables.

Compliance with the nuclear safety performance criteria is achieved using the performance-based approach in accordance with NFPA 805, Section 4.2.4.2.

Safe and stable condition of Unit 2 will be accomplished using the Steam Generators 2 and 3 via the Unit 2 East Motor Driven Auxiliary Feedwater Pump, Unit 2 Charging via the East Pump, Process Monitoring/Indication from the Main Control Room, Unit 2 Component Cooling Water via the East

Pump and Essential Service Water via the East Pump. Power is credited via the Green Train from offsite, with Green Train EDG also available.

The Nuclear Safety Performance Criteria compliance strategy for AA24 is documented within the NSCA Report.

### 3.3.1 Variances

The variances identified for evaluation for this fire area are grouped as follows:

#### 3.3.1.1 VFDR No. AA24-001

2-ILS-950 and 2-ILS-951 - RWST level indication is required to be operable to support CVCS. RWST level indication will be available from the Control Room until battery 2-BATT-AB is depleted. Backup power can be provided to the battery charger with a manual action to transfer to backup power for 600V Bus 2-21A-NORM. Restoring 2-21A-NORM will also eliminate a spurious SI signal. If power is not restored local monitoring of the RWST level is required. 2-ILS-950 may fail due to fire induced damage of 120V Instrument Panel 2-CRID-III. 1-ILS-951 may fail due to fire induced damage of 120V Instrument Panel 2-CRID-IV. This condition represents a variance from the deterministic requirements of NFPA 805, Section 4.2.3. This is a separation issue.

This VFDR has been evaluated and it was determined that the risk, safety margin and defense-in-depth meet the acceptance criteria of NFPA 805 Section 4.2.4 with no further action required.

### 3.3.2 Recovery Actions Credited

For each VFDR, a Fire Risk Evaluation has been performed to assess the acceptability of risk, defense-in-depth, and safety margin. This evaluation determined whether or not recovery actions are required to ensure that one success path necessary to achieve and maintain the nuclear safety performance criteria is maintained free of fire damage by a single fire. Table 3-3 identifies the credited recovery actions for this area. Actions retained for DID are identified as “DID Actions” within Table 3-3. Additional information for DID actions is contained within Section 3.8 of this report. Note that, for completeness, all VFDRs are contained within Table 3-3, even if the Fire Risk Evaluation has determined that a recovery action is not required. In those instances where a recovery action has been determined to not be required, the word “None” is provided in the “Action” column in the table.

Table 3-3, Recovery Actions Credited		
VFDR	Component	Action
AA24-001	2-ILS-950	None
	2-ILS-951	

### 3.4 Non-Power Operational Modes Compliance Summary

A review of CNP for the potential effects of a fire in this Fire Area while in non-power modes of operation (NPO) was conducted. This review was conducted using the guidance provided in NEI 04-02 and FAQ 07-0040, “Non-Power Operations Clarifications”.

The review determined that there are potential failures that affect certain Key Safety Functions (KSF) as a result of the fire in this area, and the fire could result in the loss of one or more KSF

paths. Compensatory measures are required during high risk evolution periods to provide reasonable assurance a fire will not adversely affect key safety functions and the NFPA 805 performance goal for NPO is therefore satisfied. The results of the NPO analysis are contained within Technical Evaluation R1900-005-001, Non-Power Operation Modes Transition Review Report.

### 3.5 Radioactive Release Compliance Summary

The NFPA 805 radiological release goal is to provide reasonable assurance that a fire will not result in a radiological release that adversely affects the public, plant personnel or the environment. The NFPA 805 requirement is to ensure a radiation release to any unrestricted area due to the direct effects of fire suppression activities (but not involving fuel damage) shall be as low as reasonably achievable and shall not exceed applicable plant Technical Specification limits.

AA24 is located outside the Radiological Controlled Area (RCA) and is not a storage location for contaminated materials, therefore there is reasonable assurance a fire in this area will not result in radiation release. The review of this fire area, with respect to radioactive release, is documented in Technical Evaluation 12-31, "Radioactive Release Review".

### 3.6 Probabilistic Risk Assessment-Summary of Results

A Fire PRA (FPRA) quantification of Fire Area AA24 was performed and is documented in PRA-NB-FIRE-FQ, Fire PRA Model Quantification Notebook. The fire risk quantification for Fire Area AA24 is analyzed assuming whole room burnup. PRA-NB-FIRE-FQ includes a summary of all potentially risk-significant fire scenarios (i.e., CDF > 1.0E-7 or LERF > 1.0E-8). Bounding CDF / LERF per calendar year values are reported that are based on the risk values documented in PRA-NB-FIRE-FSS, Fire PRA Fire Scenario Selection.

### 3.7 Risk-Informed, Performance-Based Evaluations

Fire Risk Evaluations (FREs) have been performed to ensure that variances from the NFPA 805 deterministic requirements are acceptable. The evaluation process consists of an integrated assessment of the acceptability of risk, defense-in-depth, and safety margins.

#### 3.7.1 Transition Risk-Informed, Performance-Based Evaluations

The 'changes' associated with NFPA 805 transition were those variances from the deterministic requirements of NFPA 805 or with the existing fire protection licensing basis that were brought into compliance with the NFPA 805 performance based approach. The change identified for evaluation for Fire Area AA24 is as follows:

- Separation Issues

The Fire Risk Evaluation has determined that the change is acceptable based upon:

- The measured change in CDF and LERF.
- Adequate defense-in-depth and safety margins being maintained.

Refer to Attachment 2 for a summary of results associated with the Fire Risk Evaluations.

### 3.8 Defense-in-Depth

A comprehensive risk-informed, performance-based analysis includes consideration of defense-in-depth (DID) as part of an integrated evaluation of risk considerations. In general, defense-in-depth involves consideration of the extent to which fire protection systems and features are provided within the three echelons of fire-protection:

- Preventing fires from starting,
- Rapidly detecting fires and controlling and extinguishing promptly those fires that do occur, thereby limiting fire damage,
- Providing an adequate level of fire protection for structures, systems, and components important to safety, so that a fire that is not promptly extinguished will not prevent the nuclear safety performance criteria from being met.

Each VFDR was evaluated for DID. No recovery actions have been retained for DID.

Based on the assessment in support of the Fire Risk Evaluation, defense-in-depth is maintained for fire area AA23. Refer to Attachment 2 for details associated with the Fire Risk Evaluation.

### 3.9 Monitoring Program Input

A Monitoring Program will be developed in accordance with FAQ 10-0059, Rev. 1. Methods to monitor availability, reliability, and performance of fire protection program structures, systems, and components (SSCs), as well as programmatic elements will be provided. Additionally, effectiveness measures are established to review program related performance and trends. For AA24 the following systems and features are candidates for inclusion in the CNP Fire Protection Monitoring Program:

- Fire Area boundary barriers discussed in Section 3.1
- Fire Detection System (Thermal)
- Fire Suppression System (Automatic CO2)
- Electrical Raceway Fire Barrier Systems (ERFBS)

## 4.0 CONCLUSION

The nuclear safety and radioactive release performance criteria of NFPA 805 are met for a fire in Fire Area AA24. This Fire Risk Evaluation for Fire Area AA24 has demonstrated that

- The change in core damage frequency (delta CDF) is acceptable, and
- The change in large early release frequency (delta LERF) is acceptable, and
- Defense-in-depth and safety margins are maintained.

This is confirmation that a success path effectively remains free of fire damage and that the performance-based approach is acceptable per Section 4.2.4.2 of NFPA 805.

## **5.0 REFERENCES**

- 5.1 Calculation PRA-FIRE-NB-CRE, Fire PRA Cumulative Risk Evaluations
- 5.2 CNP Fire Pre-Plans, Volumes I, II, and III, Revisions 17, 14, and 18 respectively
- 5.3 Fire Hazards Analysis
- 5.4 NFPA 805, Performance-Based Standard for Fire Protection for Light Water Reactor Electric Generating Plants
- 5.5 NFPPM, NFPA 805 Fire Protection Program Manual (NFPPM)
- 5.6 Nuclear Energy Institute (NEI) 04-02, Guidance for Implementing a Risk-Informed, Performance-Based Fire Protection Program under 10 CFR 50.48(c), Rev. 2
- 5.7 Nuclear Safety Capability Assessment Report
- 5.8 PRA-NB-FIRE-FQ, Fire PRA Model Quantification Notebook
- 5.9 PRA-NB-FIRE-FSS, Fire PRA Fire Scenario Selection
- 5.10 Regulatory Guide 1.205, Risk-Informed, Performance-Based Fire Protection for Existing Light-Water Nuclear Power Plants, Rev. Revision 1
- 5.11 Technical Evaluation R1900-005-001, Non-Power Operation Modes Transition Review

**Fire Area AA24 – Attachment 1 - Table B-3 - Fire Area Transition**

<u>Unit</u>	<u>Fire Area</u>	<u>Description</u>
2	AA24	Unit 2 AB Diesel Generator Room (El. 587 ft.)

<u>Fire Zone</u>	<u>Description</u>
19	2AB Diesel Generator Room - El. 587 ft. 0 in. - Unit 2

**Regulatory Basis**

4.2.4.2 - Performance-Based Approach - Fire Risk Evaluation with simplifying deterministic assumptions

<b>Performance Goal</b>	<b>Method of Accomplishment</b>	<b>Comments</b>
Reactivity Control	Unit 2 - Trip the reactor from the Control Room. Borate using Unit 2 East Charging Pump supplied from the RWST. Using source range monitoring for indication for Unit 2.	VFDR identified for RWST level indication
Inventory and Pressure Control	Unit 2 - Control inventory using Unit 2 East Charging Pump. Control pressure using Unit 2 Pressurizer Safety Relief Valves.	None
Decay Heat Removal	Unit 2 - Feed SGs 2 & 3 with Unit 2 East MDAFW Pump. The DHR function also requires MS isolation with a steam release path through the Safety Relief Valves.	None
Process Monitoring	Unit 2 Process Monitoring - Use Unit 2 process monitoring in the Control Room for the following: Pressurizer level, RCS pressure and temperature, and S/G level and Pressure. Unit 2 Source Range Monitoring - Use Unit 2 source range monitoring in the Control Room.	None
Vital Auxiliaries	Unit 2 Electrical - Control Unit 2 Green (CD) Train Electrical Distribution with Unit 2 Green (CD) Train Offsite Power or Unit 2 Green (CD) DG. Unit 2 ESW - Operate Unit 2 East ESW. Unit 2 CCW - Operate Unit 2 East CCW. Unit 2 HVAC - Operate Unit 2 Control Room HVAC. Operate Unit 2 Auxiliary Building HVAC. Operate Unit 2 Green (CD) DG HVAC. Operate Unit 2 Green (CD) Switchgear HVAC. Operate Unit 2 East MDAFW Pump Room HVAC system. Operate Unit 2 East ESW Pump HVAC system.	None

**Fire Area AA24 – Attachment 1 - Table B-3 - Fire Area Transition**

<u>Unit</u>	<u>Fire Area</u>	<u>Description</u>
2	AA24	Unit 2 AB Diesel Generator Room (El. 587 ft.)

**Reference Documents**

Genesis Solution Suite, EDISON / SAFE-PB, DC Cook V 3.4.0

Nuclear Safety Capability Assessment Report

**Licensing Actions**

None

**Existing Engineering Equivalency Evaluations (EEEE)****EEEE Title Engineering Equivalency Evaluation 11-9 - Turbine, Auxiliary and Containment Buildings Boundary Evaluation**

**Summary** The purpose of this engineering equivalency evaluation is to describe in general, the approach and existence of evaluations performed to determine and reconcile fire area boundaries having components or designs with less than a 3-hr fire rating on preventing the spread of fire. This engineering equivalency evaluation also specifically evaluates the impact of unrated door assemblies on the spread of fire.

Reasonable assurance is provided that the fire area boundaries having components or design less than a 3-hr fire rating will not increase the spread of fire or impair the safe shutdown capabilities of Units 1 or 2. In addition, this engineering equivalency evaluation does not adversely impact on other engineering equivalency evaluations or exemption requests.

This evaluation supports additional evaluations credited in this fire area.



**Fire Area AA24 – Attachment 1 - Table B-3 - Fire Area Transition**

<u>Unit</u>	<u>Fire Area</u>	<u>Description</u>
2	AA24	Unit 2 AB Diesel Generator Room (El. 587 ft.)
<hr/>		
<b><u>EEEE Title</u></b>	<b>Engineering Equivalency Evaluation 11-17 - Diesel Generator Fuel Oil Day Tank Rooms Fire Zones 15 (Fire Area AA14), 16 (Fire Area AA15), 18 (Fire Area AA23) and 19 (Fire Area AA24) Boundary Evaluation</b>	
<b><u>Summary</u></b>	<p>The purpose of this engineering equivalency evaluation is to document the acceptability of the fire seals grouted to an unknown depth protecting the penetrations between the DG fuel oil day tank rooms and their respective DG rooms in Fire Zones 15 (Fire Area AA14), 16 (Fire Area AA15), 18 (Fire Area AA23) and 19 (Fire Area AA24) for their impact on preventing the spread.</p> <p>The existing fire seals grouted to an unknown depth located within the penetrations between the DG fuel oil day tank rooms and their respective DG rooms (Fire Zones 15, 16, 18 and 19) are acceptable for maintaining the rating of the fire boundary. This engineering equivalency evaluation does not impact other engineering equivalency evaluations.</p> <p>The fire seals were evaluated and found to be acceptable based on the fire hazards and fire protection systems within the areas.</p>	
<b><u>EEEE Title</u></b>	<b>Engineering Equivalency Evaluation 11-48 - Unit 1 and Unit 2 Diesel Generator AB/CD Pipe Penetration Seals - Fire Zones 11 (Fire Area AA10), 15 (Fire Area AA14), 16 (Fire Area AA15), 18 (Fire Area AA23), 19 (Fire Area AA24) and 23 (Fire Area AA29)</b>	
<b><u>Summary</u></b>	<p>The purpose of this engineering equivalency evaluation is to document the acceptability of fire-rated penetration seals W9142, W9143, W9171, W9172, W9192, W9193, W9959 and W9960. The seals are physically located in the east fire-rated walls of the DG Rooms floor elevation 587 ft., Fire Zones 15, 16, 18 and 19.</p> <p>The existing configuration for the subject fire-rated penetration is suitable to perform their design function, to provide an acceptable level of fire protection, therefore preventing fire propagation between to fire zones. As such, there is no impact on the stations ability to achieve and maintain safe shutdown.</p> <p>The fire rated penetration seals were evaluated and found to be acceptable based on the fire hazards and fire protection systems within the evaluated areas.</p>	

**Fire Area AA24 – Attachment 1 - Table B-3 - Fire Area Transition**

<u>Unit</u>	<u>Fire Area</u>	<u>Description</u>
2	AA24	Unit 2 AB Diesel Generator Room (El. 587 ft.)

<b><u>EEEE Title</u></b>	<b>Engineering Equivalency Evaluation 11-50 - Embedded Conduit Fire Wrap Protection (Fire Areas AA14 and AA24)</b>
<b><u>Summary</u></b>	<p>The purpose of this engineering equivalency evaluation is to document the acceptability of the fire boundary for the conduits that are embedded in a concrete pilaster and covered by an external fire wrap material in both the Unit 1 CD Diesel Generator Room (Fire Area AA14) and the Unit 2 AB Diesel Generator Room (Fire Area AA24).</p> <p>The fire wrap system over the concrete pilaster was originally installed to provide 3 hour protection for the embedded conduits for compliance with NFPA 805, Section 4.2.4.2. This engineering equivalency evaluation determined if the current barrier configuration in conjunction with the existing fire detection and fire suppression provides an adequate level of protection based upon the hazards in the area and the embedded conduit configuration for compliance with NFPA 805, Section 4.2.4.2. The engineering equivalency evaluation also determined if this engineering equivalency evaluation has any impact on other evaluations or exemptions.</p> <p>This engineering equivalency evaluation evaluated the ability of the existing concrete pilaster and external fire wrap system to provide adequate conduit protection against fire in the Unit 1 CD Diesel Generator Room and in the Unit 2 AB Diesel Generator Room.</p> <p>Reasonable assurance is provided that the embedded conduits within the concrete pilaster will not impair the safe shutdown capability of CNP nor increase the potential for fire to spread to redundant safe shutdown systems. An equivalent level of protection is provided by the combination of concrete and fire wrap such that a minimum of 1-hr fire protection is reasonably achieved. This arrangement in combination with automatic detection and suppression in the area provide a degree of protection equivalent to that specified in NFPA 805 section 4.2.4.2.</p> <p>The pilasters were evaluated and found to be acceptable based on the fire protection systems and construction features within the evaluated areas.</p>
<b><u>EEEE Title</u></b>	<b>Engineering Equivalency Evaluation 11-66 - Yard to Fire Zone 19 (Fire Area AA24) Boundary Evaluation</b>
<b><u>Summary</u></b>	<p>The purpose of this evaluation is to document the acceptability of the fire area boundary between Fire Zone 19 (Fire Area AA24) and the Yard (YD) with respect to fire spread.</p> <p>Based on the evaluation, reasonable assurance is provided that a fire starting in Fire Zone 19 is not capable of propagating to Fire Zone Yard. Similarly, reasonable assurance can be provided that a fire starting in Fire Zone Yard is not capable of propagating to Fire Zone 19. Since a fire in either fire zone will not affect adjacent fire zones, the fire will not adversely impact safe shutdown capabilities of CNP.</p> <p>The fire area boundary was evaluated and found to be acceptable based on the fire hazards and construction features within the evaluated areas.</p>

**Fire Area AA24 – Attachment 1 - Table B-3 - Fire Area Transition**

<u>Unit</u>	<u>Fire Area</u>	<u>Description</u>
2	AA24	Unit 2 AB Diesel Generator Room (El. 587 ft.)

**Fire Suppression Effects on Nuclear Safety Performance Criteria**

The CNP fire brigade is trained to discharge water in a judicious manner and instructed to direct hose streams and portable extinguishers at the base of the fire to limit the amount of overspray beyond the immediate fire zone. For this reason, fire brigade activities are not expected to fail components not already considered damaged. It has been concluded that water impingement on cables is not a concern. Electrical cabinets are provided with a seal at the conduit interface. Possible impacts to surrounding equipment due to manual fire fighting activities is bounded by the analysis approach of postulating whole room damage. The drainage features of the fire area mitigate the potential for flooding damage due to fire suppression, such that the standing water would not affect credited equipment.

In the event of discharge, any damage caused by the CO2 system to other equipment operating within the fire area which is not immediately involved in the originating fire is bounded by the analysis approach of postulating whole room damage. Since it is shown that suppression effects will not impact the nuclear safety performance criteria, the fire area configuration is deemed acceptable.

## References:

Technical Evaluation 12.1, "Fire Suppression Effects Study"

Technical Evaluation 12.1, "Supplemental Information to Fire Suppression Effects Study – Supplement 1"

**Fire Area Comments**

None

## Fire Area AA24 – Attachment 2 - Fire Risk Evaluation Results Summary

### A2.1 Introduction

The ‘changes’ associated with NFPA 805 transition were those variances from the deterministic requirements of NFPA 805. The changes identified for evaluation for fire area AA15 are grouped as follows:

- Separation Issues

This attachment is a summary of the Fire Risk Evaluation for the fire area. The complete results and methodology are contained in the Cumulative Fire Risk Evaluation, PRA-FIRE-NB-CRE. (FPCE 2017-0009)

### A2.2 Inputs/Assumptions

1. Assumptions from the Fire PRA apply to this calculation.
2. Detailed fire modeling was not performed for Fire Area AA24. A single whole room burnout scenario was assumed.

### A2.3 Fire Modeling Methodology

Detailed fire modeling was not performed for Fire Area AA24. This area was modeled considering whole room burnout.

### A2.4 Scenario Descriptions and Model Results

A single whole room burnout scenario was modeled for Fire Area AA24. All targets within the fire area were assumed damaged.

#### A2.4.1 Ignition Sources

The fixed ignition sources in Fire Area AA24 consist of the diesel generator, motor control centers and the jacket water circulation pumps. Additional detail regarding the ignition sources in this area is available in the Fire PRA Report. All fire scenarios, whether resulting from fixed or transient ignition sources, are assumed to damage all targets in the fire area.

#### A2.4.2 Scenario Results

The PRA analyzed the VFDRs and determined them to be risk insignificant, therefore, a quantitative delta risk calculation was not performed.

### A2.5 Fire Risk Evaluation Results

PRA-FIRE-NB-CRE documents scenarios and corresponding impacted VFDRs that were evaluated for delta risk during the transition to NFPA 805 and also all changes to the Fire Protection Program that are currently incorporated into the Fire PRA model. The acceptability of the Cumulative Fire Risk Evaluations was based on calculated delta risk meeting the thresholds of NEI 04-02, RG 1.205 and RG 1.174. (FPCE 2017-0009)

## Fire Area AA24 – Attachment 2 - Fire Risk Evaluation Results Summary

### A-2.6 Impact of VFDR on Defense-in-Depth

Defense-in-Depth has been evaluated for this fire area. The impacts of this evaluation are summarized in the table below:

Defense-in-Depth Impact Review for AA24			
Method of Providing DID	Required to Support Deterministic Analysis or Fire PRA?	Changes or Improvements Necessary for DID?	Basis/Justification
Echelon 1: Prevent fires from starting			
Combustible Control is implemented in accordance with Procedure PMP-2270-CCM-001, Control of Combustible Materials.	Yes	No	• This element is adequate based on no perceived weakness of, or over-reliance on, another echelon of defense-in-depth.
Hot Work Control is implemented in accordance with Procedure PMP-2270-WBG-001, Welding, Burning and Grinding Activities.	Yes	No	
Echelon 2: Rapidly detect, control and extinguish promptly those fires that do occur thereby limiting fire damage			
Fire Detection System	Yes	No	• Suppression and detection are required because fire fighting activities may be challenging. No changes or improvements to Echelon 2 attributes are necessary to maintain defense-in-depth.
Fixed Fire Suppression	Yes	No	
Portable Fire Extinguishers	Yes	No	
Hose stations and hydrants	Yes	No	
Pre-Fire Plan	Yes	No	
Echelon 3: Provide adequate level of fire protection for systems and structures so that a fire will not prevent essential safety functions from being performed			
Walls, floors ceilings and structural elements are rated or have been evaluated as adequate for the hazard.	Yes	No	• Since the variance is never affected in a potentially risk significant fire scenario, internal fire area separation is adequate and no changes or improvements to Echelon 3 attributes are necessary to maintain defense-in-depth.
Penetrations in the fire area barrier are rated or have been evaluated as adequate for the hazard.	Yes	No	
Supplemental barriers (e.g., ERFBS, cable tray covers, etc.)	Yes	No	
Guidance provided to operations personnel detailing the required success path(s) including recovery actions to achieve nuclear safety performance criteria.	No	No	

## Fire Area AA24 – Attachment 2 - Fire Risk Evaluation Results Summary

### A-2.7 Safety Margin Considerations

In accordance with NEI 04-02, the maintenance of adequate Safety Margin is assessed by the consideration categories of analyses utilized by this Fire Risk Evaluation.

Safety margins are considered to be maintained if:

- Codes and Standards or their alternatives accepted for use by the NRC are met.

AND

- Safety analyses acceptance criteria in the licensing basis (e.g., FSAR, supporting analyses) are met, or provides sufficient margin to account for analysis and data uncertainty.

The following summarizes the bases for ensuring the maintenance of safety margins:

- The risk-informed, performance based processes utilized are based upon NFPA 805, 2001 edition, endorsed by the NRC in 10 CFR 50.48(c).
- The Fire Risk Evaluation process is in accordance with NEI 04-02, Revision 2, which is endorsed by the NRC in Regulatory Guide 1.205, Revision 1.
- The Fire PRA is developed in accordance with NUREG/CR-6850, which was developed jointly between the NRC and EPRI.
- The Fire PRA has undergone an industry peer review, in order to ensure the Fire PRA meets the appropriate quality standards of ASME/ANS RA-Sa-2009, "Standard for Level 1/Large Early Release Frequency Probabilistic Risk Assessment for Nuclear Power Plant Applications," Dated February 2, 2009
- The "bounding risk assessment" is used during transition (NEI 04-02, Section 5.3.4.2). This approach conservatively assumes that target set damage occurs for postulated fire events which resulted in whole room burn up, and therefore, MEFS/LFS is not analyzed separately from the Fire PRA results.
- The CNP internal events PRA model received two formal industry peer reviews conducted in accordance with applicable NEI guidelines. The initial peer review was performed in 2001, while a subsequent focused scope (i.e., limited scope) peer review was conducted in 2009. The initial, full-scope WOG peer review covered all aspects of the CNP PRA model and the administrative processes used to maintain and update the model. The CNP PRA model has been revised to address all significant issues (i.e., Category A and B Facts & Observations) identified during the initial peer review. None of the findings from the focused-scope peer review were judged to reach the significance level of a Category A or B Fact & Observation; as a result, no changes to the PRA model have yet been made to include resolutions for these latter issues.
- Fire protection systems and features determined to be required by NFPA 805 Chapter 4 have been confirmed to meet the requirements of NFPA 805 Chapter 3 and their associated referenced codes and listings, or provided with acceptable alternatives using processes accepted for use by the NRC (i.e., FAQ 06-0008, FAQ 06-0004, 07-0033).
- Fire modeling has not been performed in support of the change evaluations and results are therefore, based on whole area burn up. As such, the results are considered very conservative.
- In accordance with the requirements of 10 CFR 50.48(c)(2)(iii), the Fire PRA results, including cutsets for

## **Fire Area AA24 – Attachment 2 - Fire Risk Evaluation Results Summary**

the scenarios of concern, have been reviewed and it was verified that the results presented above do not rely solely on feed and bleed as the fire-protected safe shutdown path for maintaining reactor coolant inventory, pressure control, and decay heat removal capability for this fire area.

### **A-2.8 Transition Risk Evaluation Conclusions**

The transition change evaluation determined that these changes:

- Are acceptable based upon the measured change in CDF and LERF
- Maintained adequate defense-in-depth and safety margins

The results of this evaluation meet the requirements of NFPA 805 Risk Evaluation; therefore, the use of the performance based analysis approach is acceptable.

## D. C. Cook Nuclear Plant Fire Safety Analysis

## Fire Area: AA25

Unit 2 Transformer Room (El. 591 ft.)

## Table of Contents

<b>Purpose</b> .....	Section 1.0
<b>Analysis Methodology</b> .....	Section 2.0
<b>Analysis</b> .....	Section 3.0
<b>Conclusion</b> .....	Section 4.0
<b>References</b> .....	Section 5.0

## Attachments

Fire Area AA25 – Attachment 1 - Table B-3 - Fire Area Transition



## **1.0 PURPOSE**

This report documents the Fire Safety Analysis (FSA) for Cook Nuclear Plant (CNP) Fire Area AA25, Unit 2 Transformer Room (El. 591 ft.) which comprises fire zone(s) 20. The purpose of this analysis is to demonstrate the achievement of the nuclear safety and radioactive release performance criteria of NFPA 805 as required by 10 CFR 50.48(c). The Fire Safety Analysis is a key part of compliance with Section 2.7.1.2 Fire Protection Program Design Basis Document of NFPA 805.

## **2.0 ANALYSIS METHODOLOGY**

The FSA is the design basis document as described in NFPA 805 Section 2.7.1.2. The following steps are performed to develop the FSA on a fire area basis:

- Identify significant fire hazards in the fire area. This is based on NFPA 805 approach to analyze the plant from an ignition source and fuel package perspective.
- Summarize Nuclear Safety Capability Analysis (NSCA) compliance strategies. This is the result of the NEI 04-02 B-3 Table review of the Safe Shutdown Analysis.
- Summarize Non-Power Operations Modes compliance strategies.
- Summarize Radioactive Release compliance strategies. The transition review process required per NEI 04-02 is used to develop these results.
- Provide Fire Probabilistic Risk Assessment summary of results. This is based on the results from the plant Fire PRA.
- Perform risk informed, performance based evaluations if needed for the performance based approach.
- Summarize Defense-in-Depth strategy for each fire area.
- Determine key analysis assumptions which are candidates to be included in the NFPA 805 monitoring program.
- Provide conclusions relative to NFPA 805 compliance.

### 3.0 ANALYSIS

#### 3.1 Classical Fire Protection

##### 3.1.1 Construction

Walls, floors and ceilings to adjacent fire areas are reinforced concrete in excess of a 3-hour rating. A fire area boundary evaluation was performed for the construction features (i.e. fire doors, undampened ventilation and open penetrations) of the switchgear rooms which have a fire resistance rating of less than 3 hours (Engineering Equivalency Evaluation 11-15).

Applicable Engineering Equivalency Evaluations are documented in Attachment 1.

##### 3.1.2 Doors and Access Openings

An unlabeled Class A (3-hour) roll-up fire door is provided to adjacent Fire Area AA2 - Fire Zone 85. This roll-up fire door is manufactured to Class A (3-hour) construction in accordance with UL Procedures. The alteration of the door does not affect the true fire rating of the door.

##### 3.1.3 Penetrations

Note: Statements regarding fire resistance rating of penetration seals are not applicable to seals in barriers to Analysis Area YD.

Penetrations in fire barriers between this fire zone and adjacent fire areas are provided with fire seals.

##### 3.1.4 Detection

The table below outlines the fire detection system(s) provided in the Fire Area:

Table 3-1, Fire Area AA25 Detection Systems								
Fire Zone	Type of System	Local (L) / Remote (R)	Detection Actuates Suppression?	Required System?				
				S	L	E	R	D
20	Ionization	L/R	No Auto Supp. (N/A)	N	N	Y	N	N
Table 3-1 Legend:								
Table Field: "Required System?"								
S	- Required for Chapter 4 Separation Criteria							
L	- Required for NRC Approved Licensing Action							
E	- Required for Engineering Equivalency Evaluation							
R	- Required for Risk Significance							
D	- Required to maintain adequate balance of Defense-in-Depth in a Change Evaluation or Fire Risk Evaluation							

Fire Area AA25 is provided with 12 ionization detectors throughout the fire zone which alarm in the Unit 2 Control Room.

### 3.1.5 Fixed Suppression

The table below outlines the fixed fire suppression system(s) provided in the Fire Area:

Table 3-2, Fire Area AA25 Suppression Systems							
Fire Zone	Type of System	Full (F) / Partial (P)	Required System?				
			S	L	E	R	D
20	None	N/A	N/A	N/A	N/A	N/A	N/A
Table 3-2 Legend:							
Table Field: "Required System?"							
S	- Required for Chapter 4 Separation Criteria						
L	- Required for NRC Approved Licensing Action						
E	- Required for Engineering Equivalency Evaluation						
R	- Required for Risk Significance						
D	- Required to maintain adequate balance of Defense-in-Depth in a Change Evaluation or Fire Risk Evaluation						

Fire Area AA25 is not provided with fixed fire suppression.

### 3.1.6 Manual Suppression / Response Strategy

A postulated fire will be identified by the ionization smoke detectors or plant personnel using plant communication system to notify the control room. The automatic detection system alarms in the control room. The Control Room operator will dispatch the fire brigade for initiation of manual fire fighting. A fire in this fire area will be contained by the construction features discussed in Section 3.1.1. Manual suppression is provided by the CNP Fire Brigade.

Fire extinguishers are provided in this fire area.

A water hose reel is located in adjacent Fire Area AA2 - Fire Zone 85.

Fire Area AA25 is equipped with floor drains.

### 3.1.7 Ventilation

A fire in this area will be contained by the fire barriers. Smoke can be removed by venting to the outdoors or to other parts of the turbine building. The normal building ventilating systems in the Turbine Building will then exhaust the smoke via filtered monitored pathways. This fire area is listed as a non-controlled area in the Fire Pre Plans and therefore there is reasonable assurance that products of combustion will not be contaminated.

Fire dampers 2-HV-TS-FD-1 and 2-HV-TX-FD-1 have a 1 1/2 hour rating are adjacent Fire Area AA2 - Fire Zone 85 (Engineering Equivalency Evaluation 11-15).

### 3.1.8 Other Features

No other fire protection features provided for Fire Area AA25.

## 3.2 Fire Hazards Identification

The fire area contains both ignition sources and combustible fire hazards. The ignition sources consist of the RWST area miscellaneous power supply phases 1&2 and 2&3, Bus 21BMC, Bus 21CMC and various other motor control centers. Combustibles consist primarily of cable insulation, rubber and plastics.

This Fire Area is below grade and any exterior wall penetrations need not be rated based on the protection provided by the ground covering the exterior walls.

The current fire loading classification is considered low.

### **3.3 NSCA Compliance Summary**

Fire Area AA25, U2 Transformer Room. (EL. 591') contains Unit 2 Red and Green Train cables, conduits and raceways.

Compliance with the nuclear safety performance criteria is achieved using the deterministic approach in accordance with NFPA 805, Section 4.2.3.2.

Safe and stable condition of Unit 2 will be accomplished using Steam Generators 2 and 3 via Unit 1 East Motor Driven Auxiliary Feedwater Pump or Unit 1 Turbine Driven Auxiliary Feedwater Pump, Control Room Process Monitoring, Unit 2 Charging via the West or East Pump, Unit 2 Component Cooling Water via the East or West Pump, Unit 2 ESW via the East or West Pump. Electrical power is supplied to either Red or Green Trains via offsite power as Red and Green Train Emergency Diesels are not available.

The Nuclear Safety Performance Criteria compliance strategy for AA25 is documented within the NSCA Report.

#### **3.3.1 Variances**

There are no variances for this fire area.

#### **3.3.2 Recovery Actions Credited**

There are no recovery actions for this fire area.

### **3.4 Non-Power Operational Modes Compliance Summary**

A review of CNP for the potential effects of a fire in this Fire Area while in non-power modes of operation (NPO) was conducted. This review was conducted using the guidance provided in NEI 04-02 and FAQ 07-0040, "Non-Power Operations Clarifications".

The review determined that there are potential failures that affect certain Key Safety Functions (KSF) as a result of the fire in this area, and the fire could result in the loss of one or more KSF paths. Compensatory measures are required during high risk evolution periods to provide reasonable assurance a fire will not adversely affect key safety functions and the NFPA 805 performance goal for NPO is therefore satisfied. The results of the NPO analysis are contained within Technical Evaluation R1900-005-001, Non-Power Operation Modes Transition Review Report.

### **3.5 Radioactive Release Compliance Summary**

The NFPA 805 radiological release goal is to provide reasonable assurance that a fire will not result in a radiological release that adversely affects the public, plant personnel or the environment. The

NFPA 805 requirement is to ensure a radiation release to any unrestricted area due to the direct effects of fire suppression activities (but not involving fuel damage) shall be as low as reasonably achievable and shall not exceed applicable plant Technical Specification limits.

AA25 is located outside the Radiological Controlled Area (RCA) and is not a storage location for contaminated materials, therefore there is reasonable assurance a fire in this area will not result in radiation release. The review of this fire area, with respect to radioactive release, is documented in the NFPPM.

### 3.6 Probabilistic Risk Assessment-Summary of Results

A Fire PRA (FPRA) quantification of Fire Area AA25 was performed and is documented in PRA-NB-FIRE-FQ, Fire PRA Model Quantification Notebook. The fire risk quantification for Fire Area AA25 is analyzed assuming whole room burnup. PRA-NB-FIRE-FQ includes a summary of all potentially risk-significant fire scenarios (i.e., CDF > 1.0E-7 or LERF > 1.0E-8). Bounding CDF / LERF per calendar year values are reported that are based on the risk values documented in PRA-NB-FIRE-FSS, Fire PRA Fire Scenario Selection.

### 3.7 Risk-Informed, Performance-Based Evaluations

There are no VFDRs for this fire area, and therefore, no Fire Risk Evaluations have been performed.

#### 3.7.1 Transition Risk-Informed, Performance-Based Evaluations

There are no VFDRs for this fire area, and therefore this section is not applicable to Fire Area AA25.

### 3.8 Defense-in-Depth

Per NFPA 805, section 2.4.4.2, “Defense-in-Depth”: The deterministic approach for meeting the performance criteria shall be deemed to satisfy this defense-in-depth requirement.

### 3.9 Monitoring Program Input

A Monitoring Program will be developed in accordance with FAQ 10-0059, Rev. 1. Methods to monitor availability, reliability, and performance of fire protection program structures, systems, and components (SSCs), as well as programmatic elements will be provided. Additionally, effectiveness measures are established to review program related performance and trends. For AA25 the following systems and features are candidates for inclusion in the CNP Fire Protection Monitoring Program:

- Fire Area boundary barriers discussed in Section 3.1
- Fire Detection (Ionization)

## 4.0 CONCLUSION

The nuclear safety and radioactive release performance criteria of NFPA 805 are met for a fire in Fire Area AA25. This Fire Safety Analysis has demonstrated that for Fire Area AA25 a success path remains free of fire damage using the deterministic approach per Section 4.2.3 of NFPA 805.

## **5.0 REFERENCES**

- 5.1 CNP Fire Pre-Plans, Volumes I, II, and III, Revisions 17, 14, and 18 respectively
- 5.2 Fire Hazards Analysis
- 5.3 NFPA 805, Performance-Based Standard for Fire Protection for Light Water Reactor Electric Generating Plants
- 5.4 NFPPM, NFPA 805 Fire Protection Program Manual (NFPPM)
- 5.5 Nuclear Energy Institute (NEI) 04-02, Guidance for Implementing a Risk-Informed, Performance-Based Fire Protection Program under 10 CFR 50.48(c), Rev. 2
- 5.6 Nuclear Safety Capability Assessment Report
- 5.7 PRA-NB-FIRE-FQ, Fire PRA Model Quantification Notebook
- 5.8 PRA-NB-FIRE-FSS, Fire PRA Fire Scenario Selection
- 5.9 Regulatory Guide 1.205, Risk-Informed, Performance-Based Fire Protection for Existing Light-Water Nuclear Power Plants, Rev. Revision 1
- 5.10 Technical Evaluation R1900-005-001, Non-Power Operation Modes Transition Review

**Fire Area AA25 – Attachment 1 - Table B-3 - Fire Area Transition**

<u>Unit</u>	<u>Fire Area</u>	<u>Description</u>
2	AA25	Unit 2 Transformer Room (El. 591 ft.)

<u>Fire Zone</u>	<u>Description</u>
20	Transformer Room - El. 591 ft. 0 in. - Unit 2

**Regulatory Basis**

4.2.3.2 - Deterministic Approach

<b>Performance Goal</b>	<b>Method of Accomplishment</b>	<b>Comments</b>
Reactivity Control	Unit 2 - Trip the reactor from the Control Room. Borate using Unit 2 East or West Charging Pump supplied from the RWST. Use source range monitoring for indication for Unit 2.	None
Inventory and Pressure Control	Unit 2 - Control inventory using Unit 2 East or West Charging Pump. Control pressure using Unit 2 Pressurizer Safety Relief Valves.	None
Decay Heat Removal	Unit 2 - Feed SGs 2 & 3 with Unit 2 East MDAFW Pump or Unit 2 TDAFW Pump. The DHR function also requires MS isolation with a steam release path through the Safety Relief Valves.	None
Process Monitoring	Unit 2 Process Monitoring - Use Unit 2 process monitoring in the Control Room for the following: Pressurizer level, RCS pressure and temperature, and S/G level and Pressure. Unit 2 Source Range Monitoring - Use Unit 2 source range monitoring in the Control Room.	None
Vital Auxiliaries	Unit 2 Electrical - Control Unit 2 Red (AB) Train Electrical Distribution with Unit 2 Red (AB) Train Offsite Power. Control Unit 2 Green (CD) Train Electrical Distribution with Unit 2 Green (CD) Train Offsite Power. Unit 2 ESW - Operate Unit 2 East or West ESW. Unit 2 CCW - Operate Unit 2 East or West CCW. Unit 2 HVAC - Operate Unit 2 Control Room HVAC. Operate Unit 2 Auxiliary Building HVAC. Unit 2 DGs are not available within this fire area. Operate Unit 2 Switchgear HVAC. Operate Unit 2 East MDAFW and TDAFW Pump Room HVAC systems. Operate the Unit 2 East and West ESW Pump HVAC systems.	None

**Fire Area AA25 – Attachment 1 - Table B-3 - Fire Area Transition**

<u>Unit</u>	<u>Fire Area</u>	<u>Description</u>
2	AA25	Unit 2 Transformer Room (El. 591 ft.)

**Reference Documents**

Genesis Solution Suite, EDISON / SAFE-PB, DC Cook V 3.4.0

Nuclear Safety Capability Assessment Report

**Licensing Actions**

None

**Existing Engineering Equivalency Evaluations (EEEE)****EEEE Title Engineering Equivalency Evaluation 9-8 - Fire Zone 20 (Fire Area AA25) and Fire Zone 21 (Fire Area AA26) Boundary Evaluation**

**Summary** The purpose of this fire area engineering equivalency evaluation is to document the acceptability of an unrated field fabricated fusible link guillotine type damper presently located between the Unit 2 Diesel Oil Pump Room in Fire Zone 21 (Fire Area AA26) and the Unit 2 Transformer Room in Fire Zone 20 (Fire Area AA25).

The existing CO2 actuated damper located between Fire Zones 20 and 21 is an acceptable device for maintaining the rating of the fire area boundary. This engineering equivalency evaluation does not adversely impact other engineering equivalency evaluations.

The unrated damper was evaluated and found to be acceptable based on the fire hazards and fire protection systems within the evaluated areas.

**EEEE Title Engineering Equivalency Evaluation 11-9 - Turbine, Auxiliary and Containment Buildings Boundary Evaluation**

**Summary** The purpose of this engineering equivalency evaluation is to describe in general, the approach and existence of evaluations performed to determine and reconcile fire area boundaries having components or designs with less than a 3-hr fire rating on preventing the spread of fire. This engineering equivalency evaluation also specifically evaluates the impact of unrated door assemblies on the spread of fire.

Reasonable assurance is provided that the fire area boundaries having components or design less than a 3-hr fire rating will not increase the spread of fire or impair the safe shutdown capabilities of Units 1 or 2. In addition, this engineering equivalency evaluation does not adversely impact on other engineering equivalency evaluations or exemption requests.

This evaluation supports additional evaluations credited in this fire area.



**Fire Area AA25 – Attachment 1 - Table B-3 - Fire Area Transition**

<u>Unit</u>	<u>Fire Area</u>	<u>Description</u>
2	AA25	Unit 2 Transformer Room (El. 591 ft.)

**Fire Suppression Effects on Nuclear Safety Performance Criteria**

The CNP fire brigade is trained to discharge water in a judicious manner and instructed to direct hose streams and portable extinguishers at the base of the fire to limit the amount of overspray beyond the immediate fire zone. For this reason, fire brigade activities are not expected to fail components not already considered damaged. It has been concluded that water impingement on cables is not a concern. Electrical cabinets are provided with a seal at the conduit interface. Possible impacts to surrounding equipment due to manual fire fighting activities is bounded by the analysis approach of postulating whole room damage. The drainage features of the fire area mitigate the potential for flooding damage due to fire suppression, such that the standing water would not affect credited equipment.

This fire area is not equipped with a fixed fire suppression system. Since it is shown that suppression effects will not impact the nuclear safety performance criteria, the fire area configuration is deemed acceptable.

**References:**

Technical Evaluation 12.1, "Fire Suppression Effects Study"

Technical Evaluation 12.1, "Supplemental Information to Fire Suppression Effects Study – Supplement 1"

**Fire Area Comments**

None

# D. C. Cook Nuclear Plant Fire Safety Analysis

## Fire Area: AA26

Unit 2 Diesel Generator Oil Pump Room (El. 587 ft.)

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<b>Analysis Methodology</b> .....	Section 2.0
<b>Analysis</b> .....	Section 3.0
<b>Conclusion</b> .....	Section 4.0
<b>References</b> .....	Section 5.0

#### Attachments

Fire Area AA26 – Attachment 1 - Table B-3 - Fire Area Transition

## 1.0 PURPOSE

This report documents the Fire Safety Analysis (FSA) for Cook Nuclear Plant (CNP) Fire Area AA26, Unit 2 Diesel Generator Oil Pump Room (El. 587 ft.) which comprises fire zone(s) 21. The purpose of this analysis is to demonstrate the achievement of the nuclear safety and radioactive release performance criteria of NFPA 805 as required by 10 CFR 50.48(c). The Fire Safety Analysis is a key part of compliance with Section 2.7.1.2 Fire Protection Program Design Basis Document of NFPA 805.

## 2.0 ANALYSIS METHODOLOGY

The FSA is the design basis document as described in NFPA 805 Section 2.7.1.2. The following steps are performed to develop the FSA on a fire area basis:

- Identify significant fire hazards in the fire area. This is based on NFPA 805 approach to analyze the plant from an ignition source and fuel package perspective.
- Summarize Nuclear Safety Capability Analysis (NSCA) compliance strategies. This is the result of the NEI 04-02 B-3 Table review of the Safe Shutdown Analysis.
- Summarize Non-Power Operations Modes compliance strategies.
- Summarize Radioactive Release compliance strategies. The transition review process required per NEI 04-02 is used to develop these results.
- Provide Fire Probabilistic Risk Assessment summary of results. This is based on the results from the plant Fire PRA.
- Perform risk informed, performance based evaluations if needed for the performance based approach.
- Summarize Defense-in-Depth strategy for each fire area.
- Determine key analysis assumptions which are candidates to be included in the NFPA 805 monitoring program.
- Provide conclusions relative to NFPA 805 compliance.

### 3.0 ANALYSIS

#### 3.1 Classical Fire Protection

##### 3.1.1 Construction

Walls, floors and ceilings to adjacent fire areas are reinforced concrete in excess of a 3-hour rating.

Applicable Engineering Equivalency Evaluations are documented in Attachment 1.

##### 3.1.2 Doors and Access Openings

A fire door having a 3-hour rating is provided to the adjacent diesel generator room Fire Area AA24 - Fire Zone 19.

##### 3.1.3 Penetrations

Note: Statements regarding fire resistance rating of penetration seals are not applicable to seals in barriers to Analysis Area YD.

Penetrations in fire barriers between this fire zone and adjacent fire areas are provided with fire seals.

##### 3.1.4 Detection

The table below outlines the fire detection system(s) provided in the Fire Area:

Table 3-1, Fire Area AA26 Detection Systems								
Fire Zone	Type of System	Local (L) / Remote (R)	Detection Actuates Suppression?	Required System?				
				S	L	E	R	D
21	Thermal	L/R	Y	N	N	Y	N	N

**Table 3-1 Legend:**

Table Field: "Required System?"	
S	- Required for Chapter 4 Separation Criteria
L	- Required for NRC Approved Licensing Action
E	- Required for Engineering Equivalency Evaluation
R	- Required for Risk Significance
D	- Required to maintain adequate balance of Defense-in-Depth in a Change Evaluation or Fire Risk Evaluation

Fire Area AA26 is provided with one line type thermistor heat detector mounted at the ceiling is provided.

### 3.1.5 Fixed Suppression

The table below outlines the fixed fire suppression system(s) provided in the Fire Area:

Table 3-2, Fire Area AA26 Suppression Systems							
Fire Zone	Type of System	Full (F) / Partial (P)	Required System?				
			S	L	E	R	D
21	Automatic CO2	F	N	N	N	N	N
Table 3-2 Legend:							
Table Field: "Required System?"							
S	- Required for Chapter 4 Separation Criteria						
L	- Required for NRC Approved Licensing Action						
E	- Required for Engineering Equivalency Evaluation						
R	- Required for Risk Significance						
D	- Required to maintain adequate balance of Defense-in-Depth in a Change Evaluation or Fire Risk Evaluation						

Fire Area AA26 is provided with a low pressure CO2 total flooding system supplied from the 17-ton tank is provided. This system is actuated by operation of the thermistor detector above. Operation of this system alarms in the Unit 2 Control Room.

### 3.1.6 Manual Suppression / Response Strategy

A postulated fire will be identified by the heat detector provided or plant personnel using plant communication system to notify the control room. The automatic detection system alarms in the control room. The Control Room operator will dispatch the fire brigade for initiation of manual fire fighting. A fire in this fire area will be contained by the construction features discussed in Section 3.1.1. Manual suppression is provided by the CNP Fire Brigade.

A fire extinguisher is provided in this fire area with additional fire extinguishers located in the adjacent Fire Area AA24 - Fire Zone 19.

A 25-gallon cart of foam liquid is located in adjacent Fire Area AA2 - Fire Zone 85.

Fire Area AA26 is equipped with floor drains.

### 3.1.7 Ventilation

A fire in this area will be contained by the fire barriers. Smoke can be removed by venting to the outdoors or to other parts of the turbine building. The normal building ventilating systems in the Turbine Building will then exhaust the smoke via filtered monitored pathways. This fire area is listed as a non-controlled area in the Fire Pre Plans and therefore there is reasonable assurance that products of combustion will not be contaminated.

An unrated damper 2-HV-DOD-1 is located between Fire Zones 21 and 20 (Engineering Equivalency Evaluation 9-8). Due to HELB considerations, the standard 165°F Fusible Link has been replaced with a 135°F link. A fire damper having a 3-hour rating is provided to the adjacent yard.

### 3.1.8 Other Features

No other fire protection features provided for Fire Area AA26.

### 3.2 Fire Hazards Identification

The fire area contains both ignition sources and combustible fire hazards. The main ignition sources are the fuel oil transfer pumps. Combustibles consist primarily of rubber, plastics and 100 gallons of diesel fuel oil.

This Fire Area is below grade and any exterior wall penetrations need not be rated based on the protection provided by the ground covering the exterior walls.

The current fire loading classification is considered low.

### 3.3 NSCA Compliance Summary

Fire Area AA26, U2 Diesel Generator Oil Pump Room (El. 587') contains Unit 1 and 2 Red Train cables, conduits and raceways as well as Unit 1 and Unit 2 Red train EDG Fuel oil transfer equipment. Consequently, both Units are affected by the fire.

Compliance with the nuclear safety performance criteria is achieved using the deterministic approach in accordance with NFPA 805, Section 4.2.3.2.

Safe and stable condition of Unit 1 will be accomplished using Steam Generators 2 and 3 via Unit 1 East Motor Driven Auxiliary Feedwater Pump or Unit 1 Turbine Driven Auxiliary Feedwater Pump or Steam Generators 1 and 4 via the Unit 1 West Motor Driven Auxiliary Feedwater Pump, Control Room Process Monitoring, Unit 1 Charging via the West or East Pump, Unit 1 Component Cooling Water via the East or West Pump, Unit 1 ESW via the East or West Pump. Electrical power is supplied to either Red or Green Trains via offsite power with Green Train Emergency Diesels also available.

Safe and stable condition of Unit 2 will be accomplished using Steam Generators 2 and 3 via Unit 2 East Motor Driven Auxiliary Feedwater Pump or Unit 2 Turbine Driven Auxiliary Feedwater Pump or Steam Generators 1 and 4 via the Unit 2 West Motor Driven Auxiliary Feedwater Pump, Control Room Process Monitoring, Unit 2 Charging via the West or East Pump, Unit 2 Component Cooling Water via the East or West Pump, Unit 2 ESW via the East or West Pump. Electrical power is supplied to either Red or Green Trains via offsite power with Green Train Emergency Diesels also available.

The Nuclear Safety Performance Criteria compliance strategy for AA26 is documented within the NSCA Report.

#### 3.3.1 Variances

There are no variances for this fire area.

#### 3.3.2 Recovery Actions Credited

There are no recovery actions for this fire area.

### 3.4 Non-Power Operational Modes Compliance Summary

A review of CNP for the potential effects of a fire in this Fire Area while in non-power modes of operation (NPO) was conducted. This review was conducted using the guidance provided in NEI 04-02 and FAQ 07-0040, "Non-Power Operations Clarifications".

The review determined that there are no potential failures that affect required Key Safety Functions (KSF) as a result of the fire in this Fire Area. Therefore, the analysis has demonstrated there is reasonable assurance a fire in this fire area during NPO modes will not adversely affect key safety functions and the NFPA 805 performance goal for NPO is therefore satisfied. The results of the NPO analysis are contained within Technical Evaluation R1900-005-001, Non-Power Operation Modes Transition Review Report.

### **3.5 Radioactive Release Compliance Summary**

The NFPA 805 radiological release goal is to provide reasonable assurance that a fire will not result in a radiological release that adversely affects the public, plant personnel or the environment. The NFPA 805 requirement is to ensure a radiation release to any unrestricted area due to the direct effects of fire suppression activities (but not involving fuel damage) shall be as low as reasonably achievable and shall not exceed applicable plant Technical Specification limits.

AA26 is located outside the Radiological Controlled Area (RCA) and is not a storage location for contaminated materials, therefore there is reasonable assurance a fire in this area will not result in radiation release. The review of this fire area, with respect to radioactive release, is documented in the NFPPM.

### **3.6 Probabilistic Risk Assessment-Summary of Results**

A Fire PRA (FPRA) quantification of Fire Area AA26 was performed and is documented in PRA-NB-FIRE-FQ, Fire PRA Model Quantification Notebook. The fire risk quantification for Fire Area AA26 is analyzed assuming whole room burnup. PRA-NB-FIRE-FQ includes a summary of all potentially risk-significant fire scenarios (i.e., CDF > 1.0E-7 or LERF > 1.0E-8). Bounding CDF / LERF per calendar year values are reported that are based on the risk values documented in PRA-NB-FIRE-FSS, Fire PRA Fire Scenario Selection.

### **3.7 Risk-Informed, Performance-Based Evaluations**

There are no VFDRs for this fire area, and therefore, no Fire Risk Evaluations have been performed.

#### **3.7.1 Transition Risk-Informed, Performance-Based Evaluations**

There are no VFDRs for this fire area, and therefore this section is not applicable to Fire Area AA26.

### 3.8 Defense-in-Depth

Per NFPA 805, section 2.4.4.2, “Defense-in-Depth”: The deterministic approach for meeting the performance criteria shall be deemed to satisfy this defense-in-depth requirement.

### 3.9 Monitoring Program Input

A Monitoring Program will be developed in accordance with FAQ 10-0059, Rev. 1. Methods to monitor availability, reliability, and performance of fire protection program structures, systems, and components (SSCs), as well as programmatic elements will be provided. Additionally, effectiveness measures are established to review program related performance and trends. For AA26 the following systems and features are candidates for inclusion in the CNP Fire Protection Monitoring Program:

- Fire Area boundary barriers discussed in Section 3.1
- Fire Detection (Thermistor heat detector)
- Fire Suppression (CO<sub>2</sub>)

### 4.0 CONCLUSION

The nuclear safety and radioactive release performance criteria of NFPA 805 are met for a fire in Fire Area AA26. This Fire Safety Analysis has demonstrated that for Fire Area AA26 a success path remains free of fire damage using the deterministic approach per Section 4.2.3 of NFPA 805.

### 5.0 REFERENCES

- 5.1 CNP Fire Pre-Plans, Volumes I, II, and III, Revisions 17, 14, and 18 respectively
- 5.2 Fire Hazards Analysis
- 5.3 NFPA 805, Performance-Based Standard for Fire Protection for Light Water Reactor Electric Generating Plants
- 5.4 NFPPM, NFPA 805 Fire Protection Program Manual (NFPPM)
- 5.5 Nuclear Energy Institute (NEI) 04-02, Guidance for Implementing a Risk-Informed, Performance-Based Fire Protection Program under 10 CFR 50.48(c), Rev. 2
- 5.6 Nuclear Safety Capability Assessment Report
- 5.7 PRA-NB-FIRE-FQ, Fire PRA Model Quantification Notebook
- 5.8 PRA-NB-FIRE-FSS, Fire PRA Fire Scenario Selection
- 5.9 Regulatory Guide 1.205, Risk-Informed, Performance-Based Fire Protection for Existing Light-Water Nuclear Power Plants, Rev. Revision 1
- 5.10 Technical Evaluation R1900-005-001, Non-Power Operation Modes Transition Review



**Fire Area AA26 – Attachment 1 - Table B-3 - Fire Area Transition**

<u>Unit</u>	<u>Fire Area</u>	<u>Description</u>
1, 2	AA26	Unit 2 Diesel Generator Oil Pump Room (El. 587 ft.)

<u>Fire Zone</u>	<u>Description</u>
21	Diesel Oil Pump Room - El. 587 ft. 0 in. - Unit 2

**Regulatory Basis**

4.2.3.2 - Deterministic Approach

<b>Performance Goal</b>	<b>Method of Accomplishment</b>	<b>Comments</b>
Reactivity Control	Unit 1 - Trip the reactor from the Control Room. Borate using Unit 1 East or West Charging Pump supplied from the RWST. Use source range monitoring for indication.  Unit 2 - Trip the reactor from the Control Room. Borate using Unit 2 East or West Charging Pump supplied from the RWST. Use source range monitoring for indication.	None
Inventory and Pressure Control	Unit 1 - Control inventory using Unit 1 East or West Charging Pump. Control pressure using Unit 1 Pressurizer Safety Relief Valves.  Unit 2 - Control inventory using Unit 2 East or West Charging Pump. Control pressure using Unit 2 Pressurizer Safety Relief Valves.	None
Decay Heat Removal	Unit 1 - Feed SGs 2 & 3 with Unit 1 East MDAFW Pump or Unit 1 TDAFW Pump or feed SGs 1 & 4 with Unit 1 West MDAFW Pump. The DHR function also requires MS isolation with a steam release path through the Safety Relief Valves.  Unit 2 - Feed SGs 2 & 3 with Unit 2 East MDAFW Pump or Unit 2 TDAFW Pump or feed SGs 1 & 4 with West MDAFW Pump. The DHR function also requires MS isolation with a steam release path through the Safety Relief Valves.	None
Process Monitoring	Unit 1 Process Monitoring - Use Unit 1 process monitoring in the Control Room for the following: Pressurizer level, RCS pressure and temperature, and S/G level and Pressure. Unit 1 Source Range Monitoring - Use Unit 1 source range monitoring in the	None

**Fire Area AA26 – Attachment 1 - Table B-3 - Fire Area Transition**

<u>Unit</u>	<u>Fire Area</u>	<u>Description</u>
1, 2	AA26	Unit 2 Diesel Generator Oil Pump Room (El. 587 ft.)
Vital Auxiliaries		Control Room.
		Unit 2 Process Monitoring - Use Unit 2 process monitoring in the Control Room for the following: Pressurizer level, RCS pressure and temperature, and S/G level and Pressure.
		Unit 2 Source Range Monitoring - Use Unit 2 source range monitoring in the Control Room.
Vital Auxiliaries		Unit 1 Electrical - Control Unit 1 Red (AB) Train Electrical Distribution with Unit 1 Red (AB) Train Offsite Power. Control Unit 1 Green (CD) Train Electrical Distribution with Unit 1 Green (CD) Train Offsite Power or Unit 1 Green (CD) DG.
	None	Unit 1 ESW - Operate Unit 1 East or West ESW. Unit 1 CCW - Operate Unit 1 East or West CCW. Unit 1 HVAC - Operate Unit 1 Control Room HVAC. Operate Unit 1 Auxiliary Building HVAC. Operate Unit 1 Green (CD) DG HVAC. Operate Unit 1 Switchgear HVAC. Operate Unit 1 AFW Pump Room HVAC systems. Operate the Unit 1 East and West ESW Pump.
Vital Auxiliaries		Unit 2 Electrical - Control Unit 2 Red (AB) Train Electrical Distribution with Unit 2 Red (AB) Train Offsite Power. Control Unit 2 Green (CD) Train Electrical Distribution with Unit 2 Green (CD) Train Offsite Power or Unit 2 Green (CD) DG.
		Unit 2 ESW - Operate Unit 2 East or West ESW. Unit 2 CCW - Operate Unit 2 East or West CCW. Unit 2 HVAC - Operate Unit 2 Control Room HVAC. Operate Unit 2 Auxiliary Building HVAC. Operate Unit 2 Green (CD) DG HVAC. Operate Unit 2 Switchgear HVAC. Operate Unit 2 AFW Pump Room HVAC systems. Operate the Unit 2 East and West ESW Pump.

**Reference Documents**

Genesis Solution Suite, EDISON / SAFE-PB, DC Cook V 3.4.0

Nuclear Safety Capability Assessment Report

**Fire Area AA26 – Attachment 1 - Table B-3 - Fire Area Transition**

<u>Unit</u>	<u>Fire Area</u>	<u>Description</u>
1, 2	AA26	Unit 2 Diesel Generator Oil Pump Room (El. 587 ft.)

**Licensing Actions**

None

**Existing Engineering Equivalency Evaluations (EEEE)****EEEE Title Engineering Equivalency Evaluation 9-8 - Fire Zone 20 (Fire Area AA25) and Fire Zone 21 (Fire Area AA26) Boundary Evaluation**

**Summary** The purpose of this fire area engineering equivalency evaluation is to document the acceptability of an unrated field fabricated fusible link guillotine type damper presently located between the Unit 2 Diesel Oil Pump Room in Fire Zone 21 (Fire Area AA26) and the Unit 2 Transformer Room in Fire Zone 20 (Fire Area AA25).

The existing CO2 actuated damper located between Fire Zones 20 and 21 is an acceptable device for maintaining the rating of the fire area boundary. This engineering equivalency evaluation does not adversely impact other engineering equivalency evaluations.

The unrated damper was evaluated and found to be acceptable based on the fire hazards and fire protection systems within the evaluated areas.

**EEEE Title Engineering Equivalency Evaluation 11-9 - Turbine, Auxiliary and Containment Buildings Boundary Evaluation**

**Summary** The purpose of this engineering equivalency evaluation is to describe in general, the approach and existence of evaluations performed to determine and reconcile fire area boundaries having components or designs with less than a 3-hr fire rating on preventing the spread of fire. This engineering equivalency evaluation also specifically evaluates the impact of unrated door assemblies on the spread of fire.

Reasonable assurance is provided that the fire area boundaries having components or design less than a 3-hr fire rating will not increase the spread of fire or impair the safe shutdown capabilities of Units 1 or 2. In addition, this engineering equivalency evaluation does not adversely impact on other engineering equivalency evaluations or exemption requests.

This evaluation supports additional evaluations credited in this fire area.

**Fire Area AA26 – Attachment 1 - Table B-3 - Fire Area Transition**

<u>Unit</u>	<u>Fire Area</u>	<u>Description</u>
1, 2	AA26	Unit 2 Diesel Generator Oil Pump Room (El. 587 ft.)

**Fire Suppression Effects on Nuclear Safety Performance Criteria**

The CNP fire brigade is trained to discharge water in a judicious manner and instructed to direct hose streams and portable extinguishers at the base of the fire to limit the amount of overspray beyond the immediate fire zone. For this reason, fire brigade activities are not expected to fail components not already considered damaged. It has been concluded that water impingement on cables is not a concern. Electrical cabinets are provided with a seal at the conduit interface. Possible impacts to surrounding equipment due to manual fire fighting activities is bounded by the analysis approach of postulating whole room damage. The drainage features of the fire area mitigate the potential for flooding damage due to fire suppression, such that the standing water would not affect credited equipment.

In the event of discharge, any damage caused by the CO2 system to other equipment operating within the fire area which is not immediately involved in the originating fire is bounded by the analysis approach of postulating whole room damage. Since it is shown that suppression effects will not impact the nuclear safety performance criteria, the fire area configuration is deemed acceptable.

## References:

Technical Evaluation 12.1, "Fire Suppression Effects Study"

Technical Evaluation 12.1, "Supplemental Information to Fire Suppression Effects Study – Supplement 1"

**Fire Area Comments**

None

## D. C. Cook Nuclear Plant Fire Safety Analysis

## Fire Area: AA27

Unit 2 Quadrant 2 Piping Tunnel (El. 591 ft.)

## Table of Contents

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## Attachments

Fire Area AA27 – Attachment 1 - Table B-3 - Fire Area Transition

## Fire Area AA27 – Attachment 2 - Fire Risk Evaluation Results Summary

## 1.0 PURPOSE

This report documents the Fire Safety Analysis (FSA) for Cook Nuclear Plant (CNP) Fire Area AA27, Unit 2 Quadrant 2 Piping Tunnel (El. 591 ft.) which comprises fire zone(s) 22. The purpose of this analysis is to demonstrate the achievement of the nuclear safety and radioactive release performance criteria of NFPA 805 as required by 10 CFR 50.48(c). The Fire Safety Analysis is a key part of compliance with Section 2.7.1.2 Fire Protection Program Design Basis Document of NFPA 805.

## 2.0 ANALYSIS METHODOLOGY

The FSA is the design basis document as described in NFPA 805 Section 2.7.1.2. The following steps are performed to develop the FSA on a fire area basis:

- Identify significant fire hazards in the fire area. This is based on NFPA 805 approach to analyze the plant from an ignition source and fuel package perspective.
- Summarize Nuclear Safety Capability Analysis (NSCA) compliance strategies. This is the result of the NEI 04-02 B-3 Table review of the Safe Shutdown Analysis.
- Summarize Non-Power Operations Modes compliance strategies.
- Summarize Radioactive Release compliance strategies. The transition review process required per NEI 04-02 is used to develop these results.
- Provide Fire Probabilistic Risk Assessment summary of results. This is based on the results from the plant Fire PRA.
- Perform risk informed, performance based evaluations if needed for the performance based approach.
- Summarize Defense-in-Depth strategy for each fire area.
- Determine key analysis assumptions which are candidates to be included in the NFPA 805 monitoring program.
- Provide conclusions relative to NFPA 805 compliance.

### 3.0 ANALYSIS

#### 3.1 Classical Fire Protection

##### 3.1.1 Construction

Walls, floors, and ceilings to adjacent fire areas are reinforced concrete in excess of a 3-hour rating.

Applicable Engineering Equivalency Evaluations are documented in Attachment 1.

##### 3.1.2 Doors and Access Openings

Fire doors having a 3-hour rating are provided to adjacent Fire Areas AA5/6 and AA38 - Fire Zones 6S and 39, respectively. The door in adjacent Fire Zone 39 provides access through the Boric Acid Injection Tank Room into the upper platform levels of Fire Zone 22.

A fire area boundary evaluation was performed for the manway opening to Fire Area AA29 - Fire Zone 117 (Engineering Equivalency Evaluation 9-24).

##### 3.1.3 Penetrations

Penetrations in fire barriers between this fire zone and adjacent fire areas are provided with fire seals. The seismic gaps are sealed with a glass fiber reinforced silicone sheeting.

One exception is a seismic gap exemption was granted for Fire Zone 22 interface with Fire Areas AA29, AA31, AA35 and AA38 - Fire Zones 23, 27, 34B and 39, respectively (Engineering Equivalency Evaluation 11-46).

##### 3.1.4 Detection

The table below outlines the fire detection system(s) provided in the Fire Area:

Table 3-1, Fire Area AA27 Detection Systems								
Fire Zone	Type of System	Local (L) / Remote (R)	Detection Actuates Suppression?	Required System?				
				S	L	E	R	D
22	None	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Table 3-1 Legend:								
Table Field: "Required System?"								
S	- Required for Chapter 4 Separation Criteria							
L	- Required for NRC Approved Licensing Action							
E	- Required for Engineering Equivalency Evaluation							
R	- Required for Risk Significance							
D	- Required to maintain adequate balance of Defense-in-Depth in a Change Evaluation or Fire Risk Evaluation							

Fire Area AA27 is not provided with automatic fire detection.

### 3.1.5 Fixed Suppression

The table below outlines the fixed fire suppression system(s) provided in the Fire Area:

Table 3-2, Fire Area AA27 Suppression Systems							
Fire Zone	Type of System	Full (F) / Partial (P)	Required System?				
			S	L	E	R	D
22	None	N/A	N/A	N/A	N/A	N/A	N/A

**Table 3-2 Legend:**

Table Field: "Required System?"	
S	- Required for Chapter 4 Separation Criteria
L	- Required for NRC Approved Licensing Action
E	- Required for Engineering Equivalency Evaluation
R	- Required for Risk Significance
D	- Required to maintain adequate balance of Defense-in-Depth in a Change Evaluation or Fire Risk Evaluation

Fire Area AA27 is not provided with fixed fire suppression.

### 3.1.6 Manual Suppression / Response Strategy

A postulated fire will be identified by plant personnel using plant communication system to notify the control room. The Control Room operator will dispatch the fire brigade for initiation of manual fire fighting. A fire in this fire area will be contained by the construction features discussed in Section 3.1.1. Manual suppression is provided by the CNP Fire Brigade.

Fire extinguishers are located within the fire area, one of which is in the RHR valve pit, and others located outside the Boric Acid Injection Tank Room in Adjacent Fire Area AA38 - Fire Zone 39 for upper level platforms.

Water hose reels are located within the fire area.

Floor drains are available in Fire Area AA27.

### 3.1.7 Ventilation

A fire in this area will be contained by the fire barriers. Smoke can be removed by portable fans and flexible ducting to other areas of the Auxiliary Building and outdoors if not contaminated. Contaminated smoke can be removed by portable fans and flexible ducting to other areas of the Auxiliary Building per the Fire Pre-Plans. The normal building ventilating systems in the Auxiliary Building will then exhaust the smoke via filtered monitored pathways.

A fire area boundary evaluation was performed for an undampered ventilation duct to Fire Areas AA1, AA36/42, AA3 and AA5/6 - Fire Zones 1E and 1F, 44E-H, 50 and 65A, respectively (Boundary Evaluation 9-4).

Fire dampers having a 3-hour rating are provided to adjacent Fire Areas AA1, AA5/6 and AA55 - Fire Zones 1G, 1H, 6S and 63A-C.



The manway opening to Fire Area AA29 - Fire Zone 117 is also used for ventilation purposes.

### 3.1.8 Other Features

The vertical air shaft starts at the 570 ft elevation has a pipe trench that is located along the west wall of the fire zone at the 586 ft elevation. The trench opens directly into Fire Zone 117 along the south wall of this fire zone.

### 3.2 Fire Hazards Identification

The fire area contains both ignition sources and combustible fire hazards. The main hazards are the blowdown demineralizer pump, radiation monitor, local shutdown indication panels and instrumentation and control cables. Combustibles consist primarily of cellulose and rubber/plastics. The current fire loading classification is considered low.

### 3.3 NSCA Compliance Summary

Fire Area AA27 contains Red and Green Train cables, conduits, and raceways as well as safe shutdown equipment.

Compliance with the nuclear safety performance criteria is achieved using the performance-based approach in accordance with NFPA 805, Section 4.2.4.2.

Safe and stable condition of the affected Unit 2 will be accomplished using Steam Generators 1 and 4 via the Unit 2 West Motor Driven Auxiliary Feedwater Pump, Unit 2 Charging via the East or West Pump, Unit 2 Component Cooling Water via the East or West Pump, Unit 2 Essential Service Water via the East or West Pump and Process Monitoring from the Main Control Room. Power is credited to be available to the Red and Green train systems via offsite power with the Red Train EDG available as well.

The Nuclear Safety Performance Criteria compliance strategy for AA27 is documented within the NSCA Report.

#### 3.3.1 Variances

The variances identified for evaluation for this fire area are grouped as follows:

##### 3.3.1.1 VFDR No. AA27-001

2-CLI-113 and 2-CLI-114 - CST Control Room level indication is required to be operable to support AFW for decay heat removal. Decay heat removal is required to remove sufficient heat from the reactor core such that the fuel is maintained in a safe and stable condition. The CST level indicators provide Control Room indication of the initial water source for AFW. All of the Control Room CST level indicators may fail due to a full area fire within Fire Area AA27. 2-CLI-113 may fail due to fire induced damage of cable 19867-2. 2-CLI-114 may fail due to fire induced damage of cable 8202Y-2. This condition represents a variance from deterministic requirements of NFPA 805, Section 4.2.3. This is a separation issue.

This VFDR has been evaluated and it was determined that the risk, safety margin and defense-in-depth meet the acceptance criteria of NFPA 805 Section 4.2.4 with a defense-in-depth action credited.

**3.3.1.2 VFDR No. AA27-002**

2-DCR-310, 2-DCR-320, 2-DCR-330 and 2-DCR-340 - SG 1 through 4 Blowdown Isolation Valves are required to be closed to support main steam isolation. Main steam isolation is required to prevent uncontrolled cooldown through over-steaming. All SG Blowdown Isolation Valves may fail due to a full area fire within Fire Area AA27. 2-DCR-310 may fail due to fire induced damage of cable(s) 8682G-2, and 80282G-2. 2-DCR-320 may fail due to fire induced damage of cable(s) 8682R-2, 80282R-2, and 8683R-2. 2-DCR-330 may fail due to fire induced damage of cable(s) 8686R-2, 80284R-2 and 8687R-2. 2-DCR-340 may fail due to fire induced damage of cable(s) 8686G-2, 80284G-2 and 8687G-2. These cable failures could spuriously open the valves. SGs 1 and 4 are credited for decay heat removal for a fire within Fire Area AA27. This condition represents a variance from the deterministic requirements of NFPA 805, Section 4.2.3. This is a separation issue.

This VFDR has been evaluated and it was determined that the risk, safety margin and defense-in-depth meet the acceptance criteria of NFPA 805 Section 4.2.4 with a defense-in-depth action credited.

**3.3.1.3 VFDR No. AA27-003**

2-QRV-251 - The Charging Flow Control Valve is required to be open to support CVCS. CVCS is required to be operable to maintain inventory, pressure and reactivity control. Loss of 2-QRV-251 will fail Unit 1 seal injection charging. 2-QRV-251 may fail due to fire induced damage of cable 6116-2. This cable failure could spuriously close the valve. This condition represents a variance from deterministic requirements of NFPA 805, Section 4.2.3. This is a separation issue.

This VFDR has been evaluated and it was determined that the risk, safety margin and defense-in-depth meet the acceptance criteria of NFPA 805 Section 4.2.4 with no further action required.

**3.3.2 Recovery Actions Credited**

For each VFDR, a Fire Risk Evaluation has been performed to assess the acceptability of risk, defense-in-depth, and safety margin. This evaluation determined whether or not recovery actions are required to ensure that one success path necessary to achieve and maintain the nuclear safety performance criteria is maintained free of fire damage by a single fire. Table 3-3 identifies the credited recovery actions for this area. Actions retained for DID are identified as "DID Actions" within Table 3-3. Additional information for DID actions is contained within Section 3.8 of this report. Note that, for completeness, all VFDRs are contained within Table 3-3, even if the Fire Risk Evaluation has determined that a recovery action is not required. In those instances where a recovery action has been determined to not be required, the word "None" is provided in the "Action" column in the table.

Table 3-3, Recovery Actions Credited		
VFDR	Component	Action
AA27-001	2-CLI-113	DID ACTION
	2-CLI-114	2-CLI-113-LOCAL (Locally monitor CST level)

Table 3-3, Recovery Actions Credited		
VFDR	Component	Action
AA27-002	2-DCR-310	DID ACTION(S)
	2-DCR-320	2-DCR-310-CLOSE
	2-DCR-330	2-DCR-320-CLOSE
	2-DCR-340	2-DCR-330-CLOSE
		2-DCR-340-CLOSE
		(Remove fuses in MCR to fail closed AOVs 2-DCR-310, 2-DCR-320, 2-DCR-330 and 2-DCR-340)
AA27-003	2-QRV-251	None

### 3.4 Non-Power Operational Modes Compliance Summary

A review of CNP for the potential effects of a fire in this Fire Area while in non-power modes of operation (NPO) was conducted. This review was conducted using the guidance provided in NEI 04-02 and FAQ 07-0040, "Non-Power Operations Clarifications".

The review determined that there are potential failures that affect certain Key Safety Functions (KSF) as a result of the fire in this area, and the fire could result in the loss of one or more KSF paths. Compensatory measures are required during high risk evolution periods to provide reasonable assurance a fire will not adversely affect key safety functions and the NFPA 805 performance goal for NPO is therefore satisfied. The results of the NPO analysis are contained within the Non-Power Operation Modes Transition Review Report.

### 3.5 Radioactive Release Compliance Summary

The NFPA 805 radiological release goal is to provide reasonable assurance that a fire will not result in a radiological release that adversely affects the public, plant personnel or the environment. The NFPA 805 requirement is to ensure a radiation release to any unrestricted area due to the direct effects of fire suppression activities (but not involving fuel damage) shall be as low as reasonably achievable and shall not exceed applicable plant Technical Specification limits.

AA27 is within the Radiological Controlled Area (RCA) and has been identified as a potential fire area for radioactive release due to fire fighting activities. In accordance with NFPA 805 FAQ 09-0056, this potential has been reviewed to ensure that engineering controls, fire pre-plans, and fire brigade training materials are provided for containment and monitoring of gaseous and liquid effluents associated with fire suppression agents and products of combustion.

The review concludes that the steps to limit radiation release to other areas due to the direct effects of fire suppression activities, in addition to compliance with NFPA 805, Chapter 4, ensure that any radioactive release will be as low as reasonably achievable and will not exceed limits designated in the CNP Technical Specifications.

The review of this fire area, with respect to radioactive release, is documented in the NFPPM.

### 3.6 Probabilistic Risk Assessment-Summary of Results

A Fire PRA (FPRA) quantification of Fire Area AA27 was performed and is documented in PRA-NB-FIRE-FQ, Fire PRA Model Quantification Notebook. The fire risk quantification for Fire Area AA27 is analyzed using detailed fire modeling to consider risk of fire scenarios of ignition sources. PRA-NB-FIRE-FQ includes a summary of all potentially risk-significant fire scenarios (i.e., CDF > 1.0E-7 or LERF > 1.0E-8). Bounding CDF / LERF per calendar year values are reported that are based on the risk values documented in PRA-NB-FIRE-FSS, Fire PRA Fire Scenario Selection.

Fire Protection features credited in the Fire PRA are documented in R1900-0411-AA27, Detailed Fire Modeling Report: Fire Compartment: AA27 Unit 2 Quadrant 2 Piping Tunnel (EL. 591 FT). PRA-NB-FIRE-FSS documents the revision level of the fire modeling reports used in the most recent Fire PRA quantification.

### 3.7 Risk-Informed, Performance-Based Evaluations

Fire Risk Evaluations (FREs) have been performed to ensure that variances from the NFPA 805 deterministic requirements are acceptable. The evaluation process consists of an integrated assessment of the acceptability of risk, defense-in-depth, and safety margins.

#### 3.7.1 Transition Risk-Informed, Performance-Based Evaluations

The 'changes' associated with NFPA 805 transition were those variances from the deterministic requirements of NFPA 805 or with the existing fire protection licensing basis that were brought into compliance with the NFPA 805 performance based approach. The change identified for evaluation for Fire Area AA27 is as follows:

- Separation Issues

The Fire Risk Evaluation has determined that the change is acceptable based upon:

- The measured change in CDF and LERF.
- Adequate defense-in-depth and safety margins being maintained.

Refer to Attachment 2 for a summary of results associated with the Fire Risk Evaluations.

### 3.8 Defense-in-Depth

A comprehensive risk-informed, performance-based analysis includes consideration of defense-in-depth (DID) as part of an integrated evaluation of risk considerations. In general, defense-in-depth involves consideration of the extent to which fire protection systems and features are provided within the three echelons of fire-protection:

- Preventing fires from starting,
- Rapidly detecting fires and controlling and extinguishing promptly those fires that do occur, thereby limiting fire damage,
- Providing an adequate level of fire protection for structures, systems, and components important to safety, so that a fire that is not promptly extinguished will not prevent the nuclear safety performance criteria from being met.

Each VFDR was evaluated for DID. The following recovery actions have been retained for DID.

VFDR No. AA27-001: 2-CLI-113 and 2-CLI-114 - CST Control Room level indication is required to be operable to support AFW for decay heat removal. Decay heat removal is required to remove sufficient heat from the reactor core such that the fuel is maintained in a safe and stable condition. The CST level indicators provide Control Room indication of the initial water source for AFW. All of the Control Room CST level indicators may fail due to a full area fire within Fire Area AA27. Loss of CST indication can be mitigated by locally monitoring the CST level. This recovery action is being retained for DID to ensure CST level indication is maintained.

VFDR No. AA11-002: 2-DCR-310, 2-DCR-320, 2-DCR-330 and 2-DCR-340 - SG 1 through 4 Blowdown Isolation Valves are required to be closed to support main steam isolation. Main steam isolation is required to prevent uncontrolled cooldown through over-steaming. Loss of Main Steam isolation can be mitigated by removing fuses to ensure valves fail shut. This recovery action is being retained for DID to ensure Main Steam isolation is maintained.

VFDR No. AA11-003: 2-QRV-251: The Charging Flow Control Valve is required to be open to support CVCS. CVCS is required to be operable to maintain inventory, pressure and reactivity control. Loss of 2-QRV-251 will fail Unit 2 seal injection charging. Loss of seal injection charging can be mitigated by removing fuses to fail the valve open. This recovery action is being retained for DID to ensure seal injection is maintained.

Based on the assessment in support of the Fire Risk Evaluation, defense-in-depth is maintained for fire area AA27. Refer to Attachment 2 for details associated with the Fire Risk Evaluation.

### 3.9 Monitoring Program Input

A Monitoring Program will be developed in accordance with FAQ 10-0059, Rev. 1. Methods to monitor availability, reliability, and performance of fire protection program structures, systems, and components (SSCs), as well as programmatic elements will be provided. Additionally, effectiveness measures are established to review program related performance and trends. For AA27 the following systems and features are candidates for inclusion in the CNP Fire Protection Monitoring Program:

- Fire Area boundary barriers discussed in Section 3.1

## 4.0 CONCLUSION

The nuclear safety and radioactive release performance criteria of NFPA 805 are met for a fire in

Fire Area AA27. This Fire Risk Evaluation for Fire Area AA27 has demonstrated that

- The change in core damage frequency (delta CDF) is acceptable, and
- The change in large early release frequency (delta LERF) is acceptable, and
- Defense-in-depth and safety margins are maintained.

This is confirmation that a success path effectively remains free of fire damage and that the performance-based approach is acceptable per Section 4.2.4.2 of NFPA 805.

## 5.0 REFERENCES

- 5.1 Calculation PRA-FIRE-NB-CRE, Fire PRA Cumulative Risk Evaluations
- 5.2 CNP Fire Pre-Plans, Volumes I, II, and III, Revisions 17, 14, and 18 respectively
- 5.3 Fire Hazards Analysis
- 5.4 NFPA 805, Performance-Based Standard for Fire Protection for Light Water Reactor Electric Generating Plants
- 5.5 NFPPM, NFPA 805 Fire Protection Program Manual (NFPPM)
- 5.6 Nuclear Energy Institute (NEI) 04-02, Guidance for Implementing a Risk-Informed, Performance-Based Fire Protection Program under 10 CFR 50.48(c), Rev. 2
- 5.7 Nuclear Safety Capability Assessment Report
- 5.8 PRA-NB-FIRE-FQ, Fire PRA Model Quantification Notebook
- 5.9 PRA-NB-FIRE-FSS, Fire PRA Fire Scenario Selection
- 5.10 Regulatory Guide 1.205, Risk-Informed, Performance-Based Fire Protection for Existing Light-Water Nuclear Power Plants, Rev. Revision 1
- 5.11 Technical Evaluation R1900-005-001, Non-Power Operation Modes Transition Review

**Fire Area AA27 – Attachment 1 - Table B-3 - Fire Area Transition**

<u>Unit</u>	<u>Fire Area</u>	<u>Description</u>
2	AA27	Unit 2 Quadrant 2 Piping Tunnel (El. 591 ft.)

<u>Fire Zone</u>	<u>Description</u>
22	Quadrant 2 Piping Tunnel - El. 591 ft. 0 in. - Unit 2

**Regulatory Basis**

4.2.4.2 - Performance-Based Approach - Fire Risk Evaluation with simplifying deterministic assumptions

<b>Performance Goal</b>	<b>Method of Accomplishment</b>	<b>Comments</b>
Reactivity Control	Unit 2 - Trip the reactor from the Control Room. Borate using Unit 2 East or West Charging Pump supplied from the RWST. Use source range monitoring for indication for Unit 2.	VFDR identified for charging flow control.
Inventory and Pressure Control	Unit 2 - Control inventory using Unit 2 East or West Charging Pump. Control pressure using Unit 2 Pressurizer Safety Relief Valves.	VFDR identified for charging flow control.
Decay Heat Removal	Unit 2 - Feed SGs 1 & 4 with Unit 2 West MDAFW Pump. The DHR function also requires MS isolation with a steam release path through the Safety Relief Valves.	VFDRs identified for CST level indication and Main Steam Isolation.
Process Monitoring	Unit 2 Process Monitoring - Use Unit 2 process monitoring in the Control Room for the following: Pressurizer level, RCS pressure and temperature, and S/G level and Pressure. Unit 2 Source Range Monitoring - Use Unit 2 source range monitoring in the Control Room.	None
Vital Auxiliaries	Unit 2 Electrical - Control Unit 2 Red (AB) Train Electrical Distribution with Unit 2 Red (AB) Train Offsite Power or Unit 2 Red (AB) DG. Control Unit 2 Green (CD) Train Electrical Distribution with Unit 2 Green (CD) Train Offsite Power. Unit 2 ESW - Operate Unit 2 East or West ESW Unit 2 CCW - Operate Unit 2 East or West CCW Unit 2 HVAC - Operate Unit 2 Control Room HVAC. Operate Unit 2 Auxiliary Building HVAC. Operate Unit 2 Red (AB) DG HVAC. Operate Unit 2 Switchgear HVAC. Operate Unit 2 West MDAFW Pump Room HVAC system. Operate Unit 2 East and West ESW Pump HVAC systems.	None

**Fire Area AA27 – Attachment 1 - Table B-3 - Fire Area Transition**

<u>Unit</u>	<u>Fire Area</u>	<u>Description</u>
2	AA27	Unit 2 Quadrant 2 Piping Tunnel (El. 591 ft.)

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**Reference Documents**

Genesis Solution Suite, EDISON / SAFE-PB, DC Cook V 3.4.0

Nuclear Safety Capability Assessment Report

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**Licensing Actions**

None

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**Existing Engineering Equivalency Evaluations (EEEE)**

**EEEE Title** Engineering Equivalency Evaluation 9-4 - Auxiliary Building Vertical Air Shafts Evaluation: Fire Zones 12 (Fire Area AA11) and 22 (Fire Area AA27)

**Summary** The purpose of this engineering equivalency evaluation is to document the acceptability of two vertical air shafts, located in the Auxiliary Building (Fire Areas AA11 and AA27), that extend from the 573 ft. elevation to just below the 650 ft. elevation with dampered and undampered ventilation openings.

Reasonable assurance is provided that a fire in any of the adjoining fire areas to the Auxiliary Building air shafts with undampered or unrated duct penetrations or a fire in either air shaft will not adversely impact on safe shutdown capabilities of CNP. In addition, this engineering equivalency evaluation does not adversely impact other engineering equivalency evaluations.

The air shafts were evaluated and found to be acceptable based on the fire hazards, fire protection systems and construction features within the evaluated areas.



**Fire Area AA27 – Attachment 1 - Table B-3 - Fire Area Transition**

<u>Unit</u>	<u>Fire Area</u>	<u>Description</u>
2	AA27	Unit 2 Quadrant 2 Piping Tunnel (El. 591 ft.)

<b><u>EEEE Title</u></b>	<b>Engineering Equivalency Evaluation 9-24 - Fire Zone 117 (Fire Area AA29) Boundary Evaluation</b>
<b><u>Summary</u></b>	<p>The purpose of this engineering equivalency evaluation is to document the acceptability of two manway openings connecting Fire Zone 117 (Fire Area AA29) with adjacent fire areas.</p> <p>Reasonable assurance is provided that the two manway openings connecting Fire Zone 117 with Fire Zone 22 and Fire Zone 34 do not impair safe shutdown capability. This engineering equivalency evaluation does not adversely impact other engineering equivalency evaluations.</p> <p>The two manway openings were evaluated and found to be acceptable based on the fire hazards and construction features within the evaluated areas.</p>
<b><u>EEEE Title</u></b>	<b>Engineering Equivalency Evaluation 11-9 - Turbine, Auxiliary and Containment Buildings Boundary Evaluation</b>
<b><u>Summary</u></b>	<p>The purpose of this engineering equivalency evaluation is to describe in general, the approach and existence of evaluations performed to determine and reconcile fire area boundaries having components or designs with less than a 3-hr fire rating on preventing the spread of fire. This engineering equivalency evaluation also specifically evaluates the impact of unrated door assemblies on the spread of fire.</p> <p>Reasonable assurance is provided that the fire area boundaries having components or design less than a 3-hr fire rating will not increase the spread of fire or impair the safe shutdown capabilities of Units 1 or 2. In addition, this engineering equivalency evaluation does not adversely impact on other engineering equivalency evaluations or exemption requests.</p> <p>This evaluation supports additional evaluations credited in this fire area.</p>

**Fire Area AA27 – Attachment 1 - Table B-3 - Fire Area Transition**

<u>Unit</u>	<u>Fire Area</u>	<u>Description</u>
2	AA27	Unit 2 Quadrant 2 Piping Tunnel (El. 591 ft.)
<b><u>EEEE Title</u></b>	<b>Engineering Equivalency Evaluation 11-46 - Seismic Gaps between the Containment and Auxiliary Buildings Boundary Evaluation (Fire Areas AA2, AA3, AA7, AA8, AA9, AA10, AA11, AA27, AA29, AA30, AA31, AA34, AA35, AA37 and AA38)</b>	
<b><u>Summary</u></b>	<p>A seismic gap exists around the Containment Building of each unit that provides an opening of approximately 6 in. between the Containment Building and the walls, ceilings and floors of the structures immediately adjacent to containment. These Fire Areas include AA2, AA3, AA7, AA8, AA9, AA10, AA11, AA27, AA29, AA30, AA31, AA34, AA35, AA37 and AA38. This engineering equivalency evaluation has been performed to document the acceptability of these seismic gaps in the fire boundaries.</p> <p>This seismic gap evaluation shows the safe shutdown capability for CNP Unit 1 and Unit 2 has not been compromised as a result of seismic gaps. The analysis performed and the results presented in the tables indicate, on a system basis, the capability to safely shut down both units when considering fire damage to safe shutdown components and circuits contained in the seismic gap evaluation areas. The method of analysis is conservative when considering the fire hazards involved in the vicinity of the seismic gaps. That is, it is not anticipated that the evaluated areas would be affected to the extent that fire would propagate through the seismic gaps and cause damage throughout the evaluated area. This engineering equivalency evaluation has no impact on the exemption requests contained in other engineering equivalency evaluations.</p> <p>The seismic gaps were evaluated and found to be acceptable based on the fire hazards, fire protection systems and construction features within the evaluated areas.</p>	

**Fire Suppression Effects on Nuclear Safety Performance Criteria**

The CNP fire brigade is trained to discharge water in a judicious manner and instructed to direct hose streams and portable extinguishers at the base of the fire to limit the amount of overspray beyond the immediate fire zone. For this reason, fire brigade activities are not expected to fail components not already considered damaged. It has been concluded that water impingement on cables is not a concern. Electrical cabinets are provided with a seal at the conduit interface. Possible impacts to surrounding equipment due to manual fire fighting activities is bounded by the analysis approach of postulating whole room damage. The drainage features of the fire area mitigate the potential for flooding damage due to fire suppression, such that the standing water would not affect credited equipment.

This fire area is not equipped with a fixed fire suppression system. Since it is shown that suppression effects will not impact the nuclear safety performance criteria, the fire area configuration is deemed acceptable.

**References:**

Technical Evaluation 12.1, "Fire Suppression Effects Study"

Technical Evaluation 12.1, "Supplemental Information to Fire Suppression Effects Study – Supplement 1"

**Fire Area AA27 – Attachment 1 - Table B-3 - Fire Area Transition**

<u>Unit</u>	<u>Fire Area</u>	<u>Description</u>
2	AA27	Unit 2 Quadrant 2 Piping Tunnel (El. 591 ft.)

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**Fire Area Comments**

None

## Fire Area AA27 – Attachment 2 - Fire Risk Evaluation Results Summary

### A2.1 Introduction

The ‘changes’ associated with NFPA 805 transition were those variances from the deterministic requirements of NFPA 805. The changes identified for evaluation for fire area AA27 are grouped as follows:

- Separation Issues

This attachment is a summary of the Fire Risk Evaluation for the fire area. The complete results and methodology are contained in the Cumulative Fire Risk Evaluation, PRA-FIRE-NB-CRE. (FPCE 2017-0009)

### A2.2 Inputs/Assumptions

Fire modeling processes and inputs provided in NUREG/CR-6850 are appropriate for use in a risk-informed, performance-based evaluation. The complete list of assumptions used in the fire modeling methodology for this fire area is contained in Detailed Fire Modeling Technical Evaluation R1900-0411-AA27.

### A2.3 Fire Modeling Methodology

Fire PRA fire modeling results are used as the initial input into this Fire Risk Evaluation. The process consists of conservative bounding analyses using NUREG/CR-6850 methods. As needed, refinements are made to utilize more realistic parameters. The complete fire modeling methodology for this fire area is contained in Detailed Fire Modeling Technical Evaluation R1900-0411-AA27.

### A2.4 Scenario Descriptions and Model Results

Fire Area AA27 was evaluated for the impact of fires originating from both fixed and transient ignition sources. Complete descriptions of each fire scenario is contained within the Detailed Fire Modeling Technical Evaluation R1900-0411-AA27.

#### A2.4.1 Ignition Sources

Fire Area AA27 contains SG Blowdown Pump. Ignition sources in Fire Area AA27 were modeled using the 98th percentile fire as a screening approach. These scenarios were not risk significant enough to require further refinement. The oil Ignition source was broken down into a 10% spill and 100% spill.

In Fire Area AA27, the 98th percentile HRR was used for all transient fires. The 98th percentile HRR bounds the possible transient ignition sources expected for this fire area, which were fire tested and identified in NUREG/CR-6850, Appendix G, Table G-7.

#### A2.4.2 Scenario Results

A delta risk calculation has been performed to quantify the risk associated with the VFDRs in the fire area.

### A2.5 Fire Risk Evaluation Results

PRA-FIRE-NB-CRE documents scenarios and corresponding impacted VFDRs that were evaluated for delta risk during the transition to NFPA 805 and also all changes to the Fire Protection Program that are currently incorporated into the Fire PRA model. The acceptability of the Cumulative Fire Risk Evaluations was based on calculated delta risk meeting the thresholds of NEI 04-02, RG 1.205 and RG 1.174. (FPCE 2017-0009)

## Fire Area AA27 – Attachment 2 - Fire Risk Evaluation Results Summary

### A-2.6 Impact of VFDR on Defense-in-Depth

Defense-in-Depth has been evaluated for this fire area. The impacts of this evaluation are summarized in the table below:

Defense-in-Depth Impact Review for AA27			
Method of Providing DID	Required to Support Deterministic Analysis or Fire PRA?	Changes or Improvements Necessary for DID?	Basis/Justification
Echelon 1: Prevent fires from starting			
Combustible Control is implemented in accordance with Procedure PMP-2270-CCM-001, Control of Combustible Materials.	Yes	No	• This element is adequate based on no perceived weakness of, or over-reliance on, another echelon of defense-in-depth.
Hot Work Control is implemented in accordance with Procedure PMP-2270-WBG-001, Welding, Burning and Grinding Activities.	Yes	No	
Echelon 2: Rapidly detect, control and extinguish promptly those fires that do occur thereby limiting fire damage			
Fire Detection System	No	No	• Although a recovery action is required to maintain defense-in-depth, this action is not considered a time sensitive action, further, since fire fighting activities would not be challenging, no changes or improvements to Echelon 2 attributes are necessary to maintain defense-in-depth.
Fixed Fire Suppression	No	No	
Portable Fire Extinguishers	Yes	No	
Hose stations and hydrants	Yes	No	
Pre-Fire Plan	Yes	No	
Echelon 3: Provide adequate level of fire protection for systems and structures so that a fire will not prevent essential safety functions from being performed			
Walls, floors ceilings and structural elements are rated or have been evaluated as adequate for the hazard.	Yes	No	• Although VFDR AA27-001 is not considered a significant contribution to core damage frequency, the variance is considered important enough to the NSCA to retain as a recovery action to ensure that defense-in-depth is maintained.
Penetrations in the fire area barrier are rated or have been evaluated as adequate for the hazard.	Yes	No	
Supplemental barriers (e.g., ERFBS, cable tray covers, etc.)	No	No	• Defense in Depth actions were credited to remove fuses in the Control Room to prevent spurious equipment operation due to internal shorts.
Guidance provided to operations personnel detailing the required success path(s) including recovery actions to achieve nuclear safety performance criteria.	No	Yes	

## Fire Area AA27 – Attachment 2 - Fire Risk Evaluation Results Summary

### A-2.7 Safety Margin Considerations

In accordance with NEI 04-02, the maintenance of adequate Safety Margin is assessed by the consideration categories of analyses utilized by this Fire Risk Evaluation.

Safety margins are considered to be maintained if:

- Codes and Standards or their alternatives accepted for use by the NRC are met.

AND

- Safety analyses acceptance criteria in the licensing basis (e.g., FSAR, supporting analyses) are met, or provides sufficient margin to account for analysis and data uncertainty.

The following summarizes the bases for ensuring the maintenance of safety margins:

- The risk-informed, performance based processes utilized are based upon NFPA 805, 2001 edition, endorsed by the NRC in 10 CFR 50.48(c).
- The Fire Risk Evaluation process is in accordance with NEI 04-02, Revision 2, which is endorsed by the NRC in Regulatory Guide 1.205, Revision 1.
- The Fire PRA is developed in accordance with NUREG/CR-6850, which was developed jointly between the NRC and EPRI.
- The Fire PRA has undergone an industry peer review, in order to ensure the Fire PRA meets the appropriate quality standards of ASME/ANS RA-Sa-2009, "Standard for Level 1/Large Early Release Frequency Probabilistic Risk Assessment for Nuclear Power Plant Applications," Dated February 2, 2009
- The "bounding risk assessment" is used during transition (NEI 04-02, Section 5.3.4.2). This approach conservatively assumes that target set damage occurs for postulated fire events which resulted in whole room burn up, and therefore, MEFS/LFS is not analyzed separately from the Fire PRA results.
- The CNP internal events PRA model received two formal industry peer reviews conducted in accordance with applicable NEI guidelines. The initial peer review was performed in 2001, while a subsequent focused scope (i.e., limited scope) peer review was conducted in 2009. The initial, full-scope WOG peer review covered all aspects of the CNP PRA model and the administrative processes used to maintain and update the model. The CNP PRA model has been revised to address all significant issues (i.e., Category A and B Facts & Observations) identified during the initial peer review. None of the findings from the focused-scope peer review were judged to reach the significance level of a Category A or B Fact & Observation; as a result, no changes to the PRA model have yet been made to include resolutions for these latter issues.
- Fire protection systems and features determined to be required by NFPA 805 Chapter 4 have been confirmed to meet the requirements of NFPA 805 Chapter 3 and their associated referenced codes and listings, or provided with acceptable alternatives using processes accepted for use by the NRC (i.e., FAQ 06-0008, FAQ 06-0004, 07-0033).
- Fire modeling performed has been performed within the Fire PRA utilizing codes and standards developed by industry and NRC staff which have been verified and validated in authoritative publications, such as NUREG 1824, "Verification and Validation of Selected Fire Models for Nuclear Power Plant Applications". In general, the fire modeling performed in support of the Fire Risk Evaluations has been

## Fire Area AA27 – Attachment 2 - Fire Risk Evaluation Results Summary

performed using conservative methods and input parameters that are based upon NUREG/CR-6850 as documented in the AA27 Detailed Fire Modeling Report, section 7.2. While this is generally not ideal in the context of best estimate probabilistic risk analysis, it is a pragmatic approach given the current state of knowledge regarding the uncertainties related to the application of the fire modeling tools and associated input parameters for specific plant configurations.

- In accordance with the requirements of 10 CFR 50.48(c)(2)(iii), the Fire PRA results, including cutsets for the scenarios of concern, have been reviewed and it was verified that the results presented above do not rely solely on feed and bleed as the fire-protected safe shutdown path for maintaining reactor coolant inventory, pressure control, and decay heat removal capability for this fire area.

### A-2.8 Transition Risk Evaluation Conclusions

The transition change evaluation determined that these changes:

- Are acceptable based upon the measured change in CDF and LERF
- Maintained adequate defense-in-depth and safety margins

The results of this evaluation meet the requirements of NFPA 805 Risk Evaluation; therefore, the use of the performance based analysis approach is acceptable.





## 1.0 PURPOSE

This report documents the Fire Safety Analysis (FSA) for Cook Nuclear Plant (CNP) Fire Area AA29, Unit 2 Quadrant 3M & 3S Cable Tunnel (El. 596 ft.) which comprises fire zone(s) 23, 24, 25, 117. The purpose of this analysis is to demonstrate the achievement of the nuclear safety and radioactive release performance criteria of NFPA 805 as required by 10 CFR 50.48(c). The Fire Safety Analysis is a key part of compliance with Section 2.7.1.2 Fire Protection Program Design Basis Document of NFPA 805. This analysis also documents results of risk-informed, performance-based Fire Risk Evaluations (FREs). These evaluations are associated with Variances from Deterministic Requirements (VFDRs) of NFPA 805 Chapter 4.

## 2.0 ANALYSIS METHODOLOGY

The FSA is the design basis document as described in NFPA 805 Section 2.7.1.2. The following steps are performed to develop the FSA on a fire area basis:

- Identify significant fire hazards in the fire area. This is based on NFPA 805 approach to analyze the plant from an ignition source and fuel package perspective.
- Summarize Nuclear Safety Capability Analysis (NSCA) compliance strategies. This is the result of the NEI 04-02 B-3 Table review of the Safe Shutdown Analysis.
- Summarize Non-Power Operations Modes compliance strategies.
- Summarize Radioactive Release compliance strategies. The transition review process required per NEI 04-02 is used to develop these results.
- Provide Fire Probabilistic Risk Assessment summary of results. This is based on the results from the plant Fire PRA.
- Perform risk informed, performance based evaluations if needed for the performance based approach.
- Summarize Defense-in-Depth strategy for each fire area.
- Determine key analysis assumptions which are candidates to be included in the NFPA 805 monitoring program.
- Provide conclusions relative to NFPA 805 compliance.

### 3.0 ANALYSIS

#### 3.1 Classical Fire Protection

##### 3.1.1 Construction

For Fire Zones 23, 25 and 117, walls, floors and ceilings to adjacent fire areas are reinforced concrete in excess of a 3-hour rating.

For Fire Zone 24, walls, floors and ceilings to adjacent fire areas and fire zones are reinforced concrete in excess of a 3-hour rating.

For Fire Zones 23, 24 and 25, a fire area boundary evaluation was performed for a damper and penetration seal in this area which has a fire resistance rating of less than 3 hours.

Applicable Engineering Equivalency Evaluations are documented in Attachment 1.

##### 3.1.2 Doors and Access Openings

For Fire Zone 23, A fire door having a 3-hour rating is provided to adjacent Fire Zone 24.

For Fire Zone 24, fire doors having a 3-hour rating are provided to adjacent Fire Zones 23 and 25 as well as adjacent Fire Area AA2, Fire Zone 85.

For Fire Zone 25, fire doors having a 3-hour rating are provided to adjacent Fire Area AA30 - Fire Zone 26 and adjacent Fire Zone 24.

For Fire Zone 117, there are no door openings to adjacent fire areas.

A fire area boundary evaluation was performed for open access penetrations from Fire Area AA27 - Fire Zone 22 and Fire Area AA35 - Fire Zone 34.

##### 3.1.3 Penetrations

Note: Statements regarding fire resistance rating of penetration seals are not applicable to seals in barriers to Analysis Area YD.

For Fire Zone 117, penetrations in fire barriers between this fire zone and adjacent fire areas are provided with fire seals.

The seismic gaps are sealed with a glass fiber reinforced silicone sheeting.

For Fire Zone 23, penetrations in fire barriers between this fire zone and adjacent fire areas are provided with fire seals, however, a seismic gap exemption was granted for Fire Zone 23 interface with Fire Areas AA27 and AA35 - Fire Zones 22 and 34A, respectively.

The seismic gap is provided with a glass fiber reinforced silicone sheeting.

For Fire Zone 24, penetrations in fire barriers between this fire zone and adjacent fire areas and fire zones are provided with fire seals, however, a seismic gap exemption was granted for the Fire Zone 24 interface with Fire Areas AA30 and AA35 - Fire Zones 26 and 34A, respectively.

The seismic gap is provided with a glass fiber reinforced silicone sheeting.

For Fire Zone 25, penetrations in fire barriers between this fire zone and adjacent fire areas and adjacent fire zones are provided with fire seals.

The seismic gap is provided with a glass fiber reinforced silicone sheeting.

### 3.1.4 Detection

The table below outlines the fire detection system(s) provided in the Fire Area:

Table 3-1, Fire Area AA29 Detection Systems								
Fire Zone	Type of System	Local (L) / Remote (R)	Detection Actuates Suppression?	Required System?				
				S	L	E	R	D
23	Infrared	L/R	N	N	N	Y	Y	N
23	Ionization	L/R	N	N	N	Y	Y	N
24	Infrared	L/R	N	N	N	Y	Y	N
24	Ionization	L/R	N	N	N	Y	Y	N
25	Infrared	L/R	N	N	N	Y	Y	N
25	Ionization	L/R	N	N	N	Y	Y	N
117	None	N/A	N/A	N/A	N/A	N/A	N/A	N/A

**Table 3-1 Legend:**

Table Field: "Required System?"	
S	- Required for Chapter 4 Separation Criteria
L	- Required for NRC Approved Licensing Action
E	- Required for Engineering Equivalency Evaluation
R	- Required for Risk Significance
D	- Required to maintain adequate balance of Defense-in-Depth in a Change Evaluation or Fire Risk Evaluation

For Fire Zones 24 and 25, a cross zoned ionization smoke detectors (4) and infra-red detectors (3) are provided which alarm in the Unit 2 Control Room.

For Fire Zone 23, cross zoned ionization smoke detectors (3) and infra-red detectors (3) are provided which alarm in the Unit 2 Control Room. No detectors are located in the corridor between quadrants 3M and 3N.

Fire Zone 117 is not provided with an automatic fire detection system.

### 3.1.5 Fixed Suppression

The table below outlines the fixed fire suppression system(s) provided in the Fire Area:

Table 3-2, Fire Area AA29 Suppression Systems								
Fire Zone	Type of System	Full (F) / Partial (P)	Required System?					
			S	L	E	R	D	
23	Manual CO2	P	N	N	Y	N	N	
24	Manual CO2	F	N	N	Y	Y	N	
25	Manual CO2	F	N	N	Y	N	N	
117	None	N/A	N/A	N/A	N/A	N/A	N/A	
Table 3-2 Legend:								
Table Field: "Required System?"								
S	- Required for Chapter 4 Separation Criteria							
L	- Required for NRC Approved Licensing Action							
E	- Required for Engineering Equivalency Evaluation							
R	- Required for Risk Significance							
D	- Required to maintain adequate balance of Defense-in-Depth in a Change Evaluation or Fire Risk Evaluation							

Fire Area AA29 is not provided with an automatic fire suppression system.

### 3.1.6 Manual Suppression / Response Strategy

For fire zones within AA29 equipped with automatic detection systems, a postulated fire will be identified by early detection using ionization type smoke detection, infra-red detection or by plant personnel using plant communication system to notify the control room. The automatic detection systems alarm in the control room. For Fire Zone 117, which is not equipped with automatic detection systems, a postulated fire will be identified by plant personnel using plant communication system to notify the control room. The Control Room operator will dispatch the fire brigade for initiation of manual fire fighting. A fire in this fire area will be contained by the construction features discussed in Section 3.1.1. Manual suppression is provided by the CNP Fire Brigade.

For Fire Zones 24 and 25, a low pressure CO2 total flooding system supplied from the 17 ton tank is provided. This system is manually actuated.

For Fire Zone 23, a low pressure CO2 total flooding system supplied from the 17 ton tank is provided. This system is manually actuated. No CO2 protection is provided in the corridor between quadrants 3M and 3N.

A water hose reel is located in Fire Zone 25. Adjacent Fire Areas AA30 and AA2, Fire Zones 26 and 85, respectively, are also provided with fire hose reels. For Fire Zone 117, a water hose reel is provided in adjacent Fire Area AA27, Fire Zone 22 with an additional hose reel provided in adjacent Fire Area AA35, Fire Zone 34A.

Fire extinguishers are provided in Fire Zones 23, 24 and 25. For Fire Zone 117, fire extinguisher are provided in adjacent Fire Area AA27, Fire Zone 22 with additional extinguishers in adjacent Fire Area AA35, Fire Zones 34 and 34A.

Floor drains are available throughout Fire Area AA29. For Fire Zone 117, the floor is trenched to channel water to the floor drains.

### 3.1.7 Ventilation

A fire in this area will be contained by the fire barriers. Smoke can be removed by portable fans and flexible ducting to other areas of the Auxiliary Building. The normal building ventilating systems in the Auxiliary Building will then exhaust the smoke via filtered monitored pathways. This fire area is listed as a non-controlled area in the Fire Pre Plans and therefore there is reasonable assurance that products of combustion will not be contaminated.

For Fire Zone 117, there are ventilation penetrations to adjacent fire areas. Access openings from Fire Area AA27 - Fire Zone 22 and Fire Area AA35 - Fire Zone 34 are also used for ventilation purposes.

For Fire Zone 23, there is a 1 1/2-hour fire damper in an interior wall of Fire Zone 23. A fire damper having a 3-hour rating is provided to adjacent Fire Area AA23 - Fire Zone 18. Fire dampers having a 1 1/2-hour rating are provided to adjacent Fire Zone 24.

For Fire Zone 24, fire dampers having a 1 1/2-hour rating are provided to adjacent Fire Zone 23 as well as Fire Area AA30 - Fire Zone 26. A fire damper having a 1 1/2-hour rating is provided to adjacent Fire Zone 25.

For Fire Zone 25, a fire damper having a 1 1/2-hour rating is provided to adjacent Fire Area AA30 - Fire Zone 26. A fire damper having a 1 1/2-hour rating is provided to adjacent Fire Zone 24.

### 3.1.8 Other Features

Fire Zone 117 is a pipe tunnel located entirely below grade. Access to Fire Zone 117 on the East Side is through a ladder opening in the floor of Fire Zone 34. Access down into the trench on the West Side is from a ladder in Fire Zone 22. The trench opens directly into Fire Zone 117 along the south wall of Fire Zone 22.

## 3.2 Fire Hazards Identification

The fire area contains both ignition sources and combustible fire hazards. The ignition sources consist of the thermocouple transmitter cabinet, the local shutdown indication panel, motor control centers and containment water level instrumentation. Combustibles consist primarily of exposed electrical cables in trays, thermo-lag and rubber/plastics.

The exterior fire hazards that are adjacent to exterior walls are the Auxiliary Transformers. However, water spray suppression systems are provided for the transformers. In addition, this Fire Area is mostly below grade and constructed of reinforced concrete. The missile barriers around each transformer also provide a measure of fire barrier protection, limiting radiant heat in the direction of the Fire Area.

The exterior wall penetrations of this Fire Area do not require a rating for protection. The ground surrounding the Fire Area protects most of the Fire Area from exterior fire hazards and the lack of surface area for direct heat impact, as well as the spatial separation between the yard equipment and fire hazards to this Fire Area is sufficient to provide protection against heat damage. The impact of a

fire in the yard on AA29 would be limited to radiant heat with no ceiling to contain the fire plume. Spatial separation, fixed suppression as well as the reinforced concrete construction of the Fire Area is sufficient to prevent an exposure to credited equipment inside the plant through unrated exterior wall penetrations of this Fire Area.

The current fire loading classification of Fire Zones 23, 25 and 117 is considered low.

The current fire loading classification of Fire Zone 24 is considered moderate.

### 3.3 NSCA Compliance Summary

Fire Area AA29 contains Red and Green Train cables, conduits, and raceways as well as safe shutdown equipment.

Compliance with the nuclear safety performance criteria is achieved using the performance-based approach in accordance with NFPA 805, Section 4.2.4.2.

Safe and stable condition of the affected Unit 2, will be accomplished using Steam Generators 1 and 4 via the Unit 2 West Motor Driven Auxiliary Feedwater Pump, Unit 2 Charging via the East Pump, Unit 2 Component Cooling Water via the East or West Pump, Essential Service Water via the East or West Pump and Process Monitoring from the Main Control Room. Power is credited to be available to the Red and Green train systems via offsite power with the Red Train EDG available as well.

The Nuclear Safety Performance Criteria compliance strategy for AA29 is documented within the NSCA Report.

#### 3.3.1 Variances

The variances identified for evaluation for this fire area are grouped as follows:

##### 3.3.1.1 VFDR No. AA29-001

2-CLI-113 and 2-CLI-114 - CST Control Room level indication is required to be operable to support AFW for decay heat removal. Decay heat removal is required to remove sufficient heat from the reactor core such that the fuel is maintained in a safe and stable condition. The CST level indicators provide Control Room indication of the initial water source for AFW. All of the Control Room level indicators may fail due to a full area fire within Fire Area AA29. 2-CLI-113 may fail due to fire induced damage cable 19867-2. 2-CLI-114 may fail due to fire induced damage of cable 8202Y-2. This condition represents a variance from deterministic requirements of NFPA 805, Section 4.2.3. This is a separation issue.

This VFDR has been evaluated and it was determined that the risk, safety margin and defense-in-depth meet the acceptance criteria of NFPA 805 Section 4.2.4 with a defense-in-depth action credited.

**3.3.1.2 VFDR No. AA29-002**

2-ILS-950 and 2-ILS-951 - RWST level indication is required to support CVCS. CVCS is required to be operable to maintain inventory, pressure and reactivity control. The RWST is the primary credit borated water source for CVCS. The level indicators may fail due to a full area fire within Fire Area AA29. 2-ILS-950 may fail due to fire induced damage of cables 9451G-2 and 9590G-2. 2-ILS-951 may fail due to fire induced damage of cable 9544R-2. This condition represents a variance from deterministic requirements of NFPA 805, Section 4.2.3. This is a separation issue.

This VFDR has been evaluated and it was determined that the risk, safety margin and defense-in-depth meet the acceptance criteria of NFPA 805 Section 4.2.4 with no further action required.

**3.3.1.3 VFDR No. AA29-003**

2-ICM-129.P and 2-IMO-128.P - RHR Boundary Isolation Valves are required closed to support RCS integrity. RCS integrity is required to control coolant level such that inventory and pressure control is maintained. 2-ICM-129.P or 2-IMO-128.P are in series and one of the valves is required to be closed to support RCS integrity. 2-ICM-129.P may fail due to fire induced damage of cable 9188PG-2. 2-IMO-128.P may fail due to fire induced damage of cable 8086PR-2. These cable failures could spuriously open the valves. This condition represents a variance from the deterministic requirements of NFPA 805, Section 4.2.3. This is a separation issue.

This VFDR has been evaluated and it was determined that the risk, safety margin and defense-in-depth meet the acceptance criteria of NFPA 805 Section 4.2.4 with no further action required.

**3.3.1.4 VFDR No. AA29-004**

2-NRV-153 - Pressurizer PORVs are required to be closed to support RCS integrity. RCS integrity is required to maintain positive control over RCS inventory and pressure. 2-NRV-153 may fail due to fire induced damage of cable 8757PG-2. Failure of this cables could spuriously open the valve. This condition represents a variance from the deterministic requirements of NFPA 805, Section 4.2.3. This is a separation issue.

This VFDR has been evaluated and it was determined that the risk, safety margin and defense-in-depth meet the acceptance criteria of NFPA 805 Section 4.2.4 with a defense-in-depth action credited.

**3.3.1.5 VFDR No. AA29-005**

2-NSO-021 and 2-NSO-022 - The RX Head Vent Valves are required to be closed to support RCS integrity. RCS integrity is required to maintain positive control over RCS inventory and pressure. 2-NSO-021 and 2-NSO-022 are in series, requiring 1 of the valves to remain closed to provide RCS integrity. 2-NSO-021 may fail due to fire induced damage of cable 9801PG-2. 2-NSO-022 may fail due to fire induced damage of cable 9807PG-2. These cable failures could spuriously open the valves. This condition represents a variance from the deterministic requirements of NFPA 805, Section 4.2.3. This is a separation issue.

This VFDR has been evaluated and it was determined that the risk, safety margin and defense-in-depth meet the acceptance criteria of NFPA 805 Section 4.2.4 with a defense-in-depth action credited.

**3.3.1.6 VFDR No. AA29-006**

2-NSO-061 and 2-NSO-062 - The Post Accident Valves are required to be closed to support RCS integrity. RCS integrity is required to maintain positive control over RCS inventory and pressure. 2-NSO-061 and 2-NSO-062 are in series, requiring 1 of the valves to remain closed to provide RCS integrity. 2-NSO-061 may fail due to fire induced damage of cable 9814PG-2. 2-NSO-062 may fail due to fire induced damage of cable 9820PG-2. These cable failures could spuriously open the valves. This condition represents a variance from the deterministic requirements of NFPA 805, Section 4.2.3. This is a separation issue.

This VFDR has been evaluated and it was determined that the risk, safety margin and defense-in-depth meet the acceptance criteria of NFPA 805 Section 4.2.4 with a defense-in-depth action credited.

**3.3.1.7 VFDR No. AA29-007**

2-QRV-20 and 2-QRV-30 - RCP Seal Water Return Isolation Valves are required to be open to support RCS integrity by maintaining the RCP seal. RCS integrity is required to maintain positive control over RCS inventory and pressure. 2-QVR-20 may fail due to fire induced damage of cable 4955-2. 2-QVR-30 may fail due to fire induced damage of cable 5654-2. These cables could cause spurious closure of these valves. This condition represents a variance from the deterministic requirements of NFPA 805, Section 4.2.3. This is a separation issue.

This VFDR has been evaluated and it was determined that the risk, safety margin and defense-in-depth meet the acceptance criteria of NFPA 805 Section 4.2.4 with a defense-in-depth action credited.

**3.3.2 Recovery Actions Credited**

For each VFDR, a Fire Risk Evaluation has been performed to assess the acceptability of risk, defense-in-depth, and safety margin. This evaluation determined whether or not recovery actions are required to ensure that one success path necessary to achieve and maintain the nuclear safety performance criteria is maintained free of fire damage by a single fire. Table 3-3 identifies the credited recovery actions for this area. Actions retained for DID are identified as “DID Actions” within Table 3-3. Additional information for DID actions is contained within Section 3.8 of this report. Note that, for completeness, all VFDRs are contained within Table 3-3, even if the Fire Risk Evaluation has determined that a recovery action is not required. In those instances where a recovery action has been determined to not be required, the word “None” is provided in the



“Action” column in the table.

<b>Table 3-3, Recovery Actions Credited</b>		
<b>VFDR</b>	<b>Component</b>	<b>Action</b>
AA29-001	2-CLI-113 2-CLI-114	DID 2-CLI-113-LOCAL (Locally monitor CST level)
AA29-002	2-ILS-950 2-CLI-951	None
AA29-003	2-ICM-129.P 2-IMO-128.P	None
AA29-004	2-NRV-153	DID ACTION(S) 2-NRV-153-CLOSE (Remove fuses in MCR to fail closed PORV 2-NRV-153)
AA29-005	2-NSO-021	DID ACTION(S) 2-NSO-021-CLOSE (Remove fuses in MCR to fail closed AOV 2-NSO-021)
AA29-006	2-NSO-061	DID ACTION(S) 2-NSO-061-CLOSE (Remove fuses in MCR to fail closed AOV 2-NSO-061)
AA29-007	2-QRV-20 2-QRV-30	DID ACTION(S) 2-QRV-20-OPEN 2-QRV-30-OPEN (Remove fuses in MCR to fail open AOV 2-QRV-20 and AOV 2-QRV-30)

### 3.4 Non-Power Operational Modes Compliance Summary

A review of CNP for the potential effects of a fire in this Fire Area while in non-power modes of operation (NPO) was conducted. This review was conducted using the guidance provided in NEI 04-02 and FAQ 07-0040, “Non-Power Operations Clarifications”.

The review determined that there are potential failures that affect certain Key Safety Functions (KSF) as a result of the fire in this area, and the fire could result in the loss of one or more KSF paths. Compensatory measures are required during high risk evolution periods to provide reasonable assurance a fire will not adversely affect key safety functions and the NFPA 805 performance goal for NPO is therefore satisfied. The results of the NPO analysis are contained within Technical Evaluation R1900-005-001, Non-Power Operation Modes Transition Review Report.

### 3.5 Radioactive Release Compliance Summary

The NFPA 805 radiological release goal is to provide reasonable assurance that a fire will not result in a radiological release that adversely affects the public, plant personnel or the environment. The NFPA 805 requirement is to ensure a radiation release to any unrestricted area due to the direct effects of fire suppression activities (but not involving fuel damage) shall be as low as reasonably achievable and shall not exceed applicable plant Technical Specification limits.

AA29 is located outside the Radiological Controlled Area (RCA) and is not a storage location for contaminated materials, therefore there is reasonable assurance a fire in this area will not result in radiation release. The review of this fire area, with respect to radioactive release, is documented in the NFPPM.

### 3.6 Probabilistic Risk Assessment-Summary of Results

A Fire PRA (FPRA) quantification of Fire Area AA29 was performed and is documented in PRA-NB-FIRE-FQ, Fire PRA Model Quantification Notebook. The fire risk quantification for Fire Area AA29 is analyzed assuming whole room burnup. PRA-NB-FIRE-FQ includes a summary of all potentially risk-significant fire scenarios (i.e., CDF > 1.0E-7 or LERF > 1.0E-8). Bounding CDF / LERF per calendar year values are reported that are based on the risk values documented in PRA-NB-FIRE-FSS, Fire PRA Fire Scenario Selection.

### 3.7 Risk-Informed, Performance-Based Evaluations

Fire Risk Evaluations (FREs) have been performed to ensure that variances from the NFPA 805 deterministic requirements are acceptable. The evaluation process consists of an integrated assessment of the acceptability of risk, defense-in-depth, and safety margins.

#### 3.7.1 Transition Risk-Informed, Performance-Based Evaluations

The 'changes' associated with NFPA 805 transition were those variances from the deterministic requirements of NFPA 805 or with the existing fire protection licensing basis that were brought into compliance with the NFPA 805 performance based approach. The change identified for evaluation for Fire Area AA29 is as follows:

- Separation Issues

The Fire Risk Evaluation has determined that the change is acceptable based upon:

- The measured change in CDF and LERF.
- Adequate defense-in-depth and safety margins being maintained.

Refer to Attachment 2 for a summary of results associated with the Fire Risk Evaluations.

### 3.8 Defense-in-Depth

A comprehensive risk-informed, performance-based analysis includes consideration of defense-in-depth (DID) as part of an integrated evaluation of risk considerations. In general, defense-in-depth involves consideration of the extent to which fire protection systems and features are provided within the three echelons of fire-protection:

- Preventing fires from starting,
- Rapidly detecting fires and controlling and extinguishing promptly those fires that do occur, thereby limiting fire damage,
- Providing an adequate level of fire protection for structures, systems, and components important to safety, so that a fire that is not promptly extinguished will not prevent the nuclear safety performance criteria from being met.

Each VFDR was evaluated for DID. The following recovery actions have been retained for DID.

VFDR No. AA29-001: 2-CLI-113 and 2-CLI-114 - CST Control Room level indication is required to be operable to support AFW for decay heat removal. Decay heat removal is required to remove sufficient heat from the reactor core such that the fuel is maintained in a safe and stable condition. The CST level indicators provide Control Room indication of the initial water source for AFW. All of the Control Room CST level indicators may fail due to a full area fire within Fire Area AA29. Loss of CST indication can be mitigated by locally monitoring the CST level. This recovery action is being retained for DID to ensure CST level indication is maintained.

VFDR No. AA29-004: 2-NRV-153 - Pressurizer PORVs are required to be closed to support RCS integrity. RCS integrity is required to maintain positive control over RCS inventory and pressure. The spurious opening can be mitigated by de-energizing the valve to fail it closed. This recovery action is being retained for DID to ensure RCS pressure and inventory control is maintained.

VFDR No. AA29-005: 2-NSO-021 and 2-NSO-022 - The RX Head Vent Valves are required to be closed to support RCS integrity. RCS integrity is required to maintain positive control over RCS inventory and pressure. The spurious opening can be mitigated by de-energizing the valve to fail it closed. This recovery action is being retained for DID to ensure RCS pressure and inventory control is maintained.

VFDR No. AA29-006: 2-NSO-061 and 2-NSO-062 - The Post Accident Valves are required to be closed to support RCS integrity. RCS integrity is required to maintain positive control over RCS inventory and pressure. 2-NSO-061 and 2-NSO-062 are in series, requiring 1 of the valves to remain closed to provide RCS integrity. The spurious opening can be mitigated by de-energizing the valve to fail it closed. This recovery action is being retained for DID to ensure RCS pressure and inventory control is maintained.

VFDR No. AA29-007: 2-QRV-20 and 2-QRV-30 - RCP Seal Water Return Isolation Valves are required to be open to support RCS integrity by maintaining the RCP seal. RCS integrity is required to maintain positive control over RCS inventory and pressure. The spurious closing can be mitigated by de-energizing the valve to fail it open. This recovery action is being retained for DID to ensure RCS integrity is maintained.

Based on the assessment in support of the Fire Risk Evaluation, defense-in-depth is maintained for fire area AA29. Refer to Attachment 2 for details associated with the Fire Risk Evaluation.

### 3.9 Monitoring Program Input

A Monitoring Program will be developed in accordance with FAQ 10-0059, Rev. 1. Methods to monitor availability, reliability, and performance of fire protection program structures, systems, and components (SSCs), as well as programmatic elements will be provided. Additionally, effectiveness measures are established to review program related performance and trends. For AA29 the following systems and features are candidates for inclusion in the CNP Fire Protection Monitoring Program:

- Fire Area boundary barriers discussed in Section 3.1
- Fire Detection System (Ionization)
- Manual Fire Suppression System (CO2)

### 4.0 CONCLUSION

The nuclear safety and radioactive release performance criteria of NFPA 805 are met for a fire in Fire Area AA29. This Fire Risk Evaluation for Fire Area AA29 has demonstrated that

- The change in core damage frequency (delta CDF) is acceptable, and
- The change in large early release frequency (delta LERF) is acceptable, and
- Defense-in-depth and safety margins are maintained.

This is confirmation that a success path effectively remains free of fire damage and that the performance-based approach is acceptable per Section 4.2.4.2 of NFPA 805.

### 5.0 REFERENCES

- 5.1 Calculation PRA-FIRE-NB-CRE, Fire PRA Cumulative Risk Evaluations
- 5.2 CNP Fire Pre-Plans, Volumes I, II, and III, Revisions 17, 14, and 18 respectively
- 5.3 Fire Hazards Analysis
- 5.4 NFPA 805, Performance-Based Standard for Fire Protection for Light Water Reactor Electric Generating Plants
- 5.5 NFPPM, NFPA 805 Fire Protection Program Manual (NFPPM)
- 5.6 Nuclear Energy Institute (NEI) 04-02, Guidance for Implementing a Risk-Informed, Performance-Based Fire Protection Program under 10 CFR 50.48(c), Rev. 2
- 5.7 Nuclear Safety Capability Assessment Report
- 5.8 PRA-NB-FIRE-FQ, Fire PRA Model Quantification Notebook
- 5.9 PRA-NB-FIRE-FSS, Fire PRA Fire Scenario Selection
- 5.10 Regulatory Guide 1.205, Risk-Informed, Performance-Based Fire Protection for Existing Light-Water Nuclear Power Plants, Rev. Revision 1
- 5.11 Technical Evaluation R1900-005-001, Non-Power Operation Modes Transition Review

**Fire Area AA29 – Attachment 1 - Table B-3 - Fire Area Transition**

<u>Unit</u>	<u>Fire Area</u>	<u>Description</u>
2	AA29	Unit 2 Quadrant 3M & 3S Cable Tunnel (El. 596 ft.)

<u>Fire Zone</u>	<u>Description</u>
23	Quadrant 3N Cable Tunnel - El. 596 ft. 3-1/2 in. - Unit 2
24	Quadrant 3M Cable Tunnel - El. 596 ft. 3-1/2 in. - Unit 2
25	Quadrant 3S Cable Tunnel - El. 596 ft. 3-1/2 in. - Unit 2
117	RW, CS, PW Tank Area Pipe Tunnel - Unit 2 - El. 593 ft. 0 in.

**Regulatory Basis**

4.2.4.2 - Performance-Based Approach - Fire Risk Evaluation with simplifying deterministic assumptions

<b>Performance Goal</b>	<b>Method of Accomplishment</b>	<b>Comments</b>
Reactivity Control	Unit 2 -Trip the reactor from the Control Room. Borate using Unit 2 East Charging Pump supplied from the RWST. Use source range monitoring for indication for Unit 2.	None
Inventory and Pressure Control	Unit 2 - Control inventory using Unit 2 East Charging Pump. Control pressure using Unit 2 Pressurizer Safety Relief Valves.	VFDRs identified for RWST level indication and RCS integrity for the Pressurizer, RX Head, and RCP Seal.
Decay Heat Removal	Unit 2 - Feed SGs 1 & 4 with Unit 2 West MDAFW Pump. The DHR function also requires MS isolation with a steam release path through the Safety Relief Valves.	VFDR identified for CST level indication.
Process Monitoring	Unit 2 Process Monitoring - Use Unit 2 process monitoring in the Control Room for the following: Pressurizer level, RCS pressure and temperature, and S/G level and Pressure. Unit 2 Source Range Monitoring - Use Unit 2 source range monitoring in the Control Room.	None
Vital Auxiliaries	Unit 2 Electrical - Control Unit 2 Red (AB) Train Electrical Distribution with Unit 2 Red (AB) Train Offsite Power or Unit 2 Red (AB) DG. Control Unit 2 Green (CD) Train Electrical Distribution with Unit 2 Green (CD) Train Offsite Power. Unit 2 ESW - Operate Unit 2 East or West ESW. Unit 2 CCW - Operate Unit 2 East or West CCW.	None

**Fire Area AA29 – Attachment 1 - Table B-3 - Fire Area Transition**

<u>Unit</u>	<u>Fire Area</u>	<u>Description</u>
2	AA29	Unit 2 Quadrant 3M & 3S Cable Tunnel (El. 596 ft.)
Unit 2 HVAC - Operate Unit 2 Control Room HVAC. Operate Unit 2 Auxiliary Building HVAC. Operate Unit 2 Red (AB) DG HVAC. Operate Unit 2 Switchgear HVAC. Operate Unit 2 West MDAFW Room HVAC system. Operate Unit 2 East and West ESW Pump Room HVAC systems.		

**Reference Documents**

Genesis Solution Suite, EDISON / SAFE-PB, DC Cook V 3.4.0

Nuclear Safety Capability Assessment Report

**Licensing Actions**

None

**Existing Engineering Equivalency Evaluations (EEEE)****EEEE Title Engineering Equivalency Evaluation 9-24 - Fire Zone 117 (Fire Area AA29) Boundary Evaluation**

**Summary** The purpose of this engineering equivalency evaluation is to document the acceptability of two manway openings connecting Fire Zone 117 (Fire Area AA29) with adjacent fire areas.

Reasonable assurance is provided that the two manway openings connecting Fire Zone 117 with Fire Zone 22 and Fire Zone 34 do not impair safe shutdown capability. This engineering equivalency evaluation does not adversely impact other engineering equivalency evaluations.

The two manway openings were evaluated and found to be acceptable based on the fire hazards and construction features within the evaluated areas.

**Fire Area AA29 – Attachment 1 - Table B-3 - Fire Area Transition**

<b><u>Unit</u></b>	<b><u>Fire Area</u></b>	<b><u>Description</u></b>
2	AA29	Unit 2 Quadrant 3M & 3S Cable Tunnel (El. 596 ft.)

<b><u>EEEE Title</u></b>	<b>Engineering Equivalency Evaluation 11-9 - Turbine, Auxiliary and Containment Buildings Boundary Evaluation</b>
<b><u>Summary</u></b>	<p>The purpose of this engineering equivalency evaluation is to describe in general, the approach and existence of evaluations performed to determine and reconcile fire area boundaries having components or designs with less than a 3-hr fire rating on preventing the spread of fire. This engineering equivalency evaluation also specifically evaluates the impact of unrated door assemblies on the spread of fire.</p> <p>Reasonable assurance is provided that the fire area boundaries having components or design less than a 3-hr fire rating will not increase the spread of fire or impair the safe shutdown capabilities of Units 1 or 2. In addition, this engineering equivalency evaluation does not adversely impact on other engineering equivalency evaluations or exemption requests.</p> <p>This evaluation supports additional evaluations credited in this fire area.</p>
<b><u>EEEE Title</u></b>	<b>Engineering Equivalency Evaluation 11-14 - Cable Spreading Room Construction Boundary Evaluation (Fire Areas AA3, AA7, AA8, AA9, AA10, AA29, AA30, AA31, AA34, AA35, AA36/42, AA37, AA38, AA48, AA50, AA51 and AA52)</b>
<b><u>Summary</u></b>	<p>The purpose of this engineering equivalency evaluation is to document the acceptability of the construction features of the cable spreading rooms which have a fire resistance rating of less than 3 hours for their impact on the spread. In particular, fire dampers having a 1 1/2-hr fire rating were analyzed by this evaluation. Other unrated construction features have been previously analyzed under separate engineering equivalency evaluations. The applicable fire areas include: AA3, AA7, AA8, AA9, AA10, AA29, AA30, AA31, AA34, AA35, AA36/42, AA37, AA38, AA48, AA50, AA51 and AA52.</p> <p>Reasonable assurance is provided that the construction features of the cable spreading rooms which have a fire resistance rating of less than 3 hours will prevent the spread of fire and not impair the safe shutdown capabilities of Unit 1 and Unit 2. In addition, this engineering equivalency evaluation does not adversely impact other engineering equivalency evaluations.</p> <p>The construction features of the cable spreading room were evaluated and found to be acceptable based on the fire hazards, fire protection systems and construction features within the areas.</p>

**Fire Area AA29 – Attachment 1 - Table B-3 - Fire Area Transition**

<u>Unit</u>	<u>Fire Area</u>	<u>Description</u>
2	AA29	Unit 2 Quadrant 3M & 3S Cable Tunnel (El. 596 ft.)
<b><u>EEEE Title</u></b>	<b>Engineering Equivalency Evaluation 11-46 - Seismic Gaps between the Containment and Auxiliary Buildings Boundary Evaluation (Fire Areas AA2, AA3, AA7, AA8, AA9, AA10, AA11, AA27, AA29, AA30, AA31, AA34, AA35, AA37 and AA38)</b>	
<b><u>Summary</u></b>	<p>A seismic gap exists around the Containment Building of each unit that provides an opening of approximately 6 in. between the Containment Building and the walls, ceilings and floors of the structures immediately adjacent to containment. These Fire Areas include AA2, AA3, AA7, AA8, AA9, AA10, AA11, AA27, AA29, AA30, AA31, AA34, AA35, AA37 and AA38. This engineering equivalency evaluation has been performed to document the acceptability of these seismic gaps in the fire boundaries.</p> <p>This seismic gap evaluation shows the safe shutdown capability for CNP Unit 1 and Unit 2 has not been compromised as a result of seismic gaps. The analysis performed and the results presented in the tables indicate, on a system basis, the capability to safely shut down both units when considering fire damage to safe shutdown components and circuits contained in the seismic gap evaluation areas. The method of analysis is conservative when considering the fire hazards involved in the vicinity of the seismic gaps. That is, it is not anticipated that the evaluated areas would be affected to the extent that fire would propagate through the seismic gaps and cause damage throughout the evaluated area. This engineering equivalency evaluation has no impact on the exemption requests contained in other engineering equivalency evaluations.</p> <p>The seismic gaps were evaluated and found to be acceptable based on the fire hazards, fire protection systems and construction features within the evaluated areas.</p>	
<b><u>EEEE Title</u></b>	<b>Engineering Equivalency Evaluation 11-48 - Unit 1 and Unit 2 Diesel Generator AB/CD Pipe Penetration Seals - Fire Zones 11 (Fire Area AA10), 15 (Fire Area AA14), 16 (Fire Area AA15), 18 (Fire Area AA23), 19 (Fire Area AA24) and 23 (Fire Area AA29)</b>	
<b><u>Summary</u></b>	<p>The purpose of this engineering equivalency evaluation is to document the acceptability of fire-rated penetration seals W9142, W9143, W9171, W9172, W9192, W9193, W9959 and W9960. The seals are physically located in the east fire-rated walls of the DG Rooms floor elevation 587 ft., Fire Zones 15, 16, 18 and 19.</p> <p>The existing configuration for the subject fire-rated penetration is suitable to perform their design function, to provide an acceptable level of fire protection, therefore preventing fire propagation between to fire zones. As such, there is no impact on the stations ability to achieve and maintain safe shutdown.</p> <p>The fire rated penetration seals were evaluated and found to be acceptable based on the fire hazards and fire protection systems within the evaluated areas.</p>	



**Fire Area AA29 – Attachment 1 - Table B-3 - Fire Area Transition**

<u>Unit</u>	<u>Fire Area</u>	<u>Description</u>
2	AA29	Unit 2 Quadrant 3M & 3S Cable Tunnel (El. 596 ft.)

<b><u>EEEE Title</u></b>	<b>Engineering Equivalency Evaluation 12-19 - CO2 Fire Suppression System Concentrations (Fire Areas AA7, AA8, AA9, AA10, AA29, AA30, AA31, AA37, AA38, AA39, AA40, AA41, AA43, AA44, AA45, AA48, AA49, AA50, AA51, AA52 and AA53)</b>
<b><u>Summary</u></b>	<p>The purpose of this engineering equivalency evaluation is to document the acceptability of the CO2 fire suppression systems in fire zones containing concentrations of cable insulation and the potential for deep-seated fires. This engineering equivalency evaluation determines the CO2 system's impact on the spread of fire and previous engineering equivalency evaluations and exemption requests. Although there are other fire zones that use CO2 for fire suppression such as the DG Rooms, they are installed to suppress surface-type, combustible liquid fires and are not included in this analysis, because they do not contain significant concentrations of cable insulation capable of producing deep-seated fires.</p> <p>All of the CO2 systems included in this engineering equivalency evaluation are capable of performing their intended function, containing the fire until the Fire Brigade arrives, preventing fire spread to adjacent fire zones, and ensuring that safe shutdown of CNP can be achieved and maintained.</p> <p>The existing suppression systems were evaluated and found to be acceptable based on the fire hazards and fire protection systems within the evaluated areas.</p>

**Fire Suppression Effects on Nuclear Safety Performance Criteria**

The CNP fire brigade is trained to discharge water in a judicious manner and instructed to direct hose streams and portable extinguishers at the base of the fire to limit the amount of overspray beyond the immediate fire zone. For this reason, fire brigade activities are not expected to fail components not already considered damaged. It has been concluded that water impingement on cables is not a concern. Electrical cabinets are provided with a seal at the conduit interface. Possible impacts to surrounding equipment due to manual fire fighting activities is bounded by the analysis approach of postulating whole room damage. The drainage features of the fire area mitigate the potential for flooding damage due to fire suppression, such that the standing water would not affect credited equipment.

In the event of discharge, any damage caused by the CO2 system to other equipment operating within the fire area which is not immediately involved in the originating fire is bounded by the analysis approach of postulating whole room damage. Since it is shown that suppression effects will not impact the nuclear safety performance criteria, the fire area configuration is deemed acceptable.

**References:**

Technical Evaluation 12.1, "Fire Suppression Effects Study"

Technical Evaluation 12.1, "Supplemental Information to Fire Suppression Effects Study – Supplement 1"

**Fire Area AA29 – Attachment 1 - Table B-3 - Fire Area Transition**

<u>Unit</u>	<u>Fire Area</u>	<u>Description</u>
2	AA29	Unit 2 Quadrant 3M & 3S Cable Tunnel (El. 596 ft.)

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**Fire Area Comments**

None

## Fire Area AA29 – Attachment 2 - Fire Risk Evaluation Results Summary

### A2.1 Introduction

The ‘changes’ associated with NFPA 805 transition were those variances from the deterministic requirements of NFPA 805. The changes identified for evaluation for fire area AA29 are grouped as follows:

- Separation Issues

This attachment is a summary of the Fire Risk Evaluation for the fire area. The complete results and methodology are contained in the Cumulative Fire Risk Evaluation, PRA-FIRE-NB-CRE. (FPCE 2017-0009)

### A2.2 Inputs/Assumptions

1. Assumptions from the Fire PRA apply to this calculation.
2. Detailed fire modeling was not performed for Fire Area AA29. A single whole room burnout scenario was assumed.

### A2.3 Fire Modeling Methodology

Detailed fire modeling was not performed for Fire Area AA29. This area was modeled considering whole room burnout.

### A2.4 Scenario Descriptions and Model Results

A single whole room burnout scenario was modeled for Fire Area AA29. All targets within the fire area were assumed damaged.

#### A2.4.1 Ignition Sources

The fixed ignition sources in Fire Area AA29 consist of Motor Control Centers, local S/D indication, lower containment water level instrumentation, core thermocouple monitoring system cabinet b and various ventilation fans. Additional detail regarding the ignition sources in this area is available in the Fire PRA Report. All fire scenarios, whether resulting from credited fixed or transient ignition sources, are assumed to damage all targets in the fire area.

#### A2.4.2 Scenario Results

A delta risk calculation has been performed to quantify the risk associated with the VFDRs in the fire area.

### A2.5 Fire Risk Evaluation Results

PRA-FIRE-NB-CRE documents scenarios and corresponding impacted VFDRs that were evaluated for delta risk during the transition to NFPA 805 and also all changes to the Fire Protection Program that are currently incorporated into the Fire PRA model. The acceptability of the Cumulative Fire Risk Evaluations was based on calculated delta risk meeting the thresholds of NEI 04-02, RG 1.205 and RG 1.174. (FPCE 2017-0009)

## Fire Area AA29 – Attachment 2 - Fire Risk Evaluation Results Summary

### A-2.6 Impact of VFDR on Defense-in-Depth

Defense-in-Depth has been evaluated for this fire area. The impacts of this evaluation are summarized in the table below:

Defense-in-Depth Impact Review for AA29			
Method of Providing DID	Required to Support Deterministic Analysis or Fire PRA?	Changes or Improvements Necessary for DID?	Basis/Justification
<b>Echelon 1: Prevent fires from starting</b>			
Combustible Control is implemented in accordance with Procedure PMP-2270-CCM-001, Control of Combustible Materials.	Yes	No	• This element is adequate based on no perceived weakness of, or over-reliance on, another echelon of defense-in-depth.
Hot Work Control is implemented in accordance with Procedure PMP-2270-WBG-001, Welding, Burning and Grinding Activities.	Yes	No	
<b>Echelon 2: Rapidly detect, control and extinguish promptly those fires that do occur thereby limiting fire damage</b>			
Fire Detection System	Yes	No	• Although a recovery action is required to maintain defense-in-depth, this action is not considered a time sensitive action, further, since fire fighting activities would not be challenging, no changes or improvements to Echelon 2 attributes are necessary to maintain defense-in-depth.
Fixed Fire Suppression	Yes	No	
Portable Fire Extinguishers	Yes	No	
Hose stations and hydrants	Yes	No	
Pre-Fire Plan	Yes	No	
<b>Echelon 3: Provide adequate level of fire protection for systems and structures so that a fire will not prevent essential safety functions from being performed</b>			
Walls, floors ceilings and structural elements are rated or have been evaluated as adequate for the hazard.	Yes	No	• Although VFDR AA29-001 is not considered a significant contribution to core damage frequency, the variance is considered important enough to the NSCA to retain as a recovery action to ensure that defense-in-depth is maintained.
Penetrations in the fire area barrier are rated or have been evaluated as adequate for the hazard.	Yes	No	
Supplemental barriers (e.g., ERFBS, cable tray covers, etc.)	No	No	• VFDRs AA29-002 and AA29-003 are not affected in a potentially high risk scenario and would provide negligible risk improvement, therefore implementing additional DID Echelon 3 attributes for these VFDRs is not required.
Guidance provided to operations personnel detailing the required success path(s) including recovery actions to achieve nuclear safety performance criteria.	No	Yes	
			• Defense in Depth actions were credited to remove fuses or open breakers in the Control Room to prevent spurious equipment operation due to internal shorts.

## Fire Area AA29 – Attachment 2 - Fire Risk Evaluation Results Summary

### A-2.7 Safety Margin Considerations

In accordance with NEI 04-02, the maintenance of adequate Safety Margin is assessed by the consideration categories of analyses utilized by this Fire Risk Evaluation.

Safety margins are considered to be maintained if:

- Codes and Standards or their alternatives accepted for use by the NRC are met.

AND

- Safety analyses acceptance criteria in the licensing basis (e.g., FSAR, supporting analyses) are met, or provides sufficient margin to account for analysis and data uncertainty.

The following summarizes the bases for ensuring the maintenance of safety margins:

- The risk-informed, performance based processes utilized are based upon NFPA 805, 2001 edition, endorsed by the NRC in 10 CFR 50.48(c).
- The Fire Risk Evaluation process is in accordance with NEI 04-02, Revision 2, which is endorsed by the NRC in Regulatory Guide 1.205, Revision 1.
- The Fire PRA is developed in accordance with NUREG/CR-6850, which was developed jointly between the NRC and EPRI.
- The Fire PRA has undergone an industry peer review, in order to ensure the Fire PRA meets the appropriate quality standards of ASME/ANS RA-Sa-2009, "Standard for Level 1/Large Early Release Frequency Probabilistic Risk Assessment for Nuclear Power Plant Applications," Dated February 2, 2009
- The "bounding risk assessment" is used during transition (NEI 04-02, Section 5.3.4.2). This approach conservatively assumes that target set damage occurs for postulated fire events which resulted in whole room burn up, and therefore, MEFS/LFS is not analyzed separately from the Fire PRA results.
- The CNP internal events PRA model received two formal industry peer reviews conducted in accordance with applicable NEI guidelines. The initial peer review was performed in 2001, while a subsequent focused scope (i.e., limited scope) peer review was conducted in 2009. The initial, full-scope WOG peer review covered all aspects of the CNP PRA model and the administrative processes used to maintain and update the model. The CNP PRA model has been revised to address all significant issues (i.e., Category A and B Facts & Observations) identified during the initial peer review. None of the findings from the focused-scope peer review were judged to reach the significance level of a Category A or B Fact & Observation; as a result, no changes to the PRA model have yet been made to include resolutions for these latter issues.
- Fire protection systems and features determined to be required by NFPA 805 Chapter 4 have been confirmed to meet the requirements of NFPA 805 Chapter 3 and their associated referenced codes and listings, or provided with acceptable alternatives using processes accepted for use by the NRC (i.e., FAQ 06-0008, FAQ 06-0004, 07-0033).
- Fire modeling has not been performed in support of the change evaluations and results are therefore, based on whole area burn up. As such, the results are considered very conservative.
- In accordance with the requirements of 10 CFR 50.48(c)(2)(iii), the Fire PRA results, including cutsets for

## **Fire Area AA29 – Attachment 2 - Fire Risk Evaluation Results Summary**

the scenarios of concern, have been reviewed and it was verified that the results presented above do not rely solely on feed and bleed as the fire-protected safe shutdown path for maintaining reactor coolant inventory, pressure control, and decay heat removal capability for this fire area.

### **A-2.8 Transition Risk Evaluation Conclusions**

The transition change evaluation determined that these changes:

- Are acceptable based upon the measured change in CDF and LERF
- Maintained adequate defense-in-depth and safety margins

The results of this evaluation meet the requirements of NFPA 805 Risk Evaluation; therefore, the use of the performance based analysis approach is acceptable.

D. C. Cook Nuclear Plant  
Fire Safety Analysis

Fire Area: AA30

Unit 2 Quadrant 4 Cable Tunnel (El. 596 ft.)

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Attachments

Fire Area AA30 – Attachment 1 - Table B-3 - Fire Area Transition

Fire Area AA30 – Attachment 2 - Fire Risk Evaluation Results Summary

## 1.0 PURPOSE

This report documents the Fire Safety Analysis (FSA) for Cook Nuclear Plant (CNP) Fire Area AA30, Unit 2 Quadrant 4 Cable Tunnel (El. 596 ft.) which comprises fire zone(s) 26. The purpose of this analysis is to demonstrate the achievement of the nuclear safety and radioactive release performance criteria of NFPA 805 as required by 10 CFR 50.48(c). The Fire Safety Analysis is a key part of compliance with Section 2.7.1.2 Fire Protection Program Design Basis Document of NFPA 805. This analysis also documents results of risk-informed, performance-based Fire Risk Evaluations (FREs). These evaluations are associated with Variances from Deterministic Requirements (VFDRs) of NFPA 805 Chapter 4.

## 2.0 ANALYSIS METHODOLOGY

The FSA is the design basis document as described in NFPA 805 Section 2.7.1.2. The following steps are performed to develop the FSA on a fire area basis:

- Identify significant fire hazards in the fire area. This is based on NFPA 805 approach to analyze the plant from an ignition source and fuel package perspective.
- Summarize Nuclear Safety Capability Analysis (NSCA) compliance strategies. This is the result of the NEI 04-02 B-3 Table review of the Safe Shutdown Analysis.
- Summarize Non-Power Operations Modes compliance strategies.
- Summarize Radioactive Release compliance strategies. The transition review process required per NEI 04-02 is used to develop these results.
- Provide Fire Probabilistic Risk Assessment summary of results. This is based on the results from the plant Fire PRA.
- Perform risk informed, performance based evaluations if needed for the performance based approach.
- Summarize Defense-in-Depth strategy for each fire area.
- Determine key analysis assumptions which are candidates to be included in the NFPA 805 monitoring program.
- Provide conclusions relative to NFPA 805 compliance.



## **3.0 ANALYSIS**

### **3.1 Classical Fire Protection**

#### **3.1.1 Construction**

Walls, floors and ceilings to adjacent fire areas are reinforced concrete in excess of a 3-hour rating.

A fire area boundary evaluation was performed for a damper and penetration seal in this area which has a fire resistance rating of less than 3 hours.

Applicable Engineering Equivalency Evaluations are documented in Attachment 1.

#### **3.1.2 Doors and Access Openings**

Fire doors having a 3-hour rating are provided to adjacent Fire Area AA29 and AA31 - Fire Zone 25 and 27, respectively.

#### **3.1.3 Penetrations**

Note: Statements regarding fire resistance rating of penetration seals are not applicable to seals in barriers to Analysis Area YD.

Penetrations in fire barriers between this fire zone and adjacent fire areas are provided with fire seals except as noted below.

A fire area boundary evaluation was performed for the 8-inch thick unrated silicone foam fire seals installed between this fire zone and Fire Area AA38 - Fire Zone 39.

The seismic gap is provided with a glass fiber reinforced silicone sheeting. A seismic gap exemption was granted for Fire Zone 26 interface with Fire Areas AA29, AA31 and AA35, - Fire Zones 24, 27 and 34A, respectively.

### 3.1.4 Detection

The table below outlines the fire detection system(s) provided in the Fire Area:

Table 3-1, Fire Area AA30 Detection Systems								
Fire Zone	Type of System	Local (L) / Remote (R)	Detection Actuates Suppression?	Required System?				
				S	L	E	R	D
26	Infrared	L/R	N	N	N	Y	Y	N
26	Ionization	L/R	N	N	N	Y	Y	N

**Table 3-1 Legend:**

Table Field: "Required System?"	
S	- Required for Chapter 4 Separation Criteria
L	- Required for NRC Approved Licensing Action
E	- Required for Engineering Equivalency Evaluation
R	- Required for Risk Significance
D	- Required to maintain adequate balance of Defense-in-Depth in a Change Evaluation or Fire Risk Evaluation

Cross zoned ionization smoke detectors (6) and infra-red detectors (5) are provided which alarm in the Unit 2 Control Room. No detection is provided in the two most eastern cubicles.

### 3.1.5 Fixed Suppression

The table below outlines the fixed fire suppression system(s) provided in the Fire Area:

Table 3-2, Fire Area AA30 Suppression Systems							
Fire Zone	Type of System	Full (F) / Partial (P)	Required System?				
			S	L	E	R	D
26	Manual CO2	P	N	N	Y	N	N
Table 3-2 Legend:							
Table Field: "Required System?"							
S	- Required for Chapter 4 Separation Criteria						
L	- Required for NRC Approved Licensing Action						
E	- Required for Engineering Equivalency Evaluation						
R	- Required for Risk Significance						
D	- Required to maintain adequate balance of Defense-in-Depth in a Change Evaluation or Fire Risk Evaluation						

Fire Area AA30 is not provided with automatic fire suppression.

### 3.1.6 Manual Suppression / Response Strategy

A postulated fire will be identified by early detection using ionization type smoke detection, the infra-red detection or by plant personnel using plant communication system to notify the control room. The automatic detection systems alarm in the control room. The Control Room operator will dispatch the fire brigade for initiation of manual fire fighting. A fire in this fire area will be contained by the construction features discussed in Section 3.1.1. Manual suppression is provided

by the CNP Fire Brigade. A low pressure CO2 total flooding system supplied from the 17 ton tank is provided. This system is manually actuated. Operation of this system discharges CO2 into Fire Area AA30. No CO2 suppression is provided in the two cubicles.

Fire extinguishers are provided in Fire Area AA30.

Water hose reels are provided in Fire Area AA30 with an additional hose reel located in adjacent Fire Area AA29, Fire Zone 25.

Floor drains are available in Fire Area AA30.

### 3.1.7 Ventilation

A fire in this area will be contained by the fire barriers. Smoke can be removed by portable fans and flexible ducting to other parts of the Auxiliary Building and outdoors if not contaminated. Contaminated smoke can be removed by portable fans and flexible ducting to other areas of the Auxiliary Building per the Fire Pre-Plans. The normal building ventilating systems in the Auxiliary Building will then exhaust the smoke via filtered monitored pathways. This fire area is listed as a non-controlled area in the Fire Pre Plans therefore there is reasonable assurance that products of combustion will not be contaminated.

There is a 1 1/2-hour fire damper on an interior wall in Fire Zone 26. Fire dampers having a 1 1/2-hour rating are provided to adjacent Fire Area AA29 - Fire Zones 24 and 25.

Fire dampers having a 3-hour rating are provided to adjacent Fire Areas AA31 - Fire Zones 27, and Fire Area AA35 - Fire Zone 34. The fire dampers to Fire Zone 34 are installed beneath the grated opening in the ceiling.

### 3.1.8 Other Features

No other fire protection features provided for Fire Area AA30.

## 3.2 Fire Hazards Identification

The fire area contains both ignition sources and combustible fire hazards. The ignition sources consist of motor control centers and ventilation fans. Combustibles consist primarily of cellulose and rubber/plastics.

The exterior fire hazards that are adjacent to exterior walls are the Auxiliary Transformers. However, water spray suppression systems are provided for the transformers. In addition, this Fire Area is mostly below grade and constructed of reinforced concrete. The missile barriers around each transformer also provide a measure of fire barrier protection, limiting radiant heat in the direction of the Fire Area.

The exterior wall penetrations of this Fire Area do not require a rating for protection. The ground surrounding the Fire Area protects most of the Fire Area from exterior fire hazards and the lack of surface area for direct heat impact, as well as the spatial separation between the yard equipment and fire hazards to this Fire Area is sufficient to provide protection against heat damage. The impact of a fire in the yard on AA30 would be limited to radiant heat with no ceiling to contain the fire plume. Spatial separation, fixed suppression as well as the reinforced concrete construction of the Fire Area is sufficient to prevent an exposure to credited equipment inside the plant through unrated exterior wall penetrations of this Fire Area.

The current fire loading classification is considered low.

### 3.3 NSCA Compliance Summary

Fire Area AA30 contains Red and Green Train cables, conduits, and raceways as well as safe shutdown equipment.

Compliance with the nuclear safety performance criteria is achieved using the performance-based approach in accordance with NFPA 805, Section 4.2.4.2.

Safe and stable condition of the affected Unit 2, will be accomplished using Steam Generators 2 and 3 with the Unit 2 East Motor Driven Auxiliary Feedwater Pump, Unit 2 Charging via the East Pump, Unit 2 Component Cooling Water via the East Pump, Essential Service Water via the East Pump, the Unit 2 West ESW Pump is available to support cooling to the Unit 2 Diesel Generator AB, Process Monitoring from the Main Control Room. Power is credited to be available to the Red and Green train systems via offsite power with the Red and Green Train EDGs available as well.

The Nuclear Safety Performance Criteria compliance strategy for AA30 is documented within the NSCA Report.

#### 3.3.1 Variances

The variances identified for evaluation for this fire area are grouped as follows:

##### 3.3.1.1 VFDR No. AA30-001

2-MRV-213-P and 2-MRV-243-P - SG 1 and 4 PORVs are required to be closed to support main steam isolation. The valves are required closed to prevent uncontrolled cooldown through over steaming. 2-MRV-213-P may fail due to fire induced damage of cable 6841-2. 2-MRV-243-P may fail due to fire induced damage of cable 6842-2 and 9051W-2. Failure of these cables could spuriously open the valves. SG 1 and 4 are not credited for decay heat removal due to a fire within Fire Area AA30. This condition represents a variance from deterministic requirements of NFPA 805, Section 4.2.3. This is a separation issue.

This VFDR has been evaluated and it was determined that the risk, safety margin and defense-in-depth meet the acceptance criteria of NFPA 805 Section 4.2.4 with a defense-in-depth action credited.

#### 3.3.2 Recovery Actions Credited

For each VFDR, a Fire Risk Evaluation has been performed to assess the acceptability of risk, defense-in-depth, and safety margin. This evaluation determined whether or not recovery actions are required to ensure that one success path necessary to achieve and maintain the nuclear safety performance criteria is maintained free of fire damage by a single fire. Table 3-3 identifies the credited recovery actions for this area. Actions retained for DID are identified as "DID Actions" within Table 3-3. Additional information for DID actions is contained within Section 3.8 of this report. Note that, for completeness, all VFDRs are contained within Table 3-3, even if the Fire Risk Evaluation has determined that a recovery action is not required. In those instances where a recovery action has been determined to not be required, the word "None" is provided in the "Action" column in the table.

<b>Table 3-3, Recovery Actions Credited</b>
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VFDR	Component	Action
AA30-001	2-MRV-213-P 2-MRV-243-P	DID ACTION 2-MRV-213-P-CLOSE (Vent air to manually close 2-MRV-213)  2-MRV-243-P-CLOSE (Vent air to manually close 2-MRV-243)

### 3.4 Non-Power Operational Modes Compliance Summary

A review of CNP for the potential effects of a fire in this Fire Area while in non-power modes of operation (NPO) was conducted. This review was conducted using the guidance provided in NEI 04-02 and FAQ 07-0040, "Non-Power Operations Clarifications".

The review determined that there are potential failures that affect certain Key Safety Functions (KSF) as a result of the fire in this area, and the fire could result in the loss of one or more KSF paths. Compensatory measures are required during high risk evolution periods to provide reasonable assurance a fire will not adversely affect key safety functions and the NFPA 805 performance goal for NPO is therefore satisfied. The results of the NPO analysis are contained within Technical Evaluation R1900-005-001, Non-Power Operation Modes Transition Review Report.

### 3.5 Radioactive Release Compliance Summary

The NFPA 805 radiological release goal is to provide reasonable assurance that a fire will not result in a radiological release that adversely affects the public, plant personnel or the environment. The NFPA 805 requirement is to ensure a radiation release to any unrestricted area due to the direct effects of fire suppression activities (but not involving fuel damage) shall be as low as reasonably achievable and shall not exceed applicable plant Technical Specification limits.

AA30 is located outside the Radiological Controlled Area (RCA) and is not a storage location for contaminated materials, therefore there is reasonable assurance a fire in this area will not result in radiation release. The review of this fire area, with respect to radioactive release, is documented in the NFPPM.

### 3.6 Probabilistic Risk Assessment-Summary of Results

A Fire PRA (FPRA) quantification of Fire Area AA30 was performed and is documented in PRA-NB-FIRE-FQ, Fire PRA Model Quantification Notebook. The fire risk quantification for Fire Area AA30 is analyzed assuming whole room burnup. PRA-NB-FIRE-FQ includes a summary of all potentially risk-significant fire scenarios (i.e., CDF > 1.0E-7 or LERF > 1.0E-8). Bounding CDF / LERF per calendar year values are reported that are based on the risk values documented in PRA-NB-FIRE-FSS, Fire PRA Fire Scenario Selection.

### **3.7 Risk-Informed, Performance-Based Evaluations**

Fire Risk Evaluations (FREs) have been performed to ensure that variances from the NFPA 805 deterministic requirements are acceptable. The evaluation process consists of an integrated assessment of the acceptability of risk, defense-in-depth, and safety margins.

#### **3.7.1 Transition Risk-Informed, Performance-Based Evaluations**

The ‘changes’ associated with NFPA 805 transition were those variances from the deterministic requirements of NFPA 805 or with the existing fire protection licensing basis that were brought into compliance with the NFPA 805 performance based approach. The change identified for evaluation for Fire Area AA30 is as follows:

- Separation Issues

The Fire Risk Evaluation has determined that the change is acceptable based upon:

- The measured change in CDF and LERF.
- Adequate defense-in-depth and safety margins being maintained.

Refer to Attachment 2 for a summary of results associated with the Fire Risk Evaluations.

### 3.8 Defense-in-Depth

A comprehensive risk-informed, performance-based analysis includes consideration of defense-in-depth (DID) as part of an integrated evaluation of risk considerations. In general, defense-in-depth involves consideration of the extent to which fire protection systems and features are provided within the three echelons of fire-protection:

- Preventing fires from starting,
- Rapidly detecting fires and controlling and extinguishing promptly those fires that do occur, thereby limiting fire damage,
- Providing an adequate level of fire protection for structures, systems, and components important to safety, so that a fire that is not promptly extinguished will not prevent the nuclear safety performance criteria from being met.

Each VFDR was evaluated for DID. The following recovery actions have been retained for DID.

VFDR No. AA30-001: 2-MRV-213-P and 2-MRV-243-P - SG 1 and 4 PORVs are required to be closed to support main steam isolation. Main steam isolation provides integrity of the secondary side of the SGs to prevent uncontrolled cooldown through over-steaming. SG 1 and 4 PORVs could spuriously open due cable failures cause by a full area fire within Fire Area AA30. These failures can be mitigated by locally venting air to close to the SG 1 and 4 PORVs. This recovery action is being retained for DID to ensure main steam isolation is maintained.

Based on the assessment in support of the Fire Risk Evaluation, defense-in-depth is maintained for fire area AA30. Refer to Attachment 2 for details associated with the Fire Risk Evaluation.

### 3.9 Monitoring Program Input

A Monitoring Program will be developed in accordance with FAQ 10-0059, Rev. 1. Methods to monitor availability, reliability, and performance of fire protection program structures, systems, and components (SSCs), as well as programmatic elements will be provided. Additionally, effectiveness measures are established to review program related performance and trends. For AA30 the following systems and features are candidates for inclusion in the CNP Fire Protection Monitoring Program:

- Fire Area boundary barriers discussed in Section 3.1
- Fire Detection System (infrared)
- Manual Fire Suppression System (CO2)

### 4.0 CONCLUSION

The nuclear safety and radioactive release performance criteria of NFPA 805 are met for a fire in Fire Area AA30. This Fire Risk Evaluation for Fire Area AA30 has demonstrated that

- The change in core damage frequency (delta CDF) is acceptable, and
- The change in large early release frequency (delta LERF) is acceptable, and
- Defense-in-depth and safety margins are maintained.

This is confirmation that a success path effectively remains free of fire damage and that the performance-based approach is acceptable per Section 4.2.4.2 of NFPA 805.

## **5.0 REFERENCES**

- 5.1 Calculation PRA-FIRE-NB-CRE, Fire PRA Cumulative Risk Evaluations
- 5.2 CNP Fire Pre-Plans, Volumes I, II, and III, Revisions 17, 14, and 18 respectively
- 5.3 Fire Hazards Analysis
- 5.4 NFPA 805, Performance-Based Standard for Fire Protection for Light Water Reactor Electric Generating Plants
- 5.5 NFPPM, NFPA 805 Fire Protection Program Manual (NFPPM)
- 5.6 Nuclear Energy Institute (NEI) 04-02, Guidance for Implementing a Risk-Informed, Performance-Based Fire Protection Program under 10 CFR 50.48(c), Rev. 2
- 5.7 Nuclear Safety Capability Assessment Report
- 5.8 PRA-NB-FIRE-FQ, Fire PRA Model Quantification Notebook
- 5.9 PRA-NB-FIRE-FSS, Fire PRA Fire Scenario Selection
- 5.10 Regulatory Guide 1.205, Risk-Informed, Performance-Based Fire Protection for Existing Light-Water Nuclear Power Plants, Rev. Revision 1
- 5.11 Technical Evaluation R1900-005-001, Non-Power Operation Modes Transition Review



**Fire Area AA30 – Attachment 1 - Table B-3 - Fire Area Transition**

<u>Unit</u>	<u>Fire Area</u>	<u>Description</u>
2	AA30	Unit 2 Quadrant 4 Cable Tunnel (El. 596 ft.)

<u>Fire Zone</u>	<u>Description</u>
26	Quadrant 4 Cable Tunnel - El. 596 ft. 3-1/2 in. - Unit 2

**Regulatory Basis**

4.2.4.2 - Performance-Based Approach - Fire Risk Evaluation with simplifying deterministic assumptions

<b>Performance Goal</b>	<b>Method of Accomplishment</b>	<b>Comments</b>
Reactivity Control	Unit 2 - Trip the reactor from the Control Room. Borate using Unit 2 East Charging Pump supplied from the RWST. Use source range monitoring for indication for Unit 2.	None
Inventory and Pressure Control	Unit 2 - Control inventory using Unit 2 East Charging Pump. Control pressure using Unit 2 Pressurizer Safety Relief Valves.	None
Decay Heat Removal	Unit 2 - Feed SGs 2 & 3 with Unit 2 East MDAFW Pump. The DHR function also requires MS isolation with a steam release path through the Safety Relief Valves.	VFDR identified for MS isolation.
Process Monitoring	Unit 2 Process Monitoring - Use Unit 2 process monitoring in the Control Room for the following: Pressurizer level, RCS pressure and temperature, and S/G level and Pressure. Unit 2 Source Range Monitoring - Use Unit 2 source range monitoring in the Control Room.	None
Vital Auxiliaries	Unit 2 Electrical - Control Unit 2 Red (AB) Train Electrical Distribution with Unit 2 Red (AB) Train Offsite Power or Unit 2 Red (AB) DG. Control Unit 2 Green (CD) Train Electrical Distribution with Unit 2 Green (CD) Train Offsite Power or Unit 2 Green (CD) DG. Unit 2 ESW - Operate Unit 2 East ESW. Unit 2 West ESW is available to support Red (AB) DG cooling. Unit 2 CCW - Operate Unit 2 East CCW. Unit 2 HVAC - Operate Unit 2 Control Room HVAC. Operate Unit 2 Auxiliary Building HVAC. Operate Unit 2 Red (AB) and Green (CD) DG HVAC. Operate Unit 2 Switchgear HVAC. Operate Unit 2 East MDAFW Room HVAC system. Operate Unit 2 East and West ESW Pump Room HVAC	None

**Fire Area AA30 – Attachment 1 - Table B-3 - Fire Area Transition**

<u>Unit</u>	<u>Fire Area</u>	<u>Description</u>
2	AA30	Unit 2 Quadrant 4 Cable Tunnel (El. 596 ft.)

systems.

**Reference Documents**

Genesis Solution Suite, EDISON / SAFE-PB, DC Cook V 3.4.0

Nuclear Safety Capability Assessment Report

**Licensing Actions**

None

**Existing Engineering Equivalency Evaluations (EEEE)****EEEE Title Engineering Equivalency Evaluation 11-9 - Turbine, Auxiliary and Containment Buildings Boundary Evaluation**

**Summary** The purpose of this engineering equivalency evaluation is to describe in general, the approach and existence of evaluations performed to determine and reconcile fire area boundaries having components or designs with less than a 3-hr fire rating on preventing the spread of fire. This engineering equivalency evaluation also specifically evaluates the impact of unrated door assemblies on the spread of fire.

Reasonable assurance is provided that the fire area boundaries having components or design less than a 3-hr fire rating will not increase the spread of fire or impair the safe shutdown capabilities of Units 1 or 2. In addition, this engineering equivalency evaluation does not adversely impact on other engineering equivalency evaluations or exemption requests.

This evaluation supports additional evaluations credited in this fire area.

**Fire Area AA30 – Attachment 1 - Table B-3 - Fire Area Transition**

<u>Unit</u>	<u>Fire Area</u>	<u>Description</u>
2	AA30	Unit 2 Quadrant 4 Cable Tunnel (El. 596 ft.)
<b><u>EEEE Title</u></b>	<b>Engineering Equivalency Evaluation 11-14 - Cable Spreading Room Construction Boundary Evaluation (Fire Areas AA3, AA7, AA8, AA9, AA10, AA29, AA30, AA31, AA34, AA35, AA36/42, AA37, AA38, AA48, AA50, AA51 and AA52)</b>	
<b><u>Summary</u></b>	<p>The purpose of this engineering equivalency evaluation is to document the acceptability of the construction features of the cable spreading rooms which have a fire resistance rating of less than 3 hours for their impact on the spread. In particular, fire dampers having a 1 1/2-hr fire rating were analyzed by this evaluation. Other unrated construction features have been previously analyzed under separate engineering equivalency evaluations. The applicable fire areas include: AA3, AA7, AA8, AA9, AA10, AA29, AA30, AA31, AA34, AA35, AA36/42, AA37, AA38, AA48, AA50, AA51 and AA52.</p> <p>Reasonable assurance is provided that the construction features of the cable spreading rooms which have a fire resistance rating of less than 3 hours will prevent the spread of fire and not impair the safe shutdown capabilities of Unit 1 and Unit 2. In addition, this engineering equivalency evaluation does not adversely impact other engineering equivalency evaluations.</p> <p>The construction features of the cable spreading room were evaluated and found to be acceptable based on the fire hazards, fire protection systems and construction features within the areas.</p>	
<b><u>EEEE Title</u></b>	<b>Engineering Equivalency Evaluation 11-46 - Seismic Gaps between the Containment and Auxiliary Buildings Boundary Evaluation (Fire Areas AA2, AA3, AA7, AA8, AA9, AA10, AA11, AA27, AA29, AA30, AA31, AA34, AA35, AA37 and AA38)</b>	
<b><u>Summary</u></b>	<p>A seismic gap exists around the Containment Building of each unit that provides an opening of approximately 6 in. between the Containment Building and the walls, ceilings and floors of the structures immediately adjacent to containment. These Fire Areas include AA2, AA3, AA7, AA8, AA9, AA10, AA11, AA27, AA29, AA30, AA31, AA34, AA35, AA37 and AA38. This engineering equivalency evaluation has been performed to document the acceptability of these seismic gaps in the fire boundaries.</p> <p>This seismic gap evaluation shows the safe shutdown capability for CNP Unit 1 and Unit 2 has not been compromised as a result of seismic gaps. The analysis performed and the results presented in the tables indicate, on a system basis, the capability to safely shut down both units when considering fire damage to safe shutdown components and circuits contained in the seismic gap evaluation areas. The method of analysis is conservative when considering the fire hazards involved in the vicinity of the seismic gaps. That is, it is not anticipated that the evaluated areas would be affected to the extent that fire would propagate through the seismic gaps and cause damage throughout the evaluated area. This engineering equivalency evaluation has no impact on the exemption requests contained in other engineering equivalency evaluations.</p> <p>The seismic gaps were evaluated and found to be acceptable based on the fire hazards, fire protection systems and construction features within the evaluated areas.</p>	

**Fire Area AA30 – Attachment 1 - Table B-3 - Fire Area Transition**

<u>Unit</u>	<u>Fire Area</u>	<u>Description</u>
2	AA30	Unit 2 Quadrant 4 Cable Tunnel (El. 596 ft.)

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**EEEE Title** **Engineering Equivalency Evaluation 12-19 - CO2 Fire Suppression System Concentrations (Fire Areas AA7, AA8, AA9, AA10, AA29, AA30, AA31, AA37, AA38, AA39, AA40, AA41, AA43, AA44, AA45, AA48, AA49, AA50, AA51, AA52 and AA53)**

**Summary** The purpose of this engineering equivalency evaluation is to document the acceptability of the CO2 fire suppression systems in fire zones containing concentrations of cable insulation and the potential for deep-seated fires. This engineering equivalency evaluation determines the CO2 system's impact on the spread of fire and previous engineering equivalency evaluations and exemption requests. Although there are other fire zones that use CO2 for fire suppression such as the DG Rooms, they are installed to suppress surface-type, combustible liquid fires and are not included in this analysis, because they do not contain significant concentrations of cable insulation capable of producing deep-seated fires.

All of the CO2 systems included in this engineering equivalency evaluation are capable of performing their intended function, containing the fire until the Fire Brigade arrives, preventing fire spread to adjacent fire zones, and ensuring that safe shutdown of CNP can be achieved and maintained.

The existing suppression systems were evaluated and found to be acceptable based on the fire hazards and fire protection systems within the evaluated areas.

**Fire Suppression Effects on Nuclear Safety Performance Criteria**

The CNP fire brigade is trained to discharge water in a judicious manner and instructed to direct hose streams and portable extinguishers at the base of the fire to limit the amount of overspray beyond the immediate fire zone. For this reason, fire brigade activities are not expected to fail components not already considered damaged. It has been concluded that water impingement on cables is not a concern. Electrical cabinets are provided with a seal at the conduit interface. Possible impacts to surrounding equipment due to manual fire fighting activities is bounded by the analysis approach of postulating whole room damage. The drainage features of the fire area mitigate the potential for flooding damage due to fire suppression, such that the standing water would not affect credited equipment.

In the event of discharge, any damage caused by the CO2 system to other equipment operating within the fire area which is not immediately involved in the originating fire is bounded by the analysis approach of postulating whole room damage. Since it is shown that suppression effects will not impact the nuclear safety performance criteria, the fire area configuration is deemed acceptable.

**References:**

Technical Evaluation 12.1, "Fire Suppression Effects Study"

Technical Evaluation 12.1, "Supplemental Information to Fire Suppression Effects Study – Supplement 1"

**Fire Area AA30 – Attachment 1 - Table B-3 - Fire Area Transition**

<u>Unit</u>	<u>Fire Area</u>	<u>Description</u>
2	AA30	Unit 2 Quadrant 4 Cable Tunnel (El. 596 ft.)

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**Fire Area Comments**

None

## Fire Area AA30 – Attachment 2 - Fire Risk Evaluation Results Summary

### A2.1 Introduction

The ‘changes’ associated with NFPA 805 transition were those variances from the deterministic requirements of NFPA 805. The changes identified for evaluation for fire area AA30 are grouped as follows:

- Separation Issues

This attachment is a summary of the Fire Risk Evaluation for the fire area. The complete results and methodology are contained in the Cumulative Fire Risk Evaluation, PRA-FIRE-NB-CRE. (FPCE 2017-0009)

### A2.2 Inputs/Assumptions

1. Assumptions from the Fire PRA apply to this calculation.
2. Detailed fire modeling was not performed for Fire Area AA30. A single whole room burnout scenario was assumed.

### A2.3 Fire Modeling Methodology

Detailed fire modeling was not performed for Fire Area AA30. This area was modeled considering whole room burnout.

### A2.4 Scenario Descriptions and Model Results

A single whole room burnout scenario was modeled for Fire Area AA30. All targets within the fire area were assumed damaged.

#### A2.4.1 Ignition Sources

The fixed ignition sources in Fire Area AA30 consist of the motor control centers as well as small fans which are less than 5 horsepower. Additional detail regarding the ignition sources in this area is available in the Fire PRA Report. All fire scenarios, whether resulting from credited fixed or transient ignition sources, are assumed to damage all targets in the fire area.

#### A2.4.2 Scenario Results

A delta risk calculation has been performed to quantify the risk associated with the VFDRs in the fire area.

### A2.5 Fire Risk Evaluation Results

PRA-FIRE-NB-CRE documents scenarios and corresponding impacted VFDRs that were evaluated for delta risk during the transition to NFPA 805 and also all changes to the Fire Protection Program that are currently incorporated into the Fire PRA model. The acceptability of the Cumulative Fire Risk Evaluations was based on calculated delta risk meeting the thresholds of NEI 04-02, RG 1.205 and RG 1.174. (FPCE 2017-0009)

## Fire Area AA30 – Attachment 2 - Fire Risk Evaluation Results Summary

### A-2.6 Impact of VFDR on Defense-in-Depth

Defense-in-Depth has been evaluated for this fire area. The impacts of this evaluation are summarized in the table below:

Defense-in-Depth Impact Review for AA30			
Method of Providing DID	Required to Support Deterministic Analysis or Fire PRA?	Changes or Improvements Necessary for DID?	Basis/Justification
Echelon 1: Prevent fires from starting			
Combustible Control is implemented in accordance with Procedure PMP-2270-CCM-001, Control of Combustible Materials.	Yes	No	• This element is adequate based on no perceived weakness of, or over-reliance on, another echelon of defense-in-depth.
Hot Work Control is implemented in accordance with Procedure PMP-2270-WBG-001, Welding, Burning and Grinding Activities.	Yes	No	
Echelon 2: Rapidly detect, control and extinguish promptly those fires that do occur thereby limiting fire damage			
Fire Detection System	Yes	No	• Suppression and detection are already required and fire fighting activities are not expected to be challenging; therefore, no changes or improvements to Echelon 2 attributes are necessary to maintain defense-in-depth.
Fixed Fire Suppression	Yes	No	
Portable Fire Extinguishers	Yes	No	
Hose stations and hydrants	Yes	No	
Pre-Fire Plan	Yes	No	
Echelon 3: Provide adequate level of fire protection for systems and structures so that a fire will not prevent essential safety functions from being performed			
Walls, floors ceilings and structural elements are rated or have been evaluated as adequate for the hazard.	Yes	No	• Although VFDR AA30-001 is not considered a significant contribution to core damage frequency, the variance is considered important enough to the NSCA to retain as a recovery action to ensure that defense-in-depth is maintained.
Penetrations in the fire area barrier are rated or have been evaluated as adequate for the hazard.	Yes	No	
Supplemental barriers (e.g., ERFBS, cable tray covers, etc.)	No	No	
Guidance provided to operations personnel detailing the required success path(s) including recovery actions to achieve nuclear safety performance criteria.	No	Yes	

## Fire Area AA30 – Attachment 2 - Fire Risk Evaluation Results Summary

### A-2.7 Safety Margin Considerations

In accordance with NEI 04-02, the maintenance of adequate Safety Margin is assessed by the consideration categories of analyses utilized by this Fire Risk Evaluation.

Safety margins are considered to be maintained if:

- Codes and Standards or their alternatives accepted for use by the NRC are met.

AND

- Safety analyses acceptance criteria in the licensing basis (e.g., FSAR, supporting analyses) are met, or provides sufficient margin to account for analysis and data uncertainty.

The following summarizes the bases for ensuring the maintenance of safety margins:

- The risk-informed, performance based processes utilized are based upon NFPA 805, 2001 edition, endorsed by the NRC in 10 CFR 50.48(c).
- The Fire Risk Evaluation process is in accordance with NEI 04-02, Revision 2, which is endorsed by the NRC in Regulatory Guide 1.205, Revision 1.
- The Fire PRA is developed in accordance with NUREG/CR-6850, which was developed jointly between the NRC and EPRI.
- The Fire PRA has undergone an industry peer review, in order to ensure the Fire PRA meets the appropriate quality standards of ASME/ANS RA-Sa-2009, "Standard for Level 1/Large Early Release Frequency Probabilistic Risk Assessment for Nuclear Power Plant Applications," Dated February 2, 2009
- The "bounding risk assessment" is used during transition (NEI 04-02, Section 5.3.4.2). This approach conservatively assumes that target set damage occurs for postulated fire events which resulted in whole room burn up, and therefore, MEFS/LFS is not analyzed separately from the Fire PRA results.
- The CNP internal events PRA model received two formal industry peer reviews conducted in accordance with applicable NEI guidelines. The initial peer review was performed in 2001, while a subsequent focused scope (i.e., limited scope) peer review was conducted in 2009. The initial, full-scope WOG peer review covered all aspects of the CNP PRA model and the administrative processes used to maintain and update the model. The CNP PRA model has been revised to address all significant issues (i.e., Category A and B Facts & Observations) identified during the initial peer review. None of the findings from the focused-scope peer review were judged to reach the significance level of a Category A or B Fact & Observation; as a result, no changes to the PRA model have yet been made to include resolutions for these latter issues.
- Fire protection systems and features determined to be required by NFPA 805 Chapter 4 have been confirmed to meet the requirements of NFPA 805 Chapter 3 and their associated referenced codes and listings, or provided with acceptable alternatives using processes accepted for use by the NRC (i.e., FAQ 06-0008, FAQ 06-0004, 07-0033).
- Fire modeling has not been performed in support of the change evaluations and results are therefore, based on whole area burn up. As such, the results are considered very conservative.
- In accordance with the requirements of 10 CFR 50.48(c)(2)(iii), the Fire PRA results, including cutsets for



## **Fire Area AA30 – Attachment 2 - Fire Risk Evaluation Results Summary**

the scenarios of concern, have been reviewed and it was verified that the results presented above do not rely solely on feed and bleed as the fire-protected safe shutdown path for maintaining reactor coolant inventory, pressure control, and decay heat removal capability for this fire area.

### **A-2.8 Transition Risk Evaluation Conclusions**

The transition change evaluation determined that these changes:

- Are acceptable based upon the measured change in CDF and LERF
- Maintained adequate defense-in-depth and safety margins

The results of this evaluation meet the requirements of NFPA 805 Risk Evaluation; therefore, the use of the performance based analysis approach is acceptable.

D. C. Cook Nuclear Plant  
Fire Safety Analysis

Fire Area: AA31

Unit 2 Quadrant 1 Cable Tunnel (El. 596 ft.)

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Attachments

Fire Area AA31 – Attachment 1 - Table B-3 - Fire Area Transition

Fire Area AA31 – Attachment 2 - Fire Risk Evaluation Results Summary

## 1.0 PURPOSE

This report documents the Fire Safety Analysis (FSA) for Cook Nuclear Plant (CNP) Fire Area AA31, Unit 2 Quadrant 1 Cable Tunnel (El. 596 ft.) which comprises fire zone(s) 27. The purpose of this analysis is to demonstrate the achievement of the nuclear safety and radioactive release performance criteria of NFPA 805 as required by 10 CFR 50.48(c). The Fire Safety Analysis is a key part of compliance with Section 2.7.1.2 Fire Protection Program Design Basis Document of NFPA 805. This analysis also documents results of risk-informed, performance-based Fire Risk Evaluations (FREs). These evaluations are associated with Variances from Deterministic Requirements (VFDRs) of NFPA 805 Chapter 4.

## 2.0 ANALYSIS METHODOLOGY

The FSA is the design basis document as described in NFPA 805 Section 2.7.1.2. The following steps are performed to develop the FSA on a fire area basis:

- Identify significant fire hazards in the fire area. This is based on NFPA 805 approach to analyze the plant from an ignition source and fuel package perspective.
- Summarize Nuclear Safety Capability Analysis (NSCA) compliance strategies. This is the result of the NEI 04-02 B-3 Table review of the Safe Shutdown Analysis.
- Summarize Non-Power Operations Modes compliance strategies.
- Summarize Radioactive Release compliance strategies. The transition review process required per NEI 04-02 is used to develop these results.
- Provide Fire Probabilistic Risk Assessment summary of results. This is based on the results from the plant Fire PRA.
- Perform risk informed, performance based evaluations if needed for the performance based approach.
- Summarize Defense-in-Depth strategy for each fire area.
- Determine key analysis assumptions which are candidates to be included in the NFPA 805 monitoring program.
- Provide conclusions relative to NFPA 805 compliance.

### **3.0 ANALYSIS**

#### **3.1 Classical Fire Protection**

##### **3.1.1 Construction**

Walls, floors and ceilings to adjacent fire areas are reinforced concrete in excess of a 3-hour rating.

A fire area boundary evaluation was performed for a damper and penetration seal in this area which has a fire resistance rating of less than 3 hours.

Applicable Engineering Equivalency Evaluations are documented in Attachment 1.

##### **3.1.2 Doors and Access Openings**

Fire doors having a 3-hour rating are provided to adjacent Fire Areas AA30 and AA38 - Fire Zones 26 and 39, respectively.

##### **3.1.3 Penetrations**

Note: Statements regarding fire resistance rating of penetration seals are not applicable to seals in barriers to Analysis Area YD.

Penetrations in fire barriers between this fire zone and adjacent fire areas are provided with fire seals except as noted below.

A fire area engineering equivalency evaluation was performed to evaluate a fire seal design between Fire Zones 27 and Fire Area 38, Fire Zone 39.

The seismic gap is provided with a glass fiber reinforced silicone sheeting. A seismic gap exemption was granted for Fire Zone 27 interface with Fire Areas AA30, AA27 and AA3 - Fire Zones 26, 22, and 50, 69, respectively.

### 3.1.4 Detection

The table below outlines the fire detection system(s) provided in the Fire Area:

Table 3-1, Fire Area AA31 Detection Systems								
Fire Zone	Type of System	Local (L) / Remote (R)	Detection Actuates Suppression?	Required System?				
				S	L	E	R	D
27	Infrared	L/R	N	N	N	Y	Y	N
27	Ionization	L/R	N	N	N	Y	Y	N

**Table 3-1 Legend:**

Table Field: "Required System?"	
S	- Required for Chapter 4 Separation Criteria
L	- Required for NRC Approved Licensing Action
E	- Required for Engineering Equivalency Evaluation
R	- Required for Risk Significance
D	- Required to maintain adequate balance of Defense-in-Depth in a Change Evaluation or Fire Risk Evaluation

Cross zoned ionization smoke detectors (4) and infra-red detectors (3) are provided which alarm in the Unit 2 Control Room.

### 3.1.5 Fixed Suppression

The table below outlines the fixed fire suppression system(s) provided in the Fire Area:

Table 3-2, Fire Area AA31 Suppression Systems							
Fire Zone	Type of System	Full (F) / Partial (P)	Required System?				
			S	L	E	R	D
27	Manual CO2	F	N	N	Y	Y	N
Table 3-2 Legend:							
Table Field: "Required System?"							
S	- Required for Chapter 4 Separation Criteria						
L	- Required for NRC Approved Licensing Action						
E	- Required for Engineering Equivalency Evaluation						
R	- Required for Risk Significance						
D	- Required to maintain adequate balance of Defense-in-Depth in a Change Evaluation or Fire Risk Evaluation						

Fire Area AA31 is not provided with an automatic fire suppression.

### 3.1.6 Manual Suppression / Response Strategy

A postulated fire will be identified by early detection using ionization type smoke detection, the infra-red detection or by plant personnel using plant communication system to notify the control room. The automatic detection systems alarm in the control room. The Control Room operator will dispatch the fire brigade for initiation of manual fire fighting. A fire in this fire area will be contained by the construction features discussed in Section 3.1.1. Manual suppression is provided

by the CNP Fire Brigade. A low pressure CO2 total flooding system supplied from the 17 ton tank is provided. This system is manually actuated. Operation of this system discharges CO2 into Fire Area AA31.

Fire extinguishers are provided in Fire Area AA31.

Water hose reels are provided in Fire Area AA31 with an additional hose reel located in adjacent Fire Area AA29, Fire Zone 25, and in Fire Area AA30, Fire Zone 26.

Floor drains are available in Fire Area AA31.

### 3.1.7 Ventilation

A fire in this area will be contained by the fire barriers. Smoke can be removed by portable fans and flexible ducting to other parts of the Auxiliary Building and outdoors if not contaminated. Contaminated smoke can be removed by portable fans and flexible ducting to other areas of the Auxiliary Building per the Fire Pre-Plans. The normal building ventilating systems in the Auxiliary Building will then exhaust the smoke via filtered monitored pathways. This fire area is listed as a non-controlled area in the Fire Pre Plans therefore there is reasonable assurance that products of combustion will not be contaminated.

A fire damper having a 3-hour rating is provided to adjacent Fire Area AA30 - Fire Zone 26.

### 3.1.8 Other Features

No other fire protection features provided for Fire Area AA31.

## 3.2 Fire Hazards Identification

The fire area contains both ignition sources and combustible fire hazards. The ignition sources consist of a thermocouple transmitter cabinet, neutron flux equipment and a local shutdown indication panel. Combustibles consist primarily of cellulose and rubber/plastics.

The exterior wall penetrations of this Fire Area do not require a rating for protection. The spatial separation between the yard equipment and fire hazards to this Fire Area is sufficient to provide protection against heat damage. The impact of a fire in the yard on AA31 would be limited to radiant heat with no ceiling to contain the fire plume. Spatial separation as well as the reinforced concrete construction of the Fire Area is sufficient to prevent an exposure to credited equipment inside the plant through unrated exterior wall penetrations of this Fire Area.

The current fire loading classification is considered moderate.

## 3.3 NSCA Compliance Summary

Fire Area AA31 contains Red and Green Train cables, conduits, and raceways as well as safe shutdown equipment.

Compliance with the nuclear safety performance criteria is achieved using the performance-based approach in accordance with NFPA 805, Section 4.2.4.2.

Safe and stable condition of the affected Unit 2, will be accomplished using Steam Generators 2 and 3 via the Unit 2 East Motor Driven Auxiliary Feedwater Pump, Unit 2 Charging via the East Pump,

Unit 2 Component Cooling Water via the East or West Pump, Unit 2 Essential Service Water via the East or West Pump and Process Monitoring from the Main Control Room. Power is credited to be available to the Red and Green train systems via offsite power with the Red and Green Train EDGs available as well.

The Nuclear Safety Performance Criteria compliance strategy for AA31 is documented within the NSCA Report.

### 3.3.1 Variances

The variances identified for evaluation for this fire area are grouped as follows:

#### 3.3.1.1 VFDR No. AA31-001

2-MRV-213-P and 2-MRV-243-P - SG 1 and 4 PORVs are required to be closed to support main steam isolation. The valves are required closed to prevent the uncontrolled cooldown through over steaming. 2-MRV-213-P may fail due to fire induced damage of cable 6841-2. 2-MRV-243-P may fail due to fire induced damage of cable 6842-2. Failure of these cables could spuriously open the valves. SG 1 and 4 are not credited for decay heat removal within Fire Area AA31. This condition represents a variance from deterministic requirements of NFPA 805, Section 4.2.3. This is a separation issue.

This VFDR has been evaluated and it was determined that the risk, safety margin and defense-in-depth meet the acceptance criteria of NFPA 805 Section 4.2.4 with a defense-in-depth action credited.

#### 3.3.1.2 VFDR No. AA31-002

2-NRV-151 and 2-NRV-152 - Pressurizer PORVs are required to be closed to support RCS integrity. RCS integrity is required to maintain positive control over RCS inventory and pressure. 2-NRV-151 may fail due to fire induced damage of cable 9705PR-2. 2-NRV-152 may fail due to fire induced damage of cable 9706PR-2. Failure of these cables could spuriously open the valves. This condition represents a variance from the deterministic requirements of NFPA 805, Section 4.2.3. This is a separation issue.

This VFDR has been evaluated and it was determined that the risk, safety margin and defense-in-depth meet the acceptance criteria of NFPA 805 Section 4.2.4 with a defense-in-depth action credited.

#### 3.3.1.3 VFDR No. AA31-003

2-NSO-023 and 2-NSO-024 - RX Head Vent Valves are required to be closed to support RCS integrity. RCS integrity is required to maintain positive control over RCS inventory and pressure. 2-NSO-023 and 2-NSO-024 are in series requiring one of the valves to be closed to maintain RCS integrity. 2-NSO-023 may fail due to fire induced damage of cable 9801PR-2. 2-NSO-024 may fail due to fire induced damage of cable 9807PR-2. Failure of these cables could spuriously open the valves. This condition represents a variance from the deterministic requirements of NFPA 805, Section 4.2.3. This is a separation issue.

This VFDR has been evaluated and it was determined that the risk, safety margin and defense-in-depth meet the acceptance criteria of NFPA 805 Section 4.2.4 with a defense-in-depth action credited.

**3.3.1.4 VFDR No. AA31-004**

2-NSO-063 and 2-NSO-064 - Post Accident Vent Valves are required to be closed to support RCS integrity. RCS integrity is required to maintain positive control over RCS inventory and pressure. 2-NSO-063 and 2-NSO-064 are in series requiring one of the valves to be closed to maintain RCS integrity. 2-NSO-063 may fail due to fire induced damage of cable 9814PR-2. 2-NSO-064 may fail due to fire induced damage of cable 9820PR-2. Failure of these cables could spuriously open the valves. This condition represents a variance from the deterministic requirements of NFPA 805, Section 4.2.3. This is a separation issue.

This VFDR has been evaluated and it was determined that the risk, safety margin and defense-in-depth meet the acceptance criteria of NFPA 805 Section 4.2.4 with a defense-in-depth action credited.

**3.3.1.5 VFDR No. AA31-005**

2-QRV-10 and 2-QRV-40 - RCP Seal Water Return Isolation Valves are required to be open to support RCS integrity by maintaining the RCP seal. RCS integrity is required to maintain positive control over RCS inventory and pressure. 2-QVR-10 may fail due to fire induced damage of cable 4418-2. 2-QVR-40 may fail due to fire induced damage of cable 5002-2. These cables could cause spurious closure of these valves. This condition represents a variance from the deterministic requirements of NFPA 805, Section 4.2.3. This is a separation issue.

This VFDR has been evaluated and it was determined that the risk, safety margin and defense-in-depth meet the acceptance criteria of NFPA 805 Section 4.2.4 with a defense-in-depth action credited.

**3.3.2 Recovery Actions Credited**

For each VFDR, a Fire Risk Evaluation has been performed to assess the acceptability of risk, defense-in-depth, and safety margin. This evaluation determined whether or not recovery actions are required to ensure that one success path necessary to achieve and maintain the nuclear safety performance criteria is maintained free of fire damage by a single fire. Table 3-3 identifies the credited recovery actions for this area. Actions retained for DID are identified as “DID Actions” within Table 3-3. Additional information for DID actions is contained within Section 3.8 of this report. Note that, for completeness, all VFDRs are contained within Table 3-3, even if the Fire Risk Evaluation has determined that a recovery action is not required. In those instances where a recovery action has been determined to not be required, the word “None” is provided in the “Action” column in the table.

Table 3-3, Recovery Actions Credited		
VFDR	Component	Action
AA31-001	2-MRV-213-P	DID ACTION
	2-MRV-243-P	2-MRV-213-P-CLOSE (Vent air to manually close 2-MRV-213)
		2-MRV-243-P-CLOSE (Vent air to manually close 2-MRV-243)



Table 3-3, Recovery Actions Credited		
VFDR	Component	Action
AA31-002	2-NRV-151 2-NRV-152	DID ACTION(S) 2-NRV-151-CLOSE 2-NRV-152-CLOSE (Remove fuses in MCR to fail closed PORVs 2-NRV-151 and 2-NRV-152)
AA31-003	2-NSO-023	DID ACTION(S) 2-NSO-023-CLOSE (Remove fuses in MCR to fail closed AOV 2-NSO-023)
AA31-004	2-NSO-063	DID ACTION(S) 2-NSO-063-CLOSE (Remove fuses in MCR to fail closed AOV 2-NSO-063)
AA31-005	2-QRV-10 2-QRV-40	DID ACTION(S) 2-QRV-10-OPEN 2-QRV-40-OPEN (Remove fuses in MCR to fail open AOVs 2-QRV-10 and 2-QRV-40)

### 3.4 Non-Power Operational Modes Compliance Summary

A review of CNP for the potential effects of a fire in this Fire Area while in non-power modes of operation (NPO) was conducted. This review was conducted using the guidance provided in NEI 04-02 and FAQ 07-0040, "Non-Power Operations Clarifications".

The review determined that there are potential failures that affect certain Key Safety Functions (KSF) as a result of the fire in this area, and the fire could result in the loss of one or more KSF paths. Compensatory measures are required during high risk evolution periods to provide reasonable assurance a fire will not adversely affect key safety functions and the NFPA 805 performance goal for NPO is therefore satisfied. The results of the NPO analysis are contained within Technical Evaluation R1900-005-001, Non-Power Operation Modes Transition Review Report.

### 3.5 Radioactive Release Compliance Summary

The NFPA 805 radiological release goal is to provide reasonable assurance that a fire will not result in a radiological release that adversely affects the public, plant personnel or the environment. The NFPA 805 requirement is to ensure a radiation release to any unrestricted area due to the direct effects of fire suppression activities (but not involving fuel damage) shall be as low as reasonably achievable and shall not exceed applicable plant Technical Specification limits.

AA31 is located outside the Radiological Controlled Area (RCA) and is not a storage location for contaminated materials, therefore there is reasonable assurance a fire in this area will not result in radiation release. The review of this fire area, with respect to radioactive release, is documented in the NFPPM.

### 3.6 Probabilistic Risk Assessment-Summary of Results

A Fire PRA (FPRA) quantification of Fire Area AA31 was performed and is documented in PRA-NB-FIRE-FQ, Fire PRA Model Quantification Notebook. The fire risk quantification for Fire Area AA31 is analyzed assuming whole room burnup. PRA-NB-FIRE-FQ includes a summary of all potentially risk-significant fire scenarios (i.e., CDF > 1.0E-7 or LERF > 1.0E-8). Bounding CDF / LERF per calendar year values are reported that are based on the risk values documented in PRA-NB-FIRE-FSS, Fire PRA Fire Scenario Selection.

### 3.7 Risk-Informed, Performance-Based Evaluations

Fire Risk Evaluations (FREs) have been performed to ensure that variances from the NFPA 805 deterministic requirements are acceptable. The evaluation process consists of an integrated assessment of the acceptability of risk, defense-in-depth, and safety margins.

#### 3.7.1 Transition Risk-Informed, Performance-Based Evaluations

The 'changes' associated with NFPA 805 transition were those variances from the deterministic requirements of NFPA 805 or with the existing fire protection licensing basis that were brought into compliance with the NFPA 805 performance based approach. The change identified for evaluation for Fire Area AA31 is as follows:

- Separation Issues

The Fire Risk Evaluation has determined that the change is acceptable based upon:

- The measured change in CDF and LERF.
- Adequate defense-in-depth and safety margins being maintained.

Refer to Attachment 2 for a summary of results associated with the Fire Risk Evaluations.

### 3.8 Defense-in-Depth

A comprehensive risk-informed, performance-based analysis includes consideration of defense-in-depth (DID) as part of an integrated evaluation of risk considerations. In general, defense-in-depth involves consideration of the extent to which fire protection systems and features are provided within the three echelons of fire-protection:

- Preventing fires from starting,
- Rapidly detecting fires and controlling and extinguishing promptly those fires that do occur, thereby limiting fire damage,
- Providing an adequate level of fire protection for structures, systems, and components important to safety, so that a fire that is not promptly extinguished will not prevent the nuclear safety performance criteria from being met.

Each VFDR was evaluated for DID. The following recovery actions have been retained for DID.

VFDR No. AA31-001: 2-MRV-213-P and 2-MRV-243-P - SG 1 and 4 PORVs are required to be closed to support main steam isolation. Main steam isolation provides integrity of the secondary side of the SGs to prevent uncontrolled cooldown through over-steaming. SG 1 and 4 PORVs could spuriously open due cable failures cause by a full area fire within Fire Area AA31. These failures can be mitigated by locally venting air to close to the SG 1 and 4 PORVs. This recovery action is being retained for DID to ensure main steam isolation is maintained.

VFDR No. AA31-002: 2-NRV-151 and 2-NRV-152 - Pressurizer PORVs are required to be closed to support RCS integrity. RCS integrity is required to maintain positive control over RCS inventory and pressure. The spurious opening can be mitigated by de-energizing the valve to fail it closed. This recovery action is being retained for DID to ensure RCS pressure and inventory control is maintained.

VFDR No. AA31-003: 2-NSO-023 and 2-NSO-024 - RX Head Vent Valves are required to be closed to support

RCS integrity. RCS integrity is required to maintain positive control over RCS inventory and pressure. 2-NSO-023 and 2-NSO-024 are in series requiring one of the valves to be closed to maintain RCS integrity. The spurious opening can be mitigated by de-energizing the valve to fail it closed. This recovery action is being retained for DID to ensure RCS pressure and inventory control is maintained.

VFDR No. AA31-004: 2-NSO-063 and 2-NSO-064 - Post Accident Vent Valves are required to be closed to support

RCS integrity. RCS integrity is required to maintain positive control over RCS inventory and pressure. 2-NSO-063 and 2-NSO-064 are in series requiring one of the valves to be closed to maintain RCS integrity. The spurious opening can be mitigated by de-energizing the valve to fail it closed. This recovery action is being retained for DID to ensure RCS pressure and inventory control is maintained.

VFDR No. AA31-005: 2-QVR-10 and 2-QVR-40 - RCP Seal Water Return Isolation Valves are required to be open to support RCS integrity by maintaining the RCP seal. RCS integrity is required to maintain positive control over RCS inventory and pressure. The spurious closing can be mitigated by de-energizing the valve to fail it open. This recovery action is being retained for DID to ensure RCS integrity is maintained.

Based on the assessment in support of the Fire Risk Evaluation, defense-in-depth is maintained for

fire area AA31. Refer to Attachment 2 for details associated with the Fire Risk Evaluation.

### 3.9 Monitoring Program Input

A Monitoring Program will be developed in accordance with FAQ 10-0059, Rev. 1. Methods to monitor availability, reliability, and performance of fire protection program structures, systems, and components (SSCs), as well as programmatic elements will be provided. Additionally, effectiveness measures are established to review program related performance and trends. For AA31 the following systems and features are candidates for inclusion in the CNP Fire Protection Monitoring Program:

- Fire Area boundary barriers discussed in Section 3.1
- Fire Detection System (infrared)
- Manual Fire Suppression System (CO2)

### 4.0 CONCLUSION

The nuclear safety and radioactive release performance criteria of NFPA 805 are met for a fire in Fire Area AA31. This Fire Risk Evaluation for Fire Area AA31 has demonstrated that

- The change in core damage frequency (delta CDF) is acceptable, and
- The change in large early release frequency (delta LERF) is acceptable, and
- Defense-in-depth and safety margins are maintained.

This is confirmation that a success path effectively remains free of fire damage and that the performance-based approach is acceptable per Section 4.2.4.2 of NFPA 805.

### 5.0 REFERENCES

- 5.1 Calculation PRA-FIRE-NB-CRE, Fire PRA Cumulative Risk Evaluations
- 5.2 CNP Fire Pre-Plans, Volumes I, II, and III, Revisions 17, 14, and 18 respectively
- 5.3 Fire Hazards Analysis
- 5.4 NFPA 805, Performance-Based Standard for Fire Protection for Light Water Reactor Electric Generating Plants
- 5.5 NFPPM, NFPA 805 Fire Protection Program Manual (NFPPM)
- 5.6 Nuclear Energy Institute (NEI) 04-02, Guidance for Implementing a Risk-Informed, Performance-Based Fire Protection Program under 10 CFR 50.48(c), Rev. 2
- 5.7 Nuclear Safety Capability Assessment Report
- 5.8 PRA-NB-FIRE-FQ, Fire PRA Model Quantification Notebook
- 5.9 PRA-NB-FIRE-FSS, Fire PRA Fire Scenario Selection
- 5.10 Regulatory Guide 1.205, Risk-Informed, Performance-Based Fire Protection for Existing Light-Water Nuclear Power Plants, Rev. Revision 1
- 5.11 Technical Evaluation R1900-005-001, Non-Power Operation Modes Transition Review

**Fire Area AA31 – Attachment 1 - Table B-3 - Fire Area Transition**

<u>Unit</u>	<u>Fire Area</u>	<u>Description</u>
2	AA31	Unit 2 Quadrant 1 Cable Tunnel (El. 596 ft.)

<u>Fire Zone</u>	<u>Description</u>
27	Quadrant 1 Cable Tunnel - El. 596 ft. 3-1/2 in. - Unit 2

**Regulatory Basis**

4.2.4.2 - Performance-Based Approach - Fire Risk Evaluation with simplifying deterministic assumptions

<b>Performance Goal</b>	<b>Method of Accomplishment</b>	<b>Comments</b>
Reactivity Control	Unit 2 - Trip the reactor from the Control Room. Borate using Unit 2 East Charging Pump supplied from the RWST. Use source range monitoring for indication for Unit 2.	None
Inventory and Pressure Control	Unit 2 - Control inventory using Unit 2 East Charging Pump. Control pressure using Unit 2 Pressurizer Safety Relief Valves.	VFDR identified for Main Steam Isolation and RCS integrity for Pressurizer, RX Head and RCP Seals.
Decay Heat Removal	Unit 2 - Feed SGs 2 & 3 with Unit 2 East MDAFW. The DHR function also requires MS isolation with a steam release path through the Safety Relief Valves.	VFDR identified for MS isolation.
Process Monitoring	Unit 2 Process Monitoring - Use Unit 2 process monitoring in the Control Room for the following: Pressurizer level, RCS pressure and temperature, and S/G level and Pressure. Unit 2 Source Range Monitoring - Use Unit 2 source range monitoring in the Control Room.	None
Vital Auxiliaries	Unit 2 Electrical - Control Unit 2 Red (AB) Train Electrical Distribution with Unit 2 Red (AB) Train Offsite Power or Unit 2 Red (AB) DG. Control Unit 2 Green (CD) Train Electrical Distribution with Unit 2 Green (CD) Train Offsite Power or Unit 2 Green (CD) DG. Unit 2 ESW - Operate Unit 2 East or West ESW. Unit 2 CCW - Operate Unit 2 East or West CCW. Unit 2 HVAC - Operate Unit 2 Control Room HVAC. Operate Unit 2 Auxiliary Building HVAC. Operate Unit 2 Red (AB) and Green (CD) DG HVAC. Operate Unit 2 Switchgear HVAC. Operate Unit 2 East MDAFW Pump Room HVAC system. Operate Unit 2 East and West ESW Pump Room	None

**Fire Area AA31 – Attachment 1 - Table B-3 - Fire Area Transition**

<u>Unit</u>	<u>Fire Area</u>	<u>Description</u>
2	AA31	Unit 2 Quadrant 1 Cable Tunnel (El. 596 ft.)

HVAC systems.

**Reference Documents**

Genesis Solution Suite, EDISON / SAFE-PB, DC Cook V 3.4.0

Nuclear Safety Capability Assessment Report

**Licensing Actions**

None

**Existing Engineering Equivalency Evaluations (EEEE)**

**EEEE Title** Engineering Equivalency Evaluation 11-3 - Fire Retention Capability of Nonconforming Fire Seals in Fire Zone 27 (Fire Area AA31) to Fire Zone 39 (Fire Area AA38)

**Summary** The purpose of this engineering equivalency evaluation is to document the acceptability of the 8 in. thick silicone foam fire seals protecting the penetrations between the Quadrant 1 cable tunnel at elevation 596 ft. in Unit 2 of Fire Zone 27 (Fire Area AA31) and the Quadrant 2 cable tunnel at elevation 612 ft. in Unit 2 of Fire Zone 39 (Fire Area AA38).

The existing 8 in. silicone foam fire seals located within the penetrations between Fire Zone 27 and Fire Zone 39 are acceptable for maintaining the rating of the fire area boundary. This engineering equivalency evaluation does not impact engineering equivalency evaluations.

The silicone foam fire seals were evaluated and found to be acceptable based on the fire hazards and fire protection systems within the evaluated areas.

**Fire Area AA31 – Attachment 1 - Table B-3 - Fire Area Transition**

<u>Unit</u>	<u>Fire Area</u>	<u>Description</u>
2	AA31	Unit 2 Quadrant 1 Cable Tunnel (El. 596 ft.)

**EEEE Title Engineering Equivalency Evaluation 11-9 - Turbine, Auxiliary and Containment Buildings Boundary Evaluation**

**Summary** The purpose of this engineering equivalency evaluation is to describe in general, the approach and existence of evaluations performed to determine and reconcile fire area boundaries having components or designs with less than a 3-hr fire rating on preventing the spread of fire. This engineering equivalency evaluation also specifically evaluates the impact of unrated door assemblies on the spread of fire.

Reasonable assurance is provided that the fire area boundaries having components or design less than a 3-hr fire rating will not increase the spread of fire or impair the safe shutdown capabilities of Units 1 or 2. In addition, this engineering equivalency evaluation does not adversely impact on other engineering equivalency evaluations or exemption requests.

This evaluation supports additional evaluations credited in this fire area.

**EEEE Title Engineering Equivalency Evaluation 11-14 - Cable Spreading Room Construction Boundary Evaluation (Fire Areas AA3, AA7, AA8, AA9, AA10, AA29, AA30, AA31, AA34, AA35, AA36/42, AA37, AA38, AA48, AA50, AA51 and AA52)**

**Summary** The purpose of this engineering equivalency evaluation is to document the acceptability of the construction features of the cable spreading rooms which have a fire resistance rating of less than 3 hours for their impact on the spread. In particular, fire dampers having a 1 1/2-hr fire rating were analyzed by this evaluation. Other unrated construction features have been previously analyzed under separate engineering equivalency evaluations. The applicable fire areas include: AA3, AA7, AA8, AA9, AA10, AA29, AA30, AA31, AA34, AA35, AA36/42, AA37, AA38, AA48, AA50, AA51 and AA52.

Reasonable assurance is provided that the construction features of the cable spreading rooms which have a fire resistance rating of less than 3 hours will prevent the spread of fire and not impair the safe shutdown capabilities of Unit 1 and Unit 2. In addition, this engineering equivalency evaluation does not adversely impact other engineering equivalency evaluations.

The construction features of the cable spreading room were evaluated and found to be acceptable based on the fire hazards, fire protection systems and construction features within the areas.

**Fire Area AA31 – Attachment 1 - Table B-3 - Fire Area Transition**

<u>Unit</u>	<u>Fire Area</u>	<u>Description</u>
2	AA31	Unit 2 Quadrant 1 Cable Tunnel (El. 596 ft.)

<b><u>EEEE Title</u></b>	<b>Engineering Equivalency Evaluation 11-24 - Fire Retention Capability of Nonconforming Fire Seals in Fire Zones having a Low Combustible Loading Classification</b>
<b><u>Summary</u></b>	<p>The purpose of this engineering equivalency evaluation is to document the acceptability of fire seal designs which do not meet the requirements of the installation specification or fire test data in fire zones having a low combustible loading classification would have on preventing the spread of fire.</p> <p>Reasonable assurance is provided that fire seals which do not meet the requirements of the installation specification or fire test data in fire zones having a low combustible loading classification, will provide adequate fire retention capabilities and will not impair the safe shutdown capabilities of CNP or increase the spread of fire between fire zones. In addition, this engineering equivalency evaluation does not adversely impact other engineering equivalency evaluations or exemptions.</p> <p>Refer to Engineering Equivalency Evaluation 11.31.</p>
<b><u>EEEE Title</u></b>	<b>Engineering Equivalency Evaluation 11-31 - Generic Fire Seal Design 5 (Fire Areas AA31 and AA38)</b>
<b><u>Summary</u></b>	<p>The purpose of this engineering equivalency evaluation is to document the acceptability of deviations to Generic Fire Seal Design 5 (in Fire Areas AA31 and AA38) on preventing the spread of fire.</p> <p>Reasonable assurance is provided that deviations to Generic Fire Seal Design 5, Fire Seals W9134 and W9597, and the attributes discussed in this engineering equivalency evaluation will not impair the safe shutdown capabilities of CNP or increase the spread of fire between fire zones. This engineering equivalency evaluation does not impact other engineering equivalency evaluations.</p> <p>Generic Fire Seal Design 5 deviations, Attribute Numbers 1, 2, 3, 4, 5, 6, 7 and 9, and Fire Seals W9134 and W9597 were evaluated and found to be acceptable based on the fire hazards, fire protection systems and construction features within the evaluated</p>



**Fire Area AA31 – Attachment 1 - Table B-3 - Fire Area Transition**

<u>Unit</u>	<u>Fire Area</u>	<u>Description</u>
2	AA31	Unit 2 Quadrant 1 Cable Tunnel (El. 596 ft.)
<b><u>EEEE Title</u></b>	<b>Engineering Equivalency Evaluation 11-46 - Seismic Gaps between the Containment and Auxiliary Buildings Boundary Evaluation (Fire Areas AA2, AA3, AA7, AA8, AA9, AA10, AA11, AA27, AA29, AA30, AA31, AA34, AA35, AA37 and AA38)</b>	
<b><u>Summary</u></b>	<p>A seismic gap exists around the Containment Building of each unit that provides an opening of approximately 6 in. between the Containment Building and the walls, ceilings and floors of the structures immediately adjacent to containment. These Fire Areas include AA2, AA3, AA7, AA8, AA9, AA10, AA11, AA27, AA29, AA30, AA31, AA34, AA35, AA37 and AA38. This engineering equivalency evaluation has been performed to document the acceptability of these seismic gaps in the fire boundaries.</p> <p>This seismic gap evaluation shows the safe shutdown capability for CNP Unit 1 and Unit 2 has not been compromised as a result of seismic gaps. The analysis performed and the results presented in the tables indicate, on a system basis, the capability to safely shut down both units when considering fire damage to safe shutdown components and circuits contained in the seismic gap evaluation areas. The method of analysis is conservative when considering the fire hazards involved in the vicinity of the seismic gaps. That is, it is not anticipated that the evaluated areas would be affected to the extent that fire would propagate through the seismic gaps and cause damage throughout the evaluated area. This engineering equivalency evaluation has no impact on the exemption requests contained in other engineering equivalency evaluations.</p> <p>The seismic gaps were evaluated and found to be acceptable based on the fire hazards, fire protection systems and construction features within the evaluated areas.</p>	
<b><u>EEEE Title</u></b>	<b>Engineering Equivalency Evaluation 12-19 - CO2 Fire Suppression System Concentrations (Fire Areas AA7, AA8, AA9, AA10, AA29, AA30, AA31, AA37, AA38, AA39, AA40, AA41, AA43, AA44, AA45, AA48, AA49, AA50, AA51, AA52 and AA53)</b>	
<b><u>Summary</u></b>	<p>The purpose of this engineering equivalency evaluation is to document the acceptability of the CO2 fire suppression systems in fire zones containing concentrations of cable insulation and the potential for deep-seated fires. This engineering equivalency evaluation determines the CO2 system's impact on the spread of fire and previous engineering equivalency evaluations and exemption requests. Although there are other fire zones that use CO2 for fire suppression such as the DG Rooms, they are installed to suppress surface-type, combustible liquid fires and are not included in this analysis, because they do not contain significant concentrations of cable insulation capable of producing deep-seated fires.</p> <p>All of the CO2 systems included in this engineering equivalency evaluation are capable of performing their intended function, containing the fire until the Fire Brigade arrives, preventing fire spread to adjacent fire zones, and ensuring that safe shutdown of CNP can be achieved and maintained.</p> <p>The existing suppression systems were evaluated and found to be acceptable based on the fire hazards and fire protection systems within the evaluated areas.</p>	

**Fire Area AA31 – Attachment 1 - Table B-3 - Fire Area Transition**

<u>Unit</u>	<u>Fire Area</u>	<u>Description</u>
2	AA31	Unit 2 Quadrant 1 Cable Tunnel (El. 596 ft.)

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**Fire Suppression Effects on Nuclear Safety Performance Criteria**

The CNP fire brigade is trained to discharge water in a judicious manner and instructed to direct hose streams and portable extinguishers at the base of the fire to limit the amount of overspray beyond the immediate fire zone. For this reason, fire brigade activities are not expected to fail components not already considered damaged. It has been concluded that water impingement on cables is not a concern. Electrical cabinets are provided with a seal at the conduit interface. Possible impacts to surrounding equipment due to manual fire fighting activities is bounded by the analysis approach of postulating whole room damage. The drainage features of the fire area mitigate the potential for flooding damage due to fire suppression, such that the standing water would not affect credited equipment.

In the event of discharge, any damage caused by the CO2 system to other equipment operating within the fire area which is not immediately involved in the originating fire is bounded by the analysis approach of postulating whole room damage. Since it is shown that suppression effects will not impact the nuclear safety performance criteria, the fire area configuration is deemed acceptable.

## References:

Technical Evaluation 12.1, "Fire Suppression Effects Study"

Technical Evaluation 12.1, "Supplemental Information to Fire Suppression Effects Study – Supplement 1"

**Fire Area Comments**

None

## Fire Area AA31 – Attachment 2 - Fire Risk Evaluation Results Summary

### A2.1 Introduction

The ‘changes’ associated with NFPA 805 transition were those variances from the deterministic requirements of NFPA 805. The changes identified for evaluation for fire area AA31 are grouped as follows:

- Separation Issues

This attachment is a summary of the Fire Risk Evaluation for the fire area. The complete results and methodology are contained in the Cumulative Fire Risk Evaluation, PRA-FIRE-NB-CRE. (FPCE 2017-0009)

### A2.2 Inputs/Assumptions

1. Assumptions from the Fire PRA apply to this calculation.
2. Detailed fire modeling was not performed for Fire Area AA31. A single whole room burnout scenario was assumed.

### A2.3 Fire Modeling Methodology

Detailed fire modeling was not performed for Fire Area AA31. This area was modeled considering whole room burnout.

### A2.4 Scenario Descriptions and Model Results

A single whole room burnout scenario was modeled for Fire Area AA31. All targets within the fire area were assumed damaged.

#### A2.4.1 Ignition Sources

The fixed ignition sources in Fire Area AA31 consist of the Local S/D indication panel, core exit thermocouple monitoring cabinet, the unit 2 containment transmitter and a signal processor. Additional detail regarding the ignition sources in this area is available in the Fire PRA Report. All fire scenarios, whether resulting from credited fixed or transient ignition sources, are assumed to damage all targets in the fire area.

#### A2.4.2 Scenario Results

The PRA analyzed the VFDRs and determined them to be risk insignificant, therefore, a quantitative delta risk calculation was not performed.

### A2.5 Fire Risk Evaluation Results

PRA-FIRE-NB-CRE documents scenarios and corresponding impacted VFDRs that were evaluated for delta risk during the transition to NFPA 805 and also all changes to the Fire Protection Program that are currently incorporated into the Fire PRA model. The acceptability of the Cumulative Fire Risk Evaluations was based on calculated delta risk meeting the thresholds of NEI 04-02, RG 1.205 and RG 1.174. (FPCE 2017-0009)

## Fire Area AA31 – Attachment 2 - Fire Risk Evaluation Results Summary

### A-2.6 Impact of VFDR on Defense-in-Depth

Defense-in-Depth has been evaluated for this fire area. The impacts of this evaluation are summarized in the table below:

Defense-in-Depth Impact Review for AA31			
Method of Providing DID	Required to Support Deterministic Analysis or Fire PRA?	Changes or Improvements Necessary for DID?	Basis/Justification
Echelon 1: Prevent fires from starting			
Combustible Control is implemented in accordance with Procedure PMP-2270-CCM-001, Control of Combustible Materials.	Yes	No	• This element is adequate based on no perceived weakness of, or over-reliance on, another echelon of defense-in-depth.
Hot Work Control is implemented in accordance with Procedure PMP-2270-WBG-001, Welding, Burning and Grinding Activities.	Yes	No	
Echelon 2: Rapidly detect, control and extinguish promptly those fires that do occur thereby limiting fire damage			
Fire Detection System	Yes	No	• Suppression and detection are already required and fire fighting activities are not expected to be challenging; therefore, no changes or improvements to Echelon 2 attributes are necessary to maintain defense-in-depth.
Fixed Fire Suppression	Yes	No	
Portable Fire Extinguishers	Yes	No	
Hose stations and hydrants	Yes	No	
Pre-Fire Plan	Yes	No	
Echelon 3: Provide adequate level of fire protection for systems and structures so that a fire will not prevent essential safety functions from being performed			
Walls, floors ceilings and structural elements are rated or have been evaluated as adequate for the hazard.	Yes	No	• There are significant modeling differences between the Fire PRA and nuclear safety capability assessment (i.e., due to different success criteria, end states, etc.) and therefore a recovery action for VFDR AA31-001 has been credited to ensure that defense-in-depth is maintained.
Penetrations in the fire area barrier are rated or have been evaluated as adequate for the hazard.	Yes	No	
Supplemental barriers (e.g., ERFBS, cable tray covers, etc.)	No	No	• Defense in Depth actions were credited to remove fuses or open breakers in the Control Room to prevent spurious equipment operation due to internal shorts.
Guidance provided to operations personnel detailing the required success path(s) including recovery actions to achieve nuclear safety performance criteria.	No	Yes	

## Fire Area AA31 – Attachment 2 - Fire Risk Evaluation Results Summary

### A-2.7 Safety Margin Considerations

In accordance with NEI 04-02, the maintenance of adequate Safety Margin is assessed by the consideration categories of analyses utilized by this Fire Risk Evaluation.

Safety margins are considered to be maintained if:

- Codes and Standards or their alternatives accepted for use by the NRC are met.

AND

- Safety analyses acceptance criteria in the licensing basis (e.g., FSAR, supporting analyses) are met, or provides sufficient margin to account for analysis and data uncertainty.

The following summarizes the bases for ensuring the maintenance of safety margins:

- The risk-informed, performance based processes utilized are based upon NFPA 805, 2001 edition, endorsed by the NRC in 10 CFR 50.48(c).
- The Fire Risk Evaluation process is in accordance with NEI 04-02, Revision 2, which is endorsed by the NRC in Regulatory Guide 1.205, Revision 1.
- The Fire PRA is developed in accordance with NUREG/CR-6850, which was developed jointly between the NRC and EPRI.
- The Fire PRA has undergone an industry peer review, in order to ensure the Fire PRA meets the appropriate quality standards of ASME/ANS RA-Sa-2009, "Standard for Level 1/Large Early Release Frequency Probabilistic Risk Assessment for Nuclear Power Plant Applications," Dated February 2, 2009
- The "bounding risk assessment" is used during transition (NEI 04-02, Section 5.3.4.2). This approach conservatively assumes that target set damage occurs for postulated fire events which resulted in whole room burn up, and therefore, MEFS/LFS is not analyzed separately from the Fire PRA results.
- The CNP internal events PRA model received two formal industry peer reviews conducted in accordance with applicable NEI guidelines. The initial peer review was performed in 2001, while a subsequent focused scope (i.e., limited scope) peer review was conducted in 2009. The initial, full-scope WOG peer review covered all aspects of the CNP PRA model and the administrative processes used to maintain and update the model. The CNP PRA model has been revised to address all significant issues (i.e., Category A and B Facts & Observations) identified during the initial peer review. None of the findings from the focused-scope peer review were judged to reach the significance level of a Category A or B Fact & Observation; as a result, no changes to the PRA model have yet been made to include resolutions for these latter issues.
- Fire protection systems and features determined to be required by NFPA 805 Chapter 4 have been confirmed to meet the requirements of NFPA 805 Chapter 3 and their associated referenced codes and listings, or provided with acceptable alternatives using processes accepted for use by the NRC (i.e., FAQ 06-0008, FAQ 06-0004, 07-0033).
- Fire modeling has not been performed in support of the change evaluations and results are therefore, based on whole area burn up. As such, the results are considered very conservative.
- In accordance with the requirements of 10 CFR 50.48(c)(2)(iii), the Fire PRA results, including cutsets for

## **Fire Area AA31 – Attachment 2 - Fire Risk Evaluation Results Summary**

the scenarios of concern, have been reviewed and it was verified that the results presented above do not rely solely on feed and bleed as the fire-protected safe shutdown path for maintaining reactor coolant inventory, pressure control, and decay heat removal capability for this fire area.

### **A-2.8 Transition Risk Evaluation Conclusions**

The transition change evaluation determined that these changes:

- Are acceptable based upon the measured change in CDF and LERF
- Maintained adequate defense-in-depth and safety margins

The results of this evaluation meet the requirements of NFPA 805 Risk Evaluation; therefore, the use of the performance based analysis approach is acceptable.

D. C. Cook Nuclear Plant  
Fire Safety Analysis

Fire Area: AA32

Unit 1 Essential Service Water Pump Area and Unit 1 and Unit 2  
Basement Motor Control Center Room (El. 591 ft. and 575 ft.)

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Conclusion ..... Section 4.0

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Attachments

Fire Area AA32 – Attachment 1 - Table B-3 - Fire Area Transition

## **1.0 PURPOSE**

This report documents the Fire Safety Analysis (FSA) for Cook Nuclear Plant (CNP) Fire Area AA32, Unit 1 Essential Service Water Pump Area and Unit 1 and Unit 2 Basement Motor Control Center Room (El. 591 ft. and 575 ft.) which comprises fire zone(s) 29A, 29B, 29E, 29G. The purpose of this analysis is to demonstrate the achievement of the nuclear safety and radioactive release performance criteria of NFPA 805 as required by 10 CFR 50.48(c). The Fire Safety Analysis is a key part of compliance with Section 2.7.1.2 Fire Protection Program Design Basis Document of NFPA 805.

## **2.0 ANALYSIS METHODOLOGY**

The FSA is the design basis document as described in NFPA 805 Section 2.7.1.2. The following steps are performed to develop the FSA on a fire area basis:

- Identify significant fire hazards in the fire area. This is based on NFPA 805 approach to analyze the plant from an ignition source and fuel package perspective.
- Summarize Nuclear Safety Capability Analysis (NSCA) compliance strategies. This is the result of the NEI 04-02 B-3 Table review of the Safe Shutdown Analysis.
- Summarize Non-Power Operations Modes compliance strategies.
- Summarize Radioactive Release compliance strategies. The transition review process required per NEI 04-02 is used to develop these results.
- Provide Fire Probabilistic Risk Assessment summary of results. This is based on the results from the plant Fire PRA.
- Perform risk informed, performance based evaluations if needed for the performance based approach.
- Summarize Defense-in-Depth strategy for each fire area.
- Determine key analysis assumptions which are candidates to be included in the NFPA 805 monitoring program.
- Provide conclusions relative to NFPA 805 compliance.



## 3.0 ANALYSIS

### 3.1 Classical Fire Protection

#### 3.1.1 Construction

For all fire zones within AA32, walls, floors and ceilings to adjacent fire areas and fire zones are reinforced concrete in excess of a 3-hour rating.

The wall separating Fire Zones 29A and 29B of Unit 1 from Fire Zones 29C and 29D of Unit 2 is a fire barrier with a 3-hour fire rating.

Applicable Licensing Actions and Engineering Equivalency Evaluations are documented in Attachment 1.

#### 3.1.2 Doors and Access Openings

For Fire Zones 29A, 29B and 29E, a locked wire mesh screen gate is provided at the entrance to adjacent Fire Area AA2 - Fire Zone 142 for ventilation purposes. A fire area boundary evaluation was performed for the unrated wire mesh gate to Fire Area AA2 - Fire Zone 142 (Engineering Equivalency Evaluation 9-25).

For Fire Zone 29B, the open stairway down to Fire Zone 29G was included in Engineering Equivalency Evaluation 9-25 assessing the separation between the Unit 1 and Unit 2 ESW pump cubicles

For Fire Zone 29E, Engineering Equivalency Evaluation 9-25 was also performed for an unrated floor hatch to Fire Zone 29G.

For Fire Zone 29G, there are no door openings to adjacent fire areas. A fire area boundary evaluation was performed for an unrated floor hatch to Fire Zone 29C (Engineering Equivalency Evaluation 9-25). That fire area boundary evaluation included the open stairway leading up to adjacent Fire Zone 29B.

#### 3.1.3 Penetrations

For all fire zones within AA32, penetrations in the fire barriers between these fire zones and adjacent fire areas are provided with fire seals.

For Fire Zone 29A, the fire wall separating this fire zone from the Unit 2 ESW pump cubicle, Fire Zone 29C, is a barrier which is also provided with fire seals. The floor to Fire Zone 29G is also provided with fire seals. However, the remaining barrier between this fire zone and Fire Zone 29B is not fire sealed.

For Fire Zone 29B, the fire wall separating this fire zone from the Unit 2 ESW pump cubicle, Fire Zone 29D, is a barrier which is also provided with fire seals. The floor to Fire Zone 29G is also provided with fire seals. However, the remaining barriers between this fire zone and Fire Zones 29A and 29E are not fire sealed.

For Fire Zone 29E, barriers between this fire zone and the adjacent fire zone are not fire sealed.

For Fire Zone 29G, penetrations in fire barriers between this fire zone and adjacent Fire Zones 29A, 29B, 29C and 29D are provided with fire seals. However, penetrations in fire barriers to the other fire zones are not sealed.

### 3.1.4 Detection

The table below outlines the fire detection system(s) provided in the Fire Area:

Table 3-1, Fire Area AA32 Detection Systems									
Fire Zone	Type of System	Local (L) / Remote (R)	Detection Actuates Suppression?	Required System?					
				S	L	E	R	D	
29A	Ionization	L/R	No Auto Supp. (N/A)	Y	Y	Y	N	N	
29B	Ionization	L/R	No Auto Supp. (N/A)	Y	Y	Y	N	N	
29E	Ionization	L/R	No Auto Supp. (N/A)	Y	Y	Y	N	N	
29G	Ionization	L/R	No Auto Supp. (N/A)	Y	Y	Y	N	N	

Table 3-1 Legend:	
Table Field: "Required System?"	
S	- Required for Chapter 4 Separation Criteria
L	- Required for NRC Approved Licensing Action
E	- Required for Engineering Equivalency Evaluation
R	- Required for Risk Significance
D	- Required to maintain adequate balance of Defense-in-Depth in a Change Evaluation or Fire Risk Evaluation

For Fire Zone 29A, four ionization detectors are provided which alarm in the Unit 1 Control Room. One of the detectors is located at the top of the common access gate opening due to the high air flow rate out of the room. These detectors are part of the detection circuit also protecting Fire Zones 29B and 29E.

For Fire Zone 29B, four ionization detectors are provided which alarm in the Unit 1 Control Room. A fifth detector (included as part of the detection coverage for Fire Zone 29A) is located at the top of the common access gate opening due to the high air flow rate out of the room. These detectors are part of the detection circuit also protecting Fire Zones 29A and 29E.

For Fire Zone 29E, one ionization detector is provided which alarms in the Unit 1 Control Room. This detector is part of the detection circuit also protecting Fire Zones 29A and 29B.

For Fire Zone 29G, four ionization detectors are provided which alarm in the Unit 1 Control Room.

### 3.1.5 Fixed Suppression

The table below outlines the fixed fire suppression system(s) provided in the Fire Area:

Table 3-2, Fire Area AA32 Suppression Systems								
Fire Zone	Type of System	Full (F) / Partial (P)	Required System?					
			S	L	E	R	D	
29A	None	N/A	N/A	N/A	N/A	N/A	N/A	N/A
29B	None	N/A	N/A	N/A	N/A	N/A	N/A	N/A
29E	None	N/A	N/A	N/A	N/A	N/A	N/A	N/A
29G	None	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Table 3-2 Legend:								
Table Field: "Required System?"								
S	- Required for Chapter 4 Separation Criteria							
L	- Required for NRC Approved Licensing Action							
E	- Required for Engineering Equivalency Evaluation							
R	- Required for Risk Significance							
D	- Required to maintain adequate balance of Defense-in-Depth in a Change Evaluation or Fire Risk Evaluation							

Fire Area AA32 is not provided with an automatic fire suppression.

### 3.1.6 Manual Suppression / Response Strategy

A postulated fire will be identified by early detection using ionization type smoke detection or by plant personnel using plant communication system to notify the control room. The automatic detection system alarms in the control room. The Control Room operator will dispatch the fire brigade for initiation of manual fire fighting. A fire in this fire area will be contained by the construction features discussed in Section 3.1.1. Manual suppression is provided by the CNP Fire Brigade.

For Fire Zones 29A, 29B and 29E, all manual fire suppression equipment is located in adjacent Fire Zone 142.

Fire Zone 29G is equipped with fire extinguishers, with additional extinguishers located in adjacent Fire Zone 142. A water hose reel is located in adjacent Fire Zone 142.

Floor drains are provided for Fire Zone 29A and 29B. Floor drains are not provided for Fire Zones 29E or 29G. Drainage for Fire Zone 29E is via the room entrance into the Screen House, Fire Zone 142, at the 591ft elevation. The floor of Fire Zone 29G is pitched toward a sump in the area.

### 3.1.7 Ventilation

A fire in this area will be contained by the fire barriers. Smoke can be removed by venting to the outdoors or to other parts of the Turbine Building. The normal building ventilating systems in the Turbine Building will then exhaust the smoke via filtered monitored pathways. This fire area is listed as a non-controlled area in the Fire Pre Plans and therefore there is reasonable assurance that products of combustion will not be contaminated.

For Fire Zones 29A and 29B, a fire area boundary evaluation was performed for an undampened ventilation duct to Fire Area AA2 - Fire Zone 142 (Engineering Equivalency Evaluation 9-25).

Fire Zones 29E and 29G do not have ventilation penetrations.

### 3.1.8 Other Features

For Fire Zone 29G, Electrical Raceway Fire Barrier Systems (ERFBS) with a rating of a 1-hour are provided, where required (Exemption 7.7).

6 in. high curb are provided around the stairway opening and 12 in. high curb around the hatch entrance will prevent flow of spilled combustible liquids down into Fire Zone 29G from Fire Zones 29B and 29C, respectively (Engineering Equivalency Evaluation 9-25).

## 3.2 Fire Hazards Identification

The fire area contains both ignition sources and combustible fire hazards. The ignition sources consist of the ESW pumps, room coolers, miscellaneous power panels and motor control centers.

Fire Zone 29A contains cable insulation, plastics and 5 gallons of lube oil.

Fire Zone 29B contains plastics and 5 gallons of lube oil.

Fire Zone 29E contains cable insulation and plastics.

Fire Zone 29G contains cable insulation, cellulotics, rubber and plastics.

All fire zones within this fire area have a combustible loading classification of low.

## 3.3 NSCA Compliance Summary

Unit 1 ESW Pump Area and Basement MCC Room contains Unit 1 East and West Essential Service Water pump and associated train components, Unit 1 and Unit 2 600V MCCs, as well as Red and Green train cables, conduits and raceways.

Compliance with the nuclear safety performance criteria is achieved using the deterministic approach in accordance with NFPA 805, Section 4.2.3.3(c). A previously approved exemption for the lack of automatic suppression is credited within this area.

Safe and stable condition of Unit 1 will be accomplished using Steam Generators 2 and 3 via Unit 1 Turbine Driven Auxiliary Feedwater Pump, Control Room Process Monitoring, Unit 1 Charging via the West or East Pump, Unit 1 Component Cooling Water via the East Pump, Unit 1 Essential Service Water via the Unit 2 West Pump supplying the Unit 1 East system, the Unit 2 East ESW Pump is available to support AB DG cooling. Electrical power is supplied to either Red or Green Trains via offsite power with both Red and Green Train Emergency Diesels also available.

The Nuclear Safety Performance Criteria compliance strategy for AA32 is documented within the NSCA Report.

### 3.3.1 Variances

There are no variances for this fire area.

### 3.3.2 Recovery Actions Credited

There are no recovery actions for this fire area.

### 3.4 Non-Power Operational Modes Compliance Summary

A review of CNP for the potential effects of a fire in this Fire Area while in non-power modes of operation (NPO) was conducted. This review was conducted using the guidance provided in NEI 04-02 and FAQ 07-0040, "Non-Power Operations Clarifications".

The review determined that there are potential failures that affect certain Key Safety Functions (KSF) as a result of the fire in this area, and the fire could result in the loss of one or more KSF paths. Compensatory measures are required during high risk evolution periods to provide reasonable assurance a fire will not adversely affect key safety functions and the NFPA 805 performance goal for NPO is therefore satisfied. The results of the NPO analysis are contained within Technical Evaluation R1900-005-001, Non-Power Operation Modes Transition Review Report.

### 3.5 Radioactive Release Compliance Summary

The NFPA 805 radiological release goal is to provide reasonable assurance that a fire will not result in a radiological release that adversely affects the public, plant personnel or the environment. The NFPA 805 requirement is to ensure a radiation release to any unrestricted area due to the direct effects of fire suppression activities (but not involving fuel damage) shall be as low as reasonably achievable and shall not exceed applicable plant Technical Specification limits.

AA32 is located outside the Radiological Controlled Area (RCA) and is not a storage location for contaminated materials, therefore there is reasonable assurance a fire in this area will not result in radiation release. The review of this fire area, with respect to radioactive release, is documented in the NFPPM.

### 3.6 Probabilistic Risk Assessment-Summary of Results

A Fire PRA (FPRA) quantification of Fire Area AA32 was performed and is documented in PRA-NB-FIRE-FQ, Fire PRA Model Quantification Notebook. The fire risk quantification for Fire Area AA32 is analyzed assuming whole room burnup. PRA-NB-FIRE-FQ includes a summary of all potentially risk-significant fire scenarios (i.e., CDF > 1.0E-7 or LERF > 1.0E-8). Bounding CDF / LERF per calendar year values are reported that are based on the risk values documented in PRA-NB-FIRE-FSS, Fire PRA Fire Scenario Selection.

### 3.7 Risk-Informed, Performance-Based Evaluations

There are no VFDRs for this fire area, and therefore, no Fire Risk Evaluations have been performed.

#### 3.7.1 Transition Risk-Informed, Performance-Based Evaluations

There are no VFDRs for this fire area, and therefore this section is not applicable to Fire Area AA32.

### 3.8 Defense-in-Depth

Per NFPA 805, section 2.4.4.2, “Defense-in-Depth”: The deterministic approach for meeting the performance criteria shall be deemed to satisfy this defense-in-depth requirement.

### 3.9 Monitoring Program Input

A Monitoring Program will be developed in accordance with FAQ 10-0059, Rev. 1. Methods to monitor availability, reliability, and performance of fire protection program structures, systems, and components (SSCs), as well as programmatic elements will be provided. Additionally, effectiveness measures are established to review program related performance and trends. For AA32 the following systems and features are candidates for inclusion in the CNP Fire Protection Monitoring Program:

- Fire Area boundary barriers discussed in Section 3.1
- Fire Detection System
- Manual Fire Suppression System
- Electrical Raceway Fire Barrier Systems (ERFBS)

## 4.0 CONCLUSION

The nuclear safety and radioactive release performance criteria of NFPA 805 are met for a fire in Fire Area AA32. This Fire Safety Analysis has demonstrated that for Fire Area AA32 a success path remains free of fire damage using the deterministic approach per Section 4.2.3 of NFPA 805.

## 5.0 REFERENCES

- 5.1 CNP Fire Pre-Plans, Volumes I, II, and III, Revisions 17, 14, and 18 respectively
- 5.2 Fire Hazards Analysis
- 5.3 NFPA 805, Performance-Based Standard for Fire Protection for Light Water Reactor Electric Generating Plants
- 5.4 NFPPM, NFPA 805 Fire Protection Program Manual (NFPPM)
- 5.5 Nuclear Energy Institute (NEI) 04-02, Guidance for Implementing a Risk-Informed, Performance-Based Fire Protection Program under 10 CFR 50.48(c), Rev. 2
- 5.6 Nuclear Safety Capability Assessment Report
- 5.7 PRA-NB-FIRE-FQ, Fire PRA Model Quantification Notebook
- 5.8 PRA-NB-FIRE-FSS, Fire PRA Fire Scenario Selection
- 5.9 Regulatory Guide 1.205, Risk-Informed, Performance-Based Fire Protection for Existing Light-Water Nuclear Power Plants, Rev. Revision 1
- 5.10 Technical Evaluation R1900-005-001, Non-Power Operation Modes Transition Review

**Fire Area AA32 – Attachment 1 - Table B-3 - Fire Area Transition**

<u>Unit</u>	<u>Fire Area</u>	<u>Description</u>
1	AA32	Unit 1 Essential Service Water Pump Area and Unit 1 and Unit 2 Basement Motor Control Center Room (El. 591 ft. and 575 ft.)

**Fire Zone Description**

29A	Essential Service Water Pump PP-1E - El. 591 ft. 0 in. - Unit 1
29B	Essential Service Water Pump PP-1W - El. 591 ft. 0 in. - Unit 1
29E	Motor Control Center For ESW Pumps - El. 591 ft. 0 in. - Unit 2
29G	Screen House Motor Control Room for ESW - El. 575 ft. 0 in. Unit 1 and Unit 2

**Regulatory Basis**

4.2.3.3(c) - Deterministic Approach

<b>Performance Goal</b>	<b>Method of Accomplishment</b>	<b>Comments</b>
Reactivity Control	Unit 1 - Trip the reactor from the Control Room. Borate using Unit 1 East or West Charging Pump supplied from the RWST. Use source range monitoring for indication for Unit 1.	None
Inventory and Pressure Control	Unit 1 - Control inventory using Unit 1 East or West Charging Pump. Control pressure using Unit 1 Pressurizer Safety Relief Valves.	None
Decay Heat Removal	Unit 1 - Feed SGs 2 & 3 with Unit 1 TDAFW Pump. The DHR function also requires MS isolation with a steam release path through the Safety Relief Valves.	None
Process Monitoring	Unit 1 Process Monitoring - Use Unit 1 process monitoring in the Control Room for the following: Pressurizer level, RCS pressure and temperature, and S/G level and Pressure. Unit 1 Source Range Monitoring - Use Unit 1 source range monitoring in the Control Room.	None
Vital Auxiliaries	Unit 1 Electrical - Control Unit 1 Red (AB) Train Electrical Distribution with Unit 1 Red (AB) Train Offsite Power or Unit 1 Red (AB) DG. Control Unit 1 Green (CD) Train Electrical Distribution with Unit 1 Green (CD) Train Offsite Power or Unit 1 Green (CD) DG. Unit 1 ESW - Operate Unit 1 East ESW from Unit 2 West ESW Pump. Unit 1 West ESW is available from Unit 2 East Pump for Unit 1 Red (AB) DG	None

**Fire Area AA32 – Attachment 1 - Table B-3 - Fire Area Transition**

<u>Unit</u>	<u>Fire Area</u>	<u>Description</u>
1	AA32	Unit 1 Essential Service Water Pump Area and Unit 1 and Unit 2 Basement Motor Control Center Room (El. 591 ft. and 575 ft.)
<p>cooling.</p> <p>Unit 1 CCW - Operate Unit 1 East CCW.</p> <p>Unit 1 HVAC - Operate Unit 1 Control Room HVAC. Operate Unit 1 Auxiliary Building HVAC. Operate Unit 1 Red (AB) and Green (CD) DG HVAC.</p> <p>Operate Unit 1 Switchgear HVAC. Operate Unit 1 TDAFW Room HVAC system. Operate the Unit 2 East and West ESW Pump HVAC systems to support Unit 1 ESW.</p>		

**Reference Documents**

Genesis Solution Suite, EDISON / SAFE-PB, DC Cook V 3.4.0

Nuclear Safety Capability Assessment Report

**Licensing Actions**

**Licensing Action Title** **Appendix R Exemption, Screenhouse Auxiliary MCC Room Lack of Automatic Suppression (Criteria III.G.2.c) - Exemption 7.7**

**Summary**

Exemption approval per the NRC SER dated December 23, 1983 provides the following justification for the lack of automatic suppression as required by Section III.G.2.c of Appendix R, which was submitted by I&M Letter No. AEP:NRC0692E dated March 31, 1983.

- Ceilings and walls are 3 hour fire rated.
- Arrangement of stairway and exhaust ventilation provide adequate ventilation to preclude the buildup of a hot gas layer where the ESW cables penetrate the fire zone.
- ESW cables have 1 hour fire barriers.
- Combustible loading is low.
- 3 hour fire rated dampers installed in the Unit 2 ESW pump cubicle HVAC supply ducts.

**Existing Engineering Equivalency Evaluations (EEEE)**

**EEEE Title** **Engineering Equivalency Evaluation 9-25 - Essential Service Water Pump House Hatch and Fire Damper Evaluation (Fire Areas**



**Fire Area AA32 – Attachment 1 - Table B-3 - Fire Area Transition**

<u>Unit</u>	<u>Fire Area</u>	<u>Description</u>
1	AA32	Unit 1 Essential Service Water Pump Area and Unit 1 and Unit 2 Basement Motor Control Center Room (El. 591 ft. and 575 ft.)

**AA2, AA32 and AA33)****Summary**

The purpose of this engineering equivalency evaluation is to document the acceptability of: (1) an unrated steel plate hatch located between the ceiling of the Circulating Water Pump Motor Control Room, Fire Zone 29G (Fire Area AA32), and the floor of Unit 2 ESW Pump Cubicle, Fire Zone 29C (a 3-hr fire-rated hatch assembly is not commercially available for use in this location); (2) undampened ventilation ducts located in the ceiling of Fire Zones 29A and 29B (Fire Area AA32) and Fire Zones 29C and 29D (Fire Area AA33); and (3) screen mesh access gates from Fire Zone 142 (Fire Area AA142) into the Unit 1 and Unit 2 ESW pump cubicles.

Reasonable assurance is provided that a fire originating: (1) on the roof of ESW Pump House; (2) in Fire Zones 29A and 29B; (3) in Fire Zone 29G; (4) in Fire Zones 29C and 29D; or (5) in Fire Zone 142, would not impair safe shutdown capabilities of CNP Unit 1 and Unit 2. In addition, this engineering equivalency evaluation does not impact the bases of the full area and fixed suppression exemption requests in the ESW Pump House. This engineering equivalency evaluation does not adversely impact other engineering equivalency evaluations or exemption requests.

The unrated steel plate hatch, the undampened ventilation ducts and the screen mesh access gates were evaluated and found to be acceptable based on the fire hazards, fire protection systems and construction features within the evaluated areas.

**EEEE Title Engineering Equivalency Evaluation 11-9 - Turbine, Auxiliary and Containment Buildings Boundary Evaluation****Summary**

The purpose of this engineering equivalency evaluation is to describe in general, the approach and existence of evaluations performed to determine and reconcile fire area boundaries having components or designs with less than a 3-hr fire rating on preventing the spread of fire. This engineering equivalency evaluation also specifically evaluates the impact of unrated door assemblies on the spread of fire.

Reasonable assurance is provided that the fire area boundaries having components or design less than a 3-hr fire rating will not increase the spread of fire or impair the safe shutdown capabilities of Units 1 or 2. In addition, this engineering equivalency evaluation does not adversely impact on other engineering equivalency evaluations or exemption requests.

This evaluation supports additional evaluations credited in this fire area.

**Fire Area AA32 – Attachment 1 - Table B-3 - Fire Area Transition**

<u>Unit</u>	<u>Fire Area</u>	<u>Description</u>
1	AA32	Unit 1 Essential Service Water Pump Area and Unit 1 and Unit 2 Basement Motor Control Center Room (El. 591 ft. and 575 ft.)

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**EEEE Title** **Engineering Equivalency Evaluation 11-57 - Fire-Wrapped Cable Trays and Conduit Evaluations (Fire Areas AA32, AA39A, AA45A, and AA2)**

**Summary** The purpose of this engineering equivalency evaluation is document the acceptability of the fire-wrapped cable trays and conduits that are credited in support of NFPA 805 PRA. This review will include the acceptability of the exposed structural supports that support these trays, as well as review the fire wrap for potential damage from high hazard fire sources.

CNP uses fire wrap systems over cable trays and conduits to provide 1-hr protection of cables credited for safe shutdown in the event of a fire in compliance with NFPA 805, Chapter 4 separation requirements. Many of these wrapped trays are supported by exposed structural steel. This engineering equivalency evaluation examines the ability of these exposed supports in Fire Areas AA32, AA39A, AA45A and AA2 to withstand the fire exposure presented by combustibles present in the area.

Reasonable assurance is provided that the exposed steel structural supports on raceways wrapped in accordance with the requirements of NFPA 805, Chapter 4, will not be adversely affected by the combustibles or hazards present in the area. In addition, the fire-wrap on these raceways is not subject to mechanical damage by high hazard fire sources.

The exposed steel structural supports were evaluated and found to be acceptable based on the fire hazards and fire protection systems within the evaluated areas.

**Fire Suppression Effects on Nuclear Safety Performance Criteria**

The CNP fire brigade is trained to discharge water in a judicious manner and instructed to direct hose streams and portable extinguishers at the base of the fire to limit the amount of overspray beyond the immediate fire zone. For this reason, fire brigade activities are not expected to fail components not already considered damaged. It has been concluded that water impingement on cables is not a concern. Electrical cabinets are provided with a seal at the conduit interface. Possible impacts to surrounding equipment due to manual fire fighting activities is bounded by the analysis approach of postulating whole room damage. The drainage features of the fire area mitigate the potential for flooding damage due to fire suppression, such that the standing water would not affect credited equipment.

This fire area is not equipped with a fixed fire suppression system. Since it is shown that suppression effects will not impact the nuclear safety performance criteria, the fire area configuration is deemed acceptable.

**References:**

Technical Evaluation 12.1, "Fire Suppression Effects Study"

Technical Evaluation 12.1, "Supplemental Information to Fire Suppression Effects Study – Supplement 1"

**Fire Area AA32 – Attachment 1 - Table B-3 - Fire Area Transition**

<u>Unit</u>	<u>Fire Area</u>	<u>Description</u>
1	AA32	Unit 1 Essential Service Water Pump Area and Unit 1 and Unit 2 Basement Motor Control Center Room (El. 591 ft. and 575 ft.)

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**Fire Area Comments**

None

## D. C. Cook Nuclear Plant Fire Safety Analysis

## Fire Area: AA33

## Unit 2 Essential Service Water Pump Area (El. 591 ft.)

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## Attachments

Fire Area AA33 – Attachment 1 - Table B-3 - Fire Area Transition

## Fire Area AA33 – Attachment 2 - Fire Risk Evaluation Results Summary

## 1.0 PURPOSE

This report documents the Fire Safety Analysis (FSA) for Cook Nuclear Plant (CNP) Fire Area AA33, Unit 2 Essential Service Water Pump Area (El. 591 ft.) which comprises fire zone(s) 29C, 29D, 29F. The purpose of this analysis is to demonstrate the achievement of the nuclear safety and radioactive release performance criteria of NFPA 805 as required by 10 CFR 50.48(c). The Fire Safety Analysis is a key part of compliance with Section 2.7.1.2 Fire Protection Program Design Basis Document of NFPA 805. This analysis also documents results of risk-informed, performance-based Fire Risk Evaluations (FREs). These evaluations are associated with Variances from Deterministic Requirements (VFDRs) of NFPA 805 Chapter 4.

## 2.0 ANALYSIS METHODOLOGY

The FSA is the design basis document as described in NFPA 805 Section 2.7.1.2. The following steps are performed to develop the FSA on a fire area basis:

- Identify significant fire hazards in the fire area. This is based on NFPA 805 approach to analyze the plant from an ignition source and fuel package perspective.
- Summarize Nuclear Safety Capability Analysis (NSCA) compliance strategies. This is the result of the NEI 04-02 B-3 Table review of the Safe Shutdown Analysis.
- Summarize Non-Power Operations Modes compliance strategies.
- Summarize Radioactive Release compliance strategies. The transition review process required per NEI 04-02 is used to develop these results.
- Provide Fire Probabilistic Risk Assessment summary of results. This is based on the results from the plant Fire PRA.
- Perform risk informed, performance based evaluations if needed for the performance based approach.
- Summarize Defense-in-Depth strategy for each fire area.
- Determine key analysis assumptions which are candidates to be included in the NFPA 805 monitoring program.
- Provide conclusions relative to NFPA 805 compliance.

### 3.0 ANALYSIS

#### 3.1 Classical Fire Protection

##### 3.1.1 Construction

For all fire zones within Fire Area AA33, walls, floors and ceilings to adjacent fire areas and fire zones are reinforced concrete in excess of a 3-hour rating.

Fire Zones 29C and 29D, the wall separating Fire Zones 29A and 29B of Unit 1 from Fire Zones 29C and 29D of Unit 2 is a fire barrier with a 3-hour fire rating.

Applicable Engineering Equivalency Evaluations are documented in Attachment 1.

##### 3.1.2 Doors and Access Openings

For all fire zones within Fire Area AA33, a locked wire mesh screen gate is provided at the entrance to adjacent Fire Area AA2 - Fire Zone 142 for ventilation purposes.

For Fire Zones 29C and 29D, a fire area boundary evaluation was performed for the unrated wire mesh gate to Fire Area AA2 - Fire Zone 142 (Engineering Equivalency Evaluation 9-25).

For Fire Zone 29C, a fire area boundary evaluation was performed for an unrated floor hatch to Fire Zone 29G (Engineering Equivalency Evaluation 9-25).

##### 3.1.3 Penetrations

For all fire zones in Fire Area AA33, penetrations in fire barriers between this fire zone and adjacent fire areas are provided with fire seals.

For Fire Zone 29C, the fire wall separating this fire zone from the Unit 1 ESW pump cubicle, Fire Zone 29A, is a barrier which is also provided with fire seals. The floor to Fire Zone 29G is also provided with fire seals. However, the remaining barrier between this fire zone and the other Unit 2 fire zone, 29D, is not fire sealed.

For Fire Zone 29D, the fire wall separating this fire zone from the Unit 1 ESW pump cubicle, Fire Zone 29B is a barrier which is also provided with fire seals. The floor to Fire Zone 29G is also provided with fire seals. However, the remaining barriers between this fire zone and the other Unit 2 Fire Zones 29C and 29F are not fire sealed.

For Fire Zone 29F, barriers between this fire zone and the adjacent fire zone are not fire sealed.

### 3.1.4 Detection

The table below outlines the fire detection system(s) provided in the Fire Area:

Table 3-1, Fire Area AA33 Detection Systems									
Fire Zone	Type of System	Local (L) / Remote (R)	Detection Actuates Suppression?	Required System?					
				S	L	E	R	D	
29C	Ionization	L/R	No Auto Supp. (N/A)	N	N	Y	Y	N	
29D	Ionization	L/R	No Auto Supp. (N/A)	N	N	Y	Y	N	
29F	Ionization	L/R	No Auto Supp. (N/A)	N	N	N	Y	N	

**Table 3-1 Legend:**

Table Field: "Required System?"	
S	- Required for Chapter 4 Separation Criteria
L	- Required for NRC Approved Licensing Action
E	- Required for Engineering Equivalency Evaluation
R	- Required for Risk Significance
D	- Required to maintain adequate balance of Defense-in-Depth in a Change Evaluation or Fire Risk Evaluation

For Fire Zone 29C, four ionization detectors are provided which alarm in the Unit 1 Control Room. One of the detectors is located at the top of the common access gate opening due to the high air flow rate out of the room. These detectors are part of the detection circuit also protecting Fire Zones 29D and 29F.

For Fire Zone 29D, four ionization detectors are provided which alarm in the Unit 1 Control Room. A fifth detector (included as part of the detection coverage for Fire Zone 29C) is located at the top of the common access gate opening due to the high air flow rate out of the room. These detectors are part of the detection circuit also protecting Fire Zones 29C and 29F.

For Fire Zone 29F, one ionization detector is provided which alarms in the Unit 1 Control Room. This detector is part of the detection circuit also protecting Fire Zones 29C and 29D.

### 3.1.5 Fixed Suppression

The table below outlines the fixed fire suppression system(s) provided in the Fire Area:

Table 3-2, Fire Area AA33 Suppression Systems								
Fire Zone	Type of System	Full (F) / Partial (P)	Required System?					
			S	L	E	R	D	
29C	None	N/A	N/A	N/A	N/A	N/A	N/A	N/A
29D	None	N/A	N/A	N/A	N/A	N/A	N/A	N/A
29F	None	N/A	N/A	N/A	N/A	N/A	N/A	N/A

**Table 3-2 Legend:**

Table Field: "Required System?"	
S	- Required for Chapter 4 Separation Criteria
L	- Required for NRC Approved Licensing Action
E	- Required for Engineering Equivalency Evaluation
R	- Required for Risk Significance
D	- Required to maintain adequate balance of Defense-in-Depth in a Change Evaluation or Fire Risk Evaluation

Fire Area AA33 is not provided with automatic fire suppression.

### 3.1.6 Manual Suppression / Response Strategy

A postulated fire will be identified by early detection using ionization type smoke detection or by plant personnel using plant communication system to notify the control room. The automatic detection system alarms in the control room. The Control Room operator will dispatch the fire brigade for initiation of manual fire fighting. A fire in this fire area will be contained by the construction features discussed in Section 3.1.1. Manual suppression is provided by the CNP Fire Brigade.

For fire zones located within Fire Area AA33, all the manual fire suppression equipment is located in adjacent Fire Zone 142. This includes fire extinguishers and a water hose reel.

Floor drains are provided for Fire Zone 29C and 29D. Floor drains are not provided for Fire Zone 29F. Drainage for Fire Zone 29F is via the room entrance into the Screen House, Fire Zone 142, at the 591ft elevation.

### 3.1.7 Ventilation

A fire in this area will be contained by the fire barriers. Smoke can be removed by venting to the outdoors or to other parts of the Turbine Building. The normal building ventilating systems in the Turbine Building will then exhaust the smoke via filtered monitored pathways. This fire area is listed as a non-controlled area in the Fire Pre Plans and therefore there is reasonable assurance that products of combustion will not be contaminated.

For Fire Zones 29C and 29D, fire dampers having a 3-hour rating are provided to adjacent Fire Area AA2 - Fire Zone 142.

Fire Zone 29F does not contain ventilation penetrations.



### 3.1.8 Other Features

No other fire protection features are provided for Fire Area AA33.

### 3.2 Fire Hazards Identification

The fire area contains both ignition sources and combustible fire hazards. The ignition sources consist of the ESW pumps, room coolers, miscellaneous power panels and motor control centers.

Fire Zone 29C contains cable insulation, plastics and 5 gallons of lube oil.

Fire Zone 29D contains plastics and 5 gallons of lube oil.

Fire Zone 29F contains cable insulation and plastics.

All fire zones within this fire area have a combustible loading classification of low.

### 3.3 NSCA Compliance Summary

U2 ESW Pump Area contains Unit 2 East and West Essential Service Water pump and associated train components, 600V MCCs, as well as Red and Green train cables, conduits and raceways.

Compliance with the nuclear safety performance criteria is achieved using the performance-based approach in accordance with NFPA 805, Section 4.2.4.2.

Safe and stable condition of Unit 2 will be accomplished using Steam Generators 2 and 3 via the Unit 2 East Motor Driven Auxiliary Feedwater Pump, Control Room Process Monitoring, Unit 2 Charging via the East Pump, Unit 2 Component Cooling Water via the East Pump, Unit 2 Essential Service Water via the Unit 1 West Pump supplying the Unit 2 East ESW. The Unit 1 East ESW Pump is available to provide cooling to the Unit 2 Diesel Generator AB. The Unit Electrical power is supplied to either Red or Green Trains via offsite power with both Red and Green train Emergency Diesels also available.

The Nuclear Safety Performance Criteria compliance strategy for AA33 is documented within the NSCA Report.

#### 3.3.1 Variances

The variances identified for evaluation for this fire area are grouped as follows:

##### 3.3.1.1 VFDR No. AA33-001

2-WMO-754 - A secondary water source is required to be operable to support AFW. The initial water source is drawn from the CST. This supply is credited available for nine hours. Prior to the depletion of the CST the AFW supply must be transferred to the ESW system. Transfer to ESW requires the operation of 1 of 3 motor operated valves, dependent upon which AFW pump is in operation. Valve 2-WMO-744 supplies the West MDAFW Pump, 2-PP-3W. Valve 2-WMO-754 supplies the East MDAFW Pump, 2-PP-3E. Valve 2-WMO-753 supplies the TDAFW Pump, 2-PP-4. The supply valves are normally closed and fail as is on the loss of power. For a fire in this area all ESW to AFW MOVs may fail due to the loss of power. Failure of these power supplies is due to associated cables located in the area. A manual action to mitigate these failures is required to recover AFW. The East MDAFW Pump supplying SGs 2 and 3 is credited for decay heat removal for a fire in this area.

Therefore, a manual action is required for 2-WMO-754 which may fail due to fire induced damage of 600V VCC 2-ABV-D. This condition represents a variance from the deterministic requirements of NFPA 805, Section 4.2.3. This is a separation issue.

This VFDR has been evaluated and it was determined that the risk, safety margin and defense-in-depth meet the acceptance criteria of NFPA 805 Section 4.2.4 with a defense-in-depth action credited.

### 3.3.1.2 VFDR No. AA33-002

2-DCR-310 - SG Blowdown Isolation Valves are required to be closed to support main steam isolation. Main steam isolation is required to prevent uncontrolled cooldown through over-steaming. SG Blowdown Isolation Valve may fail due to a full area fire within Fire Area AA33. 2-DCR-310 may fail due to fire induced damage of cable 8085G-2. This cable failure could spuriously open the valve. SGs 2 and 3 are credited for decay heat removal for a fire within Fire Area AA3. This condition represents a variance from the deterministic requirements of NFPA 805, Section 4.2.3. This is a separation issue.

This VFDR has been evaluated and it was determined that the risk, safety margin and defense-in-depth meet the acceptance criteria of NFPA 805 Section 4.2.4 with a defense-in-depth action credited.

### 3.3.2 Recovery Actions Credited

For each VFDR, a Fire Risk Evaluation has been performed to assess the acceptability of risk, defense-in-depth, and safety margin. This evaluation determined whether or not recovery actions are required to ensure that one success path necessary to achieve and maintain the nuclear safety performance criteria is maintained free of fire damage by a single fire. Table 3-3 identifies the credited recovery actions for this area. Actions retained for DID are identified as “DID Actions” within Table 3-3. Additional information for DID actions is contained within Section 3.8 of this report. Note that, for completeness, all VFDRs are contained within Table 3-3, even if the Fire Risk Evaluation has determined that a recovery action is not required. In those instances where a recovery action has been determined to not be required, the word “None” is provided in the “Action” column in the table.

Table 3-3, Recovery Actions Credited		
VFDR	Component	Action
AA33-001	2-WMO-754	DID ACTION 2-WMO-754-OPERATE (Manually operate 2-WMO-754)
AA33-002	2-DCR-310	DID ACTION(S) 2-DCR-310-CLOSE (Remove fuses in MCR to fail closed AOV 2-DCR-310)

### 3.4 Non-Power Operational Modes Compliance Summary

A review of CNP for the potential effects of a fire in this Fire Area while in non-power modes of operation (NPO) was conducted. This review was conducted using the guidance provided in NEI 04-02 and FAQ 07-0040, “Non-Power Operations Clarifications”.

The review determined that there are potential failures that affect certain Key Safety Functions

(KSF) as a result of the fire in this area, and the fire could result in the loss of one or more KSF paths. Compensatory measures are required during high risk evolution periods to provide reasonable assurance a fire will not adversely affect key safety functions and the NFPA 805 performance goal for NPO is therefore satisfied. The results of the NPO analysis are contained within Technical Evaluation R1900-005-001, Non-Power Operation Modes Transition Review Report.

### 3.5 Radioactive Release Compliance Summary

The NFPA 805 radiological release goal is to provide reasonable assurance that a fire will not result in a radiological release that adversely affects the public, plant personnel or the environment. The NFPA 805 requirement is to ensure a radiation release to any unrestricted area due to the direct effects of fire suppression activities (but not involving fuel damage) shall be as low as reasonably achievable and shall not exceed applicable plant Technical Specification limits.

AA33 is located outside the Radiological Controlled Area (RCA) and is not a storage location for contaminated materials, therefore there is reasonable assurance a fire in this area will not result in radiation release. The review of this fire area, with respect to radioactive release, is documented in the NFPPM.

### 3.6 Probabilistic Risk Assessment-Summary of Results

A Fire PRA (FPRA) quantification of Fire Area AA33 was performed and is documented in PRA-NB-FIRE-FQ, Fire PRA Model Quantification Notebook. The fire risk quantification for Fire Area AA33 is analyzed assuming whole room burnup. PRA-NB-FIRE-FQ includes a summary of all potentially risk-significant fire scenarios (i.e., CDF > 1.0E-7 or LERF > 1.0E-8). Bounding CDF / LERF per calendar year values are reported that are based on the risk values documented in PRA-NB-FIRE-FSS, Fire PRA Fire Scenario Selection.

### 3.7 Risk-Informed, Performance-Based Evaluations

Fire Risk Evaluations (FREs) have been performed to ensure that variances from the NFPA 805 deterministic requirements are acceptable. The evaluation process consists of an integrated assessment of the acceptability of risk, defense-in-depth, and safety margins.

#### 3.7.1 Transition Risk-Informed, Performance-Based Evaluations

The 'changes' associated with NFPA 805 transition were those variances from the deterministic requirements of NFPA 805 or with the existing fire protection licensing basis that were brought into compliance with the NFPA 805 performance based approach. The change identified for evaluation for Fire Area AA33 is as follows:

- Separation Issues

The Fire Risk Evaluation has determined that the change is acceptable based upon:

- The measured change in CDF and LERF.
- Adequate defense-in-depth and safety margins being maintained.

Refer to Attachment 2 for a summary of results associated with the Fire Risk Evaluations.

### 3.8 Defense-in-Depth

A comprehensive risk-informed, performance-based analysis includes consideration of defense-in-depth (DID) as part of an integrated evaluation of risk considerations. In general, defense-in-depth involves consideration of the extent to which fire protection systems and features are provided within the three echelons of fire-protection:

- Preventing fires from starting,
- Rapidly detecting fires and controlling and extinguishing promptly those fires that do occur, thereby limiting fire damage,
- Providing an adequate level of fire protection for structures, systems, and components important to safety, so that a fire that is not promptly extinguished will not prevent the nuclear safety performance criteria from being met.

Each VFDR was evaluated for DID. The following recovery actions have been retained for DID.

VFDR No. AA33-001: 2-WMO-754 - A secondary water source is required to be operable to support auxiliary feedwater. The initial water source is drawn from the condensate storage tank. This supply is credited available for nine hours. Prior to the depletion of the condensate storage tank the auxiliary feedwater supply must be transferred to the ESW system. The East Motor Driven Auxiliary Feedwater Pump is credited for a fire occurring within AA33. 2-WMO-754 is required to be operable to provide a secondary water source to the East AFW Pump. This valve could spuriously close or not open due to cable failures within the full area fire analysis for AA33. This failure can be mitigated by de-energizing and manually operating the valve. This recovery action is retained for DID to maintain long term decay heat removal.

VFDR No. AA33-002: 2-DCR-310 - SG Blowdown Isolation Valves are required to be closed to support main steam isolation. Main steam isolation is required to prevent uncontrolled cooldown through over-steaming. SG Blowdown Isolation Valve may fail due to a full area fire within Fire Area AA33. Loss of Main Steam isolation can be mitigated by removing fuses to ensure valves fail shut. This recovery action is being retained for DID to ensure Main Steam isolation is maintained.

Based on the assessment in support of the Fire Risk Evaluation, defense-in-depth is maintained for fire area AA33. Refer to Attachment 2 for details associated with the Fire Risk Evaluation.

### 3.9 Monitoring Program Input

A Monitoring Program will be developed in accordance with FAQ 10-0059, Rev. 1. Methods to monitor availability, reliability, and performance of fire protection program structures, systems, and components (SSCs), as well as programmatic elements will be provided. Additionally, effectiveness measures are established to review program related performance and trends. For AA33 the following systems and features are candidates for inclusion in the CNP Fire Protection Monitoring Program:

- Fire Area boundary barriers discussed in Section 3.1
- Fire Detection System (ionization)

## 4.0 CONCLUSION

The nuclear safety and radioactive release performance criteria of NFPA 805 are met for a fire in Fire Area AA33. This Fire Risk Evaluation for Fire Area AA33 has demonstrated that

- The change in core damage frequency (delta CDF) is acceptable, and

- The change in large early release frequency (delta LERF) is acceptable, and
- Defense-in-depth and safety margins are maintained.

This is confirmation that a success path effectively remains free of fire damage and that the performance-based approach is acceptable per Section 4.2.4.2 of NFPA 805.

## **5.0 REFERENCES**

- 5.1 Calculation PRA-FIRE-NB-CRE, Fire PRA Cumulative Risk Evaluations
- 5.2 CNP Fire Pre-Plans, Volumes I, II, and III, Revisions 17, 14, and 18 respectively
- 5.3 Fire Hazards Analysis
- 5.4 NFPA 805, Performance-Based Standard for Fire Protection for Light Water Reactor Electric Generating Plants
- 5.5 NFPPM, NFPA 805 Fire Protection Program Manual (NFPPM)
- 5.6 Nuclear Energy Institute (NEI) 04-02, Guidance for Implementing a Risk-Informed, Performance-Based Fire Protection Program under 10 CFR 50.48(c), Rev. 2
- 5.7 Nuclear Safety Capability Assessment Report
- 5.8 PRA-NB-FIRE-FQ, Fire PRA Model Quantification Notebook
- 5.9 PRA-NB-FIRE-FSS, Fire PRA Fire Scenario Selection
- 5.10 Regulatory Guide 1.205, Risk-Informed, Performance-Based Fire Protection for Existing Light-Water Nuclear Power Plants, Rev. Revision 1
- 5.11 Technical Evaluation R1900-005-001, Non-Power Operation Modes Transition Review

**Fire Area AA33 – Attachment 1 - Table B-3 - Fire Area Transition**

<u>Unit</u>	<u>Fire Area</u>	<u>Description</u>
2	AA33	Unit 2 Essential Service Water Pump Area (El. 591 ft.)

**Fire Zone   Description**

29C	Essential Service Water Pump PP-2E - El. 591 ft. 0 in. - Unit 2
29D	Essential Service Water Pump PP-2W - El. 591 ft. 0 in. - Unit 2
29F	Motor Control Center for ESW Pumps - El. 591 ft. 0 in. - Unit 2

**Regulatory Basis**

4.2.4.2 - Performance-Based Approach - Fire Risk Evaluation with simplifying deterministic assumptions

<b>Performance Goal</b>	<b>Method of Accomplishment</b>	<b>Comments</b>
Reactivity Control	Unit 2 - Trip the reactor from the Control Room. Borate using Unit 2 East Charging Pump supplied from the RWST. Use source range monitoring for indication for Unit 2.	None
Inventory and Pressure Control	Unit 2 - Control inventory using Unit 2 East Charging Pump. Control pressure using Unit 2 Pressurizer Safety Relief Valves.	None
Decay Heat Removal	Unit 2 - Feed SGs 2 & 3 with Unit 2 East MDAFW Pump. The DHR function also requires MS isolation with a steam release path through the Safety Relief Valves.	VFDRs identified for secondary AFW supply and Main Steam Isolation.
Process Monitoring	Unit 2 Process Monitoring - Use Unit 2 process monitoring in the Control Room for the following: Pressurizer level, RCS pressure and temperature, and S/G level and Pressure. Unit 2 Source Range Monitoring - Use Unit 2 source range monitoring in the Control Room.	None
Vital Auxiliaries	Unit 2 Electrical - Control Unit 2 Red (AB) Train Electrical Distribution with Unit 2 Red (AB) Train Offsite Power or Unit 2 Red (AB) DG. Control Unit 2 Green (CD) Train Electrical Distribution with Unit 2 Green (CD) Train Offsite Power or Unit 2 Green (CD) DG. Unit 2 ESW - Operate Unit 2 East ESW from Unit 1 West ESW Pump. Operate Unit 2 West ESW from Unit 1 East Pump for Unit 2 Red (AB) DG cooling. Unit 2 CCW - Operate Unit 2 East CCW. Unit 2 HVAC - Operate Unit 2 Control Room HVAC. Operate Unit 2 Auxiliary	None

**Fire Area AA33 – Attachment 1 - Table B-3 - Fire Area Transition**

<u>Unit</u>	<u>Fire Area</u>	<u>Description</u>
2	AA33	Unit 2 Essential Service Water Pump Area (El. 591 ft.)
<p>Building HVAC. Operate Unit 2 Red (AB) and Green (CD) DG HVAC.  Operate Unit 2 Switchgear HVAC. Unit 2 AFW Room HVAC is not available. Operate the Unit 1 East and West ESW Pump HVAC systems to support Unit 2 ESW.</p>		

**Reference Documents**

Genesis Solution Suite, EDISON / SAFE-PB, DC Cook V 3.4.0

Nuclear Safety Capability Assessment Report

**Licensing Actions**

None

**Existing Engineering Equivalency Evaluations (EEEE)**

**EEEE Title** Engineering Equivalency Evaluation 9-25 - Essential Service Water Pump House Hatch and Fire Damper Evaluation (Fire Areas AA2, AA32 and AA33)

**Summary** The purpose of this engineering equivalency evaluation is to document the acceptability of: (1) an unrated steel plate hatch located between the ceiling of the Circulating Water Pump Motor Control Room, Fire Zone 29G (Fire Area AA32), and the floor of Unit 2 ESW Pump Cubicle, Fire Zone 29C (a 3-hr fire-rated hatch assembly is not commercially available for use in this location); (2) undampened ventilation ducts located in the ceiling of Fire Zones 29A and 29B (Fire Area AA32) and Fire Zones 29C and 29D (Fire Area AA33); and (3) screen mesh access gates from Fire Zone 142 (Fire Area AA142) into the Unit 1 and Unit 2 ESW pump cubicles.

Reasonable assurance is provided that a fire originating: (1) on the roof of ESW Pump House; (2) in Fire Zones 29A and 29B; (3) in Fire Zone 29G; (4) in Fire Zones 29C and 29D; or (5) in Fire Zone 142, would not impair safe shutdown capabilities of CNP Unit 1 and Unit 2. In addition, this engineering equivalency evaluation does not impact the bases of the full area and fixed suppression exemption requests in the ESW Pump House. This engineering equivalency evaluation does not adversely impact other engineering equivalency evaluations or exemption requests.

The unrated steel plate hatch, the undampened ventilation ducts and the screen mesh access gates were evaluated and found to be acceptable based on the fire hazards, fire protection systems and construction features within the evaluated areas.

**Fire Area AA33 – Attachment 1 - Table B-3 - Fire Area Transition**

<u>Unit</u>	<u>Fire Area</u>	<u>Description</u>
2	AA33	Unit 2 Essential Service Water Pump Area (El. 591 ft.)

**EEEE Title Engineering Equivalency Evaluation 11-9 - Turbine, Auxiliary and Containment Buildings Boundary Evaluation**

**Summary** The purpose of this engineering equivalency evaluation is to describe in general, the approach and existence of evaluations performed to determine and reconcile fire area boundaries having components or designs with less than a 3-hr fire rating on preventing the spread of fire. This engineering equivalency evaluation also specifically evaluates the impact of unrated door assemblies on the spread of fire.

Reasonable assurance is provided that the fire area boundaries having components or design less than a 3-hr fire rating will not increase the spread of fire or impair the safe shutdown capabilities of Units 1 or 2. In addition, this engineering equivalency evaluation does not adversely impact on other engineering equivalency evaluations or exemption requests.

This evaluation supports additional evaluations credited in this fire area.

**Fire Suppression Effects on Nuclear Safety Performance Criteria**

The CNP fire brigade is trained to discharge water in a judicious manner and instructed to direct hose streams and portable extinguishers at the base of the fire to limit the amount of overspray beyond the immediate fire zone. For this reason, fire brigade activities are not expected to fail components not already considered damaged. It has been concluded that water impingement on cables is not a concern. Electrical cabinets are provided with a seal at the conduit interface. Possible impacts to surrounding equipment due to manual fire fighting activities is bounded by the analysis approach of postulating whole room damage. The drainage features of the fire area mitigate the potential for flooding damage due to fire suppression, such that the standing water would not affect credited equipment.

This fire area is not equipped with a fixed fire suppression system. Since it is shown that suppression effects will not impact the nuclear safety performance criteria, the fire area configuration is deemed acceptable.

**References:**

Technical Evaluation 12.1, "Fire Suppression Effects Study"

Technical Evaluation 12.1, "Supplemental Information to Fire Suppression Effects Study – Supplement 1"

**Fire Area Comments**

None



## Fire Area AA33 – Attachment 2 - Fire Risk Evaluation Results Summary

### A2.1 Introduction

The ‘changes’ associated with NFPA 805 transition were those variances from the deterministic requirements of NFPA 805. The changes identified for evaluation for fire area AA33 are grouped as follows:

- Separation Issues

This attachment is a summary of the Fire Risk Evaluation for the fire area. The complete results and methodology are contained in the Cumulative Fire Risk Evaluation, PRA-FIRE-NB-CRE. (FPCE 2017-0009)

### A2.2 Inputs/Assumptions

1. Assumptions from the Fire PRA apply to this calculation.
2. Detailed fire modeling was not performed for Fire Area AA33. Whole room burnout scenarios were assumed.

### A2.3 Fire Modeling Methodology

Detailed fire modeling was not performed for Fire Area AA33. This area was modeled considering whole room burnout.

### A2.4 Scenario Descriptions and Model Results

A single whole room burnout scenario was modeled for Fire Area AA33. All targets within the fire area were assumed damaged.

#### A2.4.1 Ignition Sources

The fixed ignition sources in Fire Area AA33 consist of the East ESW pumps, room coolers and two motor control centers. Additional detail regarding the ignition sources in this area is available in the Fire PRA Report. All fire scenarios, whether resulting from credited fixed or transient ignition sources, are assumed to damage all targets in the fire area.

#### A2.4.2 Scenario Results

The PRA analyzed the VFDRs and determined them to be risk insignificant, therefore, a quantitative delta risk calculation was not performed.

### A2.5 Fire Risk Evaluation Results

PRA-FIRE-NB-CRE documents scenarios and corresponding impacted VFDRs that were evaluated for delta risk during the transition to NFPA 805 and also all changes to the Fire Protection Program that are currently incorporated into the Fire PRA model. The acceptability of the Cumulative Fire Risk Evaluations was based on calculated delta risk meeting the thresholds of NEI 04-02, RG 1.205 and RG 1.174. (FPCE 2017-0009)

## Fire Area AA33 – Attachment 2 - Fire Risk Evaluation Results Summary

### A-2.6 Impact of VFDR on Defense-in-Depth

Defense-in-Depth has been evaluated for this fire area. The impacts of this evaluation are summarized in the table below:

Defense-in-Depth Impact Review for AA33			
Method of Providing DID	Required to Support Deterministic Analysis or Fire PRA?	Changes or Improvements Necessary for DID?	Basis/Justification
Echelon 1: Prevent fires from starting			
Combustible Control is implemented in accordance with Procedure PMP-2270-CCM-001, Control of Combustible Materials.	Yes	No	• This element is adequate based on no perceived weakness of, or over-reliance on, another echelon of defense-in-depth
Hot Work Control is implemented in accordance with Procedure PMP-2270-WBG-001, Welding, Burning and Grinding Activities.	Yes	No	
Echelon 2: Rapidly detect, control and extinguish promptly those fires that do occur thereby limiting fire damage			
Fire Detection System	Yes	No	• Detection is already required and fire fighting activities are not expected to be challenging, therefore, no changes or improvements to Echelon 2 attributes are necessary to maintain defense-in-depth.
Fixed Fire Suppression	No	No	
Portable Fire Extinguishers	Yes	No	
Hose stations and hydrants	Yes	No	
Pre-Fire Plan	Yes	No	
Echelon 3: Provide adequate level of fire protection for systems and structures so that a fire will not prevent essential safety functions from being performed			
Walls, floors ceilings and structural elements are rated or have been evaluated as adequate for the hazard.	Yes	No	• Although VFDR AA33-001 is not considered a significant contribution to core damage frequency, the variance is considered important enough to the NSCA to retain as a recovery action to ensure that defense-in-depth is maintained.
Penetrations in the fire area barrier are rated or have been evaluated as adequate for the hazard.	Yes	No	
Supplemental barriers (e.g., ERFBS, cable tray covers, etc.)	No	No	• Defense in Depth actions were credited to remove fuses in the Control Room to prevent spurious equipment operation due to internal shorts.
Guidance provided to operations personnel detailing the required success path(s) including recovery actions to achieve nuclear safety performance criteria.	No	Yes	

## Fire Area AA33 – Attachment 2 - Fire Risk Evaluation Results Summary

### A-2.7 Safety Margin Considerations

In accordance with NEI 04-02, the maintenance of adequate Safety Margin is assessed by the consideration categories of analyses utilized by this Fire Risk Evaluation.

Safety margins are considered to be maintained if:

- Codes and Standards or their alternatives accepted for use by the NRC are met.

AND

- Safety analyses acceptance criteria in the licensing basis (e.g., FSAR, supporting analyses) are met, or provides sufficient margin to account for analysis and data uncertainty.

The following summarizes the bases for ensuring the maintenance of safety margins:

- The risk-informed, performance based processes utilized are based upon NFPA 805, 2001 edition, endorsed by the NRC in 10 CFR 50.48(c).
- The Fire Risk Evaluation process is in accordance with NEI 04-02, Revision 2, which is endorsed by the NRC in Regulatory Guide 1.205, Revision 1.
- The Fire PRA is developed in accordance with NUREG/CR-6850, which was developed jointly between the NRC and EPRI.
- The Fire PRA has undergone an industry peer review, in order to ensure the Fire PRA meets the appropriate quality standards of ASME/ANS RA-Sa-2009, "Standard for Level 1/Large Early Release Frequency Probabilistic Risk Assessment for Nuclear Power Plant Applications," Dated February 2, 2009
- The "bounding risk assessment" is used during transition (NEI 04-02, Section 5.3.4.2). This approach conservatively assumes that target set damage occurs for postulated fire events which resulted in whole room burn up, and therefore, MEFS/LFS is not analyzed separately from the Fire PRA results.
- The CNP internal events PRA model received two formal industry peer reviews conducted in accordance with applicable NEI guidelines. The initial peer review was performed in 2001, while a subsequent focused scope (i.e., limited scope) peer review was conducted in 2009. The initial, full-scope WOG peer review covered all aspects of the CNP PRA model and the administrative processes used to maintain and update the model. The CNP PRA model has been revised to address all significant issues (i.e., Category A and B Facts & Observations) identified during the initial peer review. None of the findings from the focused-scope peer review were judged to reach the significance level of a Category A or B Fact & Observation; as a result, no changes to the PRA model have yet been made to include resolutions for these latter issues.
- Fire protection systems and features determined to be required by NFPA 805 Chapter 4 have been confirmed to meet the requirements of NFPA 805 Chapter 3 and their associated referenced codes and listings, or provided with acceptable alternatives using processes accepted for use by the NRC (i.e., FAQ 06-0008, FAQ 06-0004, 07-0033).
- Fire modeling has not been performed in support of the change evaluations and results are therefore, based on whole area burn up. As such, the results are considered very conservative.
- In accordance with the requirements of 10 CFR 50.48(c)(2)(iii), the Fire PRA results, including cutsets for

## **Fire Area AA33 – Attachment 2 - Fire Risk Evaluation Results Summary**

the scenarios of concern, have been reviewed and it was verified that the results presented above do not rely solely on feed and bleed as the fire-protected safe shutdown path for maintaining reactor coolant inventory, pressure control, and decay heat removal capability for this fire area.

### **A-2.8 Transition Risk Evaluation Conclusions**

The transition change evaluation determined that these changes:

- Are acceptable based upon the measured change in CDF and LERF
- Maintained adequate defense-in-depth and safety margins

The results of this evaluation meet the requirements of NFPA 805 Risk Evaluation; therefore, the use of the performance based analysis approach is acceptable.

## D. C. Cook Nuclear Plant Fire Safety Analysis

## Fire Area: AA34

Unit 1 East Main Steam Valve Enclosure, Main Steam Line Non-Essential Service Water Valve Areas & Contractor Access Control Area  
(51' x 12 ft.)

## Table of Contents

<b>Purpose</b>	Section 1.0
<b>Analysis Methodology</b>	Section 2.0
<b>Analysis</b>	Section 3.0
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## Attachments

Fire Area AA34 – Attachment 1 - Table B-3 - Fire Area Transition

## Fire Area AA34 – Attachment 2 - Fire Risk Evaluation Results Summary

## 1.0 PURPOSE

This report documents the Fire Safety Analysis (FSA) for Cook Nuclear Plant (CNP) Fire Area AA34, Unit 1 East Main Steam Valve Enclosure, Main Steam Line Non-Essential Service Water Valve Areas & Contractor Access Control Area (EL. 612 ft.) which comprises fire zone(s) 33, 33A, 33B, 105. The purpose of this analysis is to demonstrate the achievement of the nuclear safety and radioactive release performance criteria of NFPA 805 as required by 10 CFR 50.48(c). The Fire Safety Analysis is a key part of compliance with Section 2.7.1.2 Fire Protection Program Design Basis Document of NFPA 805. This analysis also documents results of risk-informed, performance-based Fire Risk Evaluations (FREs). These evaluations are associated with Variances from Deterministic Requirements (VFDRs) of NFPA 805 Chapter 4.

## 2.0 ANALYSIS METHODOLOGY

The FSA is the design basis document as described in NFPA 805 Section 2.7.1.2. The following steps are performed to develop the FSA on a fire area basis:

- Identify significant fire hazards in the fire area. This is based on NFPA 805 approach to analyze the plant from an ignition source and fuel package perspective.
- Summarize Nuclear Safety Capability Analysis (NSCA) compliance strategies. This is the result of the NEI 04-02 B-3 Table review of the Safe Shutdown Analysis.
- Summarize Non-Power Operations Modes compliance strategies.
- Summarize Radioactive Release compliance strategies. The transition review process required per NEI 04-02 is used to develop these results.
- Provide Fire Probabilistic Risk Assessment summary of results. This is based on the results from the plant Fire PRA.
- Perform risk informed, performance based evaluations if needed for the performance based approach.
- Summarize Defense-in-Depth strategy for each fire area.
- Determine key analysis assumptions which are candidates to be included in the NFPA 805 monitoring program.
- Provide conclusions relative to NFPA 805 compliance.

### 3.0 ANALYSIS

#### 3.1 Classical Fire Protection

##### 3.1.1 Construction

For Fire Zone 33, walls and floors and ceilings to the adjacent yard, fire areas and fire zones are reinforced concrete in excess of a 3-hour rating. The top section of the walls to the yard are provided with unrated steel blow out panels. An insulated sheet metal walkway is provided between the concrete portion of this fire zone and adjacent Fire Area AA3 - Fire Zone 32. The walkway is a non-combustible, unrated structure that was erected through the yard area and permanently added as part of the plant in 1995. A fire area boundary evaluation was performed to evaluate the addition of this structure. (Engineering Equivalency Evaluation 11-44).

For Fire Zone 33A, walls and floors to adjacent fire areas and Fire Zones 33 and 33B are reinforced concrete in excess of a 3-hour rating. The wall to adjacent Fire Zone 105 is constructed of an unrated gypsum wallboard. The exterior wall to the yard is constructed of metal siding. The ceiling to the yard is constructed of concrete on metal decking on unprotected steel framing.

For Fire Zone 33B, walls, floors and ceilings to adjacent fire areas and fire zones are reinforced concrete in excess of a 3-hour rating.

For Fire Zone 105, the floor to adjacent fire areas is reinforced concrete in excess of a 3-hour rating. The unrated wall to adjacent Fire Zone 33A is constructed of unrated gypsum wallboard. Walls to the exterior are unrated metal siding. The roof is constructed of an insulated ribbed metal roof. Suspended ceilings are provided at both floor levels.

Applicable Engineering Equivalency Evaluations are documented in Attachment 1.

##### 3.1.2 Doors and Access Openings

For Fire Zone 33, a fire door having a 3-hour rating is provided to adjacent Fire Area AA3 - Fire Zone 32. A fire area boundary evaluation was performed for the manway opening in the floor down to Fire Area AA9 - Fire Zone 116 (Engineering Equivalency Evaluation 9-23). An unrated missile barrier door is provided at the entrance to the personnel walkway. This door was evaluated for acceptability as part of the fire area boundary evaluation performed for adding the walkway to the Yard Analysis Area. (Engineering Equivalency Evaluation 11-44). An unlocked gate is provided to adjacent Fire Zone 33A.

For Fire Zone 33A, lower containment access is provided into Fire Area AA56 - Fire Zone 122 from this fire zone through the personnel airlock. Fire doors having a 3-hour rating are provided to adjacent Fire Area AA40 - Fire Zone 41 and to adjacent Fire Zone 105. A fire door having a 1 1/2-hour rating is provided to adjacent Fire Zone 105.

For Fire Zone 33B, a fire door having a 3-hour rating is provided to adjacent Fire Area AA37 - Fire Zone 38.

For Fire Zone 105, fire doors having a 1 1/2-hour rating and 3-hour rating are provided to adjacent Fire Zone 33A. An unrated door is provided to the yard.

##### 3.1.3 Penetrations

Note: Statements regarding fire resistance rating of penetration seals are not applicable to seals in barriers to Analysis Area YD.

For Fire Zone 33, penetrations in fire barriers between this fire zone and adjacent fire areas are provided with fire seals except as noted below. However, barriers between this fire zone and adjacent fire zones are not fire sealed. Penetrations into containment are adequately sealed to prevent the spread of fire through the containment barrier. Seismic gaps are sealed with a glass fiber reinforced silicone sheeting. The seismic gap exemption granted considered the Fire Zone 33 interface with Fire Area AA8 - Fire Zone 8 (Engineering Equivalency Evaluation 11-46).

For Fire Zone 33A, penetrations in fire barriers between this fire zone and adjacent fire areas are provided with fire seals except as noted below. However, barriers between this fire zone and adjacent fire zones are not fire sealed. All penetrations into containment are adequately sealed to prevent the spread of fire through the containment barrier. A fire area boundary evaluation was performed for open penetrations to Fire Area AA2 - Fire Zone 108 (Engineering Equivalency Evaluation 9-35). Seismic gaps are sealed with a glass fiber reinforced silicone sheeting. The seismic gap exemption granted considered the Fire Zone 33A interface with Fire Areas AA8, AA9 and AA10 - Fire Zones 8, 10 and 11, respectively, (Engineering Equivalency Evaluation 11-46).

For Fire Zone 33B, penetrations in fire barriers between this fire zone and adjacent fire areas are provided with fire seals except as noted. However, barriers between this fire zone and adjacent fire zones are not fire sealed. The seismic gaps are sealed with a glass fiber silicone sheeting. Seismic gap exemption was granted for Fire Zone 33B interface with Fire Area AA11, AA37 and AA2 - Fire Zone 12, 38 and 108, respectively (Engineering Equivalency Evaluation 11-46).

For Fire Zone 105, penetrations in fire barriers between this fire zone and adjacent fire areas are provided with fire seals. However, barriers between this fire zone and the other adjacent fire zones are not fire sealed.



### 3.1.4 Detection

The table below outlines the fire detection system(s) provided in the Fire Area:

Table 3-1, Fire Area AA34 Detection Systems								
Fire Zone	Type of System	Local (L) / Remote (R)	Detection Actuates Suppression?	Required System?				
				S	L	E	R	D
33	Infrared	L/R	No Auto Supp. (N/A)	N	N	Y	Y	N
33	Thermal	L/R	No Auto Supp. (N/A)	N	N	Y	Y	N
33A	Infrared	L/R	No Auto Supp. (N/A)	N	N	Y	Y	N
33A	Ionization	L/R	No Auto Supp. (N/A)	N	N	Y	Y	N
33B	Ionization	L/R	No Auto Supp. (N/A)	N	N	Y	Y	N
105	None	N/A	N/A	N/A	N/A	N/A	N/A	N/A

**Table 3-1 Legend:**

Table Field: "Required System?"	
S	- Required for Chapter 4 Separation Criteria
L	- Required for NRC Approved Licensing Action
E	- Required for Engineering Equivalency Evaluation
R	- Required for Risk Significance
D	- Required to maintain adequate balance of Defense-in-Depth in a Change Evaluation or Fire Risk Evaluation

For Fire Zone 33, there are 24 heat and 4 infra-red low voltage detectors on a single detection circuit which alarms in the Unit 1 Control Room. The heat detectors are mounted beneath the concrete floor and steel grated platforms. The infra-red detectors provide coverage for the open area, not under the steel grated platform.

For Fire Zone 33A, there are 3 low voltage ionization detectors in the access tunnel and 10 low voltage infra-red detectors for the general floor coverage on a single circuit. This detection circuit alarms in the Unit 1 Control Room. A line type thermistor heat detector is provided for the charcoal filter unit. The thermistor has a prealarm temperature setting and a high temperature alarm.

For Fire Zone 33B, two ionization detectors are provided which alarm in the Unit 1 Control Room.

Fire Zone 105 is not provided with an automatic fire detection system.

### 3.1.5 Fixed Suppression

The table below outlines the fixed fire suppression system(s) provided in the Fire Area:

Table 3-2, Fire Area AA34 Suppression Systems							
Fire Zone	Type of System	Full (F) / Partial (P)	Required System?				
			S	L	E	R	D
33	None	N/A	N/A	N/A	N/A	N/A	N/A
33A	None	N/A	N/A	N/A	N/A	N/A	N/A
33B	None	N/A	N/A	N/A	N/A	N/A	N/A
105	Wet Pipe	F	N	N	N	N	N

**Table 3-2 Legend:**

Table Field: "Required System?"	
S	- Required for Chapter 4 Separation Criteria
L	- Required for NRC Approved Licensing Action
E	- Required for Engineering Equivalency Evaluation
R	- Required for Risk Significance
D	- Required to maintain adequate balance of Defense-in-Depth in a Change Evaluation or Fire Risk Evaluation

For Fire Zones 33, 33A and 33B, there are no automatic suppression systems installed.

For Fire Zone 105, an automatic wet pipe sprinkler system is provided which alarms in the Unit 1 Control Room.

### 3.1.6 Manual Suppression / Response Strategy

A postulated fire will be identified by early detection using ionization type smoke detection or by plant personnel using plant communication system to notify the control room. The automatic detection system alarms in the control room. The Control Room operator will dispatch the fire brigade for initiation of manual fire fighting. A fire in this fire area will be contained by the construction features discussed in Section 3.1.1. Manual suppression is provided by the CNP Fire Brigade.

For Fire Zone 33, fire extinguishers are placed at the 612' and 621' elevations. There is also a water hose reel located in adjacent Fire Zone 33A.

Fire Zone 33A contains fire extinguishers and water hose reels.

For Fire Zone 33B, a fire extinguisher is located in adjacent Fire Zones 33A and 38. There are also water hose reels located in adjacent Fire Zone 33A.

For Fire Zone 105, there is a fire extinguisher in the fire zone with additional extinguishers and water hose reels in adjacent Fire Zone 33A.

Floor Drains are provided in all Fire Zones except 105. A sump is provided which pumps water to the laundry and hot shower tank for this Fire Zone. Drainage is also available via door to the yard for Fire Zones 33 and 33A. For Fire Zone 33, additional drainage at the 621 ft. elevation was determined to be unnecessary per A/R # A85938. These drains were sealed per A/R A0109453.

### 3.1.7 Ventilation

A fire in this area will be contained by the fire barriers. Smoke can be removed by venting to the outdoors or to other parts of the Auxiliary Building. The normal building ventilating systems in the Auxiliary Building will then exhaust the smoke via filtered monitored pathways. This fire area is listed as a non-controlled area in the Fire Pre Plans and therefore there is reasonable assurance that products of combustion will not be contaminated.

For Fire Zone 33, fire dampers having a 1 1/2-hour rating are provided for the grated floor ventilation opening to adjacent Fire Area AA8 - Fire Zone 8. Undampened louvers are provided to the yard. The manway opening down into Fire Area AA9 - Fire Zone 116 is also used for ventilation purposes.

For Fire Zone 33A, a fire area boundary evaluation was performed for an undampened ventilation duct to Fire Area AA8 - Fire Zone 108 (Engineering Equivalency Evaluation 9-35). There are ventilation penetrations to adjacent fire areas provided with isolation valves on the outside of containment. These valves are assumed to provide adequate protection; therefore, the undampened ventilation ducts to Fire Area AA56 - Fire Zone 122 do not require fire dampers. Also, fire dampers having a 1 1/2-hour rating are provided to adjacent Fire Zone 105.

For Fire Zone 33B, fire dampers having a 1 1/2-hour rating are provided to adjacent Fire Area AA37 - Fire Zone 38.

For Fire Zone 105, there are no ventilation penetrations to adjacent fire areas. A fire damper having a 1 1/2-hour rating is provided to adjacent Fire Zone 33A.

### 3.1.8 Other Features

For Fire Zone 33A, a manual deluge water spray system is provided for the charcoal filter unit. The system is a temperature regulating system and is not treated as a manual suppression system. The system isolating valve is normally closed and must be manually open. The high temperature thermistor alarm automatically opens the suppression system valve. The water flow period is timed to run for approximately 20-30 seconds after the opening of the suppression system valve and then shut off. Subsequent temperatures above the thermistor high temperature setting will restart the water application for as many times as is necessary until the temperature is lowered below the high temperature setting. Operation of the system alarms in the Control Room.

## 3.2 Fire Hazards Identification

The fire area contains both ignition sources and combustible fire hazards. The ignition sources consist of the transformers, the containment hydrogen monitoring isolation valve subpanels and various exhaust and supply fans.

Combustibles consist primarily of cable insulation, cellulosic, rubber and plastics. Fire Zone 33A also includes charcoal.

The exterior fire hazards that are adjacent to exterior walls are the Start-up Transformers. However, water spray suppression systems are provided for the transformers. The missile barriers around each transformer also provide a measure of fire barrier protection, limiting radiant heat in the direction of the Fire Area.

The exterior walls of this Fire Area do not require a rating for protection. The spatial separation between the yard equipment and fire hazards to this Fire Area is sufficient to provide protection against heat damage. The impact of a fire in the yard on AA34 would be limited to radiant heat with no ceiling to contain the fire plume. Spatial separation, fixed suppression as well as the missile barriers around the transformers are sufficient to prevent an exposure to credited equipment inside the plant through unrated exterior walls of this Fire Area.

All fire zones within this fire area have a combustible loading classification of low. Although the MSIV valves contain a large amount of hydraulic fluid, this is fire resistive fluid known as Fyrquel and is not included in the combustible loading classification.

### 3.3 NSCA Compliance Summary

Unit 1 East Main Steam Valve Enclosure, Main Steam Line NESW Valve Areas contains Unit 1 LSI panels, Auxiliary Feed Water flow indicators, Auxiliary Feed Water Motor Operated Valves, Steam Generator Motor Operated Valves, Steam Generator Pressure Sense Lines, Main Steam Stop and Stop control valves, Steam Generator PORVs, Steam Generator PORV Nitrogen control valves and Safety Relief valves as well as Red and Green train cables, conduits and raceways.

Compliance with the nuclear safety performance criteria is achieved using the performance-based approach in accordance with NFPA 805, Section 4.2.4.2.

Safe and stable condition of Unit 1 will be accomplished using Steam Generators 2 and 3 via the Unit 1 East Motor Driven Auxiliary Feedwater Pump, Control Room Process Monitoring, Unit 1 Charging via the West or East pump, Unit 1 Component Cooling Water via the East Pump, Unit 1 Essential Service Water via the West Pump. The Unit 1 West ESW pump is available to provided cooling to the Unit 1 Diesel Generator AB. Electrical power is supplied to either Red or Green Trains via offsite power with both Red and Green train Emergency Diesels also available.

The Nuclear Safety Performance Criteria compliance strategy for AA34 is documented within the NSCA Report.

#### 3.3.1 Variances

The variances identified for evaluation for this fire area are grouped as follows:

##### 3.3.1.1 VFDR No. AA34-001

1-MPP-220-CRI, 1-MPP-221-CRI, 1-MPP-222-CRI, 1-MPP-230-CRI, 1-MPP-231-CRI and 1-MPP-232-CRI - SG pressure indication is required to be operable to support process monitoring. Process monitoring is required to monitor key primary and secondary parameters. All Unit 1 SG Control Room pressure indication may be lost due to cable damage as a result of a full area fire within Fire Area AA34. Decay heat removal credits the East MDAFW Pump supplying water to SGs 2 and 3. Therefore, pressure indication must be restored for SGs 2 and 3. 1-MPP-220-CRI, 1-MPP-221-CRI and 1-MPP-222-CRI provide Control Room pressure indication for SG 2. 1-MPP-230-CRI, 1-MPP-231-CRI and 1-MPP-232-CRI provide Control Room pressure indication for SG 3. 1-MPP-220-CRI may fail due to fire induced damage of cable 9075O-1. 1-MPP-221-CRI may fail due to fire induced damage cable 9074B-1. 1-MPP-222-CRI may fail due to fire induced damage of cable 9050Y-1. 1-MPP-230-CRI may fail due to fire induced damage of cable 9068O-1. 1-MPP-231-CRI may fail due to fire induced damage of cable 9069B-1. 1-MPP-232-CRI may fail due to fire induced damage of cable 9051Y-1. This condition represents a variance from the

deterministic requirements of NFPA 805, Section 4.2.3. This is a separation issue.

This VFDR has been evaluated and it was determined that the risk, safety margin and defense-in-depth meet the acceptance criteria of NFPA 805 Section 4.2.4 with no further action required.

### 3.3.1.2 VFDR No. AA34-002

1-MRV-213-P, 1-MRV-223-P, 1-MRV-233-P and 1-MRV-243-P - SG 1, 2, 3 & 4 PORVs are required to be closed to support main steam isolation. Main steam isolation is required to prevent uncontrolled cooldown through over steaming. 1-MRV-213-P may fail due to fire induced damage of cable 6841-1. 1-MRV-223-P may fail due to fire induced damage of cable 18132-1. 1-MRV-233-P may fail due to fire induced damage of cable 18133-1. 1-MRV-243-P may fail due to fire induced damage of cable 6842-1. Failure of these cables could spuriously open the valves. SGs 1 & 4 are not credited for decay heat removal due to a fire within this fire area. This condition represents a variance from deterministic requirements of NFPA 805, Section 4.2.3. This is a separation issue.

This VFDR has been evaluated and it was determined that the risk, safety margin and defense-in-depth meet the acceptance criteria of NFPA 805 Section 4.2.4 with a defense-in-depth action credited.

### 3.3.2 Recovery Actions Credited

For each VFDR, a Fire Risk Evaluation has been performed to assess the acceptability of risk, defense-in-depth, and safety margin. This evaluation determined whether or not recovery actions are required to ensure that one success path necessary to achieve and maintain the nuclear safety performance criteria is maintained free of fire damage by a single fire. Table 3-3 identifies the credited recovery actions for this area. Actions retained for DID are identified as "DID Actions" within Table 3-3. Additional information for DID actions is contained within Section 3.8 of this report. Note that, for completeness, all VFDRs are contained within Table 3-3, even if the Fire Risk Evaluation has determined that a recovery action is not required. In those instances where a recovery action has been determined to not be required, the word "None" is provided in the "Action" column in the table.

Table 3-3, Recovery Actions Credited		
VFDR	Component	Action
AA34-001	1-MPP-220-CRI 1-MPP-221-CRI 1-MPP-222-CRI 1-MPP-230-CRI 1-MPP-231-CRI 1-MPP-232-CRI	None
AA34-002	1-MRV-213 1-MRV-223 1-MRV-233 1-MRV-243	DID ACTION(S) 1-MRV-213-P-ISOLATE 1-MRV-223-P-ISOLATE 1-MRV-233-P-ISOLATE 1-MRV-243-P-ISOLATE (Place SG PORV controller in manual for affected valves to close SG PORVs)

Table 3-3, Recovery Actions Credited		
VFDR	Component	Action

### 3.4 Non-Power Operational Modes Compliance Summary

A review of CNP for the potential effects of a fire in this Fire Area while in non-power modes of operation (NPO) was conducted. This review was conducted using the guidance provided in NEI 04-02 and FAQ 07-0040, "Non-Power Operations Clarifications".

The review determined that there are potential failures that affect certain Key Safety Functions (KSF) as a result of the fire in this area, and the fire could result in the loss of one or more KSF paths. Compensatory measures are required during high risk evolution periods to provide reasonable assurance a fire will not adversely affect key safety functions and the NFPA 805 performance goal for NPO is therefore satisfied. The results of the NPO analysis are contained within Technical Evaluation R1900-005-001, Non-Power Operation Modes Transition Review Report.

### 3.5 Radioactive Release Compliance Summary

The NFPA 805 radiological release goal is to provide reasonable assurance that a fire will not result in a radiological release that adversely affects the public, plant personnel or the environment. The NFPA 805 requirement is to ensure a radiation release to any unrestricted area due to the direct effects of fire suppression activities (but not involving fuel damage) shall be as low as reasonably achievable and shall not exceed applicable plant Technical Specification limits.

AA34 is within the Radiological Controlled Area (RCA) and has been identified as a potential fire area for radioactive release due to fire fighting activities. In accordance with NFPA 805 FAQ 09-0056, this potential has been reviewed to ensure that engineering controls, fire pre-plans, and fire brigade training materials are provided for containment and monitoring of gaseous and liquid effluents associated with fire suppression agents and products of combustion.

The review concludes that the steps to limit radiation release to other areas due to the direct effects of fire suppression activities, in addition to compliance with NFPA 805, Chapter 4, ensure that any radioactive release will be as low as reasonably achievable and will not exceed limits designated in the CNP Technical Specifications.

The review of this fire area, with respect to radioactive release, is documented in the NFPPM.

### 3.6 Probabilistic Risk Assessment-Summary of Results

A Fire PRA (FPRA) quantification of Fire Area AA34 was performed and is documented in PRA-NB-FIRE-FQ, Fire PRA Model Quantification Notebook. The fire risk quantification for Fire Area AA34 is analyzed using detailed fire modeling to consider risk of fire scenarios of ignition sources. PRA-NB-FIRE-FQ includes a summary of all potentially risk-significant fire scenarios (i.e., CDF > 1.0E-7 or LERF > 1.0E-8). Bounding CDF / LERF per calendar year values are reported that are based on the risk values documented in PRA-NB-FIRE-FSS, Fire PRA Fire Scenario Selection.

Fire Protection features credited in the Fire PRA are documented in R1900-0411-AA34, Detailed Fire Modeling Report: Fire Compartment: AA34 Unit 1 East Main Steam Valve Enclosure, Main Steam Line Non-Essential Service Water Areas & Contractor Access Control Area (EL. 612 FT.). PRA-NB-FIRE-FSS documents the revision level of the fire modeling reports used in the most recent Fire PRA quantification.

### 3.7 Risk-Informed, Performance-Based Evaluations

Fire Risk Evaluations (FREs) have been performed to ensure that variances from the NFPA 805 deterministic requirements are acceptable. The evaluation process consists of an integrated assessment of the acceptability of risk, defense-in-depth, and safety margins.

#### 3.7.1 Transition Risk-Informed, Performance-Based Evaluations

The 'changes' associated with NFPA 805 transition were those variances from the deterministic requirements of NFPA 805 or with the existing fire protection licensing basis that were brought into compliance with the NFPA 805 performance based approach. The change identified for evaluation for Fire Area AA34 is as follows:

- Separation Issues

The Fire Risk Evaluation has determined that the change is acceptable based upon:

- The measured change in CDF and LERF.
- Adequate defense-in-depth and safety margins being maintained.

Refer to Attachment 2 for a summary of results associated with the Fire Risk Evaluations.



### 3.8 Defense-in-Depth

A comprehensive risk-informed, performance-based analysis includes consideration of defense-in-depth (DID) as part of an integrated evaluation of risk considerations. In general, defense-in-depth involves consideration of the extent to which fire protection systems and features are provided within the three echelons of fire-protection:

- Preventing fires from starting,
- Rapidly detecting fires and controlling and extinguishing promptly those fires that do occur, thereby limiting fire damage,
- Providing an adequate level of fire protection for structures, systems, and components important to safety, so that a fire that is not promptly extinguished will not prevent the nuclear safety performance criteria from being met.

Each VFDR was evaluated for DID. The following recovery actions have been retained for DID.

VFDR No. AA34-002: 1-MRV-213-P, 1-MRV-223-P, 1-MRV-233-P and 1-MRV-243-P - SG 1, 2, 3 & 4 PORVs are required to be closed to support main steam isolation. Main steam isolation is required to prevent uncontrolled cooldown through over steaming. Loss of Main Steam isolation can be mitigated by removing fuses to ensure valves fail shut. This recovery action is being retained for DID to ensure Main Steam isolation is maintained.

Based on the assessment in support of the Fire Risk Evaluation, defense-in-depth is maintained for fire area AA34. Refer to Attachment 2 for details associated with the Fire Risk Evaluation.

### 3.9 Monitoring Program Input

A Monitoring Program will be developed in accordance with FAQ 10-0059, Rev. 1. Methods to monitor availability, reliability, and performance of fire protection program structures, systems, and components (SSCs), as well as programmatic elements will be provided. Additionally, effectiveness measures are established to review program related performance and trends. For AA34 the following systems and features are candidates for inclusion in the CNP Fire Protection Monitoring Program:

- Fire Area boundary barriers discussed in Section 3.1
- Fire Detection System (ionization/infrared)

## 4.0 CONCLUSION

The nuclear safety and radioactive release performance criteria of NFPA 805 are met for a fire in Fire Area AA34. This Fire Risk Evaluation for Fire Area AA34 has demonstrated that

- The change in core damage frequency (delta CDF) is acceptable, and
- The change in large early release frequency (delta LERF) is acceptable, and
- Defense-in-depth and safety margins are maintained.

This is confirmation that a success path effectively remains free of fire damage and that the performance-based approach is acceptable per Section 4.2.4.2 of NFPA 805.



## **5.0 REFERENCES**

- 5.1 Calculation PRA-FIRE-NB-CRE, Fire PRA Cumulative Risk Evaluations
- 5.2 CNP Fire Pre-Plans, Volumes I, II, and III, Revisions 17, 14, and 18 respectively
- 5.3 Fire Hazards Analysis
- 5.4 NFPA 805, Performance-Based Standard for Fire Protection for Light Water Reactor Electric Generating Plants
- 5.5 NFPPM, NFPA 805 Fire Protection Program Manual (NFPPM)
- 5.6 Nuclear Energy Institute (NEI) 04-02, Guidance for Implementing a Risk-Informed, Performance-Based Fire Protection Program under 10 CFR 50.48(c), Rev. 2
- 5.7 Nuclear Safety Capability Assessment Report
- 5.8 PRA-NB-FIRE-FQ, Fire PRA Model Quantification Notebook
- 5.9 PRA-NB-FIRE-FSS, Fire PRA Fire Scenario Selection
- 5.10 R1900-0411-AA34, AA34 - Detailed Fire Modeling Report
- 5.11 Regulatory Guide 1.205, Risk-Informed, Performance-Based Fire Protection for Existing Light-Water Nuclear Power Plants, Rev. Revision 1
- 5.12 Technical Evaluation R1900-005-001, Non-Power Operation Modes Transition Review

**Fire Area AA34 – Attachment 1 - Table B-3 - Fire Area Transition**

<u>Unit</u>	<u>Fire Area</u>	<u>Description</u>
1	AA34	Unit 1 East Main Steam Valve Enclosure, Main Steam Line Non-Essential Service Water Valve Areas & Contractor Access Control Area (EL. 612 ft.)

<u>Fire Zone</u>	<u>Description</u>
33	Main Steam Valve Enclosure, East - EL. 612 ft. 0 in. - Unit 1
33A	Main Steam Line Area, East - EL. 612 ft. 0 in. - Unit 1
33B	Non Essential Service Water Valve Area, West - EL. 612 ft. 0 in. - Unit 1
105	Contractor Access Control Building - EL. 612 ft. 0 in.

**Regulatory Basis**

4.2.4.2 - Performance-Based Approach - Fire Risk Evaluation with simplifying deterministic assumptions

<b>Performance Goal</b>	<b>Method of Accomplishment</b>	<b>Comments</b>
Reactivity Control	Unit 1 - Trip the reactor from the Control Room. Borate using Unit 1 East or West Charging Pump from the RWST. Use source range monitoring for indication for Unit 1.	None
Inventory and Pressure Control	Unit 1 - Control inventory using Unit 1 East or West Charging Pump. Control pressure using Unit 1 Pressurizer Safety Relief Valves.	None
Decay Heat Removal	Unit 1 - Feed SGs 2 & 3 with Unit 1 East MDAFW Pump. The DHR function also requires MS isolation with a steam release path through the Safety Relief Valves.	VFDR identified for Main Steam Isolation.
Process Monitoring	Unit 1 Process Monitoring - Use Unit 1 process monitoring in the Control Room for the following: Pressurizer level, RCS pressure and temperature, and S/G level and Pressure. Unit 1 Source Range Monitoring - Use Unit 1 source range monitoring in the Control Room.	VFDR identified for SG 2 and 3 pressure indication.
Vital Auxiliaries	Unit 1 Electrical - Control Unit 1 Red (AB) Train Electrical Distribution with Unit 1 Red (AB) Train Offsite Power or Unit 1 Red (AB) DG. Control Unit 1 Green (CD) Train Electrical Distribution with Unit 1 Green (CD) Train Offsite Power or Unit 1 Green (CD) DG. Unit 1 ESW - Operate Unit 1 East ESW. Unit 1 West ESW is available to provide cooling to Unit 1 Red (AB) DG.	None

**Fire Area AA34 – Attachment 1 - Table B-3 - Fire Area Transition**

<u>Unit</u>	<u>Fire Area</u>	<u>Description</u>
1	AA34	Unit 1 East Main Steam Valve Enclosure, Main Steam Line Non-Essential Service Water Valve Areas & Contractor Access Control Area (EL. 612 ft.)

Unit 1 CCW - Operate Unit 1 East CCW.  
Unit 1 HVAC - Operate Unit 1 Control Room HVAC. Operate Unit 1 Auxiliary Building HVAC. Operate Unit 1 Red (AB) and Green (CD) DG HVAC.  
Operate Unit 1 Switchgear HVAC. Operate Unit 1 East MDAFW Room HVAC system. Operate the Unit 1 East and West ESW HVAC systems.

**Reference Documents**

Genesis Solution Suite, EDISON / SAFE-PB, DC Cook V 3.4.0

Nuclear Safety Capability Assessment Report

**Licensing Actions**

None

**Existing Engineering Equivalency Evaluations (EEEE)**

**EEEE Title** Engineering Equivalency Evaluation 9-23 - Fire Zone 116 (Fire Area AA9) Boundary Evaluation Adjacent to Fire Areas AA11 and AA34

**Summary** The purpose of this engineering equivalency evaluation is to document the acceptability of two manway openings connecting Fire Zone 116 (Fire Area AA9) with adjacent fire areas.

Reasonable assurance is provided that the two manway openings connecting Fire Zone 116 with Fire Zone 12 and Fire Zone 33 do not impair redundant safe shutdown capability. This engineering equivalency evaluation does not adversely impact other engineering equivalency evaluations.

The two manway openings were evaluated and found to be acceptable based on the fire hazards and construction features within the evaluated areas.

**Fire Area AA34 – Attachment 1 - Table B-3 - Fire Area Transition**

<u>Unit</u>	<u>Fire Area</u>	<u>Description</u>
1	AA34	Unit 1 East Main Steam Valve Enclosure, Main Steam Line Non-Essential Service Water Valve Areas & Contractor Access Control Area (EL. 612 ft.)

**EEEE Title Engineering Equivalency Evaluation 9-35 - Fire Zone 108 (Fire Area AA2) to Fire Zone 33A (Fire Area AA34) Boundary Evaluation**

**Summary** The purpose of this evaluation is to document the acceptability of unsealed penetrations and an undampened installation duct in the barrier separating Fire Zone 108 (Fire Area AA2) from Fire Zone 33A (Fire Area AA34). This engineering equivalency evaluation does not adversely impact other engineering equivalency evaluations or exemption requests.

Reasonable assurance is provided that a fire will not impact the redundant safe shutdown capability in Fire Zones 108, 33A, and 33. In addition, the evaluation does not adversely impact other evaluations or exemption requests.

The unsealed penetrations and undampened duct were evaluated and found to be acceptable based on the fire hazards, fire protection systems and construction features within the evaluated areas.

**EEEE Title Engineering Equivalency Evaluation 11-9 - Turbine, Auxiliary and Containment Buildings Boundary Evaluation**

**Summary** The purpose of this engineering equivalency evaluation is to describe in general, the approach and existence of evaluations performed to determine and reconcile fire area boundaries having components or designs with less than a 3-hr fire rating on preventing the spread of fire. This engineering equivalency evaluation also specifically evaluates the impact of unrated door assemblies on the spread of fire.

Reasonable assurance is provided that the fire area boundaries having components or design less than a 3-hr fire rating will not increase the spread of fire or impair the safe shutdown capabilities of Units 1 or 2. In addition, this engineering equivalency evaluation does not adversely impact on other engineering equivalency evaluations or exemption requests.

This evaluation supports additional evaluations credited in this fire area.

**Fire Area AA34 – Attachment 1 - Table B-3 - Fire Area Transition**

<u>Unit</u>	<u>Fire Area</u>	<u>Description</u>
1	AA34	Unit 1 East Main Steam Valve Enclosure, Main Steam Line Non-Essential Service Water Valve Areas & Contractor Access Control Area (EL. 612 ft.)

**EEEE Title** **Engineering Equivalency Evaluation 11-14 - Cable Spreading Room Construction Boundary Evaluation (Fire Areas AA3, AA7, AA8, AA9, AA10, AA29, AA30, AA31, AA34, AA35, AA36/42, AA37, AA38, AA48, AA50, AA51 and AA52)**

**Summary** The purpose of this engineering equivalency evaluation is to document the acceptability of the construction features of the cable spreading rooms which have a fire resistance rating of less than 3 hours for their impact on the spread. In particular, fire dampers having a 1 1/2-hr fire rating were analyzed by this evaluation. Other unrated construction features have been previously analyzed under separate engineering equivalency evaluations. The applicable fire areas include: AA3, AA7, AA8, AA9, AA10, AA29, AA30, AA31, AA34, AA35, AA36/42, AA37, AA38, AA48, AA50, AA51 and AA52.

Reasonable assurance is provided that the construction features of the cable spreading rooms which have a fire resistance rating of less than 3 hours will prevent the spread of fire and not impair the safe shutdown capabilities of Unit 1 and Unit 2. In addition, this engineering equivalency evaluation does not adversely impact other engineering equivalency evaluations.

The construction features of the cable spreading room were evaluated and found to be acceptable based on the fire hazards, fire protection systems and construction features within the areas.

**EEEE Title** **Engineering Equivalency Evaluation 11-44 - Unrated Fire Doors (361 and 362) and Unrated Personnel Walkways (AA3, AA34, AA35, and AAYD)**

**Summary** The purpose of this engineering equivalency evaluation is to document the acceptability of the impact the erection of new personnel walkways in each operating unit will have on the expansion of an existing fire area boundary and an existing area that neighbors other fire areas, on the potential spread of fire.

The defense-in-depth fire protection philosophy installed in these areas adequately protects the fire safety of the plant and that the installed unrated personnel walkways and doors #361 and #362 are acceptable. The personnel walkways in each unit will not impair the safe shutdown capability of CNP, aid in the spread of fire between fire areas or jeopardize existing fire area boundaries. This engineering equivalency evaluation does not impact other engineering equivalency evaluations.

The personnel walkways were evaluated and found to be acceptable based on the fire hazards, fire protection systems and construction features within the evaluated areas.

**Fire Area AA34 – Attachment 1 - Table B-3 - Fire Area Transition**

<u>Unit</u>	<u>Fire Area</u>	<u>Description</u>
1	AA34	Unit 1 East Main Steam Valve Enclosure, Main Steam Line Non-Essential Service Water Valve Areas & Contractor Access Control Area (EL. 612 ft.)

**EEEE Title** **Engineering Equivalency Evaluation 11-46 - Seismic Gaps between the Containment and Auxiliary Buildings Boundary Evaluation (Fire Areas AA2, AA3, AA7, AA8, AA9, AA10, AA11, AA27, AA29, AA30, AA31, AA34, AA35, AA37 and AA38)**

**Summary** A seismic gap exists around the Containment Building of each unit that provides an opening of approximately 6 in. between the Containment Building and the walls, ceilings and floors of the structures immediately adjacent to containment. These Fire Areas include AA2, AA3, AA7, AA8, AA9, AA10, AA11, AA27, AA29, AA30, AA31, AA34, AA35, AA37 and AA38. This engineering equivalency evaluation has been performed to document the acceptability of these seismic gaps in the fire boundaries.

This seismic gap evaluation shows the safe shutdown capability for CNP Unit 1 and Unit 2 has not been compromised as a result of seismic gaps. The analysis performed and the results presented in the tables indicate, on a system basis, the capability to safely shut down both units when considering fire damage to safe shutdown components and circuits contained in the seismic gap evaluation areas. The method of analysis is conservative when considering the fire hazards involved in the vicinity of the seismic gaps. That is, it is not anticipated that the evaluated areas would be affected to the extent that fire would propagate through the seismic gaps and cause damage throughout the evaluated area. This engineering equivalency evaluation has no impact on the exemption requests contained in other engineering equivalency evaluations.

The seismic gaps were evaluated and found to be acceptable based on the fire hazards, fire protection systems and construction features within the evaluated areas.

**EEEE Title** **Engineering Equivalency Evaluation 12-11 - Structural Steel Evaluations in Fire Areas AA2, AA3, AA34, AA35, AA56 and AA58.**

**Summary** The purpose of this engineering equivalency evaluation is to document the acceptability of the unprotected structural steel located throughout CNP and ensure its ability to withstand the fire exposure presented by combustibles present in the area. This engineering equivalency evaluation is concerned with structural steel members that form a part of or support fire barriers required by NFPA 805, Chapter 4.

Reasonable assurance is provided that exposed structural steel supporting fire barriers will not be adversely impacted by the combustibles or hazards present in the areas evaluated. In addition, reasonable assurance is provided that falling structures supported by structural steel will not have an adverse impact on other fire barriers inside the area that are required for separation of safe shutdown components.

The unprotected structural steel was evaluated and found to be acceptable based on the fire hazards and fire protection systems within the evaluated areas.

**Fire Area AA34 – Attachment 1 - Table B-3 - Fire Area Transition**

<b><u>Unit</u></b>	<b><u>Fire Area</u></b>	<b><u>Description</u></b>
1	AA34	Unit 1 East Main Steam Valve Enclosure, Main Steam Line Non-Essential Service Water Valve Areas & Contractor Access Control Area (EL. 612 ft.)

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**Fire Suppression Effects on Nuclear Safety Performance Criteria**

The CNP fire brigade is trained to discharge water in a judicious manner and instructed to direct hose streams and portable extinguishers at the base of the fire to limit the amount of overspray beyond the immediate fire zone. For this reason, fire brigade activities are not expected to fail components which are not immediately involved in the fire scenario. It has been concluded that water impingement on cables is not a concern. Electrical cabinets are provided with a seal at the conduit interface to prevent water intrusion. Per visual inspection any side vents for this equipment are pointed downward to prevent water intrusion. Therefore, in the event of discharge, the wet pipe system will not adversely effect the other equipment operating within the fire zone. The drainage features of the fire area mitigate the potential for flooding damage due to fire suppression, such that the standing water would not affect credited equipment.

Since it is shown that suppression effects will not impact the nuclear safety performance criteria, the fire area configuration is deemed acceptable.

**References:**

Technical Evaluation 12.1, "Fire Suppression Effects Study"

Technical Evaluation 12.1, "Supplemental Information to Fire Suppression Effects Study – Supplement 1"

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**Fire Area Comments**

None

## Fire Area AA34 – Attachment 2 - Fire Risk Evaluation Results Summary

### A2.1 Introduction

The ‘changes’ associated with NFPA 805 transition were those variances from the deterministic requirements of NFPA 805. The changes identified for evaluation for fire area AA34 are grouped as follows:

- Separation Issues

This attachment is a summary of the Fire Risk Evaluation for the fire area. The complete results and methodology are contained in the Cumulative Fire Risk Evaluation, PRA-FIRE-NB-CRE. (FPCE 2017-0009)

### A2.2 Inputs/Assumptions

Fire modeling processes and inputs provided in NUREG/CR-6850 are appropriate for use in a risk-informed, performance-based evaluation. The complete list of assumptions used in the fire modeling methodology for this fire area is contained in Detailed Fire Modeling Technical Evaluation R1900-0411-AA34.

### A2.3 Fire Modeling Methodology

Fire PRA fire modeling results are used as the initial input into this Fire Risk Evaluation. The process consists of conservative bounding analyses using NUREG/CR-6850 methods. As needed, refinements are made to utilize more realistic parameters. The complete fire modeling methodology for this fire area is contained in Detailed Fire Modeling Technical Evaluation R1900-0411-AA34.

### A2.4 Scenario Descriptions and Model Results

Fire Area AA34 was evaluated for the impact of fires originating from both fixed and transient ignition sources. Complete descriptions of each fire scenario is contained within the Detailed Fire Modeling Technical Evaluation R1900-0411-AA34.

#### A2.4.1 Ignition Sources

Fire Area AA34 contains the containment post-accident hydrogen sampling sub panel, vent fans supply and exhaust (1-HIV-A and 1-HIV-B), transformers and the MSIV valves. Per discussion with plant personnel, the heat release rates for all switchgear, load centers, and MCC electrical cabinets have been characterized as qualified cable because items of this nature are generally constructed on-site. For other electrical cabinet types, where the internal cable qualification was unknown, the heat release rates have been assumed as non-qualified. Ignition sources in Fire Area AA34 were modeled using the 98th percentile fire as a screening approach. These scenarios were not risk significant enough to require further refinement.

In Fire Area AA34, the 98th percentile HRR was used for all transient fires. The 98th percentile HRR bounds the possible transient ignition sources expected for this fire area, which were fire tested and identified in NUREG/CR-6850, Appendix G, Table G-7.

#### A2.4.2 Scenario Results

The PRA analyzed the VFDRs and determined them to be risk insignificant, therefore, a quantitative delta risk calculation was not performed.

### A2.5 Fire Risk Evaluation Results

PRA-FIRE-NB-CRE documents scenarios and corresponding impacted VFDRs that were evaluated for



### **Fire Area AA34 – Attachment 2 - Fire Risk Evaluation Results Summary**

delta risk during the transition to NFPA 805 and also all changes to the Fire Protection Program that are currently incorporated into the Fire PRA model. The acceptability of the Cumulative Fire Risk Evaluations was based on calculated delta risk meeting the thresholds of NEI 04-02, RG 1.205 and RG 1.174. (FPCE 2017-0009)

## Fire Area AA34 – Attachment 2 - Fire Risk Evaluation Results Summary

### A-2.6 Impact of VFDR on Defense-in-Depth

Defense-in-Depth has been evaluated for this fire area. The impacts of this evaluation are summarized in the table below:

Defense-in-Depth Impact Review for AA34			
Method of Providing DID	Required to Support Deterministic Analysis or Fire PRA?	Changes or Improvements Necessary for DID?	Basis/Justification
Echelon 1: Prevent fires from starting			
Combustible Control is implemented in accordance with Procedure PMP-2270-CCM-001, Control of Combustible Materials.	Yes	No	• This element is adequate based on no perceived weakness of, or over-reliance on, another echelon of defense-in-depth.
Hot Work Control is implemented in accordance with Procedure PMP-2270-WBG-001, Welding, Burning and Grinding Activities.	Yes	No	
Echelon 2: Rapidly detect, control and extinguish promptly those fires that do occur thereby limiting fire damage			
Fire Detection System	Yes	No	• Since fire fighting activities would not be challenging, and since no recovery actions are required, no changes or improvements to Echelon 2 attributes are necessary to maintain defense-in-depth.
Fixed Fire Suppression	No	No	
Portable Fire Extinguishers	Yes	No	
Hose stations and hydrants	Yes	No	
Pre-Fire Plan	Yes	No	
Echelon 3: Provide adequate level of fire protection for systems and structures so that a fire will not prevent essential safety functions from being performed			
Walls, floors ceilings and structural elements are rated or have been evaluated as adequate for the hazard.	Yes	No	• Since variance AA34-001 is never affected in a potentially risk significant fire scenario, internal fire area separation is adequate and no changes or improvements to Echelon 3 attributes are necessary to maintain defense-in-depth.
Penetrations in the fire area barrier are rated or have been evaluated as adequate for the hazard.	Yes	No	
Supplemental barriers (e.g., ERFBS, cable tray covers, etc.)	No	No	• A Defense in Depth action was credited in the Control Room to isolate instrument loop cable failures to prevent spurious operation of the Steam Generator PORVs.
Guidance provided to operations personnel detailing the required success path(s) including recovery actions to achieve nuclear safety performance criteria.	No	No	

## Fire Area AA34 – Attachment 2 - Fire Risk Evaluation Results Summary

### A-2.7 Safety Margin Considerations

In accordance with NEI 04-02, the maintenance of adequate Safety Margin is assessed by the consideration categories of analyses utilized by this Fire Risk Evaluation.

Safety margins are considered to be maintained if:

- Codes and Standards or their alternatives accepted for use by the NRC are met.

AND

- Safety analyses acceptance criteria in the licensing basis (e.g., FSAR, supporting analyses) are met, or provides sufficient margin to account for analysis and data uncertainty.

The following summarizes the bases for ensuring the maintenance of safety margins:

- The risk-informed, performance based processes utilized are based upon NFPA 805, 2001 edition, endorsed by the NRC in 10 CFR 50.48(c).
- The Fire Risk Evaluation process is in accordance with NEI 04-02, Revision 2, which is endorsed by the NRC in Regulatory Guide 1.205, Revision 1.
- The Fire PRA is developed in accordance with NUREG/CR-6850, which was developed jointly between the NRC and EPRI.
- The Fire PRA has undergone an industry peer review, in order to ensure the Fire PRA meets the appropriate quality standards of ASME/ANS RA-Sa-2009, "Standard for Level 1/Large Early Release Frequency Probabilistic Risk Assessment for Nuclear Power Plant Applications," Dated February 2, 2009
- The "combined analysis approach" is used during transition (NEI 04-02, Section 5.3.4.3); therefore, MEFS/LFS is not analyzed separately from the Fire PRA results.
- The CNP internal events PRA model received two formal industry peer reviews conducted in accordance with applicable NEI guidelines. The initial peer review was performed in 2001, while a subsequent focused scope (i.e., limited scope) peer review was conducted in 2009. The initial, full-scope WOG peer review covered all aspects of the CNP PRA model and the administrative processes used to maintain and update the model. The CNP PRA model has been revised to address all significant issues (i.e., Category A and B Facts & Observations) identified during the initial peer review. None of the findings from the focused-scope peer review were judged to reach the significance level of a Category A or B Fact & Observation; as a result, no changes to the PRA model have yet been made to include resolutions for these latter issues.
- Fire protection systems and features determined to be required by NFPA 805 Chapter 4 have been confirmed to meet the requirements of NFPA 805 Chapter 3 and their associated referenced codes and listings, or provided with acceptable alternatives using processes accepted for use by the NRC (i.e., FAQ 06-0008, FAQ 06-0004, 07-0033).
- Fire modeling performed in support of the transition has been performed within the Fire PRA utilizing codes and standards developed by industry and NRC staff which have been verified and validated in authoritative publications, such as NUREG 1824, "Verification and Validation of Selected Fire Models for Nuclear Power Plant Applications". In general, the fire modeling performed in support of the Fire Risk Evaluations has been performed using conservative methods and input parameters that are based upon

## Fire Area AA34 – Attachment 2 - Fire Risk Evaluation Results Summary

NUREG/CR-6850 as documented in the AA34 Detailed Fire Modeling Report, section 7.2. While this is generally not ideal in the context of best estimate probabilistic risk analysis, it is a pragmatic approach given the current state of knowledge regarding the uncertainties related to the application of the fire modeling tools and associated input parameters for specific plant configurations.

- In accordance with the requirements of 10 CFR 50.48(c)(2)(iii), the Fire PRA results, including cutsets for the scenarios of concern, have been reviewed and it was verified that the results presented above do not rely solely on feed and bleed as the fire-protected safe shutdown path for maintaining reactor coolant inventory, pressure control, and decay heat removal capability for this fire area.

### A-2.8 Transition Risk Evaluation Conclusions

The transition change evaluation determined that these changes:

- Are acceptable based upon the measured change in CDF and LERF
- Maintained adequate defense-in-depth and safety margins

The results of this evaluation meet the requirements of NFPA 805 Risk Evaluation; therefore, the use of the performance based analysis approach is acceptable.

## D. C. Cook Nuclear Plant Fire Safety Analysis

## Fire Area: AA35

Unit 2 East Main Steam Valve Enclosure, Main Steam Line Non-Essential Service Water Valve Areas (EL. 612 ft.)

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## Attachments

Fire Area AA35 – Attachment 1 - Table B-3 - Fire Area Transition

## Fire Area AA35 – Attachment 2 - Fire Risk Evaluation Results Summary

## **1.0 PURPOSE**

This report documents the Fire Safety Analysis (FSA) for Cook Nuclear Plant (CNP) Fire Area AA35, Unit 2 East Main Steam Valve Enclosure, Main Steam Line Non-Essential Service Water Valve Areas (EL. 612 ft.) which comprises fire zone(s) 34, 34A, 34B. The purpose of this analysis is to demonstrate the achievement of the nuclear safety and radioactive release performance criteria of NFPA 805 as required by 10 CFR 50.48(c). The Fire Safety Analysis is a key part of compliance with Section 2.7.1.2 Fire Protection Program Design Basis Document of NFPA 805.

## **2.0 ANALYSIS METHODOLOGY**

The FSA is the design basis document as described in NFPA 805 Section 2.7.1.2. The following steps are performed to develop the FSA on a fire area basis:

- Identify significant fire hazards in the fire area. This is based on NFPA 805 approach to analyze the plant from an ignition source and fuel package perspective.
- Summarize Nuclear Safety Capability Analysis (NSCA) compliance strategies. This is the result of the NEI 04-02 B-3 Table review of the Safe Shutdown Analysis.
- Summarize Non-Power Operations Modes compliance strategies.
- Summarize Radioactive Release compliance strategies. The transition review process required per NEI 04-02 is used to develop these results.
- Provide Fire Probabilistic Risk Assessment summary of results. This is based on the results from the plant Fire PRA.
- Perform risk informed, performance based evaluations if needed for the performance based approach.
- Summarize Defense-in-Depth strategy for each fire area.
- Determine key analysis assumptions which are candidates to be included in the NFPA 805 monitoring program.
- Provide conclusions relative to NFPA 805 compliance.

### 3.0 ANALYSIS

#### 3.1 Classical Fire Protection

##### 3.1.1 Construction

For Fire Zone 34, walls and floors and ceilings to the adjacent yard, fire areas and fire zones are reinforced concrete in excess of a 3-hour rating. The top section of the walls to the yard are provided with unrated steel blow out panels. A fire area boundary evaluation was performed for the unrated fire barrier separating this fire zone with the oil filled transformer located in the yard (Engineering Equivalency Evaluation 11-8).

For Fire Zone 34A, walls and floors to adjacent fire areas and Fire Zones 34A and 34B are reinforced concrete in excess of a 3-hour rating. The exterior wall to the yard is constructed of metal siding. A fire area boundary evaluation was performed for the unrated fire barrier separating this fire zone with the oil filled transformer located in the yard (Engineering Equivalency Evaluation 11-8). The ceiling to the yard is constructed of concrete on metal decking on unprotected steel framing.

For Fire Zone 34B, walls, floors and ceilings to adjacent fire areas and fire zones are reinforced concrete in excess of a 3-hour rating.

Applicable Engineering Equivalency Evaluations are documented in Attachment 1.

##### 3.1.2 Doors and Access Openings

For Fire Zone 34, a fire area boundary evaluation was performed for the manway opening in the floor down to Fire Area AA29 - Fire Zone 117 (Engineering Equivalency Evaluation 9-24). An unrated missile barrier door is provided to adjacent Fire Zone 146. A fire area boundary evaluation was performed for this door. (Engineering Equivalency Evaluation 11-44.) An unlocked gate is provided to adjacent Fire Zone 34A.

For Fire Zone 34A, lower containment access is provided into Fire Area AA58 - Fire Zone 123 from this fire zone through the personnel airlock. Fire doors having a 3-hour rating are provided to adjacent Fire Area AA43 - Fire Zone 45.

For Fire Zone 34B, a fire door having a 3-hour rating is provided to adjacent Fire Area AA38 - Fire Zone 39.

##### 3.1.3 Penetrations

Note: Statements regarding fire resistance rating of penetration seals are not applicable to seals in barriers to Analysis Area YD.

For all fire zones in Fire Area AA35, penetrations in fire barriers between this fire zone and adjacent fire areas are provided with fire seals except as noted below. However, barriers between this fire zone and adjacent fire zones are not fire sealed. Seismic gaps are sealed with a glass fiber reinforced silicone sheeting.

For Fire Zone 34, penetrations into containment are adequately sealed to prevent the spread of fire through the containment barrier. The seismic gap exemption granted considered the Fire Zone 34

interface with Fire Area AA30 - Fire Zone 26 (Engineering Equivalency Evaluation 11-46).

For Fire Zone 34A, all penetrations into containment are adequately sealed to prevent the spread of fire through the containment barrier. A fire area boundary evaluation was performed for open penetrations to Fire Area AA2 - Fire Zone 109 (Engineering Equivalency Evaluation 9-36.) The seismic gap exemption granted considered the Fire Zone 34A interface with Fire Areas AA29 - Fire Zones 23 and 24, and AA30 - Fire Zone 26 (Engineering Equivalency Evaluation 11-46).

For Fire Zone 34B, a seismic gap exemption was granted for Fire Zone 34B interface with Fire Areas AA27, AA38 and AA2 - Fire Zones 22, 39, and 109, respectively (Engineering Equivalency Evaluation 11-46).

### 3.1.4 Detection

The table below outlines the fire detection system(s) provided in the Fire Area:

Table 3-1, Fire Area AA35 Detection Systems									
Fire Zone	Type of System	Local (L) / Remote (R)	Detection Actuates Suppression?	Required System?					
				S	L	E	R	D	
34	Infrared	L/R	No Auto Supp. (N/A)	N	N	Y	N	N	
34	Thermal	L/R	No Auto Supp. (N/A)	N	N	Y	N	N	
34A	Infrared	L/R	No Auto Supp. (N/A)	N	N	Y	N	N	
34A	Ionization	L/R	No Auto Supp. (N/A)	N	N	Y	N	N	
34B	Ionization	L/R	No Auto Supp. (N/A)	N	N	Y	N	N	

**Table 3-1 Legend:**

Table Field: "Required System?"	
S	- Required for Chapter 4 Separation Criteria
L	- Required for NRC Approved Licensing Action
E	- Required for Engineering Equivalency Evaluation
R	- Required for Risk Significance
D	- Required to maintain adequate balance of Defense-in-Depth in a Change Evaluation or Fire Risk Evaluation

For Fire Zone 34, there are 24 heat and 4 infra-red low voltage detectors on a single detection circuit which alarms in the Unit 2 Control Room. The heat detectors are mounted beneath the concrete floor and steel grated platforms. The infra-red detectors provide coverage for the open area, not under the steel grated platform.

For Fire Zone 34A, there are 3 low voltage ionization detectors in the access tunnel and 10 low voltage infra-red detectors for the general floor coverage on a single circuit. This detection circuit alarms in the Unit 2 Control Room. A line type thermistor heat detector is provided for the charcoal filter unit. The thermistor has a prealarm temperature setting and a high temperature alarm setting.

For Fire Zone 34B, two ionization detectors are provided which alarm in the Unit 2 Control Room.



### 3.1.5 Fixed Suppression

The table below outlines the fixed fire suppression system(s) provided in the Fire Area:

Table 3-2, Fire Area AA35 Suppression Systems								
Fire Zone	Type of System	Full (F) / Partial (P)	Required System?					
			S	L	E	R	D	
34	None	N/A	N/A	N/A	N/A	N/A	N/A	N/A
34A	None	N/A	N/A	N/A	N/A	N/A	N/A	N/A
34B	None	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Table 3-2 Legend:	
Table Field: "Required System?"	
S	- Required for Chapter 4 Separation Criteria
L	- Required for NRC Approved Licensing Action
E	- Required for Engineering Equivalency Evaluation
R	- Required for Risk Significance
D	- Required to maintain adequate balance of Defense-in-Depth in a Change Evaluation or Fire Risk Evaluation

Fire Area AA35 is not provided with automatic fire suppression.

### 3.1.6 Manual Suppression / Response Strategy

A postulated fire will be identified by early detection using ionization type smoke detection or by plant personnel using plant communication system to notify the control room. The automatic detection system alarms in the control room. The Control Room operator will dispatch the fire brigade for initiation of manual fire fighting. A fire in this fire area will be contained by the construction features discussed in Section 3.1.1. Manual suppression is provided by the CNP Fire Brigade.

For Fire Zone 34, fire extinguishers are located on the 612' and 621' elevations. There is also a water hose reel in adjacent Fire Zone 34A.

Fire Zone 34A contains fire extinguishers and water hose reels.

For Fire Zone 34B, fire extinguishers are located in adjacent Fire Zones 34A and 39. there are also water hose reels located in adjacent Fire Zone 34A.

Floor Drains are provided in all Fire Zones. Drainage is also available via door to the yard for Fire Zones 34 and 34A.

### 3.1.7 Ventilation

A fire in this area will be contained by the fire barriers. Smoke can be removed by venting to the outdoors or to other parts of the Auxiliary Building. The normal building ventilating systems in the Auxiliary Building will then exhaust the smoke via filtered monitored pathways. This fire area is listed as a non-controlled area in the Fire Pre Plans and therefore there is reasonable assurance that products of combustion will not be contaminated.

For Fire Zone 34, fire dampers having a 1 1/2-hour rating are provided for the grated floor ventilation opening to adjacent Fire Area AA30 - Fire Zone 26. Undampened louvers are provided to the yard. The manway opening down in Fire Area AA29 - Fire Zone 117 is also used for ventilation purposes.

For Fire Zone 34A, a fire area boundary evaluation was performed for an undampened ventilation duct to Fire Area AA2 - Fire Zone 109 (Engineering Equivalency Evaluation 9-36). There are ventilation penetrations to adjacent fire areas provided with isolation valves on the outside of containment. These valves are assumed to provide adequate protection, therefore, the undampened ventilation ducts to Fire Area AA58 - Fire Zone 123 do not require fire dampers.

For Fire Zone 34B, fire dampers having a 1 1/2-hour rating are provided to adjacent Fire Area AA38 - Fire Zone 39.

### 3.1.8 Other Features

For Fire Zone 34A, a manual deluge water spray system is provided for the charcoal filter unit. The system is a temperature regulating system and is not treated as a manual suppression system. The system isolating valve is normally closed and must be manually opened. The high temperature thermistor alarm automatically opens the suppression system valve. The water flow period is timed to run for approximately 20-30 seconds after the opening of the suppression system valve and then shut off. Subsequent temperatures above the thermistor high temperature setting will restart the water application for as many times as is necessary until the temperature is lowered below the high temperature setting. Operation of the system alarms in the Control Room.

## 3.2 Fire Hazards Identification

The fire area contains both ignition sources and combustible fire hazards. The ignition sources consist of the transformers, the containment hydrogen monitoring isolation valve subpanels and various exhaust and supply fans.

Combustibles consist primarily of cable insulation, cellulosic, rubber and plastics. Fire Zone 34A also includes charcoal and a hydrogen gas cylinder.

The exterior fire hazards that are adjacent to exterior walls are the Auxiliary Transformers to the south and Start-up Transformer, 201AB. EEE-11-8 has evaluated the unrated features of this Fire Area in regards to these exterior fire hazards.

All fire zones within this fire area have a combustible loading classification of low. Although the MSIV valves contain a large amount of hydraulic fluid, this is fire resistive fluid known as Fyrquel and is not included in the combustible loading classification.

## 3.3 NSCA Compliance Summary

Fire Area AA35, Unit 2 East Main Steam Valve Enclosure, Main Steam Line NESW Valve Areas contains Unit 2 LSI panels, Auxiliary Feed Water flow indicators, Auxiliary Feed Water Motor Operated Valves, Steam Generator Motor Operated Valves, Steam Generator Pressure Sense Lines, Main Steam Stop and Stop control valves, Steam Generator PORVs, Steam Generator PORV Nitrogen control valves and Safety Relief valves as well as Red and Green train cables, conduits and raceways.

Compliance with the nuclear safety performance criteria is achieved using the performance-based

approach in accordance with NFPA 805, Section 4.2.4.2.

Safe and stable condition of Unit 2 will be accomplished using Steam Generators 2 and 3 via Unit 1 East Motor Driven Auxiliary Feedwater, Control Room Process Monitoring, Unit 2 Charging via the West or East pump, Unit 2 Component Cooling Water via the East Pump, Unit 2 ESW via the East Pump the West Pump is available to support DG cooling. Electrical power is supplied to either Red or Green Trains via offsite power with both Red and Green Train Emergency Diesels also available.

The Nuclear Safety Performance Criteria compliance strategy for AA35 is documented within the NSCA Report.

### 3.3.1 Variances

The variances identified for evaluation for this fire area are grouped as follows:

#### 3.3.1.1 VFDR No. AA35-001

2-MRV-213-P, 2-MRV-223-P, 2-MRV-233-P and 2-MRV-243-P - SG 1, 2, 3 & 4 PORVs are required to be closed to support main steam isolation. Main steam isolation is required to prevent uncontrolled cooldown through over steaming. 2-MRV-213-P may fail due to fire induced damage of cable 6841-2. 2-MRV-223-P may fail due to fire induced damage of cable 18132-2. 2-MRV-233-P may fail due to fire induced damage of cable 18133-2. 2-MRV-243-P may fail due to fire induced damage of cable 6842-2. Failure of these cables could spuriously open the valves. SGs 1 & 4 are not credited for decay heat removal due to a fire within this fire area. This condition represents a variance from deterministic requirements of NFPA 805, Section 4.2.3. This is a separation issue.

This VFDR has been evaluated and it was determined that the risk, safety margin and defense-in-depth meet the acceptance criteria of NFPA 805 Section 4.2.4 with a defense-in-depth action credited.

### 3.3.2 Recovery Actions Credited

For each VFDR, a Fire Risk Evaluation has been performed to assess the acceptability of risk, defense-in-depth, and safety margin. This evaluation determined whether or not recovery actions are required to ensure that one success path necessary to achieve and maintain the nuclear safety performance criteria is maintained free of fire damage by a single fire. Table 3-3 identifies the credited recovery actions for this area. Actions retained for DID are identified as "DID Actions" within Table 3-3. Additional information for DID actions is contained within Section 3.8 of this report. Note that, for completeness, all VFDRs are contained within Table 3-3, even if the Fire Risk Evaluation has determined that a recovery action is not required. In those instances where a recovery action has been determined to not be required, the word "None" is provided in the "Action" column in the table.

Table 3-3, Recovery Actions Credited		
VFDR	Component	Action
AA35-001	2-MRV-213	DID ACTION(S)
	2-MRV-223	2-MRV-213-P-CLOSE
	2-MRV-233	2-MRV-223-P-CLOSE
	2-MRV-243	2-MRV-233-P-CLOSE
		2-MRV-243-P-CLOSE

Table 3-3, Recovery Actions Credited		
VFDR	Component	Action
		(Remove power from affected valves to fail closed the SG PORVs)

### 3.4 Non-Power Operational Modes Compliance Summary

A review of CNP for the potential effects of a fire in this Fire Area while in non-power modes of operation (NPO) was conducted. This review was conducted using the guidance provided in NEI 04-02 and FAQ 07-0040, "Non-Power Operations Clarifications".

The review determined that there are potential failures that affect certain Key Safety Functions (KSF) as a result of the fire in this area, and the fire could result in the loss of one or more KSF paths. Compensatory measures are required during high risk evolution periods to provide reasonable assurance a fire will not adversely affect key safety functions and the NFPA 805 performance goal for NPO is therefore satisfied. The results of the NPO analysis are contained within Technical Evaluation R1900-005-001, Non-Power Operation Modes Transition Review Report.

### 3.5 Radioactive Release Compliance Summary

The NFPA 805 radiological release goal is to provide reasonable assurance that a fire will not result in a radiological release that adversely affects the public, plant personnel or the environment. The NFPA 805 requirement is to ensure a radiation release to any unrestricted area due to the direct effects of fire suppression activities (but not involving fuel damage) shall be as low as reasonably achievable and shall not exceed applicable plant Technical Specification limits.

AA35 is within the Radiological Controlled Area (RCA) and has been identified as a potential fire area for radioactive release due to fire fighting activities. In accordance with NFPA 805 FAQ 09-0056, this potential has been reviewed to ensure that engineering controls, fire pre-plans, and fire brigade training materials are provided for containment and monitoring of gaseous and liquid effluents associated with fire suppression agents and products of combustion.

The review concludes that the steps to limit radiation release to other areas due to the direct effects of fire suppression activities, in addition to compliance with NFPA 805, Chapter 4, ensure that any radioactive release will be as low as reasonably achievable and will not exceed limits designated in the CNP Technical Specifications.

The review of this fire area, with respect to radioactive release, is documented in the NFPPM.

### 3.6 Probabilistic Risk Assessment-Summary of Results

A Fire PRA (FPRA) quantification of Fire Area AA35 was performed and is documented in PRA-NB-FIRE-FQ, Fire PRA Model Quantification Notebook. The fire risk quantification for Fire Area AA35 is analyzed assuming whole room burnup. PRA-NB-FIRE-FQ includes a summary of all potentially risk-significant fire scenarios (i.e., CDF > 1.0E-7 or LERF > 1.0E-8). Bounding CDF / LERF per calendar year values are reported that are based on the risk values documented in PRA-NB-FIRE-FSS, Fire PRA Fire Scenario Selection.

### **3.7 Risk-Informed, Performance-Based Evaluations**

Fire Risk Evaluations (FREs) have been performed to ensure that variances from the NFPA 805 deterministic requirements are acceptable. The evaluation process consists of an integrated assessment of the acceptability of risk, defense-in-depth, and safety margins.

#### **3.7.1 Transition Risk-Informed, Performance-Based Evaluations**

The ‘changes’ associated with NFPA 805 transition were those variances from the deterministic requirements of NFPA 805 or with the existing fire protection licensing basis that were brought into compliance with the NFPA 805 performance based approach. The change identified for evaluation for Fire Area AA35 is as follows:

- Separation Issues

The Fire Risk Evaluation has determined that the change is acceptable based upon:

- The measured change in CDF and LERF.
- Adequate defense-in-depth and safety margins being maintained.

Refer to Attachment 2 for a summary of results associated with the Fire Risk Evaluations.

### 3.8 Defense-in-Depth

A comprehensive risk-informed, performance-based analysis includes consideration of defense-in-depth (DID) as part of an integrated evaluation of risk considerations. In general, defense-in-depth involves consideration of the extent to which fire protection systems and features are provided within the three echelons of fire-protection:

- Preventing fires from starting,
- Rapidly detecting fires and controlling and extinguishing promptly those fires that do occur, thereby limiting fire damage,
- Providing an adequate level of fire protection for structures, systems, and components important to safety, so that a fire that is not promptly extinguished will not prevent the nuclear safety performance criteria from being met.

Each VFDR was evaluated for DID. The following recovery actions have been retained for DID.

VFDR No. AA35-001: 2-MRV-213-P, 2-MRV-223-P, 2-MRV-233-P and 2-MRV-243-P - SG 1, 2, 3 & 4 PORVs are required to be closed to support main steam isolation. Main steam isolation is required to prevent uncontrolled cooldown through over steaming. Loss of Main Steam isolation can be mitigated by removing fuses to ensure valves fail shut. This recovery action is being retained for DID to ensure Main Steam isolation is maintained.

Based on the assessment in support of the Fire Risk Evaluation, defense-in-depth is maintained for fire area AA34. Refer to Attachment 2 for details associated with the Fire Risk Evaluation.

### 3.9 Monitoring Program Input

A Monitoring Program will be developed in accordance with FAQ 10-0059, Rev. 1. Methods to monitor availability, reliability, and performance of fire protection program structures, systems, and components (SSCs), as well as programmatic elements will be provided. Additionally, effectiveness measures are established to review program related performance and trends. For AA35 the following systems and features are candidates for inclusion in the CNP Fire Protection Monitoring Program:

- Fire Area boundary barriers discussed in Section 3.1
- Fire Detection System

## 4.0 CONCLUSION

The nuclear safety and radioactive release performance criteria of NFPA 805 are met for a fire in Fire Area AA35. This Fire Risk Evaluation for Fire Area AA35 has demonstrated that

- The change in core damage frequency (delta CDF) is acceptable, and
- The change in large early release frequency (delta LERF) is acceptable, and
- Defense-in-depth and safety margins are maintained.

This is confirmation that a success path effectively remains free of fire damage and that the performance-based approach is acceptable per Section 4.2.4.2 of NFPA 805.

## **5.0 REFERENCES**

- 5.1 Calculation PRA-FIRE-NB-CRE, Fire PRA Cumulative Risk Evaluations
- 5.2 CNP Fire Pre-Plans, Volumes I, II, and III, Revisions 17, 14, and 18 respectively
- 5.3 Fire Hazards Analysis
- 5.4 NFPA 805, Performance-Based Standard for Fire Protection for Light Water Reactor Electric Generating Plants
- 5.5 NFPPM, NFPA 805 Fire Protection Program Manual (NFPPM)
- 5.6 Nuclear Energy Institute (NEI) 04-02, Guidance for Implementing a Risk-Informed, Performance-Based Fire Protection Program under 10 CFR 50.48(c), Rev. 2
- 5.7 Nuclear Safety Capability Assessment Report
- 5.8 PRA-NB-FIRE-FQ, Fire PRA Model Quantification Notebook
- 5.9 PRA-NB-FIRE-FSS, Fire PRA Fire Scenario Selection
- 5.10 Regulatory Guide 1.205, Risk-Informed, Performance-Based Fire Protection for Existing Light-Water Nuclear Power Plants, Rev. Revision 1
- 5.11 Technical Evaluation R1900-005-001, Non-Power Operation Modes Transition Review

**Fire Area AA35 – Attachment 1 - Table B-3 - Fire Area Transition**

<u>Unit</u>	<u>Fire Area</u>	<u>Description</u>
2	AA35	Unit 2 East Main Steam Valve Enclosure, Main Steam Line Non-Essential Service Water Valve Areas (EL. 612 ft.)

<u>Fire Zone</u>	<u>Description</u>
34	Main Steam Valve Enclosure, East - EL. 612 ft. 0 in. - Unit 2
34A	Main Steam Line Area, East 612 ft. 0 in. - Unit 2
34B	Non Essential Service Water Valve Area, West - EL. 612 ft. 0 in. - Unit 2

**Regulatory Basis**

4.2.4.2 - Performance-Based Approach - Fire Risk Evaluation with simplifying deterministic assumptions

<b>Performance Goal</b>	<b>Method of Accomplishment</b>	<b>Comments</b>
Reactivity Control	Unit 2 - Trip the reactor from the Control Room. Borate using Unit 2 East or West Charging Pump supplied from the RWST. Use source range monitoring for indication for Unit 2.	None
Inventory and Pressure Control	Unit 2 - Control inventory using Unit 2 East or West Charging Pump. Control pressure using Unit 2 Pressurizer Safety Relief Valves.	None
Decay Heat Removal	Unit 2 - Feed SGs 2 & 3 with Unit 2 East MDAFW Pump. The DHR function also requires MS isolation with a steam release path through the Safety Relief Valves.	VFDR identified for Main Steam Isolation.
Process Monitoring	Unit 2 Process Monitoring - Use Unit 2 process monitoring in the Control Room for the following: Pressurizer level, RCS pressure and temperature, and S/G level and Pressure. Unit 2 Source Range Monitoring - Use Unit 2 source range monitoring in the Control Room.	None
Vital Auxiliaries	Unit 2 Electrical - Control Unit 2 Red (AB) Train Electrical Distribution with Unit 2 Red (AB) Train Offsite Power or Unit 2 Red (AB) DG. Control Unit 2 Green (CD) Train Electrical Distribution with Unit 2 Green (CD) Train Offsite Power or Unit 2 Green (CD) DG. Unit 2 ESW - Operate Unit 2 East ESW. Unit 2 West ESW is available to provide cooling to Unit 2 Red (AB) DG. Unit 2 CCW - Operate Unit 2 East CCW. Unit 2 HVAC - Operate Unit 2 Control Room HVAC. Operate Unit 2 Auxiliary Building HVAC. Operate Unit 2 Red (AB) and Green (CD) DG HVAC.	None



**Fire Area AA35 – Attachment 1 - Table B-3 - Fire Area Transition**

<u>Unit</u>	<u>Fire Area</u>	<u>Description</u>
2	AA35	Unit 2 East Main Steam Valve Enclosure, Main Steam Line Non-Essential Service Water Valve Areas (EL. 612 ft.)
		Operate Unit 2 Switchgear HVAC. Operate Unit 2 East MDAFW Room HVAC system. Operate the Unit 2 East and West ESW Room HVAC systems.

**Reference Documents**

Genesis Solution Suite, EDISON / SAFE-PB, DC Cook V 3.4.0

Nuclear Safety Capability Assessment Report

**Licensing Actions**

None

**Existing Engineering Equivalency Evaluations (EEEE)****EEEE Title Engineering Equivalency Evaluation 9-24 - Fire Zone 117 (Fire Area AA29) Boundary Evaluation**

**Summary** The purpose of this engineering equivalency evaluation is to document the acceptability of two manway openings connecting Fire Zone 117 (Fire Area AA29) with adjacent fire areas.

Reasonable assurance is provided that the two manway openings connecting Fire Zone 117 with Fire Zone 22 and Fire Zone 34 do not impair safe shutdown capability. This engineering equivalency evaluation does not adversely impact other engineering equivalency evaluations.

The two manway openings were evaluated and found to be acceptable based on the fire hazards and construction features within the evaluated areas.

**Fire Area AA35 – Attachment 1 - Table B-3 - Fire Area Transition**

<u>Unit</u>	<u>Fire Area</u>	<u>Description</u>
2	AA35	Unit 2 East Main Steam Valve Enclosure, Main Steam Line Non-Essential Service Water Valve Areas (EL. 612 ft.)

<b><u>EEEE Title</u></b>	<b>Engineering Equivalency Evaluation 9-36 - Fire Zone 109 (Fire Area AA2) to Fire Zone 34A (Fire Area AA35) Boundary Evaluation</b>
<b><u>Summary</u></b>	<p>The purpose of this engineering equivalency evaluation is to document the acceptability of unprotected steam line pipe penetrations and an undampened ventilation duct in the barrier separating Fire Zone 109 (Fire Area AA2) from Fire Zone 34A (Fire Area AA35).</p> <p>Reasonable assurance is provided that a fire will not impact on redundant safe shutdown capability located in Fire Zones 109, 34A, and 34. This engineering equivalency evaluation does not adversely impact other engineering equivalency evaluations.</p> <p>The unsealed penetrations and undampened duct were evaluated and found to be acceptable based on the fire hazards, fire protection systems and construction features within the evaluated areas.</p>
<b><u>EEEE Title</u></b>	<b>Engineering Equivalency Evaluation 11-8 - Yard to Fire Zones 34 (Fire Area AA35), 34A (Fire Area AA35), 90 (Fire Area AA2), 97 (Fire Area AA2), 129 (Fire Area AA2) and 130 (Fire Area AA2) Boundary Evaluations</b>
<b><u>Summary</u></b>	<p>The purpose of this engineering equivalency evaluation is to document the acceptability of fire barriers separating the oil filled transformers located in the yard and the Unit 1 and Unit 2 Turbine Building and Unit 2 Auxiliary Building for their impact on preventing the spread of fire. This engineering equivalency evaluation does not impact on other engineering equivalency evaluations or exemption requests.</p> <p>Reasonable assurance is provided that a transformer fire will not impair the safe shutdown capabilities of Unit 1 or Unit 2. This engineering equivalency evaluation does not impact on other engineering equivalency evaluations.</p> <p>The fire barriers were evaluated and found to be acceptable based on the fire hazards, fire protection systems and construction features within the evaluated areas.</p>
<b><u>EEEE Title</u></b>	<b>Engineering Equivalency Evaluation 11-9 - Turbine, Auxiliary and Containment Buildings Boundary Evaluation</b>
<b><u>Summary</u></b>	<p>The purpose of this engineering equivalency evaluation is to describe in general, the approach and existence of evaluations performed to determine and reconcile fire area boundaries having components or designs with less than a 3-hr fire rating on preventing the spread of fire. This engineering equivalency evaluation also specifically evaluates the impact of unrated door assemblies on the spread of fire.</p> <p>Reasonable assurance is provided that the fire area boundaries having components or design less than a 3-hr fire rating will not increase the spread of fire or impair the safe shutdown capabilities of Units 1 or 2. In addition, this engineering equivalency evaluation does not adversely impact on other engineering equivalency evaluations or exemption requests.</p> <p>This evaluation supports additional evaluations credited in this fire area.</p>

**Fire Area AA35 – Attachment 1 - Table B-3 - Fire Area Transition**

<u>Unit</u>	<u>Fire Area</u>	<u>Description</u>
2	AA35	Unit 2 East Main Steam Valve Enclosure, Main Steam Line Non-Essential Service Water Valve Areas (EL. 612 ft.)
<b><u>EEEE Title</u></b>	<b>Engineering Equivalency Evaluation 11-14 - Cable Spreading Room Construction Boundary Evaluation (Fire Areas AA3, AA7, AA8, AA9, AA10, AA29, AA30, AA31, AA34, AA35, AA36/42, AA37, AA38, AA48, AA50, AA51 and AA52)</b>	
<b><u>Summary</u></b>	<p>The purpose of this engineering equivalency evaluation is to document the acceptability of the construction features of the cable spreading rooms which have a fire resistance rating of less than 3 hours for their impact on the spread. In particular, fire dampers having a 1 1/2-hr fire rating were analyzed by this evaluation. Other unrated construction features have been previously analyzed under separate engineering equivalency evaluations. The applicable fire areas include: AA3, AA7, AA8, AA9, AA10, AA29, AA30, AA31, AA34, AA35, AA36/42, AA37, AA38, AA48, AA50, AA51 and AA52.</p> <p>Reasonable assurance is provided that the construction features of the cable spreading rooms which have a fire resistance rating of less than 3 hours will prevent the spread of fire and not impair the safe shutdown capabilities of Unit 1 and Unit 2. In addition, this engineering equivalency evaluation does not adversely impact other engineering equivalency evaluations.</p> <p>The construction features of the cable spreading room were evaluated and found to be acceptable based on the fire hazards, fire protection systems and construction features within the areas.</p>	
<b><u>EEEE Title</u></b>	<b>Engineering Equivalency Evaluation 11-18 - Fire Zones 3, 31, 32, and 35 (Fire Area AA3) Boundary Evaluation</b>	
<b><u>Summary</u></b>	<p>The purpose of this engineering equivalency evaluation is to document the acceptability of the unrated construction features of the radwaste area boundaries in Fire Area AA3 for their impact on the spread of fire.</p> <p>Reasonable assurance is provided that the unrated construction features of the radwaste area boundaries will not result in an increased potential for the spread of fire or potential impairment of the safe shutdown capabilities of Units 1 and Unit 2. This engineering equivalency evaluation does not impact other engineering equivalency evaluations.</p> <p>The unrated boundary construction features were evaluated and found to be acceptable based on the fire hazards and the fire protection systems and features within the evaluated areas.</p>	

**Fire Area AA35 – Attachment 1 - Table B-3 - Fire Area Transition**

<u>Unit</u>	<u>Fire Area</u>	<u>Description</u>
2	AA35	Unit 2 East Main Steam Valve Enclosure, Main Steam Line Non-Essential Service Water Valve Areas (EL. 612 ft.)
<b><u>EEEE Title</u></b>	<b>Engineering Equivalency Evaluation 11-44 - Unrated Fire Doors (361 and 362) and Unrated Personnel Walkways (AA3, AA34, AA35, and AAYD)</b>	
<b><u>Summary</u></b>	<p>The purpose of this engineering equivalency evaluation is to document the acceptability of the impact the erection of new personnel walkways in each operating unit will have on the expansion of an existing fire area boundary and an existing area that neighbors other fire areas, on the potential spread of fire.</p> <p>The defense-in-depth fire protection philosophy installed in these areas adequately protects the fire safety of the plant and that the installed unrated personnel walkways and doors #361 and #362 are acceptable. The personnel walkways in each unit will not impair the safe shutdown capability of CNP, aid in the spread of fire between fire areas or jeopardize existing fire area boundaries. This engineering equivalency evaluation does not impact other engineering equivalency evaluations.</p> <p>The personnel walkways were evaluated and found to be acceptable based on the fire hazards, fire protection systems and construction features within the evaluated areas.</p>	
<b><u>EEEE Title</u></b>	<b>Engineering Equivalency Evaluation 11-46 - Seismic Gaps between the Containment and Auxiliary Buildings Boundary Evaluation (Fire Areas AA2, AA3, AA7, AA8, AA9, AA10, AA11, AA27, AA29, AA30, AA31, AA34, AA35, AA37 and AA38)</b>	
<b><u>Summary</u></b>	<p>A seismic gap exists around the Containment Building of each unit that provides an opening of approximately 6 in. between the Containment Building and the walls, ceilings and floors of the structures immediately adjacent to containment. These Fire Areas include AA2, AA3, AA7, AA8, AA9, AA10, AA11, AA27, AA29, AA30, AA31, AA34, AA35, AA37 and AA38. This engineering equivalency evaluation has been performed to document the acceptability of these seismic gaps in the fire boundaries.</p> <p>This seismic gap evaluation shows the safe shutdown capability for CNP Unit 1 and Unit 2 has not been compromised as a result of seismic gaps. The analysis performed and the results presented in the tables indicate, on a system basis, the capability to safely shut down both units when considering fire damage to safe shutdown components and circuits contained in the seismic gap evaluation areas. The method of analysis is conservative when considering the fire hazards involved in the vicinity of the seismic gaps. That is, it is not anticipated that the evaluated areas would be affected to the extent that fire would propagate through the seismic gaps and cause damage throughout the evaluated area. This engineering equivalency evaluation has no impact on the exemption requests contained in other engineering equivalency evaluations.</p> <p>The seismic gaps were evaluated and found to be acceptable based on the fire hazards, fire protection systems and construction features within the evaluated areas.</p>	

**Fire Area AA35 – Attachment 1 - Table B-3 - Fire Area Transition**

<u>Unit</u>	<u>Fire Area</u>	<u>Description</u>
2	AA35	Unit 2 East Main Steam Valve Enclosure, Main Steam Line Non-Essential Service Water Valve Areas (EL. 612 ft.)

**EEEE Title** Engineering Equivalency Evaluation 12-11 - Structural Steel Evaluations in Fire Areas AA2, AA3, AA34, AA35, AA56 and AA58.

**Summary** The purpose of this engineering equivalency evaluation is to document the acceptability of the unprotected structural steel located throughout CNP and ensure its ability to withstand the fire exposure presented by combustibles present in the area. This engineering equivalency evaluation is concerned with structural steel members that form a part of or support fire barriers required by NFPA 805, Chapter 4.

Reasonable assurance is provided that exposed structural steel supporting fire barriers will not be adversely impacted by the combustibles or hazards present in the areas evaluated. In addition, reasonable assurance is provided that falling structures supported by structural steel will not have an adverse impact on other fire barriers inside the area that are required for separation of safe shutdown components.

The unprotected structural steel was evaluated and found to be acceptable based on the fire hazards and fire protection systems within the evaluated areas.

**Fire Suppression Effects on Nuclear Safety Performance Criteria**

The CNP fire brigade is trained to discharge water in a judicious manner and instructed to direct hose streams and portable extinguishers at the base of the fire to limit the amount of overspray beyond the immediate fire zone. For this reason, fire brigade activities are not expected to fail components not already considered damaged. It has been concluded that water impingement on cables is not a concern. Electrical cabinets are provided with a seal at the conduit interface. Possible impacts to surrounding equipment due to manual fire fighting activities is bounded by the analysis approach of postulating whole room damage. The drainage features of the fire area mitigate the potential for flooding damage due to fire suppression, such that the standing water would not affect credited equipment.

In the event of discharge, any damage caused by the manual water spray system to other equipment operating within the fire zone which is not immediately involved in the originating fire is bounded by the analysis approach of postulating whole room damage. Since it is shown that suppression effects will not impact the nuclear safety performance criteria, the fire area configuration is deemed acceptable.

**References:**

Technical Evaluation 12.1, "Fire Suppression Effects Study"

Technical Evaluation 12.1, "Supplemental Information to Fire Suppression Effects Study – Supplement 1"

**Fire Area Comments**

None

## Fire Area AA35 – Attachment 2 - Fire Risk Evaluation Results Summary

### A2.1 Introduction

The ‘changes’ associated with NFPA 805 transition were those variances from the deterministic requirements of NFPA 805. The changes identified for evaluation for fire area AA35 are grouped as follows:

- Separation Issues

This attachment is a summary of the Fire Risk Evaluation for the fire area. The complete results and methodology are contained in the Cumulative Fire Risk Evaluation, PRA-FIRE-NB-CRE. (FPCE 2017-0009)

### A2.2 Inputs/Assumptions

1. Assumptions from the Fire PRA apply to this calculation.
2. Detailed fire modeling was not performed for Fire Area AA35. A single whole room burnout scenario was assumed.

### A2.3 Fire Modeling Methodology

Detailed fire modeling was not performed for Fire Area AA35. This area was modeled considering whole room burnout.

### A2.4 Scenario Descriptions and Model Results

A single whole room burnout scenario was modeled for Fire Area AA35. All targets within the fire area were assumed damaged.

#### A2.4.1 Ignition Sources

Fire Area AA35 contains the containment post-accident hydrogen sampling sub panel, vent fans supply and exhaust (2-HIV-A and 2-HIV-B), transformers and the MSIV valves. Per discussion with plant personnel, the heat release rates for all switchgear, load centers, and MCC electrical cabinets have been characterized as qualified cable because items of this nature are generally constructed on-site. For other electrical cabinet types, where the internal cable qualification was unknown, the heat release rates have been assumed as non-qualified. Ignition sources in Fire Area AA35 were modeled using the 98th percentile fire as a screening approach. These scenarios were not risk significant enough to require further refinement.

In Fire Area AA35, the 98th percentile HRR was used for all transient fires. The 98th percentile HRR bounds the possible transient ignition sources expected for this fire area, which were fire tested and identified in NUREG/CR-6850, Appendix G, Table G-7.

#### A2.4.2 Scenario Results

The PRA analyzed the VFDRs and determined them to be risk insignificant, therefore, a quantitative delta risk calculation was not performed.

### A2.5 Fire Risk Evaluation Results

PRA-FIRE-NB-CRE documents scenarios and corresponding impacted VFDRs that were evaluated for delta risk during the transition to NFPA 805 and also all changes to the Fire Protection Program that are currently incorporated into the Fire PRA model. The acceptability of the Cumulative Fire Risk Evaluations

**Fire Area AA35 – Attachment 2 - Fire Risk Evaluation Results Summary**

was based on calculated delta risk meeting the thresholds of NEI 04-02, RG 1.205 and RG 1.174. (FPCE 2017-0009)

## Fire Area AA35 – Attachment 2 - Fire Risk Evaluation Results Summary

### A-2.6 Impact of VFDR on Defense-in-Depth

Defense-in-Depth has been evaluated for this fire area. The impacts of this evaluation are summarized in the table below:

Defense-in-Depth Impact Review for AA35			
Method of Providing DID	Required to Support Deterministic Analysis or Fire PRA?	Changes or Improvements Necessary for DID?	Basis/Justification
Echelon 1: Prevent fires from starting			
Combustible Control is implemented in accordance with Procedure PMP-2270-CCM-001, Control of Combustible Materials.	Yes	No	• This element is adequate based on no perceived weakness of, or over-reliance on, another echelon of defense-in-depth.
Hot Work Control is implemented in accordance with Procedure PMP-2270-WBG-001, Welding, Burning and Grinding Activities.	Yes	No	
Echelon 2: Rapidly detect, control and extinguish promptly those fires that do occur thereby limiting fire damage			
Fire Detection System	Yes	No	• Detection is already required. No fixed suppression exists in the area, but fire fighting activities are not expected to be challenging; therefore, no changes or improvements to Echelon 2 attributes are necessary to maintain defense-in-depth.
Fixed Fire Suppression	No	No	
Portable Fire Extinguishers	Yes	No	
Hose stations and hydrants	Yes	No	
Pre-Fire Plan	Yes	No	
Echelon 3: Provide adequate level of fire protection for systems and structures so that a fire will not prevent essential safety functions from being performed			
Walls, floors ceilings and structural elements are rated or have been evaluated as adequate for the hazard.	Yes	No	No recovery actions were credited for the VFDR in AA35. Defense in Depth actions were credited in the Control Room to isolate instrument loop cable failures to prevent spurious operation of the Steam Generator PORVs.
Penetrations in the fire area barrier are rated or have been evaluated as adequate for the hazard.	Yes	No	
Supplemental barriers (e.g., ERFBS, cable tray covers, etc.)	No	No	
Guidance provided to operations personnel detailing the required success path(s) including recovery actions to achieve nuclear safety performance criteria.	Yes	No	



## Fire Area AA35 – Attachment 2 - Fire Risk Evaluation Results Summary

### A-2.7 Safety Margin Considerations

In accordance with NEI 04-02, the maintenance of adequate Safety Margin is assessed by the consideration categories of analyses utilized by this Fire Risk Evaluation.

Safety margins are considered to be maintained if:

- Codes and Standards or their alternatives accepted for use by the NRC are met.

AND

- Safety analyses acceptance criteria in the licensing basis (e.g., FSAR, supporting analyses) are met, or provides sufficient margin to account for analysis and data uncertainty.

The following summarizes the bases for ensuring the maintenance of safety margins:

- The risk-informed, performance based processes utilized are based upon NFPA 805, 2001 edition, endorsed by the NRC in 10 CFR 50.48©.
- The Fire Risk Evaluation process is in accordance with NEI 04-02, Revision 2, which is endorsed by the NRC in Regulatory Guide 1.205, Revision 1.
- The Fire PRA is developed in accordance with NUREG/CR-6850, which was developed jointly between the NRC and EPRI.
- The Fire PRA has undergone an industry peer review, in order to ensure the Fire PRA meets the appropriate quality standards of ASME/ANS RA-Sa-2009, "Standard for Level 1/Large Early Release Frequency Probabilistic Risk Assessment for Nuclear Power Plant Applications," Dated February 2, 2009
- The "bounding risk assessment" is used during transition (NEI 04-02, Section 5.3.4.2). This approach conservatively assumes that target set damage occurs for postulated fire events which resulted in whole room burn up, and therefore, MEFS/LFS is not analyzed separately from the Fire PRA results.
- The CNP internal events PRA model received two formal industry peer reviews conducted in accordance with applicable NEI guidelines. The initial peer review was performed in 2001, while a subsequent focused scope (i.e., limited scope) peer review was conducted in 2009. The initial, full-scope WOG peer review covered all aspects of the CNP PRA model and the administrative processes used to maintain and update the model. The CNP PRA model has been revised to address all significant issues (i.e., Category A and B Facts & Observations) identified during the initial peer review. None of the findings from the focused-scope peer review were judged to reach the significance level of a Category A or B Fact & Observation; as a result, no changes to the PRA model have yet been made to include resolutions for these latter issues.
- Fire protection systems and features determined to be required by NFPA 805 Chapter 4 have been confirmed to meet the requirements of NFPA 805 Chapter 3 and their associated referenced codes and listings, or provided with acceptable alternatives using processes accepted for use by the NRC (i.e., FAQ 06-0008, FAQ 06-0004, 07-0033).
- Fire modeling has not been performed in support of the change evaluations and results are therefore, based on whole area burn up. As such, the results are considered very conservative.
- In accordance with the requirements of 10 CFR 50.48©(2)(iii), the Fire PRA results, including cutsets for

## **Fire Area AA35 – Attachment 2 - Fire Risk Evaluation Results Summary**

the scenarios of concern, have been reviewed and it was verified that the results presented above do not rely solely on feed and bleed as the fire-protected safe shutdown path for maintaining reactor coolant inventory, pressure control, and decay heat removal capability for this fire area.

### **A-2.8 Transition Risk Evaluation Conclusions**

The transition change evaluation determined that these changes:

- Are acceptable based upon the measured change in CDF and LERF
- Maintained adequate defense-in-depth and safety margins

The results of this evaluation meet the requirements of NFPA 805 Risk Evaluation; therefore, the use of the performance based analysis approach is acceptable.



## 1.0 PURPOSE

This report documents the Fire Safety Analysis (FSA) for Cook Nuclear Plant (CNP) Fire Area AA36/42, Auxiliary Building (El. 609 ft.) which comprises fire zone(s) 37, 43, 44A, 44B, 44C, 44D, 44E, 44F, 44G, 44H, 44N, 44S. The purpose of this analysis is to demonstrate the achievement of the nuclear safety and radioactive release performance criteria of NFPA 805 as required by 10 CFR 50.48(c). The Fire Safety Analysis is a key part of compliance with Section 2.7.1.2 Fire Protection Program Design Basis Document of NFPA 805. This analysis also documents results of risk-informed, performance-based Fire Risk Evaluations (FREs). These evaluations are associated with Variances from Deterministic Requirements (VFDRs) of NFPA 805 Chapter 4.

## 2.0 ANALYSIS METHODOLOGY

The FSA is the design basis document as described in NFPA 805 Section 2.7.1.2. The following steps are performed to develop the FSA on a fire area basis:

- Identify significant fire hazards in the fire area. This is based on NFPA 805 approach to analyze the plant from an ignition source and fuel package perspective.
- Summarize Nuclear Safety Capability Analysis (NSCA) compliance strategies. This is the result of the NEI 04-02 B-3 Table review of the Safe Shutdown Analysis.
- Summarize Non-Power Operations Modes compliance strategies.
- Summarize Radioactive Release compliance strategies. The transition review process required per NEI 04-02 is used to develop these results.
- Provide Fire Probabilistic Risk Assessment summary of results. This is based on the results from the plant Fire PRA.
- Perform risk informed, performance based evaluations if needed for the performance based approach.
- Summarize Defense-in-Depth strategy for each fire area.
- Determine key analysis assumptions which are candidates to be included in the NFPA 805 monitoring program.
- Provide conclusions relative to NFPA 805 compliance.

### 3.0 ANALYSIS

#### 3.1 Classical Fire Protection

##### 3.1.1 Construction

Walls, floors and ceilings to adjacent fire areas are reinforced concrete in excess of 3-hour rating with a few exceptions. The west wall of Fire Zone 44N, which separates the area from Zone 56, consists of 8" and 12" concrete block of an unspecified rating. In addition, the west wall separating Fire Zone 44S from Fire Zone 59 consists of 12" concrete block of an unspecified rating. A wire mesh screen gate is provided at the entrance to the containment spray heat exchanger and residual heat removal heat exchanger rooms (44A-44H) separating the rooms from Fire Zone 44N.

Fire doors with 1 1/2-hour and 3-hour ratings separate Fire Zones 43, 44N, and 44S from adjacent fire compartments. A fire area boundary evaluation was performed for three unrated doors to separating Fire Zone 43 and Fire Zone 110.

Applicable Engineering Equivalency Evaluations are documented in Attachment 1.

##### 3.1.2 Doors and Access Openings

For Fire Zone 37, There are no door openings to adjacent fire areas. A wire mesh screen gate is provided at the entrance to adjacent Fire Zone 44N.

For Fire Zone 43, Fire doors having a 3-hour rating are provided to adjacent Fire Area AA2 - Fire Zone 91. Fire doors having a 3-hour and 1 1/2-hour rating are provided to adjacent Fire Zone 44N. The pass through window to adjacent Fire Zone 44N is unrated. A fire area boundary evaluation was performed for three unrated doors to Fire Area AA2 - Fire Zone 110 (Engineering Equivalency Evaluation 9-21). A fire area boundary evaluation was performed for an unrated ceiling hatch to Fire Area AA48 - Fire Zone 56 (Engineering Equivalency Evaluation 9-14).

For Fire Zones 44A, 44B, 44C, 44D, 44E, 44F, 44G, and 44H, there are no door openings to adjacent fire areas. A wire mesh screen gate is provided at the entrance to adjacent Fire Zone 44N.

For Fire Zone 44N, Fire doors having a 3-hour and 1 1/2-hour are provided to adjacent Fire Zone 43. The pass through window to adjacent Fire Zone 43 is unrated. Fire doors having a 3-hour rating are provided to adjacent Fire Area AA5/6, AA37, AA48 and AA50 - Fire Zone 6A, 38, 56 and 57. Fire door to Fire Zone 38 as held open with a 160°F-165°F fusible link and CO2 pop-off arrangement for HVAC ventilation concerns. This door is to close following a HELB that occurs in Fire Zone 33 or 33A. A wire mesh screen gate is provided at the entrance to adjacent Fire Zones 37 and 44A through 44H. The elevator doors have a 1 1/2-hour rating. Fire Area boundary evaluations were performed for the unrated floor hatches to Fire Area AA3 - Fire Zone 52 (Engineering Equivalency Evaluation 11-37). Open stairways protected by a water curtain connect the 609 ft. elevation of the Auxiliary Building with the 587 ft. elevation (Fire Area AA5/6 - Fire Zones 5 and 6N) and the 633 ft. elevation (Fire Area AA3 - Fire Zone 51 and 52). A fire area boundary evaluation was performed for the rated and unrated fire barriers of the stairwells and elevators located in the Turbine and Auxiliary Buildings (Engineering Equivalency Evaluation 11-12).

For Fire Zone 44S, A fire area boundary evaluation was performed for three unrated fire doors to Fire Area AA2 - Fire Zone 111 (Engineering Equivalency Evaluation 9-22). Fire doors having a 3-

hour rating are provided to adjacent Fire Areas AA38 and AA51 - Fire Zones 39 and 58. Fire door to Fire Zone 39 is held open with a 160°F-165°F fusible link and CO2 pop-off arrangement for HVAC ventilation concerns. This door is to close following a HELB that occurs in Fire Zone 34 or 34A. An open stairway protected by a water curtain connects the 609 ft. elevation of the Auxiliary Building with the 587 ft. elevation (Fire Area AA5/6 - Fire Zone 6S) and the 633 ft. elevation (Fire Area AA3 - Fire Zone 52). A fire area boundary evaluation was performed for the rated and unrated fire barriers of the stairwells and elevators located in the Turbine and Auxiliary Buildings (Engineering Equivalency Evaluation 11-12).

### 3.1.3 Penetrations

For Fire Zone 37, penetrations in fire walls between this fire zone and adjacent fire areas are provided with fire seals. Barriers between this fire zone and adjacent fire zones are fire sealed with the exception of the walls between Fire Zone 37 and Fire Zones 44A, 44E and 44N. The penetrations in the floor between this fire zone and adjacent Fire Area 6A are unsealed and covered with lead plates attached to the ceiling of Fire Zone 6A.

For Fire Zone 43, Penetrations in fire barriers between this fire zone and adjacent fire areas are provided with fire seals. However, barriers between this fire zone and adjacent fire zones are not fire sealed with the exception of the barriers to Fire Zone 44N which are sealed for ventilation reasons.

For Fire Zones 44A, 44B, 44C, 44D, 44E, 44F, 44G and 44H, penetrations in fire barriers between this fire zone and adjacent fire areas are provided with fire seals except as noted below. However, barriers between this fire zone and adjacent fire zones are not fire sealed. A fire area boundary evaluation was performed for an open penetration shaft to Fire Area AA1 - Fire Zone 1A and Fire Area AA54 - Fire Zone 62A (Engineering Equivalency Evaluation 9-31).

For Fire Zone 44N, penetrations in fire barriers between this fire zone and adjacent fire areas and the elevator shaft are provided with fire seals except as noted below. However, barriers between this fire zone and adjacent fire zones are not fire sealed with the exception of the barriers to Fire Zone 43 which are sealed for ventilation reasons. A fire area boundary evaluation was performed for unrated 8-inch thick silicone foam fire seals installed between this fire zone and Fire Area AA48 - Fire Zone 56 (Engineering Equivalency Evaluation 11-4).

For Fire Zone 44S, penetrations in fire barriers between this fire zone and adjacent fire areas and the elevator shaft are provided with fire seals except as noted below. However, barriers between this fire zone and adjacent fire zones are not fire sealed.

### 3.1.4 Detection

The table below outlines the fire detection system(s) provided in the Fire Area:

Table 3-1, Fire Area AA36/42 Detection Systems																					
Fire Zone	Type of System	Local (L) / Remote (R)	Detection Actuates Suppression?	Required System?																	
				S	L	E	R	D													
37	Ionization	L/R	No Auto Supp. (N/A)	N	N	Y	Y	N													
43	Ionization	L/R	No Auto Supp. (N/A)	N	N	Y	Y	N													
44A	None	N/A	N/A	N/A	N/A	N/A	N/A	N/A													
44B	None	N/A	N/A	N/A	N/A	N/A	N/A	N/A													
44C	None	N/A	N/A	N/A	N/A	N/A	N/A	N/A													
44D	None	N/A	N/A	N/A	N/A	N/A	N/A	N/A													
44E	None	N/A	N/A	N/A	N/A	N/A	N/A	N/A													
44F	None	N/A	N/A	N/A	N/A	N/A	N/A	N/A													
44G	None	N/A	N/A	N/A	N/A	N/A	N/A	N/A													
44H	None	N/A	N/A	N/A	N/A	N/A	N/A	N/A													
44N	Ionization	L/R	N	Y	N	Y	Y	N													
44S	Ionization	L/R	N	Y	N	Y	Y	N													
<b>Table 3-1 Legend:</b> <table> <tr> <th colspan="2">Table Field: "Required System?"</th> </tr> <tr> <td>S</td> <td>- Required for Chapter 4 Separation Criteria</td> </tr> <tr> <td>L</td> <td>- Required for NRC Approved Licensing Action</td> </tr> <tr> <td>E</td> <td>- Required for Engineering Equivalency Evaluation</td> </tr> <tr> <td>R</td> <td>- Required for Risk Significance</td> </tr> <tr> <td>D</td> <td>- Required to maintain adequate balance of Defense-in-Depth in a Change Evaluation or Fire Risk Evaluation</td> </tr> </table>										Table Field: "Required System?"		S	- Required for Chapter 4 Separation Criteria	L	- Required for NRC Approved Licensing Action	E	- Required for Engineering Equivalency Evaluation	R	- Required for Risk Significance	D	- Required to maintain adequate balance of Defense-in-Depth in a Change Evaluation or Fire Risk Evaluation
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D	- Required to maintain adequate balance of Defense-in-Depth in a Change Evaluation or Fire Risk Evaluation																				

For Fire Zone 37, three ionization detectors are provided in the general valve area which alarm in the Unit 1 Control Room. These detectors are part of the larger Auxiliary Building El. 609 ft. detection system that includes Fire Zones 37, 44N and 44S. No detectors are provided in the individual demineralizer cubicles.

For Fire Zone 43, twenty-four ionization detectors are provided which alarm in the Unit 1 Control Room. These detectors are part of a larger detection circuit that includes one detector in Fire Zone 44N.

For Fire Zone 44N, there are 19 ionization detectors which alarm in the Unit 1 Control Room. These detectors are part of a larger detection circuit which includes Fire Zones 37, 44N and 44S. Detection coverage only extends into normally accessible areas of the fire zone.

One ionization detector is provided in the Equipment Decontamination Room. This detector is part of a larger detection circuit which includes Fire Zone 43.

For Fire Zone 44S, there are 20 ionization detectors which alarm in the Unit 1 Control Room. These detectors are part of a larger detection circuit which includes Fire Zones 37, 44N and 44S. Detection coverage only extends into normally accessible areas of the fire zone. Two ionization detectors are provided in the Snubber shop.

Other fire zones within this fire area are not provided with automatic fire detection.

### 3.1.5 Fixed Suppression

The table below outlines the fixed fire suppression system(s) provided in the Fire Area:

<b>Table 3-2, Fire Area AA36/42 Suppression Systems</b>								
<b>Fire Zone</b>	<b>Type of System</b>	<b>Full (F) / Partial (P)</b>	<b>Required System?</b>					
			<b>S</b>	<b>L</b>	<b>E</b>	<b>R</b>	<b>D</b>	
37	None	N/A	N/A	N/A	N/A	N/A	N/A	N/A
43	None	N/A	N/A	N/A	N/A	N/A	N/A	N/A
44A	None	N/A	N/A	N/A	N/A	N/A	N/A	N/A
44B	None	N/A	N/A	N/A	N/A	N/A	N/A	N/A
44C	None	N/A	N/A	N/A	N/A	N/A	N/A	N/A
44D	None	N/A	N/A	N/A	N/A	N/A	N/A	N/A
44E	None	N/A	N/A	N/A	N/A	N/A	N/A	N/A
44F	None	N/A	N/A	N/A	N/A	N/A	N/A	N/A
44G	None	N/A	N/A	N/A	N/A	N/A	N/A	N/A
44H	None	N/A	N/A	N/A	N/A	N/A	N/A	N/A
44N	Pre-Action	F	Y	N	Y	Y	N	
44N	Water Curtain	P	Y	N	Y	Y	N	
44S	Pre-Action	F	Y	N	Y	Y	N	
44S	Water Curtain	P	Y	N	Y	Y	N	

**Table 3-2 Legend:**

Table Field: "Required System?"	
S	- Required for Chapter 4 Separation Criteria
L	- Required for NRC Approved Licensing Action
E	- Required for Engineering Equivalency Evaluation
R	- Required for Risk Significance
D	- Required to maintain adequate balance of Defense-in-Depth in a Change Evaluation or Fire Risk Evaluation

For Fire Zone 44N and 44S, dry pilot preaction sprinklers are provided throughout the normally accessible portions of the fire zone and in a close spaced configuration around the perimeter of the open stairways to form a water curtain between fire areas. The pilot sprinklers are rated at 175°F and the water sprinklers are rated at 250°F. Manual release capability is provided on the 609 ft. elevation of the Auxiliary Building and at the valve station in the Turbine Building. The area sprinkler system is located at the ceiling and beneath the obstructions in order to extinguish floor based fires. These sprinklers are part of a larger sprinkler system for 609 ft. elevation of the Auxiliary Building which includes Fire Zone 44S.

For Fire Zone 44S, in addition to increased sprinkler density over the CCW pumps, directional water spray sprinklers are provided for the pump bearings.

The area sprinkler system is located at the ceiling and beneath the obstructions in order to extinguish floor based fires. These sprinklers are part of a larger sprinkler system for the 609 ft. elevation of the Auxiliary Building which includes Fire Zone 44N.



Sprinkler protection is provided beneath the wrapped cable trays to assure the 20 ft. combustible free area is maintained and adequate sprinkler coverage is provided as the cable wrapping blocked the overhead sprinklers.

Other fire zones within this fire area are not provided with fixed suppression systems.

### 3.1.6 Manual Suppression / Response Strategy

For fire zones within AA36/42 equipped with automatic detection systems, a postulated fire will be identified by early detection using ionization type smoke detection or by plant personnel using plant communication system to notify the control room. The automatic detection system alarms in the control room. For fire zones within AA36/42 which are not equipped with automatic detection systems, a postulated fire will be identified by plant personnel using plant communication system to notify the control room. The Control Room operator will dispatch the fire brigade for initiation of manual fire fighting. A fire in this fire area will be contained by the construction features discussed in Section 3.1.1. Manual suppression is provided by the CNP Fire Brigade.

Fire Zone 43 is equipped with fire extinguishers with hose reels located in adjacent Fire Zones 44N and 91.

Fire extinguishers and water hose reels are located in Fire Zones 44N and 44S. Fire Zone 44S is equipped with a second hose reel of 100 ft. The equipment in these fire zones are accessible to other fire zones within this fire area. [Ref. AR 2017-7900]

Floor drains are available in Fire Zones 37, 43, 44N and 44S.

Floor drains are not available in Fire Zones 44A through 44H. A sump in each room drains below to a sump in Fire Zones 1A through 1H, respectively.

### 3.1.7 Ventilation

A fire in this area will be contained by the fire barriers. Smoke can be removed by portable fans and flexible ducting to other areas of the Auxiliary Building and outdoors if not contaminated. Contaminated smoke can be removed by portable fans and flexible ducting to other areas of the Auxiliary Building per the Fire Pre-Plans. The normal building ventilating systems in the Auxiliary Building will then exhaust the smoke via filtered monitored pathways.

For Fire Zone 37, there are undampened ventilation penetrations to the adjacent Fire Zone 44N (in the pipe tunnel vertical area).

For Fire Zone 43, fire dampers having a 1 1/2-hour rating are provided to adjacent Fire Area AA48 - Fire Zone 56.

For Fire Zone 44N, There are undampened ventilation penetrations to the adjacent Fire Zones 37 and 43. A fire damper having a 1 1/2-hour rating is provided to adjacent Fire Area AA48 - Fire Zone 56. Fire dampers having a 3-hour rating are provided to adjacent Fire Areas AA37, AA48, AA50 and AA51 - Fire Zones 38, 56, 57 and 58, respectively.

For Fire Zone 44S contains a 3-hour fire damper. This damper is located in the wall separating this fire zone from Fire Zone 39. Fire dampers having a 3-hour rating are provided to adjacent Fire

Areas AA51 and AA52 - Fire Zones 58 and 59, respectively. The Snubber shop has two undampered ventilation openings in the roof and one wall air conditioner and a wall louver.

### 3.1.8 Other Features

Six-inch curbs have been provided around each CCW pump in Fire Zone 44S. These curbs are designed to limit the effect of a lube oil spill in any of these pumps. The curbs limit the oil spill area to 60 ft<sup>2</sup>. The confined spill area subtracted the area that the pumps occupied within the confinement and this area was used for each of the CCW pump oil spill fire scenarios.

Some cable trays within Fire Area AA36/42 are provided with bottom covers and/or are fully enclosed.

Fire Area AA36/42 is divided into two safe shutdown analysis areas AA36 and AA42 which are separated by a 20-foot separation zone. Intervening cable trays within the 20-foot separation zone are provided with fire wrap. An approximately six foot high wall is provided between the Unit 1 and Unit 2 CCW pumps. This wall provides a shield from a fire in the adjacent CCW pumps from an opposite unit.

## 3.2 Fire Hazards Identification

The fire area contains both ignition sources and combustible fire hazards. The ignition sources consist of the CCW pumps, waste gas compressors and various data acquisition panels. Combustibles consist primarily of exposed electrical cables in trays and lube oil.

No ignition sources are present in the RHR or CTS Heat Exchanger Rooms with limited combustible loading in each room. There is one Waste Gas Compressor package for each Unit and they are enclosed in separate rooms with reinforced concrete wall construction. The CCW pumps are provided a partial height wall separating the Unit 1 and Unit 2 pumps as well as curbs round each pump to contain potential lube oil spills/fires.

The current fire loading classification is considered low for all fire zones within this fire area.

## 3.3 NSCA Compliance Summary

Fire Area AA36/42 is comprised of several elevations of the Auxiliary Building. The areas contain Unit 1 and Unit 2 Red and Green Train raceways, cables and equipment. A fire effecting this area has a dual unit affect requiring both Units to be brought to hot standby. Fire Area AA36/42 is divided into 2 analysis areas with twenty foot separation occurring between the two areas. In addition the CCW pumps are separated by an intra-fire area barrier. Area 36 consists of Fire Zones 37, 43, 44A, 44B, 44C, 44D, 44E, 44F, 44G, 44H and 44N. Area 42 consists of fire zone 44S.

Compliance with the nuclear safety performance criteria is achieved using the performance-based approach in accordance with NFPA 805, Section 4.2.4.2.

The following description identifies the NSCA compliance strategy for a fire occurring within AA36.

Safe and stable condition for Unit 1 will be accomplished using Steam Generators 2 and 3 via the Unit 1 East Motor Driven Auxiliary Feedwater Pump, Unit 1 Essential Service Water via the Unit 1 West Pump, Unit 1 Alternate Charging (crosstie to Unit 2) via the Unit 2 East or West Pump, Process Monitoring from the Unit 1 Main Control Room and Unit 2 Component Cooling Water via the West Pump to support Unit 2 crosstie charging system to Unit 1. Unit 1 East ESW Pump is

available to provide cooling to the Unit 1 Diesel Generator CD. Power is credited available from offsite power with emergency diesels also available and most essential 4kV, 600V, 250V and 120V red and green train supplies available.

Safe and stable condition for Unit 2 will be accomplished using Steam Generators 2 and 3 via the Unit 2 East Motor Driven Auxiliary Feedwater Pump, Unit 2 Essential Service Water via the Unit 2 East Pump, Unit 2 Charging via the East or West Pump, Process Monitoring from the Unit 2 Main Control Room and the Unit 2 Component Cooling Water via the Unit 2 East Pump. Unit 2 West ESW Pump is available to provide cooling to the Unit 2 Diesel Generator AB. Power is credited available from offsite power with emergency diesels also available.

The following description identifies the NSCA compliance strategy for a fire occurring within AA42.

Safe and stable condition for Unit 1 will be accomplished using Steam Generators 2 and 3 via the Unit 1 East Motor Driven Auxiliary Feedwater Pump or Steam Generators 1 and 4 via the Unit 2 West Motor Driven Auxiliary Feedwater Pump, Process Monitoring from the Unit 1 Main Control Room, Unit 1 Essential Service Water via the Unit 1 East or West Pump and power available from offsite with emergency diesels also available. For a fire which impacts the Unit 1 CCW pumps, Unit 2 CCW remains unaffected and is credited to support Unit 2 components in support of Unit 1 alternate Charging (CVCS) via Unit 2 crosstie.

Safe and Stable condition for Unit 2 is accomplished using Steam Generators 2 and 3 via the Unit 2 East Motor Driven Auxiliary Feedwater Pump, Process Monitoring from the Unit 2 Main Control Room, Unit 2 Essential Service Water via the Unit 2 East Pump, and power available from offsite with emergency diesels also available. For a fire which impacts the Unit 2 CCW pumps or the Unit 2 Recirc Sump to East and West RHR/CTS valves, the Unit 1 pumps and components remain unaffected and are credited to support Unit 1 components in support of Unit 2 alternate Charging (CVCS) via Unit 1 crosstie.

The Nuclear Safety Performance Criteria compliance strategy for AA36/42 is documented within the NSCA Report.

### 3.3.1 Variances

The variances identified for evaluation for this fire area are grouped as follows:

#### 3.3.1.1 VFDR No. AA36/42.36-001

1-AM-A - 600 Volt MCC is required to be operable to support electrical distribution. This MCC provides 600 volt power to the Unit 1 Red (AB) Train. 1-AM-A is required to support Unit 1 West CCW, Thermal Barrier Cooling and Control Room HVAC. 1-AM-A may fail due to fire induced damage of cables 8501R-1 and 8502R-1. This condition represents a variance from the deterministic requirements of NFPA 805, Section 4.2.3. This is a separation issue.

This VFDR has been evaluated and it was determined that the risk, safety margin and defense-in-depth meet the acceptance criteria of NFPA 805 Section 4.2.4 with no further action required.

**3.3.1.2 VFDR No. AA36/42.36-002**

1-AM-D - 600 Volt MCC is required to be be operable to support electrical distribution. This MCC provides 600 volt power to the Unit 1 Green (CD) Train. 1-AM-D is required to support Unit 1 East CCW, Thermal Barrier Cooling, N Train Battery Charger, BIT inlet and outlet valves, RWST to CVCS valve and VCT isolation valve. 1-AM-D may fail due to fire induced damage of cable 80136G-1. This condition represents a variance from the deterministic requirements of NFPA 805, Section 4.2.3. This is a separation issue.

This VFDR has been evaluated and it was determined that the risk, safety margin and defense-in-depth meet the acceptance criteria of NFPA 805 Section 4.2.4 with no further action required.

**3.3.1.3 VFDR No. AA36/42.36-003**

1-CLI-113 and 1-CLI-114 - CST Control Room Level Indicators are required to operable to support Unit 1 AFW. One of the indicators is required to provide Control Room indication. The CST is the primary water source for the AFW system. AFW is required to provide decay heat removal from the reactor core to ensure that the fuel is maintained in a safe and stable condition. 1-CLI-113 may fail due to fire induced damage of cable 20205-1. 1-CLI-114 may fail due to fire induced damage of cable 8202Y-1. This condition represents a variance from the deterministic requirements of NFPA 805, Section 4.2.3. This is a separation issue.

This VFDR has been evaluated and it was determined that the risk, safety margin and defense-in-depth meet the acceptance criteria of NFPA 805 Section 4.2.4 with no further action required.

**3.3.1.4 VFDR No. AA36/42.36-004**

1-FMO-222 and 1-FMO-232- SG 2 and 3 AFW Supply Valves are required to be operable to support decay heat removal for Unit 1. Decay heat removal shall be capable of removing heat from the reactor core such that the fuel is maintained in a safe and stable condition. Decay heat removal requires a set of 2 supply valves be operable with their corresponding AFW pump. The following sets of Unit 1 SG AFW supply valves may fail due to a full area fire within Fire Area AA36/42; 1-FMO-212 and 1-FMO-242, 1-FMO-222 and 1-FMO-232, 1-FMO-221 and 1-FMO-231. The Unit 1 East AFW Pump is credited to provide decay heat removal through SGs 2 and 3. This requires 1-FMO-222 and 1-FMO-232 be operable. 1-FMO-222 may fail due to fire induced damage of cable 9747G-1. 1-FMO-232 is may fail due to fire induced damage of cable 9748G-1. These cable failures could spuriously close the valves. This condition represents a variance from the deterministic requirements of NFPA 805, Section 4.2.3. This is a separation issue.

This VFDR has been evaluated and it was determined that the risk, safety margin and defense-in-depth meet the acceptance criteria of NFPA 805 Section 4.2.4 with no further action required.

**3.3.1.5 VFDR No. AA36/42.36-005**

1-WMO-754 - ESW Alternate Makeup to East MDAFW Pump is required to be operable to support Unit 1 East AFW. AFW is required to provide decay heat removal from the reactor core to such that fuel is maintained in a safe and stable condition. The primary AFW source is from the CST. The system credits the use of a secondary source which is fed from the ESW. 1-WMO-754 cross-ties the ESW into the AFW system to provide the secondary make-up source. 1-WMO-754 is required to be operable to provide a secondary source of water to the East AFW system. 1-WMO-754 may fail due to fire induced damage of cable 9298G-1. This condition represents a variance from the deterministic requirements of NFPA 805, Section 4.2.3. This is a separation issue.

This VFDR has been evaluated and it was determined that the risk, safety margin and defense-in-depth meet the acceptance criteria of NFPA 805 Section 4.2.4 with no further action required.

**3.3.1.6 VFDR No. AA36/42.36-006**

1-PP-7E - East ESW Pump is required to be operable to support the East ESW system. The EAST ESW system is required to provide cooling to the Unit 1 Green (CD) DG, and provide a secondary make-up source for the AFW system for a fire within Fire Area AA36/42. The ESW system is not required to provide cooling to the CCW system within this area because alternate CVCS is credited. 1-PP-7E may fail due to fire induced damage of cable 9961G-1. This condition represents a variance from the deterministic requirements of NFPA 805, Section 4.2.3. This is a separation issue.

This VFDR has been evaluated and it was determined that the risk, safety margin and defense-in-depth meet the acceptance criteria of NFPA 805 Section 4.2.4 with no further action required.

**3.3.1.7 VFDR No. AA36/42.36-007**

This VFDR has been removed.

**3.3.1.8 VFDR No. AA36/42.36-008**

1-MMO-210, 1-MMO-240 and 1-URV-P - Air Open Valves for SGs 1 & 4 Stop Valves are required to be operable to support main steam isolation. Main steam isolation can be achieved if the SG 1 & 4 Stop Valves open by closing the Steam Dump to Condenser Valves. Main steam isolation is required to prevent uncontrolled cooldown through over steaming. 1-MMO-210 is a 3 way valve that vents air to either of the MSSV Dump Valves to close 1-MRV-210. Dump valve 1-MRV-212 may fail due to a fire within this area, therefore, requiring the Air Open Valve to vent to Dump Valve 1-MRV-211. 1-MMO-210 may fail due to fire induced damage of cable 14367R-1. This failure could position the valve to vent to the failed dump valve, therefore, eliminating the ability to close 1-MRV-210. 1-MMO-240 is a 3 way valve that vents air to either of the MSSV Dump Valves to close 1-MRV-240. Dump valve 1-MRV-242 may fail due to a fire within this area, therefore, requiring the Air Open Valve to vent to Dump Valve 1-MRV-241. 1-MMO-240 may fail due to fire induced damage of cable 14386R-1. This failure could position the valve to vent to the failed dump valve, therefore, eliminating the ability to close 1-MRV-240. 1-URV-P models the Steam Dump to Condenser Valves. 1-URV-P may fail due to cables 8710PO-1, 8711PO-1, 8723PY-1 and 8724PY-1. SGs 1 & 4 are not credited for decay heat removal due to a fire within this area. This condition represents a variance from deterministic requirements of NFPA 805, Section 4.2.3. This is a separation issue.

This VFDR has been evaluated and it was determined that the risk, safety margin and defense-in-depth meet the acceptance criteria of NFPA 805 Section 4.2.4 with no further action required.

### 3.3.1.9 VFDR No. AA36/42.36-009

1-MRV-220, 1-MRV-230 and 1-URV-P - Main Steam Stop Valves for SGs 2 & 3 are required to be closed to support main steam isolation. Main steam isolation can be achieved if the SG 2 & 3 Stop Valves open by closing the Steam Dump to Condenser Valves. Main steam isolation is required to prevent uncontrolled cooldown through over steaming. 1-MRV-220 may not be available due to the failure of 1-MMO-220, 1-MRV-221 and 1-MRV-222. 1-MMO-220, 3 Way Air Open Valve for SG 2 Stop Valve vents air from the main steam stop valve to either 1-MRV-221 or 1-MRV-222. Cable failures to the 3 way stop valve will spuriously operate it to either position. 1-MMO-220 may fail due to fire induced damage of cables 14374G-1 and 5695-1. 1-MRV-221 may fail due to fire induced damage of cables 9001G-1, 9006G-1 and 9009G-1. 1-MRV-222 may fail due to fire induced damage of cables 9001R-1, 9006R-1 and 9009R-1. SGs 2 & 3 are credited for decay heat removal due to a fire within this area. 1-MRV-230 may not be available due to the failure of 1-MMO-230, 1-MRV-231 and 1-MRV-232. 1-MMO-230, 3 Way Air Open Valve for SG 3 Stop Valve vents air from the main steam stop valve to either 1-MRV-231 or 1-MRV-232. Cable failures to the 3 way stop valve will spuriously operate it to either position. 1-MMO-230 may fail due to fire induced damage of cable 14379G-1. 1-MRV-231 may fail due to fire induced damage of cables 9016G-1, 9018G-1 and 9025G-1. 1-MRV-232 may fail due to fire induced damage of cables 9016R-1, 9018R-1 and 9025R-1. 1-URV-P models the Steam Dump to Condenser Valves. 1-URV-P may fail due to cables 8710PO-1, 8711PO-1, 8723PY-1 and 8724PY-1. This condition represents a variance from the deterministic requirements of NFPA 805, Section 4.2.3. This is a separation issue.

This VFDR has been evaluated and it was determined that the risk, safety margin and defense-in-depth meet the acceptance criteria of NFPA 805 Section 4.2.4 with no further action required.

### 3.3.1.10 VFDR No. AA36/42.36-010

1-MRV-213-P and 1-MRV-243-P - SG 1 & 4 PORVs are required to be closed to support main steam isolation. Main steam isolation is required to prevent uncontrolled cooldown through over steaming. 1-MRV-213-P may fail due to fire induced damage of cable 6841-1. 1-MRV-243-P may fail due to fire induced damage of cable 6842-1. Failure of these cables could spuriously open the valves. SGs 1 & 4 are not credited for decay heat removal due to a fire within this fire area. This condition represents a variance from deterministic requirements of NFPA 805, Section 4.2.3. This is a separation issue.

This VFDR has been evaluated and it was determined that the risk, safety margin and defense-in-depth meet the acceptance criteria of NFPA 805 Section 4.2.4 with no further action required.



**3.3.1.11 VFDR No. AA36/42.36-011**

1-MRV-223-P and 1-MRV-223-P - SG 2 & 3 PORVs are required to be closed to support main steam isolation. Main steam isolation is required to prevent uncontrolled cooldown through over steaming. 1-MRV-223-P may fail due to fire induced damage of cables 18132-1 and 9050Y-1. 1-MRV-233-P may fail due to fire induced damage of cables 18133-1 and 9051Y-1. Failure of these cables could spuriously open the valves. SGs 2 & 3 are credited for decay heat removal due to a fire within this fire area. This condition represents a variance from deterministic requirements of NFPA 805, Section 4.2.3. This is a separation issue.

This VFDR has been evaluated and it was determined that the risk, safety margin and defense-in-depth meet the acceptance criteria of NFPA 805 Section 4.2.4 with no further action required.

**3.3.1.12 VFDR No. AA36/42.36-012**

1-PP-50E and 1-PP-50W - The Unit 1 East and West Charging Pumps are required to be operable to support CVCS. CVCS is required for pressure and inventory control and RCP seal cooling. 1-PP-50E and 1-PP-50W may not be available due to fire induce damage of the Unit 1 East and West CCW systems. CCW is required to provide cooling to the charging pumps. This condition represents a variance from the deterministic requirements of NFPA 805, Section 4.2.3. This is a separation issue.

This VFDR has been evaluated and it was determined that the risk, safety margin and defense-in-depth meet the acceptance criteria of NFPA 805 Section 4.2.4 with a recovery action credited.

**3.3.1.13 VFDR No. AA36/42.36-013**

1-ICM-250 - Boron Injection Tank Outlet Shutoff Valve is required to be open to support Unit 1 alternate CVCS. CVCS is required to be operable to support inventory, pressure and reactivity control. The Unit 1 alternate charging flow path injects borated water from the Unit 2 RWST with the Unit 2 pumps through the Unit 1 the BIT into the cold leg loops. This valve is normally closed and fails as-is on the loss of power. 1-ICM-250 may fail due to fire induced damage of cables 8173G-1, 8174G-1, 9090G-1, 9091G-1 and 9548G-1. These cable failures could prevent the valve from opening. This condition represents a variance from the deterministic requirements of NFPA 805, Section 4.2.3. This is a separation issue.

This VFDR has been evaluated and it was determined that the risk, safety margin and defense-in-depth meet the acceptance criteria of NFPA 805 Section 4.2.4 with no further action required.



**3.3.1.14 VFDR No. AA36/42.36-014**

1-NRV-151 and 1-NRV-152 - Pressurizer PORVs are required to be closed to support RCS Integrity. RCS integrity is required to maintain positive control over RCS inventory and pressure. 1-NRV-151 may fail due to fire induced damage of cable 9705R-1. 1-NRV-152 may fail due to fire induced damage of cable 9706R-1. Failure of these cables could spuriously open the valves. This condition represents a variance from the deterministic requirements of NFPA 805, Section 4.2.3. This is a separation issue.

This VFDR has been evaluated and it was determined that the risk, safety margin and defense-in-depth meet the acceptance criteria of NFPA 805 Section 4.2.4 with no further action required.

**3.3.1.15 VFDR No. AA36/42.36-015**

1-NSO-023 and 1-NSO-024 - RX Head Vent Valves are required to be closed to support RCS Integrity. RCS integrity is required to maintain positive control over RCS inventory and pressure. 1-NSO-023 and 1-NSO-024 are in series requiring one of the valves to remain closed to provide RCS integrity. 1-NSO-023 may fail due to cable 9914PR-1. 1-NSO-024 may fail due to fire induce damage of cable 9920PR-1. Failure of these cables could spuriously open the valves. This condition represents a variance from the deterministic requirements of NFPA 805, Section 4.2.3. This is a separation issue.

This VFDR has been evaluated and it was determined that the risk, safety margin and defense-in-depth meet the acceptance criteria of NFPA 805 Section 4.2.4 with no further action required.

**3.3.1.16 VFDR No. AA36/42.36-016**

1-NSO-063 and 1-NSO-064 - Post Accident Vent Valves are required to be closed to support RCS integrity. RCS integrity is required to maintain positive control over RCS inventory and pressure. 1-NSO-023 and 1-NSO-024 are in series requiring one of the valves to remain closed to provide RCS integrity. 1-NSO-063 may fail due to fire induced damage of cable 9901PR-1. 1-NSO-064 may fail due to fire induced damage of cable 9907PR-1. Failure of these cables could spuriously open the valves. This condition represents a variance from the deterministic requirements of NFPA 805, Section 4.2.3. This is a separation issue.

This VFDR has been evaluated and it was determined that the risk, safety margin and defense-in-depth meet the acceptance criteria of NFPA 805 Section 4.2.4 with no further action required.

**3.3.1.17 VFDR No. AA36/42.36-017**

1-NRV-164 - Pressurizer Spray Relief Valve is required to be closed to support RCS integrity. RCS integrity is required to maintain positive control over RCS inventory and pressure. Spurious opening of 1-NRV-164 can be mitigated by tripping RCP 4 from the Control Room. RCP 4 trip circuitry may have cable failures that could prevent the pump from being tripped from the Control Room due to a full area fire within this fire area. 1-NRV-164 may fail due to fire induced damage of cables 8733PO-1 and 9600PY-1. Failure of these cables could spuriously open the valve. This condition represents a variance from the deterministic requirements of NFPA 805, Section 4.2.3. This is a separation issue.

This VFDR has been evaluated and it was determined that the risk, safety margin and defense-in-depth meet the acceptance criteria of NFPA 805 Section 4.2.4 with no further action required.

**3.3.1.18 VFDR No. AA36/42.36-018**

1-PP-45-1 and 1-PP-45-4 - RCP 1 and 4 are required to be tripped to support RCS integrity due to the loss of thermal barrier cooling and normal charging. RCS integrity is required to maintain positive control of inventory and pressure. Failure to trip the pumps could result in the loss of the ability to maintain positive control over RCS inventory and pressure due to a seal LOCA. 1-PP-45-1 may lose Control Room trip capability due to fire induced damage of cable 4448PR-1. 1-PP-45-4 may lose Control Room trip capability due to fire induced damage of cable 7992PR-1. This condition represents a variance from the deterministic requirements of NFPA 805, Section 4.2.3. This is a separation issue.

This VFDR has been evaluated and it was determined that the risk, safety margin and defense-in-depth meet the acceptance criteria of NFPA 805 Section 4.2.4 with no further action required.

**3.3.1.19 VFDR No. AA36/42.36-019**

1-PZRHTR.AUTO - Pressurizer Heater Auto Control is required not to spuriously operate to support RCS integrity. RCS integrity is required to maintain positive control of inventory and pressure. Spurious operation of the heater could raise the pressure within the pressurizer to the point pressurizer safety valves lift. If the valves do not reseal after they lift positive control over pressure and inventory will not be maintained. 1-PZRHTR.AUTO may spuriously operate due to fire induced damage of cables 8733PO-1 and 9600PY-1. This condition represents a variance from the deterministic requirements of NFPA 805, Section 4.2.3. This is a separation issue.

This VFDR has been evaluated and it was determined that the risk, safety margin and defense-in-depth meet the acceptance criteria of NFPA 805 Section 4.2.4 with no further action required.

**3.3.1.20 VFDR No. AA36/42.36-020**

1-WMO-702 - West ESW Pump Discharge Valve is required to be open to support the West ESW system. The West ESW system is required to cool the Unit 1 Red (AB) DG. Unit 1 ESW is not required to provide cooling to the CCW system within this area because alternate CVCS is credited for Unit 1. 1-WMO-702 may fail due to fire induced damage to 600V MCC 1-PS-A. This condition represents a variance from the deterministic requirements of NFPA 805, Section 4.2.3. This is a separation issue.

This VFDR has been evaluated and it was determined that the risk, safety margin and defense-in-depth meet the acceptance criteria of NFPA 805 Section 4.2.4 with a defense-in-depth action credited.

**3.3.1.21 VFDR No. AA36/42.36-021**

1-NLP-151-CRI - Pressurizer Level indication is required to be operable to support process monitoring. Process monitoring is required to provide indication of primary and secondary parameters in order to achieve and maintain a safe and stable condition. 1-NLP-151-CRI is required to provide Control Room level indication of the pressurizer. 1-NLP-151-CRI may fail due to fire induced damage of cable 8734PO-1. This condition represents a variance from the deterministic requirements of NFPA 805, Section 4.2.3. This is a separation issue.

This VFDR has been evaluated and it was determined that the risk, safety margin and defense-in-depth meet the acceptance criteria of NFPA 805 Section 4.2.4 with no further action required.

**3.3.1.22 VFDR No. AA36/42.36-022**

1-HV-AES1 and 1-HV-AES2 - The Engineering Safety Equipment Area Exhaust Fans are required to be operable to support the Auxiliary Building HVAC System. The Auxiliary Building HVAC system is required to be operable to ensure adequate habitability for operator actions. 1-HV-AES1 may fail due to fire induced damage of cable 9410G-1. 1-HV-AES2 may fail due to fire induced damage of cable 9410R-1. This condition represents a variance from the deterministic requirements of NFPA 805, Section 4.2.3. This is a separation issue.

This VFDR has been evaluated and it was determined that the risk, safety margin and defense-in-depth meet the acceptance criteria of NFPA 805 Section 4.2.4 with no further action required.

**3.3.1.23 VFDR No. AA36/42.36-023**

1-HV-ACR-1, 1-HV-ACRA and 1-PP-82N - Control Room HVAC is required for habitability. Control Room AHU 1N, AHU 1N Fan and AHU 1N Recirculating Pump are required to be operable to support the HVAC system for the Control Room. 1-HV-ACR-1 may fail due to fire induced damage of cables 14430G-1, 3010G-1 and 6124G-1. 1-HV-ACRA-1 may fail due to fire induced damage of cables 8987G-1, 8988G-1, 8989G-1 and 8992G-1. 1-PP-82N may fail due to fire induced damage of cables 14430G-1, 3010G-1 and 6124G-1. This condition represents a variance from the deterministic requirements of NFPA 805, Section 4.2.3. This is a separation issue.

This VFDR has been evaluated and it was determined that the risk, safety margin and defense-in-depth meet the acceptance criteria of NFPA 805 Section 4.2.4 with no further action required.

**3.3.1.24 VFDR No. AA36/42.36-024**

12-HV-ESW-5 and 12-HV-ESW-6 - The ESW Pump 1W Room Supply Fans are required to be operable to support 1-PP-7W, West ESW Pump. The supply fans are required to be operable to ensure adequate cooling of the pump is maintained. The West ESW Pump is required to be operable to provide cooling to the Unit 1 Red (AB) DG. 12-HV-ESW-5 and 12-HV-ESW-6 may fail due to fire induced damage of 600V MCC 1-PS-A. This condition represents a variance from the deterministic requirements of NFPA 805, Section 4.2.3. This is a separation issue.

This VFDR has been evaluated and it was determined that the risk, safety margin and defense-in-depth meet the acceptance criteria of NFPA 805 Section 4.2.4 with no further action required.

**3.3.1.25 VFDR No. AA36/42.36-025**

1-SPURIOUS-SI - Dummy Component for Spurious SI Signal is required to be not activated to maintain hot standby. A spurious SI signal will adversely affect decay heat removal, inventory control, pressure control and vital auxiliaries. The spurious SI signal may occur due to fire induced damage to the following cable failures 8733PO-1, 9050Y-1, 9068O-1, 9069O-1, 9074O-1, 9075O-1, 9051Y-1 and 9600PY-1. This condition represents a variance from the deterministic requirements of NFPA 805, Section 4.2.3. This is a separation issue.

This VFDR has been evaluated and it was determined that the risk, safety margin and defense-in-depth meet the acceptance criteria of NFPA 805 Section 4.2.4 with no further action required.

**3.3.1.26 VFDR No. AA36/42.36-026**

1-SPURIOUS-SPRAY-CIS - Dummy Component for Spurious Containment Isolation Signal is required to be not activated to maintain hot standby. A spurious signal will adversely affect inventory and pressure control. The spurious signal may occur due to fire induce damage of cables 9304O-1 and 9304Y-1. This condition represents a variance from the deterministic requirements of NFPA 805, Section 4.2.3. This is a separation issue.

This VFDR has been evaluated and it was determined that the risk, safety margin and defense-in-depth meet the acceptance criteria of NFPA 805 Section 4.2.4 with no further action required.

**3.3.1.27 VFDR No. AA36/42.36-027**

2-FMO-222 and 2-FMO-232- SG 2 and 3 AFW Supply Valves are required to be operable to support decay heat removal for Unit 2. Decay heat removal shall be capable of removing heat from the reactor core such that the fuel is maintained in a safe and stable condition. Decay heat removal requires a set of 2 supply valves be operable with their corresponding AFW pump. The Unit 2 East MDAFW Pump is credited to provide decay heat removal for a fire within this fire area. This requires 2-FMO-222 and 2-FMO-232 be operable. 2-FMO-222 may fail due to fire induced damage of cable 9747G-2. 2-FMO-232 may fail due to fire induced damage of cable 9748G-2. This condition represents a variance from the deterministic requirements of NFPA 805, Section 4.2.3. This is a separation issue.

This VFDR has been evaluated and it was determined that the risk, safety margin and defense-in-depth meet the acceptance criteria of NFPA 805 Section 4.2.4 with no further action required.

**3.3.1.28 VFDR No. AA36/42.36-028**

2-DCR-310 and 2-DCR-340 - SG 1 & 4 Blowdown Isolation Valves are required to be closed to support main steam isolation. Main steam isolation is required to prevent uncontrolled cooldown through over steaming. 2-DCR-310 may fail due to fire induced damage of cable 8682G-2. 2-DCR-340 may fail due to fire induced damage of cable 8686G-2. Failure of these cables could spuriously open the valves. SGs 1 & 4 are not credited for decay heat removal within this fire area. This condition represents a variance from deterministic requirements of NFPA 805, Section 4.2.3. This is a separation issue.

This VFDR has been evaluated and it was determined that the risk, safety margin and defense-in-depth meet the acceptance criteria of NFPA 805 Section 4.2.4 with no further action required.

**3.3.1.29 VFDR No. AA36/42.36-029**

2-QRV-251 - Charging Flow Control Valve is required to be open to support Unit 2 CVCS. Unit 2 CVCS is required to be operable to maintain inventory, pressure and reactivity control and provide seal injection. 2-QRV-251 may fail due to fire induced damage of cable 6116-2. Failure of this cable could spuriously close the valve. This condition represents a variance from the deterministic requirements of NFPA 805, Section 4.2.3. This is a separation issue.

This VFDR has been evaluated and it was determined that the risk, safety margin and defense-in-depth meet the acceptance criteria of NFPA 805 Section 4.2.4 with no further action required.

**3.3.1.30 VFDR No. AA36/42.36-030**

2-CMO-419.P - East CCW to RHR HX Isolation Valve is required to be closed to support Unit 2 CCW. The Unit 2 CCW system is required to provide cooling to the Unit 2 charging pumps. This area credits the use of the Unit 2 charging pumps for both Unit 1 and Unit 2 due to alternate charging for Unit 1 and normal charging for Unit 2. 2-CMO-419.P may fail due to fire induced damage of cables 8251G-2, 8252G-2, 8253G-2 and 8908G-2. Failure of these cables could spuriously open the valve. This condition represents a variance from the deterministic requirements of NFPA 805, Section 4.2.3. This is a separation issue.

This VFDR has been evaluated and it was determined that the risk, safety margin and defense-in-depth meet the acceptance criteria of NFPA 805 Section 4.2.4 with no further action required.

**3.3.1.31 VFDR No. AA36/42.36-031**

2-HV-ACR-1, 2-HV-ACRA and 2-PP-82N - Control Room HVAC is required for habitability. Control Room AHU 1N, AHU 1N Fan and AHU 1N Recirculating Pump are required to be operable to support the HVAC system for the Control Room. 2-HV-ACR-1 may fail due to fire induced damage of cables 14430G-2, 3014G-2 and 6123G-2. 2-HV-ACRA-1 may fail due to fire induced damage of cables 8987G-2, 8989G-2, and 8992G-2. 1-PP-82N may fail due to fire induced damage of cables 14430G-2, 3010G-2 and 6124G-2. This condition represents a variance from the deterministic requirements of NFPA 805, Section 4.2.3. This is a separation issue.

This VFDR has been evaluated and it was determined that the risk, safety margin and defense-in-depth meet the acceptance criteria of NFPA 805 Section 4.2.4 with no further action required.

**3.3.1.32 VFDR No. AA36/42.36-032**

1-DCR-320 and 1-DCR-330 - SG 2 & 3 Blowdown Isolation Valves are required to be closed to support main steam isolation. Main steam isolation is required to prevent uncontrolled cooldown through over-steaming. SG 2 & 3 Blowdown Isolation Valves may fail due to a full area fire within Fire Area AA36/42. 1-DCR-320 may fail due to fire induced damage of cable 8682R-1. 1-DCR-330 may fail due to fire induced damage of cable 8686R-1. These cable failures could spuriously open the valves. SGs 2 and 3 are credited for decay heat removal for a fire within Fire Area AA36/42. This condition represents a variance from the deterministic requirements of NFPA 805, Section 4.2.3. This is a separation issue.

This VFDR has been evaluated and it was determined that the risk, safety margin and defense-in-depth meet the acceptance criteria of NFPA 805 Section 4.2.4 with a defense-in-depth action credited.

**3.3.1.33 VFDR No. AA36/42.36-033**

1-QRV-10 and 1-QRV-40 - RCP Seal Water Return Isolation Valves are required to be open to support RCS integrity by maintaining the RCP seal. RCS integrity is required to maintain positive control over RCS inventory and pressure. 1-QRV-10 may fail due to fire induced damage of cable 4418PR-1. 1-QRV-40 may fail due to fire induced damage of cable 5002PR-1. These cables could cause spurious closure of these valves. This condition represents a variance from the deterministic requirements of NFPA 805, Section 4.2.3. This is a separation issue.

This VFDR has been evaluated and it was determined that the risk, safety margin and defense-in-depth meet the acceptance criteria of NFPA 805 Section 4.2.4 with a defense-in-depth action credited.

**3.3.1.34 VFDR No. AA36/42.42-001**

1-PP-10E and 1-PP-10W - East and West CCW Pumps are required to be operable to support Unit 1 CCW. The CCW system provides cooling to the charging pumps which are required to maintain inventory and pressure control. The Unit 1 charging pumps provide Unit 1 CVCS and Unit 2 alternate CVCS. 1-PP-10E may fail due to fire induced damage due to location and cables 8006G-1 and 9425G-1. 1-PP-10W may fail due to fire induced damage due to location and cables 8006R-1 and 8690R-1. This condition represents a variance from the deterministic requirements of NFPA 805, Section 4.2.3. This is a separation issue.

This VFDR has been evaluated and it was determined that the risk, safety margin and defense-in-depth meet the acceptance criteria of NFPA 805 Section 4.2.4 with a recovery action credited.

**3.3.1.35 VFDR No. AA36/42.42-002**

2-ABD-B - 600 Volt MCC is required to be operable to support electrical distribution. The MCC provides 600 Volt Power to the Unit 2 Red (AB) Train, "N" Train battery charger, Red (AB) DG supporting equipment. 2-ABD-D may fail due to fire induced damage of cable 9698R-2. This condition represents a variance from the deterministic requirements of NFPA 805, Section 4.2.3. This is a separation issue.

This VFDR has been evaluated and it was determined that the risk, safety margin and defense-in-depth meet the acceptance criteria of NFPA 805 Section 4.2.4 with no further action required.

**3.3.1.36 VFDR No. AA36/42.42-003**

2-AM-A - 600 Volt MCC is required to be operable to support electrical distribution. The MCC provides 600 volt power to the Unit 2 Red (AB) Train, "N" Train battery charger, west CCW valve, thermal barrier cooling valves, Control Room HVAC and Auxiliary Building HVAC. 2-AM-A may fail due to fire induced damage of cable 8547R-2. This condition represents a variance from the deterministic requirements of NFPA 805, Section 4.2.3. This is a separation issue.

This VFDR has been evaluated and it was determined that the risk, safety margin and defense-in-depth meet the acceptance criteria of NFPA 805 Section 4.2.4 with no further action required.



**3.3.1.37 VFDR No. AA36/42.42-004**

2-AM-D - 600 Volt MCC is required to be operable to support electrical distribution. The MCC provides 600 volt power to the Unit 2 Green (CD) Train, East CCW valves, thermal barrier valves, BIT inlet and outlet valves, CVCS valves, RWST valves and Auxiliary Building HVAC. 2-AM-D may fail due to fire induced damage of cable 8546G-2. This condition represents a variance from the deterministic requirements of NFPA 805, Section 4.2.3. This is a separation issue.

This VFDR has been evaluated and it was determined that the risk, safety margin and defense-in-depth meet the acceptance criteria of NFPA 805 Section 4.2.4 with no further action required.

**3.3.1.38 VFDR No. AA36/42.42-005**

2-CLI-113 and 2-CLI-114 - CST Control Room Level Indication is required to operable to support Unit 1 AFW. The CST is the primary water source for the AFW system. AFW is required to provide decay heat removal to ensure that the fuel is maintained in a safe and stable condition. 2-CLI-113 may fail due to fire induced damage of cable 19867-2. 2-CLI-114 may fail due to fire induced damage of cable 8202Y-2. This condition represents a variance from the deterministic requirements of NFPA 805, Section 4.2.3. This is a separation issue.

This VFDR has been evaluated and it was determined that the risk, safety margin and defense-in-depth meet the acceptance criteria of NFPA 805 Section 4.2.4 with no further action required.

**3.3.1.39 VFDR No. AA36/42.42-006**

2-FMO-222 and 2-FMO-232- SG 2 and 3 AFW Supply Valves are required to be operable to support decay heat removal for Unit 2. Decay heat removal shall be capable of removing heat from the reactor core such that the fuel is maintained in a safe and stable condition. Decay heat removal requires a set of 2 supply valves be operable with their corresponding AFW pump. The following sets of Unit 2 SG AFW supply valves may fail due to a full area fire within Fire Area AA36/42; 2-FMO-212 and 2-FMO-242, 2-FMO-222 and 2-FMO-232, 2-FMO-221 and 2-FMO-231. The East AFW Pump is credited to provide decay heat removal through SGs 2 and 3. This requires 2-FMO-222 and 2-FMO-232 be operable. 2-FMO-222 may fail due to fire induced damage of cable 9747G-2. 2-FMO-232 may fail due for fire induced damage of cable 9748G-2. This condition represents a variance from the deterministic requirements of NFPA 805, Section 4.2.3. This is a separation issue.

This VFDR has been evaluated and it was determined that the risk, safety margin and defense-in-depth meet the acceptance criteria of NFPA 805 Section 4.2.4 with no further action required.



**3.3.1.40 VFDR No. AA36/42.42-007**

2-WMO-754 - ESW Alternate Makeup to East MDAFW Pump Valve is required to be operable to support Unit 2 East AFW. AFW is required to provide decay heat removal from the reactor core to such that fuel is maintained in a safe and stable condition. The primary AFW source is from the CST. The system credits the use of a secondary source which is fed from the ESW. 2-WMO-754 cross-ties the ESW into the AFW system to provide the secondary make-up source. 2-WMO-754 may fail due to fire induced damage of cable 9298G-2. This condition represents a variance from the deterministic requirements of NFPA 805, Section 4.2.3. This is a separation issue.

This VFDR has been evaluated and it was determined that the risk, safety margin and defense-in-depth meet the acceptance criteria of NFPA 805 Section 4.2.4 with no further action required.

**3.3.1.41 VFDR No. AA36/42.42-008**

This VFDR has been removed.

**3.3.1.42 VFDR No. AA36/42.42-009**

This VFDR has been removed.

**3.3.1.43 VFDR No. AA36/42.42-010**

2-MRV-220, 2-MRV-230 and 2-URV-P - Main Steam Stop Valves for SGs 2 & 3 are required to be closed to support main steam isolation. Main steam isolation can be achieved if the SG 2 & 3 Stop Valves open by closing the Steam Dump to Condenser Valves. Main steam isolation is required to prevent uncontrolled cooldown through over steaming. 2-MRV-220 may not be available due to the failure of 2-MMO-220, 2-MRV-221 and 2-MRV-222. 2-MMO-220, 3 Way Air Open Valve for SG 2 Stop Valve vents air from the main steam stop valve to either 2-MRV-221 or 2-MRV-222. Cable failures to the 3 way stop valve will spuriously operate it to either position. 2-MMO-220 may fail due to fire induced damage of cable 5695R-2. 2-MRV-221 may fail due to fire induced damage of cables 9001G-2 and 9007G-2. 2-MRV-222 may fail due to fire induced damage of cables 9001R-2 and 9007R-2. 2-MRV-230 may not be available due to the failure of 2-MMO-230, 2-MRV-231 and 2-MRV-232. 2-MMO-230, 3 Way Air Open Valve for SG 3 Stop Valve vents air from the main steam stop valve to either 2-MRV-231 or 2-MRV-232. Cable failures to the 3 way stop valve will spuriously operate it to either position. 2-MMO-230 may fail due to fire induced damage of cable 14379G-2. 2-MRV-231 may fail due to fire induced damage of cables 9016G-2 and 9019G-2. 2-MRV-232 may fail due to fire induced damage of cables 9016R-2 and 9019R-2. 2-URV-P models the Steam Dump to Condenser Valves. 2-URV-P may fail due to cables 8710PO-2, 8711PO-2, 8723PY-2 and 8724PY-2. SGs 2 & 3 are credited for decay heat removal due to a fire within this Fire Area. This condition represents a variance from the deterministic requirements of NFPA 805, Section 4.2.3. This is a separation issue.

This VFDR has been evaluated and it was determined that the risk, safety margin and defense-in-depth meet the acceptance criteria of NFPA 805 Section 4.2.4 with no further action required.

**3.3.1.44 VFDR No. AA36/42.42-011**

2-MRV-223-P and 2-MRV-233-P - SG 2 and 3 PORVs are required to be closed to support main steam isolation. Main steam isolation is required to prevent uncontrolled cooldown through over steaming. 1-MRV-223-P may fail due to fire induced damage of cables 18132-2 and 9050Y-2. 1-MRV-233-P may fail due to fire induced damage of cables 18133-2 and 9051Y-2. Failure of these cables could spuriously open the valves. SGs 2 and 3 are credited for decay heat removal due to a fire within this fire area. This condition represents a variance from deterministic requirements of NFPA 805, Section 4.2.3. This is a separation issue.

This VFDR has been evaluated and it was determined that the risk, safety margin and defense-in-depth meet the acceptance criteria of NFPA 805 Section 4.2.4 with no further action required.

**3.3.1.45 VFDR No. AA36/42.42-012**

2-ICM-305 and 2-ICM-306 - Recirculation Sump to RHR/CTS Pump Suction Valves are required to be closed to support Unit 1 alternate CVCS and Unit 2 CVCS. CVCS is required to be operable to maintain inventory, pressure and reactivity control. 2-ICM-305 may fail due to fire induced damage of interlocked valve 2-IMO-310 and cable 8363G-2. 2-IMO-310 may fail due to fire induced damage of cable 8363G-2. 2-ICM-306 may fail due to fire induced damage of interlocked valve 2-IMO-320 and cable 8397R-2. 2-IMO-320 may fail due to fire induced damage of cable 8278R-2. These failures could spuriously open the valves. This condition represents a variance from the deterministic requirements of NFPA 805, Section 4.2.3. This is a separation issue.

This VFDR has been evaluated and it was determined that the risk, safety margin and defense-in-depth meet the acceptance criteria of NFPA 805 Section 4.2.4 with no further action required.

**3.3.1.46 VFDR No. AA36/42.42-013**

2-ICM-250-P, 2-ICM-251-P, 2-IMO-255-P and 2-IMO-256-P - BIT Isolation Shutoff Valves are required to be closed to support Unit 2 CVCS. CVCS is required to maintain inventory, pressure and reactivity control and provide seal injection. CVCS requires 2-ICM-250-P and 2-ICM-251-P or 2-IMO-255-P and 2-IMO-256-P to be closed. 2-ICM-250-P may fail due to fire induced damage of cables 8173G-2, 9090G-2, 9091G-2 and 9548G-2. 2-ICM-251-P may fail due to fire induced damage of cables 8173R-2, 8174R-2, 9063R-2, 9064R-2 and 9065R-2. 2-IMO-255-P may fail due to fire induced damage of cables 8176G-2, 8177G-2, 9114G-2, 9210G-2 and 9211G-2. 2-IMO-256-P may fail due to fire induced damage of 600v VCC 2-AZV-A and cables 8176R-2, 8177R-2, 8320R-2, 9205R-2 and 9206R-2. These failures could spuriously open the valves. This condition represents a variance from the deterministic requirements of NFPA 805, Section 4.2.3. This is a separation issue.

This VFDR has been evaluated and it was determined that the risk, safety margin and defense-in-depth meet the acceptance criteria of NFPA 805 Section 4.2.4 with a recovery action credited.

**3.3.1.47 VFDR No. AA36/42.42-014**

2-ICM-250 - Boron Injection Tank Outlet Shutoff Valve is required to be open to support Unit 2 alternate CVCS. CVCS is required provide inventory, pressure and reactivity control. The Unit 2 alternate charging flow path injects borated water from the Unit 1 RWST with the Unit 1 pumps through the Unit 2 BIT into the cold leg loops. This valve is normally closed and fails as-is on the loss of power. 1-ICM-250 may fail due to fire induced damage of cables 8173G-2, 9090G-2, 9091G-2 and 9548G-2. These failures could prevent the valve from opening. This condition represents a variance from the deterministic requirements of NFPA 805, Section 4.2.3. This is a separation issue.

This VFDR has been evaluated and it was determined that the risk, safety margin and defense-in-depth meet the acceptance criteria of NFPA 805 Section 4.2.4 with no further action required.

**3.3.1.48 VFDR No. AA36/42.42-015**

2-IMO-910 and 2-IMO-911 - RWST to Charging Pumps Isolation Valves are required to be open to support Unit 1 alternate CVCS and Unit 2 CVCS. CVCS is required to be operable to maintain inventory, pressure and reactivity control. CVCS requires one of the valves to be open. 2-IMO-910 may fail due to fire induced damage of cables 8938G-2, 9131G-2, 9241G-2 and 9955G-2. 2-IMO-911 may fail due to fire induced damage of 600v VCC 2-AZV-A and cables 8026R-2, 8031R-2, 8945R-2, 9139R-2 and 9241R-2. These failures could spuriously close the valves. This condition represents a variance from the deterministic requirements of NFPA 805, Section 4.2.3. This is a separation issue.

This VFDR has been evaluated and it was determined that the risk, safety margin and defense-in-depth meet the acceptance criteria of NFPA 805 Section 4.2.4 with no further action required.

**3.3.1.49 VFDR No. AA36/42.42-016**

2-QMO-225 - East Charging Pump Minimum Flow Valve is required to be open to support Unit 1 alternate CVCS and Unit 2 CVCS. CVCS is required to be operable to maintain inventory, pressure and reactivity control. 2-QMO-225 may fail due to fire induced damage of cables 8940G-2 and 9132G-2. Failure of these cables could spuriously close the valve. This condition represents a variance from the deterministic requirements of NFPA 805, Section 4.2.3. This is a separation issue.

This VFDR has been evaluated and it was determined that the risk, safety margin and defense-in-depth meet the acceptance criteria of NFPA 805 Section 4.2.4 with no further action required.

**3.3.1.50 VFDR No. AA36/42.42-017**

2-QRV-251 - Charging Flow Control Valve is required to be open to support Unit 2 CVCS. CVCS is required to be operable to maintain inventory and pressure control and provide seal injection. 2-QRV-251 may fail due to fire induced damage of cables 12472Y-2 and 6116-2. These cable failures could spuriously close the valve. This condition represents a variance from the deterministic requirements of NFPA 805, Section 4.2.3. This is a separation issue.

This VFDR has been evaluated and it was determined that the risk, safety margin and defense-in-depth meet the acceptance criteria of NFPA 805 Section 4.2.4 with no further action required.

**3.3.1.51 VFDR No. AA36/42.42-018**

2-PP-10E and 2-PP-10W - East and West CCW Pumps are required to be operable to support Unit 2 CCW. The CCW system provides cooling to the charging pumps which are required to maintain inventory, pressure and reactivity control. The Unit 2 charging pumps provide Unit 2 CVCS and Unit 1 alternate CVCS. 2-PP-10E may fail due to fire induced damage due to location and cables 8006G-2 and 9425G-2. 2-PP-10W may fail due to fire induced damage due to location and cables 8006R-2 and 8690R-2. This condition represents a variance from the deterministic requirements of NFPA 805, Section 4.2.3. This is a separation issue.

This VFDR has been evaluated and it was determined that the risk, safety margin and defense-in-depth meet the acceptance criteria of NFPA 805 Section 4.2.4 with a recovery action credited.

**3.3.1.52 VFDR No. AA36/42.42-019**

2-WMO-732 and 2-WMO-734 - East ESW from CCW HX Inlet and Outlet Valves are required to support Unit 2 East ESW. 2-WMO-732 is required to be open and 2-WMO-734 is required to be operable. The Unit 2 ESW system is required to provide cooling to the Unit 2 DGs, CCW System and a secondary makeup source for AFW. 2-WMO-732 may fail due to fire induced damage cables 8300G-2, 8301G-2, 8302G-2 and 8467G-2. 2-WMO-734 may fail due to fire induced damage of cables 8304G-2, 8305G-2, 8306G-2, 8307G-2, 8468G-2 and 9172G-2. These failures could spuriously close the valves. This condition represents a variance from the deterministic requirements of NFPA 805, Section 4.2.3. This is a separation issue.

This VFDR has been evaluated and it was determined that the risk, safety margin and defense-in-depth meet the acceptance criteria of NFPA 805 Section 4.2.4 with no further action required.

**3.3.1.53 VFDR No. AA36/42.42-020**

2-NRV-151 and 2-NRV-152 - Pressurizer PORVs are required to be closed to support RCS integrity. RCS integrity is required to maintain positive control over RCS inventory and pressure. 2-NRV-151 may fail due to fire induced damage of cable 9705PR-2. 2-NRV-152 may fail due to fire induced damage of cable 9706PR-2. Failure of these cables could spuriously open the valves. This condition represents a variance from the deterministic requirements of NFPA 805, Section 4.2.3. This is a separation issue.

This VFDR has been evaluated and it was determined that the risk, safety margin and defense-in-depth meet the acceptance criteria of NFPA 805 Section 4.2.4 with no further action required.

**3.3.1.54 VFDR No. AA36/42.42-021**

2-NSO-023 and 2-NSO-024 - RX Head Vent Valves are required to be closed to support RCS integrity. RCS integrity is required to maintain positive control over RCS inventory and pressure. 2-NSO-023 and 2-NSO-024 are in series requiring one of the valves to be closed to maintain RCS integrity. 2-NSO-023 may fail due to fire induced damage of cable 9801PR-2. 2-NSO-024 may fail due to fire induced damage of cable 9807PR-2. Failure of these cables could spuriously open the valves. This condition represents a variance from the deterministic requirements of NFPA 805, Section 4.2.3. This is a separation issue.

This VFDR has been evaluated and it was determined that the risk, safety margin and defense-in-depth meet the acceptance criteria of NFPA 805 Section 4.2.4 with no further action required.

**3.3.1.55 VFDR No. AA36/42.42-022**

2-NSO-063 and 2-NSO-064 - Post Accident Vent Valves are required to be closed to support RCS integrity. RCS integrity is required to maintain positive control over RCS inventory and pressure. 2-NSO-063 and 2-NSO-064 are in series requiring one of the valves to be closed to maintain RCS integrity. 2-NSO-063 may fail due to fire induced damage of cable 9814PR-2. 2-NSO-064 may fail due to fire induced damage of cable 9820PR-2. Failure of these cables could spuriously open the valves. This condition represents a variance from the deterministic requirements of NFPA 805, Section 4.2.3. This is a separation issue.

This VFDR has been evaluated and it was determined that the risk, safety margin and defense-in-depth meet the acceptance criteria of NFPA 805 Section 4.2.4 with no further action required.

**3.3.1.56 VFDR No. AA36/42.42-023**

2-NRV-164 - Pressurizer Spray Relief Valve is required to be closed to support RCS integrity. RCS integrity is required to maintain positive control over RCS inventory and pressure. Opening of 2-NRV-164 without the ability to trip RCP 4 from the Control Room will result in a SI. 2-NRV-164 may fail due to fire induced damage of cables 8733PO-2 and 9600PY-2. Failure of these cables could spuriously open the valve. This condition represents a variance from the deterministic requirements of NFPA 805, Section 4.2.3. This is a separation issue.

This VFDR has been evaluated and it was determined that the risk, safety margin and defense-in-depth meet the acceptance criteria of NFPA 805 Section 4.2.4 with no further action required.

**3.3.1.57 VFDR No. AA36/42.42-024**

2-PP-45-1 and 2-PP-45-4 - RCP 1 and 4 are required to be tripped to support RCS integrity. RCS integrity is required to maintain positive control over inventory and pressure. The pumps are required to be tripped if thermal barrier cooling and normal charging are lost. Failure to trip the pumps could result in a seal LOCA. 2-PP-45-1 may fail due to fire induced damage of cables 4448P-2. 2-PP-45-4 may fail due to fire induced damage of cable 7992P-2. These cable failures could prevent the pumps from being tripped from the Control Room. This condition represents a variance from the deterministic requirements of NFPA 805, Section 4.2.3. This is a separation issue.

This VFDR has been evaluated and it was determined that the risk, safety margin and defense-in-depth meet the acceptance criteria of NFPA 805 Section 4.2.4 with no further action required.

**3.3.1.58 VFDR No. AA36/42.42-025**

2-PZRHTR.AUTO - Pressurizer Heater Auto Control is required not to spuriously operate to support RCS integrity. Spurious operation of the heater could raise the pressure within the pressurizer to the point pressurizer safety valves lift. If the valves do not reseal after they lift positive control over pressure and inventory will not be maintained. 2-PZRHTR.AUTO may fail due to fire induced damage of cables 8733PO-2 and 9600PY-2. This condition represents a variance from the deterministic requirements of NFPA 805, Section 4.2.3. This is a separation issue.

This VFDR has been evaluated and it was determined that the risk, safety margin and defense-in-depth meet the acceptance criteria of NFPA 805 Section 4.2.4 with no further action required.

**3.3.1.59 VFDR No. AA36/42.42-026**

2-HV-ACR-1, 2-HV-ACRA-1 and 2-PP-82N - Control Room AHU 1N Chiller Package, AHU 2N Fan and AHU 1N Circulating Pump are required to be operable to support the HVAC system for the Control Room. The Control Room HVAC system is required for habitability. 2-HV-ACR-1 may fail due to fire induced damage of cable 6123G-2. 2-HV-ACRA-1 may fail due to fire induced damage of cable 8988G-2. 2-PP-82N may fail due to fire induced damage of cable 6124G-2. This condition represents a variance from the deterministic requirements of NFPA 805, Section 4.2.3. This is a separation issue.

This VFDR has been evaluated and it was determined that the risk, safety margin and defense-in-depth meet the acceptance criteria of NFPA 805 Section 4.2.4 with a recovery action credited.



**3.3.1.60 VFDR No. AA36/42.42-027**

2-HV-AES1 and 2-HV-AES2 - The Engineering Safety Equipment Area Exhaust Fans are required to be operable to support the Auxiliary Building HVAC system. The Auxiliary Building HVAC system is required to be operable to provide ventilation for the centrifugal charging pump enclosures and ensure adequate habitability for operator actions. 2-HV-AES1 may fail due to fire induced damage of cable 9410G-2. 2-HV-AES2 may fail due to fire induced damage of cable 9410R-2. This condition represents a variance from the deterministic requirements of NFPA 805, Section 4.2.3. This is a separation issue.

This VFDR has been evaluated and it was determined that the risk, safety margin and defense-in-depth meet the acceptance criteria of NFPA 805 Section 4.2.4 with no further action required.

**3.3.1.61 VFDR No. AA36/42.42-028**

2-MPP-220-CRI, 2-MPP-221-CRI, 2-MPP-222-CRI, 2-MPP-230-CRI, 2-MPP-231-CRI and 2-MPP-232-CRI - SG 2 and 3 Pressure Indication is required to be operable to support process monitoring from the Control Room. Process monitoring is required to monitor the key primary and secondary parameters of the SGs. 2-MPP-220-CRI may fail due to fire induced damage of cable 9075O-2. 2-MPP-221-CRI may fail due to fire induced damage of cable 9074B-2. 2-MPP-222-CRI may fail due to fire induced damage of cable 9050Y-2. 2-MPP-230-CRI may fail due to fire induced damage of cable 9068O-2. 2-MPP-231-CRI may fail due to fire induced damage of cable 9069B-2. 2-MPP-232-CRI may fail due to fire induced damage of cable 9051Y-2. This condition represents a variance from the deterministic requirements of NFPA 805, Section 4.2.3. This is a separation issue.

This VFDR has been evaluated and it was determined that the risk, safety margin and defense-in-depth meet the acceptance criteria of NFPA 805 Section 4.2.4 with no further action required.

**3.3.1.62 VFDR No. AA36/42.42-029**

2-NLP-151-CRI, 2-NLP-152-CRI and 2-NLP-153-CRI - Pressurizer Level is required to be operable to support Process Monitoring. Process monitoring is required to monitor parameters to achieve and maintain a safe and stable condition. 2-NLP-151-CRI may fail due to fire induced damage of cable 8734PO-2. 2-NLP-152-CRI may fail due to fire induced damage of cable 6693-2. 2-NLP-153-CRI may fail due to fire induced damage of cable 9601PY-2. This condition represents a variance from the deterministic requirements of NFPA 805, Section 4.2.3. This is a separation issue.

This VFDR has been evaluated and it was determined that the risk, safety margin and defense-in-depth meet the acceptance criteria of NFPA 805 Section 4.2.4 with no further action required.



**3.3.1.63 VFDR No. AA36/42.42-030**

2-NPS-111-CRI - RCS Wide Range Pressure Indication is required to be operable to support process monitoring. Process monitoring is required to monitor parameters to achieve and maintain a safe and stable condition. 2-NPS-111-CRI may fail due to fire induced damage of cable 8068Y-2. This condition represents a variance from the deterministic requirements of NFPA 805, Section 4.2.3. This is a separation issue.

This VFDR has been evaluated and it was determined that the risk, safety margin and defense-in-depth meet the acceptance criteria of NFPA 805 Section 4.2.4 with no further action required.

**3.3.1.64 VFDR No. AA36/42.42-031**

2-SPURIOUS-SI - Dummy Component for Spurious SI Signal is required not to activate to maintain hot standby. A spurious SI signal will adversely affect decay heat removal, inventory control, pressure control and vital auxiliaries. The spurious SI signal may occur due to the following cable failures 8733PO-2, 9074B-2, 9050Y-2, 9051Y-2, 9068O-2, 9069B-2, 9069O-2, 9074O-2, 9075O-2 and 9600PY-2. This condition represents a variance from the deterministic requirements of NFPA 805, Section 4.2.3. This is a separation issue.

This VFDR has been evaluated and it was determined that the risk, safety margin and defense-in-depth meet the acceptance criteria of NFPA 805 Section 4.2.4 with no further action required.

**3.3.1.65 VFDR No. AA36/42.42-032**

2-SPURIOUS-SPRAY-CIS - Dummy Component for Spurious Containment Isolation Signal is required not to activate to maintain hot standby. A spurious signal will adversely affect inventory and pressure control. The spurious signal may occur due to the following cable failures 9304Y-2 and 9304O-2. This condition represents a variance from the deterministic requirements of NFPA 805, Section 4.2.3. This is a separation issue.

This VFDR has been evaluated and it was determined that the risk, safety margin and defense-in-depth meet the acceptance criteria of NFPA 805 Section 4.2.4 with no further action required.

**3.3.1.66 VFDR No. AA36/42.42-033**

2-QMO-451 and 2-QMO-452 - VCT to CCP Pump Suction Isolation Valves are required to be closed to support VCT Isolation from the Unit 2 charging pumps. 2-QMO-451 may fail due to fire induced damage of cables 4935-2, 6114-2, 8031R-2, 8270G-2, 8271G-2, 8272G-2, 8941G-2 and 9127G-2. 2-QMO-452 may fail due to fire induced damage cables 4935-2, 6114-2, 8031R-2, 8270R-2, 8271R-2, 8272R-2, 8943R-2 and 9143R-2. This condition represents a variance from the deterministic requirements of NFPA 805, Section 4.2.3. This is a separation issue.

This VFDR has been evaluated and it was determined that the risk, safety margin and defense-in-depth meet the acceptance criteria of NFPA 805 Section 4.2.4 with a defense-in-depth action credited.

**3.3.1.67 VFDR No. AA36/42.42-034**

2-CMO-410.P, 2-CMO-411.P, 2-CMO-413.P, 2-CMO-415.P, 2-CMO-416.P, 2-CMO-419.P, 2-CMO-420.P and 2-CMO-429.P – The following CCW valves are required to support Unit 2 East CCW. 2-CMO-410.P, 2-CMO-411.P, 2-CMO-413.P, 2-CMO-415.P, 2-CMO-416.P and 2-CMO-420.P required to be closed to support CCW. 2-CMO-419.P and 2-CMO-429.P are required to be closed to support CCW. The CCW system provides cooling to the charging pumps which are required to maintain inventory, pressure and reactivity control. 2-CMO-410.P may fail due to fire induced damage of cable 8870G-2. 2-CMO-411.P may fail due to fire induced damage of 8871G-2. 2-CMO-413.P may fail due to fire induced damage of cable 8171R-2. 2-CMO-415.P may fail due to fire induced damage of cable 8906G-2. 2-CMO-416.P may fail due to fire induced damage of cable 8194R-2. 2-CMO-419.P may fail due to fire induced damage cables 8251G-2 and 8904G-2. 2-CMO-420.P may fail due to fire induced damage of cable 8170R-2. 2-CMO-429.P may fail due to fire induced damage of cables 8195R-2 and 8907R-2. These cable failures could spuriously operate the valves. This condition represents a variance from the deterministic requirements of NFPA 805, Section 4.2.3. This is a separation issue.

This VFDR has been evaluated and it was determined that the risk, safety margin and defense-in-depth meet the acceptance criteria of NFPA 805 Section 4.2.4 with no further action required.

**3.3.1.68 VFDR No. AA36/42.42-035**

2-DCR-320 and 2-DCR-330 - SG 2 & 3 Blowdown Isolation Valves are required to be closed to support main steam isolation. Main steam isolation is required to prevent uncontrolled cooldown through over-steaming. SG 2 & 3 Blowdown Isolation Valves may fail due to a full area fire within Fire Area AA36/42. 2-DCR-320 may fail due to fire induced damage of cable 8682R-2. 2-DCR-330 may fail due to fire induced damage of cable 8686R-2. These cable failures could spuriously open the valves. SGs 2 and 3 are credited for decay heat removal for a fire within Fire Area AA36/42. This condition represents a variance from the deterministic requirements of NFPA 805, Section 4.2.3. This is a separation issue.

This VFDR has been evaluated and it was determined that the risk, safety margin and defense-in-depth meet the acceptance criteria of NFPA 805 Section 4.2.4 with a defense-in-depth action credited.

**3.3.1.69 VFDR No. AA36/42.42-036**

2-QRV-10 and 2-QRV-40 - RCP Seal Water Return Isolation Valves are required to be open to support RCS integrity by maintaining the RCP seal. RCS integrity is required to maintain positive control over RCS inventory and pressure. 2-QRV-10 may fail due to fire induced damage of cable 4418-2. 2-QRV-40 may fail due to fire induced damage of cable 5002-2. These cables could cause spurious closure of these valves. This condition represents a variance from the deterministic requirements of NFPA 805, Section 4.2.3. This is a separation issue.

This VFDR has been evaluated and it was determined that the risk, safety margin and defense-in-depth meet the acceptance criteria of NFPA 805 Section 4.2.4 with a defense-in-depth action credited.

**3.3.1.70 VFDR No. AA36/42.42-037**

2-MRV-213-P and 2-MRV-243-P - SG 1 and 4 PORVs are required to be closed to support main steam isolation. Main steam isolation is required to ensure uncontrolled cooldown does not occur through over-steaming. 2-MRV-213-P may fail due to fire induced damage of cable 90740-2. 2-MRV-243-P may fail due to fire induced damage of cable 90690-2. These cable failures could spuriously open the valves. This condition requires a mitigating control room action.

**3.3.2 Recovery Actions Credited**

For each VFDR, a Fire Risk Evaluation has been performed to assess the acceptability of risk, defense-in-depth, and safety margin. This evaluation determined whether or not recovery actions are required to ensure that one success path necessary to achieve and maintain the nuclear safety performance criteria is maintained free of fire damage by a single fire. Table 3-3 identifies the credited recovery actions for this area. Actions retained for DID are identified as “DID Actions” within Table 3-3. Additional information for DID actions is contained within Section 3.8 of this report. Note that, for completeness, all VFDRs are contained within Table 3-3, even if the Fire Risk Evaluation has determined that a recovery action is not required. In those instances where a recovery action has been determined to not be required, the word “None” is provided in the “Action” column in the table.

<b>Table 3-3, Recovery Actions Credited</b>		
<b>VFDR</b>	<b>Component</b>	<b>Action</b>
AA36/42.36-001	1-AM-A	None
AA36/42.36-002	1-AM-D	None
AA36/42.36-003	1-CLI-113 1-CLI-114	None
AA36/42.36-004	1-FMO-222 1-FMO-232	None
AA36/42.36-005	1-WMO-754	None
AA36/42.36-006	1-PP-7E	None
AA36/42.36-007	None	None
AA36/42.36-008	1-MMO-210 1-MMO-240 1-URV-P	None
AA36/42.36-009	1-MRV-220 1-MRV-230 1-URV-P	None
AA36/42.36-010	1-MRV-213-P 1-MRV-243-P	None
AA36/42.36-011	1-MVR-223-P 1-MRV-233-P	None

Table 3-3, Recovery Actions Credited		
VFDR	Component	Action
AA36/42.36-012	1-PP-50E 1-PP-50W	1-CS-302-CLOSE (Close manual valve 1-CS-302)  1-CS-534-OPEN (Open manual valve 1-CS-534)  2-CS-536-OPEN (Open manual valve 2-CS-536)
AA36/42.36-013	1-ICM-250	None
AA36/42.36-014	1-NRV-151 1-NRV-152	None
AA36/42.36-015	1-NSO-023 1-NSO-024	None
AA36/42.36-016	1-NSO-063 1-NSO-064	None
AA36/42.36-017	1-NRV-164	None
AA36/42.36-018	1-PP-45-1 1-PP-45-4	None
AA36/42.36-019	1-PZRHTR.AUTO	None
AA36/42.36-020	1-WMO-702	DID ACTION 1-WMO-702-OPEN (De-energize and manually open 1-WMO-702)
AA36/42.36-021	1-NLP-151-CRI	None
AA36/42.36-022	1-HV-AES1 1-HV-AES2	None
AA36/42.36-023	1-HV-ACR-1 1-HV-ACRA-1 1-PP-82S	None
AA36/42.36-024	12-HV-ESW-5 12-HV-ESW-6	None
AA36/42.36-025	1-SPURIOUS-SI	None
AA36/42.36-026	1-SPURIOUS-SPRAY-CIS	None
AA36/42.36-027	2-FMO-222 2-FMO-232	None
AA36/42.36-028	2-DCR-310 2-DCR-340	None
AA36/42.36-029	2-QRV-251	None
AA36/42.36-030	2-CMO-419	None
AA36/42.36-031	2-HV-ACR-1 2-HV-ACRA 2-PP-82N	None

Table 3-3, Recovery Actions Credited		
VFDR	Component	Action
AA36/42.36-032	1-DCR-320 1-DCR-330	DID ACTION(S) 1-DCR-320-CLOSE 1-DCR-330-CLOSE (Remove fuses in MCR to fail closed AOVs 1-DCR-320 and 1-DCR-330).
AA36/42.36-033	1-QRV-10 1-QRV-40	DID ACTION(S) 1-QVR-10-OPEN 1-QVR-40-OPEN (Remove fuses in MCR to fail closed AOVs 1-QRV-10 and 1-QRV-40).
AA36/42.42-001	1-PP-10E 1-PP-10W	1-CS-536-OPEN (Open manual valve 1-CS-536)  2-CS-302-CLOSE (Close manual valve 2-CS-302)  2-CS-534-OPEN (Open manual valve 2-CS-534)
AA36/42.42-002	2-ABD-B	None
AA36/42.42-003	2-AM-A	None
AA36/42.42-004	2-AM-D	None
AA36/42.42-005	2-CLI-113 2-CLI-114	None
AA36/42.42-006	2-FMO-222 2-FMO-232	None
AA36/42.42-007	2-WMO-754	None
AA36/42.42-008	None	None
AA36/42.42-009	None	None
AA36/42.42-010	2-MRV-220 2-MRV-230 1-URV-P	None
AA36/42.42-011	2-MRV-223-P 2-MRV-233-P	None
AA36/42.42-012	2-ICM-305 2-ICM-306	None
AA36/42.42-013	2-ICM-250-P 2-ICM-251-P 2-IMO-255-P 2-IMO-256-P	2-ICM-250-CLOSE (De-energize to fail valve 2-ICM-250 closed)  2-ICM-251-CLOSE (De-energize to fail valve 2-ICM-251 closed)
AA36/42.42-014	2-ICM-250	None

Table 3-3, Recovery Actions Credited		
VFDR	Component	Action
AA36/42.42-015	2-IMO-910 2-IMO-911	None
AA36/42.42-016	2-QMO-225	None
AA36/42.42-017	2-QVR-251	None
AA36/42.42-018	2-PP-10E 2-PP-10W	1-CS-536-OPEN (Open manual valve 1-CS-536)  2-CS-302-CLOSE (Close manual valve 2-CS-302)  2-CS-534-OPEN (Open manual valve 2-CS-534)
AA36/42.42-019	2-WMO-732 2-WMO-734	None
AA36/42.42-020	2-NRV-151 2-NRV-152	None
AA36/42.42-021	2-NSO-023 2-NSO-024	None
AA36/42.42-022	2-NSO-063 2-NSO-064	None
AA36/42.42-023	2-NRV-164	None
AA36/42.42-024	2-PP-45-1 2-PP-45-4	None
AA36/42.42-025	2-PZRHTR.AUTO	None
AA36/42.42-026	2-HV-ACR-1 2-HV-ACRA-1 2-PP-82S	2-CR-HVAC-TEMP (Establish temporary Control Room HVAC)
AA36/42.42-027	2-HV-AES1 2-HV-AES2	None
AA36/42.42-028	2-MPP-220-CRI 2-MPP-221-CRI 2-MPP-222-CRI 2-MPP-230-CRI 2-MPP-231-CRI 2-MPP-232-CRI	None
AA36/42.42-029	2-NLP-151-CRI 2-NLP-152-CRI 2-NLP-153-CRI	None
AA36/42.42-030	2-NPS-111-CRI	None
AA36/42.42-031	2-SPURIOUS-SI	None
AA36/42.42-032	2-SPURIOUS-SPRAY-CIS	None

Table 3-3, Recovery Actions Credited		
VFDR	Component	Action
AA36/42.42-033	2-QMO-451 2-QMO-452	DID ACTION 2-QMO-451-CLOSE (De-energize and manually close 2-QMO-451)  or  2-QMO-452-CLOSE (De-energize and manually close 2-QMO-452)
AA36/42.42-034	2-CMO-410.P 2-CMO-411.P 2-CMO-413.P 2-CMO-415.P 2-CMO-416.P 2-CMO-419.P 2-CMO-420.P 2-CMO-429.P	None
AA36/42.42-035	2-DCR-320 2-DCR-330	DID ACTION(S) 2-DCR-320-CLOSE 2-DCR-330-CLOSE (Remove fuses in MCR to fail closed AOVs 2-DCR-320 and 2-DCR-330).
AA36/42.42-036	2-QRV-10 2-QRV-40	DID ACTION(S) 2-QVR-10-OPEN 2-QVR-40-OPEN (Remove power in MCR to fail open AOVs 2-QRV-10 and QRV-40).
AA36/42.42-037	2-MRV-213-P 2-MRV-243-P	2-MRV-213-P-MANUAL (Place 2-MRV-213 controller in MANUAL)  2-MRV-243-P-MANUAL (Place 2-MRV-243 controller in MANUAL)

### 3.4 Non-Power Operational Modes Compliance Summary

A review of CNP for the potential effects of a fire in this Fire Area while in non-power modes of operation (NPO) was conducted. This review was conducted using the guidance provided in NEI 04-02 and FAQ 07-0040, "Non-Power Operations Clarifications".

The review determined that there are potential failures that affect certain Key Safety Functions (KSF) as a result of the fire in this area, and the fire could result in the loss of one or more KSF paths. Compensatory measures are required during high risk evolution periods to provide reasonable

assurance a fire will not adversely affect key safety functions and the NFPA 805 performance goal for NPO is therefore satisfied. The results of the NPO analysis are contained within Technical Evaluation R1900-005-001, Non-Power Operation Modes Transition Review Report.

### 3.5 Radioactive Release Compliance Summary

The NFPA 805 radiological release goal is to provide reasonable assurance that a fire will not result in a radiological release that adversely affects the public, plant personnel or the environment. The NFPA 805 requirement is to ensure a radiation release to any unrestricted area due to the direct effects of fire suppression activities (but not involving fuel damage) shall be as low as reasonably achievable and shall not exceed applicable plant Technical Specification limits.

AA36/42 is within the Radiological Controlled Area (RCA) and has been identified as a potential fire area for radioactive release due to fire fighting activities. In accordance with NFPA 805 FAQ 09-0056, this potential has been reviewed to ensure that engineering controls, fire pre-plans, and fire brigade training materials are provided for containment and monitoring of gaseous and liquid effluents associated with fire suppression agents and products of combustion.

The review concludes that the steps to limit radiation release to other areas due to the direct effects of fire suppression activities, in addition to compliance with NFPA 805, Chapter 4, ensure that any radioactive release will be as low as reasonably achievable and will not exceed limits designated in the CNP Technical Specifications.

The review of this fire area, with respect to radioactive release, is documented in the NFPPM.

### 3.6 Probabilistic Risk Assessment-Summary of Results

A Fire PRA (FPRA) quantification of Fire Area AA36/42 was performed and is documented in PRA-NB-FIRE-FQ, Fire PRA Model Quantification Notebook. The fire risk quantification for Fire Area AA36/42 is analyzed using detailed fire modeling to consider risk of fire scenarios of ignition sources. PRA-NB-FIRE-FQ includes a summary of all potentially risk-significant fire scenarios (i.e.,  $CDF > 1.0E-7$  or  $LERF > 1.0E-8$ ). Bounding CDF / LERF per calendar year values are reported that are based on the risk values documented in PRA-NB-FIRE-FSS, Fire PRA Fire Scenario Selection.

Fire Protection features credited in the Fire PRA are documented in R1900-0411-AA36-42, Detailed Fire Modeling Report: Fire Compartment: AA36/42 Auxiliary Building (EL. 609 FT). PRA-NB-FIRE-FSS documents the revision level of the fire modeling reports used in the most recent Fire PRA quantification.



### **3.7 Risk-Informed, Performance-Based Evaluations**

Fire Risk Evaluations (FREs) have been performed to ensure that variances from the NFPA 805 deterministic requirements are acceptable. The evaluation process consists of an integrated assessment of the acceptability of risk, defense-in-depth, and safety margins.

#### **3.7.1 Transition Risk-Informed, Performance-Based Evaluations**

The ‘changes’ associated with NFPA 805 transition were those variances from the deterministic requirements of NFPA 805 or with the existing fire protection licensing basis that were brought into compliance with the NFPA 805 performance based approach. The change identified for evaluation for Fire Area AA36/42 is as follows:

- Separation Issues

The Fire Risk Evaluation has determined that the change is acceptable based upon:

- The measured change in CDF and LERF.
- Adequate defense-in-depth and safety margins being maintained.

Refer to Attachment 2 for a summary of results associated with the Fire Risk Evaluations.

### 3.8 Defense-in-Depth

A comprehensive risk-informed, performance-based analysis includes consideration of defense-in-depth (DID) as part of an integrated evaluation of risk considerations. In general, defense-in-depth involves consideration of the extent to which fire protection systems and features are provided within the three echelons of fire-protection:

- Preventing fires from starting,
- Rapidly detecting fires and controlling and extinguishing promptly those fires that do occur, thereby limiting fire damage,
- Providing an adequate level of fire protection for structures, systems, and components important to safety, so that a fire that is not promptly extinguished will not prevent the nuclear safety performance criteria from being met.

Each VFDR was evaluated for DID. The following recovery actions have been retained for DID.

VFDR No. AA36/42.36-020: 1-WMO-702 - The West ESW Pump Discharge Valve is required to be open to provide cooling to the Unit 1 Red (AB) DG. The Red (AB) DG is credited for within the NSCA and required to be operable. 1-WMO-702 may fail due to fire induced damage to its power supply, 600 V MCC 1-PS-A. This valve is normally operable, therefore, it could be in the closed position on the loss of power resulting in it failing in the closed position. This failure can be mitigated by de-energizing and manually opening the valve. This recovery action is being retained to ensure the Unit 1 Red (AB) DG remains operable.

VFDR No. AA36/42.36-032: 1-DCR-320 and 1-DCR-330 - SG 2 & 3 Blowdown Isolation Valves are required to be closed to support main steam isolation. Main steam isolation is required to prevent uncontrolled cooldown through over-steaming. SG 2 & 3 Blowdown Isolation Valves may fail due to a full area fire within Fire Area AA36/42. Loss of Main Steam isolation can be mitigated by removing fuses to ensure valves fail shut. This recovery action is being retained for DID to ensure Main Steam isolation is maintained.

VFDR No. AA36/42.36-033: 1-QVR-10 and 1-QVR-40 - RCP Seal Water Return Isolation Valves are required to be open to support RCS integrity by maintaining the RCP seal. RCS integrity is required to maintain positive control over RCS inventory and pressure. The spurious closing can be mitigated by de-energizing the valve to fail it open. This recovery action is being retained for DID to ensure RCS integrity is maintained.

VFDR No. AA36/42.42-033: 2-QMO-451 and 2-QMO-452 - VCT to CCP Pump Suction Isolation Valves are required to be closed to support VCT Isolation. The valves are in series and only one is required to remain closed. The valves are required to be closed to isolate the VCT from the Unit 2 Charging Pumps once charging is aligned to the RWST. Fire scenarios within Fire Area AA36/42 contain cables that could prevent the valves from being closed. Closure of the valves can be achieved by de-energizing and manually closing the valves. This recovery action is being retained for DID to ensure the Unit 2 VCT is isolated from the charging system.

VFDR No. AA36/42.42-035: 2-DCR-320 and 2-DCR-330 - SG 2 & 3 Blowdown Isolation Valves are required to be closed to support main steam isolation. Main steam isolation is required to prevent uncontrolled cooldown through over-steaming. SG 2 & 3 Blowdown Isolation Valves may fail due to a full area fire within Fire Area AA36/42. Loss of Main Steam isolation can be mitigated by removing fuses to ensure valves fail shut. This recovery action is being retained for DID to ensure Main Steam isolation is maintained.

VFDR No. AA36/42.42-036: 2-QVR-10 and 2-QVR-40 - RCP Seal Water Return Isolation Valves are required to be open to support RCS integrity by maintaining the RCP seal. RCS integrity is required to maintain positive control over RCS inventory and pressure. The spurious closing can be mitigated by de-energizing the valve to fail it open. This recovery action is being retained for DID to ensure RCS integrity is maintained.

Based on the assessment in support of the Fire Risk Evaluation, defense-in-depth is maintained for fire area AA36/42. Refer to Attachment 2 for details associated with the Fire Risk Evaluation.

### 3.9 Monitoring Program Input

A Monitoring Program will be developed in accordance with FAQ 10-0059, Rev. 1. Methods to monitor availability, reliability, and performance of fire protection program structures, systems, and components (SSCs), as well as programmatic elements will be provided. Additionally, effectiveness measures are established to review program related performance and trends. For AA36/42 the following systems and features are candidates for inclusion in the CNP Fire Protection Monitoring Program:

- Fire Area boundary barriers discussed in Section 3.1
- Fire Detection System
- Fire Suppression System
- Cable tray covers
- 20 ft separation between Fire Area AA36/42
- Electrical Raceway Fire Barrier Systems (ERFBS) in separation between Fire Area AA36/42
- Diking around the CCW pumps
- Dividing wall around the CCW pumps

### 4.0 CONCLUSION

The nuclear safety and radioactive release performance criteria of NFPA 805 are met for a fire in Fire Area AA36/42. This Fire Risk Evaluation for Fire Area AA36/42 has demonstrated that

- The change in core damage frequency (delta CDF) is acceptable, and
- The change in large early release frequency (delta LERF) is acceptable, and
- Defense-in-depth and safety margins are maintained.

This is confirmation that a success path effectively remains free of fire damage and that the performance-based approach is acceptable per Section 4.2.4.2 of NFPA 805.

## **5.0 REFERENCES**

- 5.1 Calculation PRA-FIRE-NB-CRE, Fire PRA Cumulative Risk Evaluations
- 5.2 CNP Fire Pre-Plans, Volumes I, II, and III, Revisions 17, 14, and 18 respectively
- 5.3 Fire Hazards Analysis
- 5.4 NFPA 805, Performance-Based Standard for Fire Protection for Light Water Reactor Electric Generating Plants
- 5.5 NFPPM, NFPA 805 Fire Protection Program Manual (NFPPM)
- 5.6 Nuclear Energy Institute (NEI) 04-02, Guidance for Implementing a Risk-Informed, Performance-Based Fire Protection Program under 10 CFR 50.48(c), Rev. 2
- 5.7 Nuclear Safety Capability Assessment Report
- 5.8 PRA-NB-FIRE-FQ, Fire PRA Model Quantification Notebook
- 5.9 PRA-NB-FIRE-FSS, Fire PRA Fire Scenario Selection
- 5.10 R1900-0411-AA36-42, AA36-42 - Detailed Fire Modeling Report
- 5.11 Regulatory Guide 1.205, Risk-Informed, Performance-Based Fire Protection for Existing Light-Water Nuclear Power Plants, Rev. Revision 1
- 5.12 Technical Evaluation R1900-005-001, Non-Power Operation Modes Transition Review

**Fire Area AA36/42 – Attachment 1 - Table B-3 - Fire Area Transition**

<u>Unit</u>	<u>Fire Area</u>	<u>Description</u>
1, 2	AA36/42	Auxiliary Building (El. 609 ft.)

**Fire Zone Description**

37	Valve Gallery - El. 617 ft. 0 in. - both Units
43	Access Control Area - El. 609 ft. 0 in. - Both Units
44A	Containment Spray Heat Exchanger Room #18E, Auxiliary Building - El. 609 ft. 0 in. - Unit 1
44B	Containment Spray Heat Exchanger Room #18W, Auxiliary Building - El. 609 ft. 0 in. - Unit 1
44C	Residual Heat Removal Heat Exchanger Room #17E, Auxiliary Building - El. 609 ft. 0 in. - Unit 1
44D	Residual Heat Removal Heat Exchanger Room #17W, Auxiliary Building - El. 609 ft. 0 in. - Unit 1
44E	Containment Spray Heat Exchanger Room #18E, Auxiliary Building - El. 609 ft. 0 in. - Unit 2
44F	Containment Spray Heat Exchanger Room #18W, Auxiliary Building - El. 609 ft. 0 in. - Unit 2
44G	Residual Heat Removal Heat Exchanger Room #17E, Auxiliary Building - El. 609 ft. 0 in. - Unit 2
44H	Residual Heat Removal Heat Exchanger Room #17W, Auxiliary Building - El. 609 ft. 0 in. - Unit 2
44N	Auxiliary Building North - El. 609 ft. 0 in. - Both Units
44S	Auxiliary Building South - El. 609 ft. 0 in. - Both Units

**Regulatory Basis**

4.2.4.2 - Performance-Based Approach - Fire Risk Evaluation with simplifying deterministic assumptions

<b>Performance Goal</b>	<b>Method of Accomplishment</b>	<b>Comments</b>
Reactivity Control	<p>Scenario AA36</p> <p>Unit 1 - Trip the reactor from the Control Room. Borate using Unit 2 East or West Charging Pump from the Unit 2 RWST. Use Unit 1 source range monitoring for indication.</p> <p>Unit 2 - Trip the reactor from the Control Room. Borate using Unit 2 East or West Charging Pump from the Unit 2 RWST. Use source range monitoring for indication.</p> <p>Scenario AA42 - with Unit 1 CCW Pumps Available</p> <p>Unit 1 - Trip the reactor from the Control Room. Borate using Unit 1 East or</p>	None

**Fire Area AA36/42 – Attachment 1 - Table B-3 - Fire Area Transition**

<u>Unit</u>	<u>Fire Area</u>	<u>Description</u>
1, 2	AA36/42	Auxiliary Building (El. 609 ft.)
		West Charging Pump from the Unit 1 RWST. Use source range monitoring for indication.
		Unit 2 - Trip the reactor from the Control Room. Borate using Unit 1 East or West Charging Pump from the Unit 1 RWST. Use source range monitoring for indication.
		Scenario AA42 - with Unit 2 CCW Pumps Available
		Unit 1 - Trip the reactor from the Control Room. Borate using Unit 2 East or West Charging Pump from the Unit 2 RWST. Use source range monitoring for indication.
		Unit 2 - Trip the reactor from the Control Room. Borate using Unit 1 East or West Charging Pump from the Unit 1 RWST. Use source range monitoring for indication.
Inventory and Pressure Control		<p>Scenario AA36</p> <p>Unit 1 - Control inventory using alternate CVCS with Unit 2 East or West Charging Pump via the unit cross-tie. Control pressure using Unit 1 Pressurizer Safety Relief Valves.</p> <p>Unit 2 - Control inventory using CVCS with Unit 2 East or West Charging Pump. Control pressure using Unit 2 Pressurizer Safety Relief Valves.</p> <p>Scenario AA42 - with Unit 1 CCW Pumps Available</p> <p>Unit 1 - Control inventory using CVCS with Unit 1 East or West Charging Pump. Control pressure using Unit 1 Pressurizer Safety Relief Valves.</p> <p>Unit 2 - Control inventory using alternate CVCS with Unit 1 East or West Charging Pump via the unit cross-tie. Control pressure using Unit 2 Pressurizer Safety Relief Valves.</p> <p>Scenario AA42 - with Unit 2 CCW Pumps Available</p>
		<p>Scenario AA36</p> <p>VFDRs identified for Unit 1 and Unit 2 CVCS.</p> <p>VFDRs identified for Unit 1 RCS integrity.</p> <p>Scenario AA42</p> <p>VFDRs identified for Unit 1 and Unit 2 CVCS.</p> <p>VFDRs identified for Unit 2 RCS integrity.</p>

**Fire Area AA36/42 – Attachment 1 - Table B-3 - Fire Area Transition**

<u>Unit</u>	<u>Fire Area</u>	<u>Description</u>
1, 2	AA36/42	Auxiliary Building (El. 609 ft.)
Decay Heat Removal		Unit 1 - Control inventory using alternate CVCS with Unit 2 East or West Charging Pump via the unit cross-tie. Control pressure using Unit 1 Pressurizer Safety Relief Valves.
		Unit 2 - Control inventory using CVCS with Unit 2 East or West Charging Pump. Control pressure using Unit 2 Pressurizer Safety Relief Valves.
		Scenario AA36
		Unit 1 - Feed SGs 2 & 3 with Unit 1 East MDAFW Pump. The DHR function also requires MS isolation with a steam release path through the Safety Relief Valves.
		Unit 2 - Feed SGs 2 & 3 with Unit 2 East MDAFW Pump. The DHR function also requires MS isolation with a steam release path through the Safety Relief Valves.
		Scenario AA42 - with Unit 1 CCW Pumps Available
		Unit 1 - Feed SGs 2&3 with Unit 1 East MDAFW Pump or feed SGs 1&4 with Unit 1 West MDAFW Pump. The DHR function also requires MS isolation with a steam release path through the Safety Relief Valves.
		Unit 2 - Feed SGs 2&3 with Unit 2 East MDAFW Pump. The DHR function also requires MS isolation with a steam release path through the Safety Relief Valves.
		Scenario AA42 - with Unit 2 CCW Pumps Available
		Unit 1 - Feed SGs 2&3 with Unit 1 East MDAFW Pump or feed SGs 1&4 with Unit 1 West MDAFW Pump. The DHR function also requires MS isolation with a steam release path through the Safety Relief Valves.
		Unit 2 - Feed SGs 2&3 with Unit 2 East MDAFW Pump. The DHR function also requires MS isolation with a steam release path through the Safety Relief Valves.

Scenario AA36  
VFDRs identified for Unit 2 and Unit 2 AFW and MS isolation.

Scenario AA42  
VFDRs identified for Unit 2 AFW and MS isolation.

**Fire Area AA36/42 – Attachment 1 - Table B-3 - Fire Area Transition**

<u>Unit</u>	<u>Fire Area</u>	<u>Description</u>
1, 2	AA36/42	Auxiliary Building (El. 609 ft.)
<hr/>		
Process Monitoring		<p>Scenario AA36</p> <p>Unit 1 Process Monitoring - Use Unit 1 process monitoring in the Control Room for the following: Pressurizer level, RCS pressure and temperature, and S/G level and Pressure.</p> <p>Unit 1 Source Range Monitoring - Use Unit 1 source range monitoring in the Control Room.</p> <p>Unit 2 Process Monitoring - Use Unit 2 process monitoring in the Control Room for the following: Pressurizer level, RCS pressure and temperature, and S/G level and Pressure.</p> <p>Unit 2 Source Range Monitoring - Use Unit 2 source range monitoring in the Control Room.</p> <p>Scenario AA42 - with Unit 1 CCW Pumps Available</p> <p>Unit 1 Process Monitoring - Use Unit 1 process monitoring in the Control Room for the following: Pressurizer level, RCS pressure and temperature, and S/G level and Pressure.</p> <p>Unit 1 Source Range Monitoring - Use Unit 1 source range monitoring in the Control Room.</p> <p>Unit 2 Process Monitoring - Use Unit 2 process monitoring in the Control Room for the following: Pressurizer level, RCS pressure and temperature, and S/G level and Pressure.</p> <p>Unit 2 Source Range Monitoring - Use Unit 2 source range monitoring in the Control Room.</p> <p>Scenario AA42 - with Unit 2 CCW Pumps Available</p> <p>Unit 1 Process Monitoring - Use Unit 1 process monitoring in the Control Room for the following: Pressurizer level, RCS pressure and temperature, and S/G level and Pressure.</p> <p>Unit 1 Source Range Monitoring - Use Unit 1 source range monitoring in the Control Room.</p>

Scenario AA36  
VFDRs identified for Unit 1 process monitoring.

Scenario AA42  
VFDRs identified for Unit 2 process monitoring.



**Fire Area AA36/42 – Attachment 1 - Table B-3 - Fire Area Transition**

<u>Unit</u>	<u>Fire Area</u>	<u>Description</u>
1, 2	AA36/42	Auxiliary Building (El. 609 ft.)
Vital Auxiliaries		Unit 2 Process Monitoring - Use Unit 2 process monitoring in the Control Room for the following: Pressurizer level, RCS pressure and temperature, and S/G level and Pressure. Unit 2 Source Range Monitoring - Use Unit 2 source range monitoring in the Control Room.
		Scenario AA36
		Unit 1 Electrical - Control Unit 1 Red (AB) Train Electrical Distribution with Unit 1 Red (AB) Train Offsite Power or Unit 1 Red (AB) DG. Control Unit 1 Green (CD) Train Electrical Distribution with Unit 1 Green (CD) Train Offsite Power or Unit 1 Green (CD) DG. Unit 1 ESW - Operate Unit 1 West ESW. Unit 1 East ESW is available to support Unit 1 Green (CD) DG. Unit 1 CCW - Operate Unit 2 East CCW to support CVCS cross-tie. Unit 1 HVAC - Operate Unit 1 Control Room HVAC. Operate Unit 1 Auxiliary Building HVAC. Operate Unit 1 Red (AB) and Green (CD) DG HVAC. Operate Unit 1 Switchgear HVAC. Unit 1 AFW Room HVAC is not available. Operate the Unit 1 East and West ESW Room HVAC systems.
		Unit 2 Electrical - Control Unit 2 Red (AB) Train Electrical Distribution with Unit 2 Red (AB) Train Offsite Power or Unit 2 Red (AB) DG. Control Unit 2 Green (CD) Train Electrical Distribution with Unit 2 Green (CD) Train Offsite Power or Unit 1 Green (CD) DG. Unit 2 ESW - Operate Unit 2 East ESW. Unit 2 West ESW is available to support Unit 2 Red (AB) DG. Unit 2 CCW - Operate Unit 2 East CCW. Unit 2 HVAC - Operate Unit 2 Control Room HVAC. Operate Unit 2 Auxiliary Building HVAC. Operate Unit 2 Red (AB) and Green (CD) DG HVAC. Operate Unit 2 Switchgear HVAC. Operate Unit 2 East MDAFW Room HVAC system. Operate the Unit 2 East and West ESW Room HVAC systems.
		Scenario AA42 - with Unit 1 CCW Pumps Available
		Unit 1 Electrical - Control Unit 1 Red (AB) Train Electrical Distribution with Unit 1 Red (AB) Train Offsite Power or Unit 1 Red (AB) DG. Control Unit 1

Scenario AA36

VFDRs identified for Unit 1 electrical distribution, ESW and ESW HVAC. VFDRs identified for Unit 2 CCW and Control Room HVAC.

Scenario AA42

VFDRs identified for Unit 2 electrical distribution, ESW, Control Room HVAC and Auxiliary Building HVAC.

**Fire Area AA36/42 – Attachment 1 - Table B-3 - Fire Area Transition**

<u>Unit</u>	<u>Fire Area</u>	<u>Description</u>
1, 2	AA36/42	<p>Auxiliary Building (El. 609 ft.)</p> <hr/> <p>Green (CD) Train Electrical Distribution with Unit 1 Green (CD) Train Offsite Power or Unit 1 Green (CD) DG.  Unit 1 ESW - Operate Unit 1 East and West ESW.  Unit 1 CCW - Operate Unit 1 East and West CCW.  Unit 1 HVAC - Operate Unit 1 Control Room HVAC. Operate Unit 1 Auxiliary Building HVAC. Operate Unit 1 Red (AB) and Green (CD) DG HVAC.  Operate Unit 1 Switchgear HVAC. Operate Unit 1 East and West MDAFW Room HVAC systems. Operate the Unit 1 East and West ESW Room HVAC systems.</p> <p>Unit 2 Electrical - Control Unit 2 Red (AB) Train Electrical Distribution with Unit 2 Red (AB) Train Offsite Power or Unit 2 Red (AB) DG. Control Unit 2 Green (CD) Train Electrical Distribution with Unit 2 Green (CD) Train Offsite Power or Unit 1 Green (CD) DG.  Unit 2 ESW - Operate Unit 2 East ESW.  Unit 2 CCW - Operate Unit 1 East and West CCW to support CVCS cross-tie.  Unit 2 HVAC - Unit 2 Control Room HVAC is not available. Operate Unit 2 Auxiliary Building HVAC. Operate Unit 2 Red (AB) and Green (CD) DG HVAC. Operate Unit 2 Switchgear HVAC. Unit 2 AFW Room HVAC is not available. Operate the Unit 2 East and West ESW Room HVAC systems.</p> <p>Scenario AA42 - with Unit 2 CCW Pumps Available</p> <p>Unit 1 Electrical - Control Unit 1 Red (AB) Train Electrical Distribution with Unit 1 Red (AB) Train Offsite Power or Unit 1 Red (AB) DG. Control Unit 1 Green (CD) Train Electrical Distribution with Unit 1 Green (CD) Train Offsite Power or Unit 1 Green (CD) DG.  Unit 1 ESW - Operate Unit 1 East and West ESW.  Unit 1 CCW - Operate Unit 2 East and West CCW to support CVCS cross-tie.  Unit 1 HVAC - Operate Unit 1 Control Room HVAC. Operate Unit 1 Auxiliary Building HVAC. Operate Unit 1 Red (AB) and Green (CD) DG HVAC.  Operate Unit 1 Switchgear HVAC. Operate Unit 1 East and West MDAFW Room HVAC systems. Operate the Unit 1 East and West ESW Room</p>

**Fire Area AA36/42 – Attachment 1 - Table B-3 - Fire Area Transition**

<u>Unit</u>	<u>Fire Area</u>	<u>Description</u>
1, 2	AA36/42	Auxiliary Building (El. 609 ft.)
		HVAC systems.
		Unit 2 Electrical - Control Unit 2 Red (AB) Train Electrical Distribution with Unit 2 Red (AB) Train Offsite Power or Unit 2 Red (AB) DG. Control Unit 2 Green (CD) Train Electrical Distribution with Unit 2 Green (CD) Train Offsite Power or Unit 1 Green (CD) DG.
		Unit 2 ESW - Operate Unit 1 East and West ESW.
		Unit 2 CCW - Operate Unit 2 East and West CCW.
		Unit 2 HVAC - Unit 2 Control Room HVAC is not available. Operate Unit 2 Auxiliary Building HVAC. Operate Unit 2 Red (AB) and Green (CD) DG HVAC. Operate Unit 2 Switchgear HVAC. Unit 2 AFW Room HVAC is not available. Operate the Unit 2 East and West ESW HVAC systems.

**Reference Documents**

Genesis Solution Suite, EDISON / SAFE-PB, DC Cook V 3.4.0

Nuclear Safety Capability Assessment Report

**Licensing Actions**

None

**Existing Engineering Equivalency Evaluations (EEEE)****EEEE Title** Engineering Equivalency Evaluation 9-1 - Fire Zone 43 (Fire Area AA36/42) and 91 (Fire Area AA2) Duct Evaluation

**Summary** The purpose of this engineering equivalency evaluation is to document the acceptability of an undampened HVAC steel duct that penetrates the wall between the Access Control Area and the southeast portion of the Unit 1 Turbine Room, Fire Zones 43 (Fire Area AA36/42) and Fire Zone 91 (Fire Area AA2), respectively.

Reasonable assurance is provided that a fire in Fire Zone 43 or Fire Zone 91 would not impair the safe shutdown capabilities of CNP Unit 1. This engineering equivalency evaluation does not adversely impact other engineering equivalency evaluations.

The HVAC duct was evaluated and found to be acceptable based on the fire hazards and construction features within the evaluated areas.

**Fire Area AA36/42 – Attachment 1 - Table B-3 - Fire Area Transition**

<b><u>Unit</u></b>	<b><u>Fire Area</u></b>	<b><u>Description</u></b>
1, 2	AA36/42	Auxiliary Building (El. 609 ft.)

<b><u>EEEE Title</u></b>	<b>Engineering Equivalency Evaluation 9-3 - CCW Pump Air Supply Duct Evaluation: Fire Zone 44S (Fire Area AA36/42)</b>
<b><u>Summary</u></b>	<p>The purpose of this engineering equivalency evaluation is to document the acceptability of the common supply air duct for the Unit 1, Unit 2 and spare CCW pumps located at elevation 609 ft. of the Auxiliary Building in Fire Zone 44S (Fire Area AA36/42). This engineering equivalency evaluation does not adversely impact other engineering equivalency evaluations or exemption requests.</p> <p>A fire-rated damper is required at the point where the main duct enters at the top of the air shaft from Fire Zone 52 on the 633 ft. elevation; however, fire-rated dampers are not required at any of the branch ducts to the CCW pump supply air hoods. This engineering equivalency evaluation does not adversely impact other engineering equivalency evaluations.</p> <p>The ducts were evaluated and found to be acceptable based on the fire hazards, fire protection systems and construction features within the evaluated areas.</p>
<b><u>EEEE Title</u></b>	<b>Engineering Equivalency Evaluation 9-4 - Auxiliary Building Vertical Air Shafts Evaluation: Fire Zones 12 (Fire Area AA11) and 22 (Fire Area AA27)</b>
<b><u>Summary</u></b>	<p>The purpose of this engineering equivalency evaluation is to document the acceptability of two vertical air shafts, located in the Auxiliary Building (Fire Areas AA11 and AA27), that extend from the 573 ft. elevation to just below the 650 ft. elevation with dampered and undampered ventilation openings.</p> <p>Reasonable assurance is provided that a fire in any of the adjoining fire areas to the Auxiliary Building air shafts with undampered or unrated duct penetrations or a fire in either air shaft will not adversely impact on safe shutdown capabilities of CNP. In addition, this engineering equivalency evaluation does not adversely impact other engineering equivalency evaluations.</p> <p>The air shafts were evaluated and found to be acceptable based on the fire hazards, fire protection systems and construction features within the evaluated areas.</p>

**Fire Area AA36/42 – Attachment 1 - Table B-3 - Fire Area Transition**

<u>Unit</u>	<u>Fire Area</u>	<u>Description</u>
1, 2	AA36/42	Auxiliary Building (El. 609 ft.)

**EEEE Title Engineering Equivalency Evaluation 9-14 - Fire Zone 43 (Fire Area AA36/42) and Fire Zone 56 (Fire Area AA48) Hatch Evaluation**

**Summary** The purpose of this engineering equivalency evaluation is to document the acceptability of an unrated steel plate floor hatch located between the Access Control Area and the Unit 1 Auxiliary Cable Vault in Fire Zones 43 (Fire Area AA36/42) and 56 (Fire Area AA48) respectively. A 3-hr fire-rated hatch assembly is not commercially available for use in this location.

Note: This engineering equivalency evaluation has been reviewed by the NRC. Refer to NRC SER dated June 17, 1988, for acceptance of unrated fire hatches in fire area boundaries. The NRC concluded that the level of fire safety is equivalent to that achieved by conformance with the guidelines of Section D.1.j of Appendix A to BTP APCSB 9.5-1, and, therefore, the deviations for the unrated fire hatches were found acceptable.

Reasonable assurance is provided that a fire in Fire Zone 43 or Fire Zone 56 would not impair the safe shutdown capabilities of Unit 1 and the current configuration of the hatch is acceptable as-is. This engineering equivalency evaluation does not adversely impact other engineering equivalency evaluations.

The hatch was evaluated and found to be acceptable based on the fire hazards and fire protection systems within the evaluated areas. Also, one of the areas being evaluated is normally manned.

**EEEE Title Engineering Equivalency Evaluation 9-21 - Fire Zone 110 (Fire Area AA2) and Fire Zone 43 (Fire Area AA36/42) Door Evaluation**

**Summary** The purpose of this engineering equivalency evaluation is to document the acceptability of three unrated door assemblies located between the Unit 1 Main Steam Accessway and the Access Control Area in Fire Zones 110 (Fire Area AA2) and 42 (Fire Area AA36/42), respectively.

Reasonable assurance is provided that a fire in Fire Zone 43 or Fire Zone 110 would not impair the safe shutdown capabilities of Unit 1. This engineering equivalency evaluation does not adversely impact other engineering equivalency evaluations.

The doors were evaluated and found to be acceptable based on the fire hazards, fire protection systems and construction features within the evaluated areas. Also, one of the areas being evaluated is normally manned.

**Fire Area AA36/42 – Attachment 1 - Table B-3 - Fire Area Transition**

<u>Unit</u>	<u>Fire Area</u>	<u>Description</u>
1, 2	AA36/42	Auxiliary Building (El. 609 ft.)

<b><u>EEEE Title</u></b>	<b>Engineering Equivalency Evaluation 9-22 - Fire Zone 111 (Fire Area AA2) and Fire Zone 44S (Fire Area AA36/42) Door Evaluation</b>
<b><u>Summary</u></b>	<p>The purpose of this engineering equivalency evaluation is to document the acceptability of three unrated door assemblies located between the Unit 2 Main Steam Accessway and the south end of the 609 ft. elevation of the Auxiliary Building in Fire Zones 111 (Fire Area AA2) and 44S (Fire Area AA36/42) respectively.</p> <p>Reasonable assurance is provided that a fire in Fire Zone 44S or Fire Zone 111 would not impair the safe shutdown capabilities of Unit 1 or Unit 2. This engineering equivalency evaluation does not adversely impact other engineering equivalency evaluations.</p> <p>The doors were evaluated and found to be acceptable based on the fire hazards, fire protection systems and construction features within the evaluated areas.</p>
<b><u>EEEE Title</u></b>	<b>Engineering Equivalency Evaluation 9-31 - Fire Zones 62A, 62B and 62C (Fire Area AA54) Boundary Evaluation</b>
<b><u>Summary</u></b>	<p>The purpose of this engineering equivalency evaluation is to document the acceptability of steel plate covered access openings to vertical chases/leakage detection boxes in Fire Zones 62A, 62B, and 62C (all from Fire Area AA54) that connect the RHR and containment spray pumps below with their heat exchangers above.</p> <p>Reasonable assurance is provided that a fire in the vicinity of the vertical chases/leakage detection boxes passing through Fire Zones 62A, 62B and 62C would not impair safe shutdown capabilities of CNP. This engineering equivalency evaluation does not adversely impact other engineering equivalency evaluations.</p> <p>The openings were evaluated and found to be acceptable based on the fire hazards, fire protection systems and construction features within the evaluated areas.</p>

**Fire Area AA36/42 – Attachment 1 - Table B-3 - Fire Area Transition**

<u>Unit</u>	<u>Fire Area</u>	<u>Description</u>
1, 2	AA36/42	Auxiliary Building (El. 609 ft.)

<b><u>EEEE Title</u></b>	<b>Engineering Equivalency Evaluation 9-32 - Fire Zones 63A, 63B and 63C (Fire Area AA56) Boundary Evaluations</b>
<b><u>Summary</u></b>	<p>The purpose of this engineering equivalency evaluation is to document the acceptability of steel plate covered access openings to vertical chases/leakage detection boxes in Fire Zones 63A, 63B and 63C (all in Fire Area AA56) that connect the RHR and containment spray pumps below with their heat exchangers above.</p> <p>Reasonable assurance is provided that a fire in the vicinity of the vertical chases/leakage detection boxes passing through Fire Zones 63A, 63B and 63C would not impair safe shutdown capabilities of CNP or impact on the full area suppression exemption request for the 573 ft. elevation of the Auxiliary Building. This engineering equivalency evaluation does not adversely impact other engineering equivalency evaluations.</p> <p>The unprotected access opening steel plate covers were evaluated and found to be acceptable based on the fire hazards, fire protection systems and construction features within the evaluated areas.</p>
<b><u>EEEE Title</u></b>	<b>Engineering Equivalency Evaluation 9-41 - Fire Zones 37 (Fire Area AA36/42) and 51 (Fire Area AA3) HVAC Duct Penetrations</b>
<b><u>Summary</u></b>	<p>The purpose of this engineering equivalency evaluation is to document the acceptability of 15 undampened HVAC penetrations connecting the 617 ft. and 633 ft. elevations of the Auxiliary Building between Fire Zones 37 (Fire Area AA36/42) and 51 (Fire Area AA3).</p> <p>Reasonable assurance is provided that a fire starting from Fire Zones 37 and/or 44N and propagating through the undampened ducts to Fire Zone 51 and 52 will not adversely impact safe shutdown capabilities of CNP. This engineering equivalency evaluation also verifies that there is no adverse impact to other engineering equivalency evaluations.</p> <p>The HVAC penetrations were evaluated and found to be acceptable based on the fire protection systems and construction features within the evaluated areas.</p>

**Fire Area AA36/42 – Attachment 1 - Table B-3 - Fire Area Transition**

<u>Unit</u>	<u>Fire Area</u>	<u>Description</u>
1, 2	AA36/42	Auxiliary Building (El. 609 ft.)
<hr/>		
<b><u>EEEE Title</u></b>	<b>Engineering Equivalency Evaluation 11-4 - Unit 1 Auxiliary Building Elevation 620 ft. 6 in. to Auxiliary Cable Vault Fire Zone 44N (Fire Area AA36/42) to Fire Zone 56 (Fire Area AA48)</b>	
<b><u>Summary</u></b>	<p>The purpose of this engineering equivalency evaluation is to document the acceptability of the 8 in. thick silicone foam fire seals protecting the penetrations between Fire Zone 56 (Fire Area AA48, auxiliary cable vault at elevation 620 ft.) and Fire Zone 44N (Fire Area AA36/42, Auxiliary Building - north end at elevation 609 ft.).</p> <p>The existing 8 in. silicone foam fire seals located within the penetrations between Fire Zone 56 and Fire Zone 44N are acceptable for maintaining the rating of the fire area boundary. In addition, this engineering equivalency evaluation does not adversely impact other engineering equivalency evaluations.</p> <p>The fire seals were evaluated and found to be acceptable based on the fire hazards, fire protection systems and construction features within the evaluated areas.</p>	
<b><u>EEEE Title</u></b>	<b>Engineering Equivalency Evaluation 11-9 - Turbine, Auxiliary and Containment Buildings Boundary Evaluation</b>	
<b><u>Summary</u></b>	<p>The purpose of this engineering equivalency evaluation is to describe in general, the approach and existence of evaluations performed to determine and reconcile fire area boundaries having components or designs with less than a 3-hr fire rating on preventing the spread of fire. This engineering equivalency evaluation also specifically evaluates the impact of unrated door assemblies on the spread of fire.</p> <p>Reasonable assurance is provided that the fire area boundaries having components or design less than a 3-hr fire rating will not increase the spread of fire or impair the safe shutdown capabilities of Units 1 or 2. In addition, this engineering equivalency evaluation does not adversely impact on other engineering equivalency evaluations or exemption requests.</p> <p>This evaluation supports additional evaluations credited in this fire area.</p>	



**Fire Area AA36/42 – Attachment 1 - Table B-3 - Fire Area Transition**

<b><u>Unit</u></b>	<b><u>Fire Area</u></b>	<b><u>Description</u></b>
1, 2	AA36/42	Auxiliary Building (El. 609 ft.)
<hr/>		
<b><u>EEEE Title</u></b>	<b>Engineering Equivalency Evaluation 11-12 - Stairwells and Elevator Construction and Boundary Evaluation (Fire Analysis Areas AA 1, AA2, AA3, AA5/6, AA3 6 and AA42)</b>	
<b><u>Summary</u></b>	<p>The purpose of this engineering equivalency evaluation is to document the acceptability of the rated and unrated fire barriers of the stairwells and elevators located in the Turbine and Auxiliary Buildings for their impact on preventing the spread of fire in Fire Areas AA1, AA2, AA3, AA5/6, and AA36/42.</p> <p>Reasonable assurance is provided that the open stairwells and elevators of the Turbine and Auxiliary Buildings will not result in an increased potential for the spread of fire or potential impairment of the safe shutdown capabilities of Unit 1 or Unit 2. This engineering equivalency evaluation does not impact other engineering equivalency evaluations.</p> <p>The stairwells and elevator boundaries were evaluated and found to be acceptable based on the fire hazards, fire protection systems and construction features within the areas.</p>	
<b><u>EEEE Title</u></b>	<b>Engineering Equivalency Evaluation 11-14 - Cable Spreading Room Construction Boundary Evaluation (Fire Areas AA3, AA7, AA8, AA9, AA10, AA29, AA30, AA31, AA34, AA35, AA36/42, AA37, AA38, AA48, AA50, AA51 and AA52)</b>	
<b><u>Summary</u></b>	<p>The purpose of this engineering equivalency evaluation is to document the acceptability of the construction features of the cable spreading rooms which have a fire resistance rating of less than 3 hours for their impact on the spread. In particular, fire dampers having a 1 1/2-hr fire rating were analyzed by this evaluation. Other unrated construction features have been previously analyzed under separate engineering equivalency evaluations. The applicable fire areas include: AA3, AA7, AA8, AA9, AA10, AA29, AA30, AA31, AA34, AA35, AA36/42, AA37, AA38, AA48, AA50, AA51 and AA52.</p> <p>Reasonable assurance is provided that the construction features of the cable spreading rooms which have a fire resistance rating of less than 3 hours will prevent the spread of fire and not impair the safe shutdown capabilities of Unit 1 and Unit 2. In addition, this engineering equivalency evaluation does not adversely impact other engineering equivalency evaluations.</p> <p>The construction features of the cable spreading room were evaluated and found to be acceptable based on the fire hazards, fire protection systems and construction features within the areas.</p>	

**Fire Area AA36/42 – Attachment 1 - Table B-3 - Fire Area Transition**

<u>Unit</u>	<u>Fire Area</u>	<u>Description</u>
1, 2	AA36/42	Auxiliary Building (El. 609 ft.)

<b><u>EEEE Title</u></b>	<b>Engineering Equivalency Evaluation 11-37 - Fire Zones 52 (Fire Area AA3) and Fire Zone 44N (Fire Area AA36/42) Hatch Evaluation</b>
<b><u>Summary</u></b>	<p>The purpose of this engineering equivalency evaluation is to document the acceptability of an unrated Auxiliary Building floor hatch between Fire Zones 52 (Fire Area AA3) and 44N (Fire Area AA36/42) on preventing the spread of fire. This engineering equivalency evaluation determines the impact that the unrated floor hatch will have on other engineering equivalency evaluations or exemption requests.</p> <p>Reasonable assurance is provided that the unrated floor/ceiling hatch located at the 633 ft. elevation of the Auxiliary Building will not impair the safe shutdown capabilities of CNP or increase the spread of fire between Fire Zones 52 and 44N.</p> <p>The unrated floor hatch was evaluated and found to be acceptable based on the fire hazards, fire protection systems and construction features within the evaluated areas.</p>
<b><u>EEEE Title</u></b>	<b>Engineering Equivalency Evaluation 11-45 - Auxiliary Building HVAC Duct Penetrations Boundary Evaluation Fire Analysis Areas AA1, AA3, AA5/6 and AA36/42</b>
<b><u>Summary</u></b>	<p>The purpose of this engineering equivalency evaluation is to document the acceptability of not installing fire dampers in the ventilation system duct penetrations that communicate between fire areas vertically from elevation to elevation in Fire Areas AA1, AA3, AA5/6, and AA36/42. The ventilation ducts associated with the 22 penetrations were located on HVAC drawings showing the entire flow path of each duct. Penetrations into fire zones/areas equipped with rated fire dampers were eliminated and what remained is discussed in this engineering equivalency evaluation.</p> <p>This analysis verifies that the safe shutdown system requirements relative to the guidelines of NFPA 805 are being met, and the exclusion of fire dampers in the ventilation ducts is justified.</p> <p>The ventilation ducts were evaluated and found to be acceptable based on the fire hazards, fire protection systems and construction features within the evaluated areas.</p>

**Fire Area AA36/42 – Attachment 1 - Table B-3 - Fire Area Transition**

<u>Unit</u>	<u>Fire Area</u>	<u>Description</u>
1, 2	AA36/42	Auxiliary Building (El. 609 ft.)

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**EEEE Title** Engineering Equivalency Evaluation 11-47 - Fire Zones 44N (Fire Area AA36/42), 44S (Fire Area AA36/42) and 52 (Fire Area AA3) Penetration Seals

**Summary** The purpose of this engineering equivalency evaluation is to document the acceptability of fire-rated penetration seals F-6414, F-6415 and F-6417. The seals are physically located in the floor of Fire Zone 52 (Aux. Bldg. 633 ft.) which communicates with Fire Zones 44N and 44S (Aux. Bldg. 609 ft.) below. The seals separate Fire Areas AA3 and AA36/42. Basis for the engineering equivalency evaluation is regulatory guidance provided in Generic Letter 86-10 and NUREG 1552, which endorses the concept of defense-in-depth for fire protection evaluation. In summary, the engineering equivalency evaluation concludes the subject seals provide an acceptable level of fire protection.

The existing configuration for fire-rated penetration seals F6414, F6415 and F6417 is acceptable and will not affect the stations ability to achieve and maintain safe shutdown.

The fire rated penetration seals were evaluated and found to be acceptable based on the fire hazards and fire protection systems within the evaluated areas.

**Fire Area AA36/42 – Attachment 1 - Table B-3 - Fire Area Transition**

<u>Unit</u>	<u>Fire Area</u>	<u>Description</u>
1, 2	AA36/42	Auxiliary Building (El. 609 ft.)
<hr/>		
<b><u>EEEE Title</u></b>	<b>Engineering Equivalency Evaluation 12-22 - Unit 1 and Unit 2 Auxiliary Building North and South Elevations 609 ft. Fire Zones 44N and 44S (Fire Area AA36/42 )Analysis of Sprinkler System</b>	
<b><u>Summary</u></b>	<p>The purpose of this engineering equivalency evaluation is to document the acceptability of the automatic sprinkler system installed in the Unit 1 and Unit 2 Auxiliary Building North and South, elevation 609 ft., Fire Zones 44N (Fire Area AA36/42) and 44S (Fire Area AA36/42), respectively. This system was reviewed against the requirements of the National Fire Protection Association (NFPA) Standard 13, "Automatic Sprinkler Systems," 1983 edition. The NFPA code non-conformances or deviations were addressed by this engineering equivalency evaluation. However, only the functional deviations were addressed by this engineering equivalency evaluation. The minor non-functional code deviations, such as missing signage, etc., did not warrant an engineering equivalency evaluation. The non-functional code non-conformances do not affect the operability of the sprinkler system and do not prevent the sprinkler system from suppressing a fire. This engineering equivalency evaluation addressed the functional code non-conformances that may affect the system's ability to control and suppress a fire and provided justification for each of the identified deviations for the as-installed configuration. This engineering equivalency evaluation determined the sprinkler system's impact on the spread of fire and previous engineering equivalency evaluations and exemption requests.</p> <p>The as-installed configuration of sidewall sprinklers in Fire Zones 44N and 44S was accepted by the property insurance carrier, American Nuclear Insurers (ANI). The minor sprinkler code non-conformance with regard to partial sprinkler obstructions are compensated for with the overlap in sprinkler spray patterns, close spacing of the installed sprinklers, the ability of the sprinkler water to pass through the grated platforms, and the manual fire fighting equipment in the area. The sprinklers and pilot heads that exceed the code allowed distance from the ceiling and walls are located below the ceiling level obstructions to minimize these obstructions and to maximize coverage for a floor based fire. The areas with sprinklers located closer than 6 ft. apart do not prevent sprinkler coverage of the area, contain negligible combustibles, have smoke detection, and the wetted sprinklers will respond if the fire is significant. In addition, the fire brigade will respond and ensure complete extinguishment. The sprinkler protection in Fire Zones 44N and 44S is adequate for the hazard. In conclusion, the sprinkler system in the Auxiliary Building North and South areas, elevation 609 ft., is capable of performing its intended function, suppressing and containing the fire, preventing fire spread to adjacent fire zones, and assuring that safe shutdown of CNP can be achieved and maintained.</p> <p>The sprinkler systems were evaluated and found to be acceptable based on the fire hazards, fire protection systems and construction features within the evaluated area.</p>	

**Fire Area AA36/42 – Attachment 1 - Table B-3 - Fire Area Transition**

<u>Unit</u>	<u>Fire Area</u>	<u>Description</u>
1, 2	AA36/42	Auxiliary Building (El. 609 ft.)

**Fire Suppression Effects on Nuclear Safety Performance Criteria**

The CNP fire brigade is trained to discharge water in a judicious manner and instructed to direct hose streams and portable extinguishers at the base of the fire to limit the amount of overspray beyond the immediate fire zone. For this reason, fire brigade activities are not expected to fail components which are not immediately involved in the fire scenario. It has been concluded that water impingement on cables is not a concern. Electrical cabinets are provided with a seal at the conduit interface to prevent water intrusion. Per visual inspection any side vents for this equipment are pointed downward to prevent water intrusion. Therefore, in the event of discharge, the pre-action system will not adversely effect the other equipment operating within the fire zone. The drainage features of the fire area mitigate the potential for flooding damage due to fire suppression, such that the standing water would not affect credited equipment.

Since it is shown that suppression effects will not impact the nuclear safety performance criteria, the fire area configuration is deemed acceptable.

**References:**

Technical Evaluation 12.1, "Fire Suppression Effects Study"

Technical Evaluation 12.1, "Supplemental Information to Fire Suppression Effects Study – Supplement 1"

**Fire Area Comments**

Appendix R Analysis Areas AA36 and AA42 are transitioned to the NFPA 805 analysis as a combined Fire Area of AA36/42.

## Fire Area AA36/42 – Attachment 2 - Fire Risk Evaluation Results Summary

### A2.1 Introduction

The ‘changes’ associated with NFPA 805 transition were those variances from the deterministic requirements of NFPA 805. The changes identified for evaluation for fire area AA36/42 are grouped as follows:

- Separation Issues

This attachment is a summary of the Fire Risk Evaluation for the fire area. The complete results and methodology are contained in the Cumulative Fire Risk Evaluation, PRA-FIRE-NB-CRE. (FPCE 2017-0009)

### A2.2 Inputs/Assumptions

Fire modeling processes and inputs provided in NUREG/CR-6850 are appropriate for use in a risk-informed, performance-based evaluation. The complete list of assumptions used in the fire modeling methodology for this fire area is contained in Detailed Fire Modeling Technical Evaluation R1900-0411-AA36-42.

### A2.3 Fire Modeling Methodology

Fire PRA fire modeling results are used as the initial input into this Fire Risk Evaluation. The process consists of conservative bounding analyses using NUREG/CR-6850 methods. As needed, refinements are made to utilize more realistic parameters. The complete fire modeling methodology for this fire area is contained in Detailed Fire Modeling Technical Evaluation R1900-0411-AA36-42.

### A2.4 Scenario Descriptions and Model Results

Fire Area AA36/42 was evaluated for the impact of fires originating from both fixed and transient ignition sources. Complete descriptions of each fire scenario is contained within the Detailed Fire Modeling Technical Evaluation R1900-0411-AA36/42.

#### A2.4.1 Ignition Sources

Fire Area AA36/42 contains the CCW pumps, the waste gas compressors, data acquisition panels, MCC 1-AZ-BC and the waste gas analyzer panel. Per discussion with plant personnel, the heat release rates for all switchgear, load centers, and MCC electrical cabinets have been characterized as qualified cable because items of this nature are generally constructed on-site. For other electrical cabinet types, where the internal cable qualification was unknown, the heat release rates have been assumed as non-qualified. As a screening approach, all ignition sources with the were modeled using a 98th heat release rate percentile fire scenario. Ignition sources 12-QC-370, 2-ERA-8300, 2-CRS-4300, 2-CRS-4400 and the CCW pumps were refined and modeled using a 75th heat release rate percentile fire scenario. The CCW pumps were also modeled as an electrical pump fire.

In Fire Area AA36/42, the 98th percentile HRR was used for all transient fires. The 98th percentile HRR bounds the possible transient ignition sources expected for this fire area, which were fire tested and identified in NUREG/CR-6850, Appendix G, Table G-7.

#### A2.4.2 Scenario Results

A delta risk calculation has been performed to quantify the risk associated with the VFDRs in the fire area.

### A2.5 Fire Risk Evaluation Results

### **Fire Area AA36/42 – Attachment 2 - Fire Risk Evaluation Results Summary**

PRA-FIRE-NB-CRE documents scenarios and corresponding impacted VFDRs that were evaluated for delta risk during the transition to NFPA 805 and also all changes to the Fire Protection Program that are currently incorporated into the Fire PRA model. The acceptability of the Cumulative Fire Risk Evaluations was based on calculated delta risk meeting the thresholds of NEI 04-02, RG 1.205 and RG 1.174. (FPCE 2017-0009)

## Fire Area AA36/42 – Attachment 2 - Fire Risk Evaluation Results Summary

### A-2.6 Impact of VFDR on Defense-in-Depth

Defense-in-Depth has been evaluated for this fire area. The impacts of this evaluation are summarized in the table below:

Defense-in-Depth Impact Review for AA36/42			
Method of Providing DID	Required to Support Deterministic Analysis or Fire PRA?	Changes or Improvements Necessary for DID?	Basis/Justification
Echelon 1: Prevent fires from starting			
Combustible Control is implemented in accordance with Procedure PMP-2270-CCM-001, Control of Combustible Materials.	Yes	No	• This element is strengthened to off set potential over-reliance on another echelon of defense-in-depth.
Hot Work Control is implemented in accordance with Procedure PMP-2270-WBG-001, Welding, Burning and Grinding Activities.	Yes	No	
Echelon 2: Rapidly detect, control and extinguish promptly those fires that do occur thereby limiting fire damage			
Fire Detection System	Yes	No	• Although fire fighting activities may be challenging, suppression and detection are provided throughout the fire area and therefore no changes or improvements to Echelon 2 attributes are necessary to maintain defense-in-depth.
Fixed Fire Suppression	Yes	No	
Portable Fire Extinguishers	Yes	No	
Hose stations and hydrants	Yes	No	
Pre-Fire Plan	Yes	No	



**Fire Area AA36/42 – Attachment 2 - Fire Risk Evaluation Results Summary**

<b>Defense-in-Depth Impact Review for AA36/42</b>			
<b>Method of Providing DID</b>	<b>Required to Support Deterministic Analysis or Fire PRA?</b>	<b>Changes or Improvements Necessary for DID?</b>	<b>Basis/Justification</b>
<b>Echelon 3: Provide adequate level of fire protection for systems and structures so that a fire will not prevent essential safety functions from being performed</b>			
Walls, floors ceilings and structural elements are rated or have been evaluated as adequate for the hazard.	Yes	No	<ul style="list-style-type: none"> <li>Although VFDRs AA36/42.36-020 and AA36/42.42-033 are not considered a significant contribution to core damage frequency, the variances are considered important enough to the NSCA to retain as recovery actions to ensure that defense-in-depth is maintained.</li> <li>Where the remaining variances can possibly be affected in a potentially high risk scenario, based on a detailed review, the VFDRs are either not the cause for the high risk of the scenario or the mitigating recovery action is credited; therefore no changes or improvements to Echelon 3 attributes are necessary to maintain defense-in-depth for these actions.</li> </ul>
Penetrations in the fire area barrier are rated or have been evaluated as adequate for the hazard.	Yes	No	<ul style="list-style-type: none"> <li>Cable tray covers are credited in the detailed fire modeling to reduce fire spread and target damage, and, are therefore, credited for defense-in-depth.</li> </ul>
Supplemental barriers (e.g., ERFBS, cable tray covers, etc.)	Yes	No	
Guidance provided to operations personnel detailing the required success path(s) including recovery actions to achieve nuclear safety performance criteria.	Yes	Yes	<ul style="list-style-type: none"> <li>Defense in Depth actions were credited to remove fuses or open breakers in the Control Room to prevent spurious equipment operation due to internal shorts.</li> </ul>

## Fire Area AA36/42 – Attachment 2 - Fire Risk Evaluation Results Summary

### A-2.7 Safety Margin Considerations

In accordance with NEI 04-02, the maintenance of adequate Safety Margin is assessed by the consideration categories of analyses utilized by this Fire Risk Evaluation.

Safety margins are considered to be maintained if:

- Codes and Standards or their alternatives accepted for use by the NRC are met.

AND

- Safety analyses acceptance criteria in the licensing basis (e.g., FSAR, supporting analyses) are met, or provides sufficient margin to account for analysis and data uncertainty.

The following summarizes the bases for ensuring the maintenance of safety margins:

- The risk-informed, performance based processes utilized are based upon NFPA 805, 2001 edition, endorsed by the NRC in 10 CFR 50.48(c).
- The Fire Risk Evaluation process is in accordance with NEI 04-02, Revision 2, which is endorsed by the NRC in Regulatory Guide 1.205, Revision 1.
- The Fire PRA is developed in accordance with NUREG/CR-6850, which was developed jointly between the NRC and EPRI.
- The Fire PRA has undergone an industry peer review, in order to ensure the Fire PRA meets the appropriate quality standards of ASME/ANS RA-Sa-2009, "Standard for Level 1/Large Early Release Frequency Probabilistic Risk Assessment for Nuclear Power Plant Applications," Dated February 2, 2009
- The "combined analysis approach" is used during transition (NEI 04-02, Section 5.3.4.3); therefore, MEFS/LFS is not analyzed separately from the Fire PRA results.
- The CNP internal events PRA model received two formal industry peer reviews conducted in accordance with applicable NEI guidelines. The initial peer review was performed in 2001, while a subsequent focused scope (i.e., limited scope) peer review was conducted in 2009. The initial, full-scope WOG peer review covered all aspects of the CNP PRA model and the administrative processes used to maintain and update the model. The CNP PRA model has been revised to address all significant issues (i.e., Category A and B Facts & Observations) identified during the initial peer review. None of the findings from the focused-scope peer review were judged to reach the significance level of a Category A or B Fact & Observation; as a result, no changes to the PRA model have yet been made to include resolutions for these latter issues.
- Fire protection systems and features determined to be required by NFPA 805 Chapter 4 have been confirmed to meet the requirements of NFPA 805 Chapter 3 and their associated referenced codes and listings, or provided with acceptable alternatives using processes accepted for use by the NRC (i.e., FAQ 06-0008, FAQ 06-0004, 07-0033).
- Fire modeling performed in support of the transition has been performed within the Fire PRA utilizing codes and standards developed by industry and NRC staff which have been verified and validated in authoritative publications, such as NUREG 1824, "Verification and Validation of Selected Fire Models for Nuclear Power Plant Applications". In general, the fire modeling performed in support of the Fire Risk Evaluations has been performed using conservative methods and input parameters that are based upon

## **Fire Area AA36/42 – Attachment 2 - Fire Risk Evaluation Results Summary**

NUREG/CR-6850 as documented in the AA36/42 Detailed Fire Modeling Report, section 7.2. While this is generally not ideal in the context of best estimate probabilistic risk analysis, it is a pragmatic approach given the current state of knowledge regarding the uncertainties related to the application of the fire modeling tools and associated input parameters for specific plant configurations.

- In accordance with the requirements of 10 CFR 50.48(c)(2)(iii), the Fire PRA results, including cutsets for the scenarios of concern, have been reviewed and it was verified that the results presented above do not rely solely on feed and bleed as the fire-protected safe shutdown path for maintaining reactor coolant inventory, pressure control, and decay heat removal capability for this fire area.

### **A-2.8 Transition Risk Evaluation Conclusions**

The transition change evaluation determined that these changes:

- Are acceptable based upon the measured change in CDF and LERF
- Maintained adequate defense-in-depth and safety margins

The results of this evaluation meet the requirements of NFPA 805 Risk Evaluation; therefore, the use of the performance based analysis approach is acceptable.

## D. C. Cook Nuclear Plant Fire Safety Analysis

**Fire Area: AA37**

## Unit 1 Quadrant 2 Cable Tunnel (El. 612 ft.)

## Table of Contents

<b>Purpose</b> .....	Section 1.0
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## Attachments

Fire Area AA37 – Attachment 1 - Table B-3 - Fire Area Transition

## Fire Area AA37 – Attachment 2 - Fire Risk Evaluation Results Summary

## 1.0 PURPOSE

This report documents the Fire Safety Analysis (FSA) for Cook Nuclear Plant (CNP) Fire Area AA37, Unit 1 Quadrant 2 Cable Tunnel (El. 612 ft.) which comprises fire zone(s) 38. The purpose of this analysis is to demonstrate the achievement of the nuclear safety and radioactive release performance criteria of NFPA 805 as required by 10 CFR 50.48(c). The Fire Safety Analysis is a key part of compliance with Section 2.7.1.2 Fire Protection Program Design Basis Document of NFPA 805. This analysis also documents results of risk-informed, performance-based Fire Risk Evaluations (FREs). These evaluations are associated with Variances from Deterministic Requirements (VFDRs) of NFPA 805 Chapter 4.

## 2.0 ANALYSIS METHODOLOGY

The FSA is the design basis document as described in NFPA 805 Section 2.7.1.2. The following steps are performed to develop the FSA on a fire area basis:

- Identify significant fire hazards in the fire area. This is based on NFPA 805 approach to analyze the plant from an ignition source and fuel package perspective.
- Summarize Nuclear Safety Capability Analysis (NSCA) compliance strategies. This is the result of the NEI 04-02 B-3 Table review of the Safe Shutdown Analysis.
- Summarize Non-Power Operations Modes compliance strategies.
- Summarize Radioactive Release compliance strategies. The transition review process required per NEI 04-02 is used to develop these results.
- Provide Fire Probabilistic Risk Assessment summary of results. This is based on the results from the plant Fire PRA.
- Perform risk informed, performance based evaluations if needed for the performance based approach.
- Summarize Defense-in-Depth strategy for each fire area.
- Determine key analysis assumptions which are candidates to be included in the NFPA 805 monitoring program.
- Provide conclusions relative to NFPA 805 compliance.

### 3.0 ANALYSIS

#### 3.1 Classical Fire Protection

##### 3.1.1 Construction

Walls, floors and ceilings to adjacent fire areas are reinforced concrete in excess of a 3-hour rating.

A fire area boundary evaluation was performed for the construction features (i.e. unrated metal hatches, unrated fire damper, unrated seismic gap penetration seals and fire dampers with only 1-1/2 hour fire ratings) of the cable spreading rooms that have a fire resistance rating of less than 3 hours (Engineering Equivalency Evaluation 11-14).

Applicable Engineering Equivalency Evaluations are documented in Attachment 1.

##### 3.1.2 Doors and Access Openings

Fire doors having a 3-hour rating are provided to adjacent Fire Area AA7, AA11, AA34 and AA36/42 - Fire Zones 7, 12, 33B and 44N, respectively.

##### 3.1.3 Penetrations

Penetrations in fire barriers between this fire zone and adjacent fire areas are provided with fire seals except as noted below.

A fire area boundary evaluation was performed for the 8 inch thick unrated silicone foam fire seals installed between this fire zone and Fire Area AA7 - Fire Zone 7 (Engineering Equivalency Evaluation 11-2).

A fire area technical evaluation was prepared to evaluate a fire seal design between Fire Zones 7 and 38 (Engineering Equivalency Evaluation 11-33).

Seismic gaps are sealed with a glass fiber reinforced silicone sheeting.

Seismic gap exemption was granted for Fire Zone 38 interface with Fire Areas AA11, AA34 and AA3 - Fire Zones 12, 33B and 49, 69, respectively.

### 3.1.4 Detection

The table below outlines the fire detection system(s) provided in the Fire Area:

Table 3-1, Fire Area AA37 Detection Systems								
Fire Zone	Type of System	Local (L) / Remote (R)	Detection Actuates Suppression?	Required System?				
				S	L	E	R	D
38	Infrared	L/R	N	N	N	Y	Y	N
38	Ionization	L/R	N	N	N	Y	Y	N

**Table 3-1 Legend:**

Table Field: "Required System?"	
S	- Required for Chapter 4 Separation Criteria
L	- Required for NRC Approved Licensing Action
E	- Required for Engineering Equivalency Evaluation
R	- Required for Risk Significance
D	- Required to maintain adequate balance of Defense-in-Depth in a Change Evaluation or Fire Risk Evaluation

Seven cross zoned ionization smoke detectors and four infra-red detectors are provided which alarm in the Unit 1 Control Room.

### 3.1.5 Fixed Suppression

The table below outlines the fixed fire suppression system(s) provided in the Fire Area:

Table 3-2, Fire Area AA37 Suppression Systems							
Fire Zone	Type of System	Full (F) / Partial (P)	Required System?				
			S	L	E	R	D
38	Manual CO2	F	N	N	Y	N	N
Table 3-2 Legend:							
Table Field: "Required System?"							
S	- Required for Chapter 4 Separation Criteria						
L	- Required for NRC Approved Licensing Action						
E	- Required for Engineering Equivalency Evaluation						
R	- Required for Risk Significance						
D	- Required to maintain adequate balance of Defense-in-Depth in a Change Evaluation or Fire Risk Evaluation						

Fire Area AA37 is not provided with automatic fire suppression.

### 3.1.6 Manual Suppression / Response Strategy

A postulated fire will be identified by early detection using ionization type smoke detection or by plant personnel using plant communication system to notify the control room. The automatic detection system alarms in the control room. The Control Room operator will dispatch the fire brigade for initiation of manual fire fighting. A fire in this fire area will be contained by the construction features discussed in Section 3.1.1. Manual suppression is provided by the CNP Fire

Brigade. A low pressure CO2 total flooding system supplied from the 17 ton tank is provided. This system is manually actuated. Operation of this system discharges CO2 into Fire Area AA37.

Fire Zone 38 is equipped with fire extinguishers, one of which is located on the 625 ft. elevation floor slab

Water hose reels are located in adjacent Fire Zones 33A and 44N, and Fire Zone 7 for the 625 ft. elevation platform.

Fire Area AA37 is equipped with floor drains.

### 3.1.7 Ventilation

A fire in this area will be contained by the fire barriers. Smoke can be removed by venting to the outdoors or to other parts of the Auxiliary Building. The normal building ventilating systems in the Auxiliary Building will then exhaust the smoke via filtered monitored pathways. This fire area is listed as a non-controlled area in the Fire Pre Plans and therefore there is reasonable assurance that products of combustion will not be contaminated.

A fire damper having a 1 1/2-hour rating is provided to adjacent Fire Area AA34 - Fire Zone 33B.

A fire damper having a 3-hour rating is provided to adjacent Fire Area AA36/42 - Fire Zone 44N.

### 3.1.8 Other Features

No other fire protection features provided for Fire Area AA37.

## 3.2 Fire Hazards Identification

The fire area contains both ignition sources and combustible fire hazards. The ignition sources consist of the heat trace distribution panels, heat trace transformers and various alarm panels.

Fire Zone 38 contains cable insulation, cellulose, plastics and rubber.

This fire area has a combustible loading classification of low.

## 3.3 NSCA Compliance Summary

Unit 1 Quadrant 2 Cable Tunnel (El. 612') contains the Unit 1 Boron Injection Tank shutoff motor operated valves as well as Red and Green train cables, conduits and raceways.

Compliance with the nuclear safety performance criteria is achieved using the performance-based approach in accordance with NFPA 805, Section 4.2.4.2.

Safe and stable condition of Unit 1 will be accomplished using Steam Generators 2 and 3 via the Unit 1 East Motor Driven Auxiliary Feedwater Pump, Control Room Process Monitoring, Unit 1 Charging via the West or East Pump, Unit 1 Component Cooling Water via the East or West Pump, Unit 1 Essential Service Water via the East or West Pump. Electrical power is supplied to either Red or Green Trains via offsite power with both Red and Green train Emergency Diesels also available.

The Nuclear Safety Performance Criteria compliance strategy for AA37 is documented within the NSCA Report.



### 3.3.1 Variances

The variances identified for evaluation for this fire area are grouped as follows:

#### 3.3.1.1 VFDR No. AA37-001

1-CLI-113 and 1-CLI-114 – CST level indication is required to be operable to support decay heat removal. Decay heat removal shall be capable of removing sufficient heat from the reactor core such that fuel is maintained in a safe and stable condition. The CST is the primary supply for the AFW system. CST level indication is required to ensure sufficient inventory is available to provide decay heat removal. 1-CLI-113 may fail due to fire induced damage of cable 20205-1. 1-CLI-114 may fail due to fire induced damage of cable 8202Y-1. This condition represents a variance from the deterministic requirements of NFPA 805, Section 4.2.3. This is a separation issue.

This VFDR has been evaluated and it was determined that the risk, safety margin and defense-in-depth meet the acceptance criteria of NFPA 805 Section 4.2.4 with a defense-in-depth action credited.

#### 3.3.1.2 VFDR No. AA37-002

1-MRV-223-P and 1-MRV-233-P - SG 2 and 3 PORVs are required to be closed to support main steam isolation. Main steam isolation is required to ensure uncontrolled cooldown through over-steaming does not occur. SGs 2 and 3 are credited for decay heat removal due to a fire within Fire Area AA37. 1-MRV-223-P may fail due to fire induced damage of cables 18132-1 and 9050Y-1. 1-MRV-233-P may fail due to fire induced damage of cables 18133-1 and 9051Y-1. These cable failures could spuriously operate the valves. This condition represents a variance from deterministic requirements of NFPA 805, Section 4.2.3. This is a separation issue.

This VFDR has been evaluated and it was determined that the risk, safety margin and defense-in-depth meet the acceptance criteria of NFPA 805 Section 4.2.4 with a defense-in-depth action credited.

#### 3.3.1.3 VFDR No. AA37-003

1-ILS-950 and 1-ILS-951 - RWST level indication is required to support CVCS. CVCS is required to be operable to maintain inventory, pressure and reactivity control. The RWST is the primary credit borated water source for CVCS. The RWST level indicators may fail due to a full area fire within Fire Area AA37. 1-ILS-950 may fail due to fire induced damage of cable 9738G-1. 1-ILS-951 may fail due to fire induced damage of cable 9738R-1. This condition represents a variance from deterministic requirements of NFPA 805, Section 4.2.3. This is a separation issue.

This VFDR has been evaluated and it was determined that the risk, safety margin and defense-in-depth meet the acceptance criteria of NFPA 805 Section 4.2.4 with no further action required.

**3.3.1.4 VFDR No. AA37-004**

1-ICM-250-P, 1-ICM-251-P, 1-IMO-255-P and 1-IMO-256-P - BIT Inlet and Outlet Valves are required to be closed to support CVCS. CVCS is required to be operable to maintain inventory, pressure and reactivity control. 1-ICM-250-P and 1-ICM-251-P or 1-IMO-255-P and 1-IMO-256-P are required to be closed for CVCS. These valves are normally closed. 1-ICM-250-P may fail due to a spurious SI signal and cables 8173G-1, 8174G-1 and 8175G-1. 1-ICM-251-P may fail due to a spurious SI signal and cables 8173R-1, 8174R-1 and 8175R-1. 1-IMO-255-P may fail due to a spurious SI signal and cables 8176G-1, 8177G-1 and 8178G-1. 1-IMO-256-P may fail due to a spurious SI signal and cables 8176R-1, 8177R-1 and 8178R-1. The cable failures for each of the valves cannot cause spurious operation and are only required to reposition the valve after spurious operation due to the SI signal. The spurious SI signal is caused by the failure of cables 9074O-1, 9075O-1, 9051Y-1, 8733PO-1, 9600PY-1, 9050Y-1, 9068O-1 and 9069O-1. This condition represents a variance from deterministic requirements of NFPA 805, Section 4.2.3. This is a separation issue.

This VFDR has been evaluated and it was determined that the risk, safety margin and defense-in-depth meet the acceptance criteria of NFPA 805 Section 4.2.4 with no further action required.

**3.3.1.5 VFDR No. AA37-005**

1-QRV-251 - The Charging Flow Control Valve is required to be open to support CVCS. CVCS is required to be operable to maintain inventory, pressure and reactivity control. Loss of 1-QRV-251 will fail Unit 1 seal injection charging. 1-QRV-251 may fail due to fire induced damage of cable 6116-1. This cable failure could spuriously close the valve. This condition represents a variance from deterministic requirements of NFPA 805, Section 4.2.3. This is a separation issue.

This VFDR has been evaluated and it was determined that the risk, safety margin and defense-in-depth meet the acceptance criteria of NFPA 805 Section 4.2.4 with no further action required.

**3.3.1.6 VFDR No. AA37-006**

1-DCR-320 and 1-DCR-330 - SG 2 & 3 Blowdown Isolation Valves are required to be closed to support main steam isolation. Main steam isolation is required to prevent uncontrolled cooldown through over-steaming. SG 2 & 3 Blowdown Isolation Valves may fail due to a full area fire within Fire Area AA37. 1-DCR-320 may fail due to fire induced damage of cable 8682R-1. 1-DCR-330 may fail due to fire induced damage of cable 8686R-1. These cable failures could spuriously open the valves. SGs 2 and 3 are credited for decay heat removal for a fire within Fire Area AA37. This condition represents a variance from the deterministic requirements of NFPA 805, Section 4.2.3. This is a separation issue.

This VFDR has been evaluated and it was determined that the risk, safety margin and defense-in-depth meet the acceptance criteria of NFPA 805 Section 4.2.4 with a defense-in-depth action credited.

**3.3.1.7 VFDR No. AA37-007**

1-NRV-151 and 1-NRV-152 - Pressurizer PORVs are required to be closed to support RCS integrity. RCS integrity is required to maintain positive control over RCS inventory and pressure. 1-NRV-151 may fail due to fire induced damage of cable 9705PR-1. 1-NRV-152 may fail due to fire induced damage of cable 9706PR-1. Failure of these cables could spuriously open the valves. This condition represents a variance from the deterministic requirements of NFPA 805, Section 4.2.3. This is a separation issue.

This VFDR has been evaluated and it was determined that the risk, safety margin and defense-in-depth meet the acceptance criteria of NFPA 805 Section 4.2.4 with a defense-in-depth action credited.

**3.3.1.8 VFDR No. AA37-008**

1-NSO-023 and 1-NSO-024 - RX Head Vent Valves are required to be closed to support RCS Integrity. RCS integrity is required to maintain positive control over RCS inventory and pressure. 1-NSO-023 and 1-NSO-024 are in series requiring one of the valves to remain closed to provide RCS integrity. 1-NSO-023 may fail due to cable 9914PR-1. 1-NSO-024 may fail due to fire induce damage of cable 9920PR-1. Failure of these cables could spuriously open the valves. This condition represents a variance from the deterministic requirements of NFPA 805, Section 4.2.3. This is a separation issue.

This VFDR has been evaluated and it was determined that the risk, safety margin and defense-in-depth meet the acceptance criteria of NFPA 805 Section 4.2.4 with a defense-in-depth action credited.

**3.3.1.9 VFDR No. AA37-009**

1-NSO-063 and 1-NSO-064 - Post Accident Vent Valves are required to be closed to support RCS integrity. RCS integrity is required to maintain positive control over RCS inventory and pressure. 1-NSO-063 and 1-NSO-064 are in series requiring one of the valves to remain closed to provide RCS integrity. 1-NSO-063 may fail due to fire induced damage of cable 9901PR-1. 1-NSO-064 may fail due to fire induced damage of cable 9907PR-1. Failure of these cables could spuriously open the valves. This condition represents a variance from the deterministic requirements of NFPA 805, Section 4.2.3. This is a separation issue.

This VFDR has been evaluated and it was determined that the risk, safety margin and defense-in-depth meet the acceptance criteria of NFPA 805 Section 4.2.4 with a defense-in-depth action credited.

**3.3.1.10 VFDR No. AA37-010**

1-QRV-10 and 1-QRV-40 - RCP Seal Water Return Isolation Valves are required to be open to support RCS integrity by maintaining the RCP seal. RCS integrity is required to maintain positive control over RCS inventory and pressure. 1-QRV-10 may fail due to fire induced damage of cable 4418PR-1. 1-QRV-40 may fail due to fire induced damage of cable 5002PR-1. These cables could cause spurious closure of these valves. This condition represents a variance from the deterministic requirements of NFPA 805, Section 4.2.3. This is a separation issue.

This VFDR has been evaluated and it was determined that the risk, safety margin and defense-in-depth meet the acceptance criteria of NFPA 805 Section 4.2.4 with a defense-in-depth action credited.

**3.3.2 Recovery Actions Credited**

For each VFDR, a Fire Risk Evaluation has been performed to assess the acceptability of risk, defense-in-depth, and safety margin. This evaluation determined whether or not recovery actions are required to ensure that one success path necessary to achieve and maintain the nuclear safety performance criteria is maintained free of fire damage by a single fire. Table 3-3 identifies the credited recovery actions for this area. Actions retained for DID are identified as “DID Actions” within Table 3-3. Additional information for DID actions is contained within Section 3.8 of this report. Note that, for completeness, all VFDRs are contained within Table 3-3, even if the Fire Risk Evaluation has determined that a recovery action is not required. In those instances where a recovery action has been determined to not be required, the word “None” is provided in the “Action” column in the table.

<b>Table 3-3, Recovery Actions Credited</b>		
<b>VFDR</b>	<b>Component</b>	<b>Action</b>
AA37-001	1-CLI-113 1-CLI-114	DID ACTION 1-CLI-113-LOCAL (Locally monitor CST level)
AA37-002	1-MRV-223-P 1-MRV-233-P	DID ACTION 1-MRV-223-P-CLOSE (Manually vent air to close 1-MRV-223)  1-MRV-233-P-CLOSE (Manually vent air to close 1-MRV-233)
AA37-003	1-ILS-950	None
AA37-004	1-ICM-250	None
AA37-005	1-QRV-251	None
AA37-006	1-DCR-320 1-DCR-330	DID ACTION(S) 1-DCR-320-CLOSE 1-DCR-330-CLOSE (Remove fuses in MCR to fail closed AOVs 1-DCR-320 and 1-DCR-330).

Table 3-3, Recovery Actions Credited		
VFDR	Component	Action
AA37-007	1-NRV-151 1-NRV-152	DID ACTION(S) 1-NRV-151-CLOSE 1-NRV-152-CLOSE (Remove fuses in MCR to fail closed PORVs 1-NRV-151 and 1-NRV-152).
AA37-008	1-NSO-023	DID ACTION(S) 1-NSO-023-CLOSE (Remove fuses in MCR to fail closed AOV 1-NSO-023).
AA37-009	1-NSO-063	DID ACTION(S) 1-NSO-063-CLOSE (Removes fuses in MCR to fail closed AOV 1-NSO-063).
AA37-010	1-QRV-10 1-QRV-40	DID ACTION(S) 1-QRV-10-OPEN 1-QRV-40-OPEN (Remove fuses in MCR to fail open AOVs 1-QRV-10 and 1-QRV-40).

### 3.4 Non-Power Operational Modes Compliance Summary

A review of CNP for the potential effects of a fire in this Fire Area while in non-power modes of operation (NPO) was conducted. This review was conducted using the guidance provided in NEI 04-02 and FAQ 07-0040, "Non-Power Operations Clarifications".

The review determined that there are potential failures that affect certain Key Safety Functions (KSF) as a result of the fire in this area, and the fire could result in the loss of one or more KSF paths. Compensatory measures are required during high risk evolution periods to provide reasonable assurance a fire will not adversely affect key safety functions and the NFPA 805 performance goal for NPO is therefore satisfied. The results of the NPO analysis are contained within Technical Evaluation R1900-005-001, Non-Power Operation Modes Transition Review Report.

### 3.5 Radioactive Release Compliance Summary

The NFPA 805 radiological release goal is to provide reasonable assurance that a fire will not result in a radiological release that adversely affects the public, plant personnel or the environment. The NFPA 805 requirement is to ensure a radiation release to any unrestricted area due to the direct effects of fire suppression activities (but not involving fuel damage) shall be as low as reasonably achievable and shall not exceed applicable plant Technical Specification limits.

AA37 is within the Radiological Controlled Area (RCA) and has been identified as a potential fire area for radioactive release due to fire fighting activities. In accordance with NFPA 805 FAQ 09-0056, this potential has been reviewed to ensure that engineering controls, fire pre-plans, and fire brigade training materials are provided for containment and monitoring of gaseous and liquid effluents associated with fire suppression agents and products of combustion.

The review concludes that the steps to limit radiation release to other areas due to the direct effects of fire suppression activities, in addition to compliance with NFPA 805, Chapter 4, ensure that any radioactive release will be as low as reasonably achievable and will not exceed limits designated in the CNP Technical Specifications.

The review of this fire area, with respect to radioactive release, is documented in the NFPPM.

### 3.6 Probabilistic Risk Assessment-Summary of Results

A Fire PRA (FPRA) quantification of Fire Area AA37 was performed and is documented in PRA-NB-FIRE-FQ, Fire PRA Model Quantification Notebook. The fire risk quantification for Fire Area AA37 is analyzed using detailed fire modeling to consider risk of fire scenarios of ignition sources. PRA-NB-FIRE-FQ includes a summary of all potentially risk-significant fire scenarios (i.e., CDF > 1.0E-7 or LERF > 1.0E-8). Bounding CDF / LERF per calendar year values are reported that are based on the risk values documented in PRA-NB-FIRE-FSS, Fire PRA Fire Scenario Selection.

Fire Protection features credited in the Fire PRA are documented in R1900-0411-AA37, Detailed Fire Modeling Report: Fire Compartment: AA37 Unit 1 Quadrant 2 Cable Tunnel (EL. 612 FT). PRA-NB-FIRE-FSS documents the revision level of the fire modeling reports used in the most recent Fire PRA quantification.

### 3.7 Risk-Informed, Performance-Based Evaluations

Fire Risk Evaluations (FREs) have been performed to ensure that variances from the NFPA 805 deterministic requirements are acceptable. The evaluation process consists of an integrated assessment of the acceptability of risk, defense-in-depth, and safety margins.

#### 3.7.1 Transition Risk-Informed, Performance-Based Evaluations

The 'changes' associated with NFPA 805 transition were those variances from the deterministic requirements of NFPA 805 or with the existing fire protection licensing basis that were brought into compliance with the NFPA 805 performance based approach. The change identified for evaluation for Fire Area AA37 is as follows:

- Separation Issues

The Fire Risk Evaluation has determined that the change is acceptable based upon:

- The measured change in CDF and LERF.
- Adequate defense-in-depth and safety margins being maintained.

Refer to Attachment 2 for a summary of results associated with the Fire Risk Evaluations.

### 3.8 Defense-in-Depth

A comprehensive risk-informed, performance-based analysis includes consideration of defense-in-depth (DID) as part of an integrated evaluation of risk considerations. In general, defense-in-depth involves consideration of the extent to which fire protection systems and features are provided within the three echelons of fire-protection:

- Preventing fires from starting,
- Rapidly detecting fires and controlling and extinguishing promptly those fires that do occur, thereby limiting fire damage,
- Providing an adequate level of fire protection for structures, systems, and components important to safety, so that a fire that is not promptly extinguished will not prevent the nuclear safety performance criteria from being met.

Each VFDR was evaluated for DID. The following VFDR manual actions have been retained for DID.

VFDR No. AA37-001: 1-CLI-113 and 1-CLI-114 - CST Control Room level indication is required to be operable to support AFW for decay heat removal. Decay heat removal is required to remove sufficient heat from the reactor core such that the fuel is maintained in a safe and stable condition. The CST level indicators provide Control Room indication of the initial water source for AFW. All of the Control Room CST level indicators may fail due to a full area fire within Fire Area AA37. Loss of CST indication can be mitigated by locally monitoring the CST level. This recovery action is being retained for DID to ensure CST level indication is maintained.

VFDR No. AA37-002: 1-MRV-223-P and 1-MRV-233-P - SG 2 and 3 PORVs are required to be closed to support main steam isolation. Main steam isolation provides integrity of the secondary side of the SGs to prevent uncontrolled cooldown through over-steaming. SG 2 and 3 PORVs could spuriously open due cable failures cause by a full area fire within Fire Area AA37. These failures can be mitigated by locally venting air to close to the SG 2 and 3 PORVs. This manual action is being retained for DID to ensure main steam isolation is maintained.

VFDR No. AA37-003: 1-ILS-950 and 1-ILS-951 - RWST level indication is required to support CVCS. CVCS is required to be operable to maintain inventory, pressure and reactivity control. The RWST is the primary credit borated water source for CVCS. The RWST level indicators may fail due to a full area fire within Fire Area AA37. Loss of RWST indication can be mitigated by locally monitoring the RWST level. This recovery action is being retained for DID to ensure RWST level indication is maintained.

VFDR No. AA37-006: 1-DCR-320 and 1-DCR-330 - SG 2 & 3 Blowdown Isolation Valves are required to be closed to support main steam isolation. Main steam isolation is required to prevent uncontrolled cooldown through over-steaming. SG 2 & 3 Blowdown Isolation Valves may fail due to a full area fire within Fire Area AA37. Loss of Main Steam isolation can be mitigated by removing fuses to ensure valves fail shut. This recovery action is being retained for DID to ensure Main Steam isolation is maintained.

VFDR No. AA37-007: 1-NRV-151 and 1-NRV-152 - Pressurizer PORVs are required to be closed to support RCS integrity. RCS integrity is required to maintain positive control over RCS inventory and pressure. The spurious opening can be mitigated by de-energizing the valve to fail it closed. This recovery action is being retained for DID to ensure RCS pressure and inventory control is maintained.



VFDR No. AA37-008:

Based on the assessment in support of the Fire Risk Evaluation, defense-in-depth is maintained for fire area AA37. Refer to Attachment 2 for details associated with the Fire Risk Evaluation.

### 3.9 Monitoring Program Input

A Monitoring Program will be developed in accordance with FAQ 10-0059, Rev. 1. Methods to monitor availability, reliability, and performance of fire protection program structures, systems, and components (SSCs), as well as programmatic elements will be provided. Additionally, effectiveness measures are established to review program related performance and trends. For AA37 the following systems and features are candidates for inclusion in the CNP Fire Protection Monitoring Program:

- Fire Area boundary barriers discussed in Section 3.1
- Fire Detection System (infrared and ionization)
- Manual CO2 Suppression System

### 4.0 CONCLUSION

The nuclear safety and radioactive release performance criteria of NFPA 805 are met for a fire in Fire Area AA37. This Fire Risk Evaluation for Fire Area AA37 has demonstrated that

- The change in core damage frequency (delta CDF) is acceptable, and
- The change in large early release frequency (delta LERF) is acceptable, and
- Defense-in-depth and safety margins are maintained.

This is confirmation that a success path effectively remains free of fire damage and that the performance-based approach is acceptable per Section 4.2.4.2 of NFPA 805.



## **5.0 REFERENCES**

- 5.1 Calculation PRA-FIRE-NB-CRE, Fire PRA Cumulative Risk Evaluations
- 5.2 CNP Fire Pre-Plans, Volumes I, II, and III, Revisions 17, 14, and 18 respectively
- 5.3 Fire Hazards Analysis
- 5.4 NFPA 805, Performance-Based Standard for Fire Protection for Light Water Reactor Electric Generating Plants
- 5.5 NFPPM, NFPA 805 Fire Protection Program Manual (NFPPM)
- 5.6 Nuclear Energy Institute (NEI) 04-02, Guidance for Implementing a Risk-Informed, Performance-Based Fire Protection Program under 10 CFR 50.48(c), Rev. 2
- 5.7 Nuclear Safety Capability Assessment Report
- 5.8 PRA-NB-FIRE-FQ, Fire PRA Model Quantification Notebook
- 5.9 PRA-NB-FIRE-FSS, Fire PRA Fire Scenario Selection
- 5.10 R1900-0411-AA37, AA37 - Detailed Fire Modeling Report
- 5.11 Regulatory Guide 1.205, Risk-Informed, Performance-Based Fire Protection for Existing Light-Water Nuclear Power Plants, Rev. Revision 1
- 5.12 Technical Evaluation R1900-005-001, Non-Power Operation Modes Transition Review

**Fire Area AA37 – Attachment 1 - Table B-3 - Fire Area Transition**

<u>Unit</u>	<u>Fire Area</u>	<u>Description</u>
1	AA37	Unit 1 Quadrant 2 Cable Tunnel (El. 612 ft.)

<u>Fire Zone</u>	<u>Description</u>
38	Quadrant 2 Penetration Cable Tunnel - El. 612 ft. 0 in. - Unit 1

**Regulatory Basis**

4.2.4.2 - Performance-Based Approach - Fire Risk Evaluation with simplifying deterministic assumptions

<b>Performance Goal</b>	<b>Method of Accomplishment</b>	<b>Comments</b>
Reactivity Control	Unit 1 - Trip the reactor from the Control Room. Borate using Unit 1 East or West Charging Pumps supplied from the RWST. Use source range monitoring for indication for Unit 1.	None
Inventory and Pressure Control	Unit 1 - Control inventory using Unit 1 East or West Charging Pump. Control pressure using Unit 1 Pressurizer Safety Relief Valves.	VFDRs identified for RWST level indication, BIT isolation valves, charging flow control valve, RX Head Vent, Post Accident Vent and RCP seals.
Decay Heat Removal	Unit 1 - Feed SGs 2 & 3 with Unit 1 East MDAFW Pump. The DHR function also requires MS isolation with a steam release path through the Safety Relief Valves.	VFDRs identified for CST level indication and MS isolation.
Process Monitoring	Unit 1 Process Monitoring - Use Unit 1 process monitoring in the Control Room for the following: Pressurizer level, RCS pressure and temperature, and S/G level and Pressure. Unit 1 Source Range Monitoring - Use Unit 1 source range monitoring in the Control Room.	None
Vital Auxiliaries	Unit 1 Electrical - Control Unit 1 Red (AB) Train Electrical Distribution with Unit 1 Red (AB) Train Offsite Power or Unit 1 Red (AB) DG. Control Unit 1 Green (CD) Train Electrical Distribution with Unit 1 Green (CD) Train Offsite Power or Unit 1 Green (CD) DG. Unit 1 ESW - Operate Unit 1 East or West ESW. Unit 1 CCW - Operate Unit 1 East or West CCW. Unit 1 HVAC - Operate Unit 1 Control Room HVAC. Operate Unit 1 Auxiliary Building HVAC. Operate Unit 1 Red (AB) and Green (CD) DG HVAC. Operate Unit 1 Switchgear HVAC. Operate Unit 1 East MDAFW Room	None

**Fire Area AA37 – Attachment 1 - Table B-3 - Fire Area Transition**

<u>Unit</u>	<u>Fire Area</u>	<u>Description</u>
1	AA37	Unit 1 Quadrant 2 Cable Tunnel (El. 612 ft.)
		HVAC system. Operate the Unit 1 East and West ESW Room HVAC systems.

**Reference Documents**

Genesis Solution Suite, EDISON / SAFE-PB, DC Cook V 3.4.0

Nuclear Safety Capability Assessment Report

**Licensing Actions**

None

**Existing Engineering Equivalency Evaluations (EEEE)**

**EEEE Title** Engineering Equivalency Evaluation 11-2 - Unit 1 Reactor Cable Tunnels Quadrant 1 to Quadrant 2 Boundary Evaluation Fire Zone 7 (Fire Area AA37) to Fire Zone 38 (Fire Area AA37)

**Summary** The purpose of this engineering equivalency evaluation is to document the acceptability of the 8 in. thick silicone foam fire seals protecting the penetrations between the Quadrant 1 cable tunnel at elevation 596 ft. in Unit 1, Fire Zone 7 (Fire Area AA7) and the Quadrant 2 cable tunnel at elevation 612 ft. in Unit 1, Fire Zone 38 (Fire Area AA37).

The existing 8 in. silicone foam fire seals located within the penetrations between Fire Zone 7 and Fire Zone 38 are acceptable for maintaining the rating of the fire area boundary. This engineering equivalency evaluation does not impact other engineering equivalency evaluations.

The silicone foam seals were evaluated and found to be acceptable based on the fire hazards and fire protection systems within the evaluated areas.

**Fire Area AA37 – Attachment 1 - Table B-3 - Fire Area Transition**

<u>Unit</u>	<u>Fire Area</u>	<u>Description</u>
1	AA37	Unit 1 Quadrant 2 Cable Tunnel (El. 612 ft.)

<b><u>EEEE Title</u></b>	<b>Engineering Equivalency Evaluation 11-9 - Turbine, Auxiliary and Containment Buildings Boundary Evaluation</b>
<b><u>Summary</u></b>	<p>The purpose of this engineering equivalency evaluation is to describe in general, the approach and existence of evaluations performed to determine and reconcile fire area boundaries having components or designs with less than a 3-hr fire rating on preventing the spread of fire. This engineering equivalency evaluation also specifically evaluates the impact of unrated door assemblies on the spread of fire.</p> <p>Reasonable assurance is provided that the fire area boundaries having components or design less than a 3-hr fire rating will not increase the spread of fire or impair the safe shutdown capabilities of Units 1 or 2. In addition, this engineering equivalency evaluation does not adversely impact on other engineering equivalency evaluations or exemption requests.</p> <p>This evaluation supports additional evaluations credited in this fire area.</p>
<b><u>EEEE Title</u></b>	<b>Engineering Equivalency Evaluation 11-14 - Cable Spreading Room Construction Boundary Evaluation (Fire Areas AA3, AA7, AA8, AA9, AA10, AA29, AA30, AA31, AA34, AA35, AA36/42, AA37, AA38, AA48, AA50, AA51 and AA52)</b>
<b><u>Summary</u></b>	<p>The purpose of this engineering equivalency evaluation is to document the acceptability of the construction features of the cable spreading rooms which have a fire resistance rating of less than 3 hours for their impact on the spread. In particular, fire dampers having a 1 1/2-hr fire rating were analyzed by this evaluation. Other unrated construction features have been previously analyzed under separate engineering equivalency evaluations. The applicable fire areas include: AA3, AA7, AA8, AA9, AA10, AA29, AA30, AA31, AA34, AA35, AA36/42, AA37, AA38, AA48, AA50, AA51 and AA52.</p> <p>Reasonable assurance is provided that the construction features of the cable spreading rooms which have a fire resistance rating of less than 3 hours will prevent the spread of fire and not impair the safe shutdown capabilities of Unit 1 and Unit 2. In addition, this engineering equivalency evaluation does not adversely impact other engineering equivalency evaluations.</p> <p>The construction features of the cable spreading room were evaluated and found to be acceptable based on the fire hazards, fire protection systems and construction features within the areas.</p>

**Fire Area AA37 – Attachment 1 - Table B-3 - Fire Area Transition**

<u>Unit</u>	<u>Fire Area</u>	<u>Description</u>
1	AA37	Unit 1 Quadrant 2 Cable Tunnel (El. 612 ft.)

<b><u>EEEE Title</u></b>	<b>Engineering Equivalency Evaluation 11-24 - Fire Retention Capability of Nonconforming Fire Seals in Fire Zones having a Low Combustible Loading Classification</b>
<b><u>Summary</u></b>	<p>The purpose of this engineering equivalency evaluation is to document the acceptability of fire seal designs which do not meet the requirements of the installation specification or fire test data in fire zones having a low combustible loading classification would have on preventing the spread of fire.</p> <p>Reasonable assurance is provided that fire seals which do not meet the requirements of the installation specification or fire test data in fire zones having a low combustible loading classification, will provide adequate fire retention capabilities and will not impair the safe shutdown capabilities of CNP or increase the spread of fire between fire zones. In addition, this engineering equivalency evaluation does not adversely impact other engineering equivalency evaluations or exemptions.</p> <p>Refer to Engineering Equivalency Evaluation 11.33.</p>
<b><u>EEEE Title</u></b>	<b>Engineering Equivalency Evaluation 11-33 - Generic Fire Seal Design 7 (Fire Areas AA7 and AA37)</b>
<b><u>Summary</u></b>	<p>The purpose of this engineering equivalency evaluation is to document the acceptability of deviations to Generic Fire Seal Design 7 (in Fire Areas AA7 and AA37) on preventing the spread of fire.</p> <p>Reasonable assurance is provided that deviations to Generic Fire Seal Design 7, Fire Seal W9077, and the attributes discussed in this engineering equivalency evaluation will not impair the safe shutdown capabilities of CNP or increase the spread of fire between fire zones. This engineering equivalency evaluation does not impact other engineering equivalency evaluations.</p> <p>Generic Fire Seal Design 7 deviations from Attribute Numbers 2, 7, 9 and Fire Seal W9077 were evaluated and found to be acceptable based on the fire hazards and construction features within the evaluated areas.</p>

**Fire Area AA37 – Attachment 1 - Table B-3 - Fire Area Transition**

<u>Unit</u>	<u>Fire Area</u>	<u>Description</u>
1	AA37	Unit 1 Quadrant 2 Cable Tunnel (El. 612 ft.)
<hr/>		
<b><u>EEEE Title</u></b>	<b>Engineering Equivalency Evaluation 11-46 - Seismic Gaps between the Containment and Auxiliary Buildings Boundary Evaluation (Fire Areas AA2, AA3, AA7, AA8, AA9, AA10, AA11, AA27, AA29, AA30, AA31, AA34, AA35, AA37 and AA38)</b>	
<b><u>Summary</u></b>	<p>A seismic gap exists around the Containment Building of each unit that provides an opening of approximately 6 in. between the Containment Building and the walls, ceilings and floors of the structures immediately adjacent to containment. These Fire Areas include AA2, AA3, AA7, AA8, AA9, AA10, AA11, AA27, AA29, AA30, AA31, AA34, AA35, AA37 and AA38. This engineering equivalency evaluation has been performed to document the acceptability of these seismic gaps in the fire boundaries.</p> <p>This seismic gap evaluation shows the safe shutdown capability for CNP Unit 1 and Unit 2 has not been compromised as a result of seismic gaps. The analysis performed and the results presented in the tables indicate, on a system basis, the capability to safely shut down both units when considering fire damage to safe shutdown components and circuits contained in the seismic gap evaluation areas. The method of analysis is conservative when considering the fire hazards involved in the vicinity of the seismic gaps. That is, it is not anticipated that the evaluated areas would be affected to the extent that fire would propagate through the seismic gaps and cause damage throughout the evaluated area. This engineering equivalency evaluation has no impact on the exemption requests contained in other engineering equivalency evaluations.</p> <p>The seismic gaps were evaluated and found to be acceptable based on the fire hazards, fire protection systems and construction features within the evaluated areas.</p>	
<b><u>EEEE Title</u></b>	<b>Engineering Equivalency Evaluation 12-19 - CO2 Fire Suppression System Concentrations (Fire Areas AA7, AA8, AA9, AA10, AA29, AA30, AA31, AA37, AA38, AA39, AA40, AA41, AA43, AA44, AA45, AA48, AA49, AA50, AA51, AA52 and AA53)</b>	
<b><u>Summary</u></b>	<p>The purpose of this engineering equivalency evaluation is to document the acceptability of the CO2 fire suppression systems in fire zones containing concentrations of cable insulation and the potential for deep-seated fires. This engineering equivalency evaluation determines the CO2 system's impact on the spread of fire and previous engineering equivalency evaluations and exemption requests. Although there are other fire zones that use CO2 for fire suppression such as the DG Rooms, they are installed to suppress surface-type, combustible liquid fires and are not included in this analysis, because they do not contain significant concentrations of cable insulation capable of producing deep-seated fires.</p> <p>All of the CO2 systems included in this engineering equivalency evaluation are capable of performing their intended function, containing the fire until the Fire Brigade arrives, preventing fire spread to adjacent fire zones, and ensuring that safe shutdown of CNP can be achieved and maintained.</p> <p>The existing suppression systems were evaluated and found to be acceptable based on the fire hazards and fire protection systems within the evaluated areas.</p>	

**Fire Area AA37 – Attachment 1 - Table B-3 - Fire Area Transition**

<u>Unit</u>	<u>Fire Area</u>	<u>Description</u>
1	AA37	Unit 1 Quadrant 2 Cable Tunnel (El. 612 ft.)

**Fire Suppression Effects on Nuclear Safety Performance Criteria**

The CNP fire brigade is trained to discharge water in a judicious manner and instructed to direct hose streams and portable extinguishers at the base of the fire to limit the amount of overspray beyond the immediate fire zone. For this reason, fire brigade activities are not expected to fail components not already considered damaged by fire. It has been concluded that water impingement on cables is not a concern. Electrical cabinets are provided with a seal at the conduit interface. Per visual inspection any side vents for this equipment are pointed downward to prevent water intrusion. The drainage features of the fire area mitigate the potential for flooding damage due to fire suppression, such that the standing water would not affect credited equipment.

In the event of discharge, the CO2 system will not adversely affect the equipment operating within the fire area. Potential condensation developing on electrical components is a long term issue that would be eliminated by ventilating the fire area after actuation. Per visual inspection, all CO2 nozzles are located greater than 5 ft. away from any credited equipment and therefore, the possibility of thermal shock due to CO2 actuation has been deemed to be a non-issue in this fire area in accordance to EPRI NP-7253 "Effects of Fire Suppressants on Electrical Components in Nuclear Power Plants". Since it is shown that suppression effects will not impact the nuclear safety performance criteria, the fire area configuration is deemed acceptable.

**References:**

Technical Evaluation 12.1, "Fire Suppression Effects Study"

Technical Evaluation 12.1, "Supplemental Information to Fire Suppression Effects Study – Supplement 1"

**Fire Area Comments**

Revised AA37-003 to no action required due to risk insignificance per AR 2016-5739.

Revised AA37-004 to no action required per AR 2016-3121.

## Fire Area AA37 – Attachment 2 - Fire Risk Evaluation Results Summary

### A2.1 Introduction

The ‘changes’ associated with NFPA 805 transition were those variances from the deterministic requirements of NFPA 805. The changes identified for evaluation for fire area AA37 are grouped as follows:

- Separation Issues

This attachment is a summary of the Fire Risk Evaluation for the fire area. The complete results and methodology are contained in the Cumulative Fire Risk Evaluation, PRA-FIRE-NB-CRE. (FPCE 2017-0009)

### A2.2 Inputs/Assumptions

Fire modeling processes and inputs provided in NUREG/CR-6850 are appropriate for use in a risk-informed, performance-based evaluation. The complete list of assumptions used in the fire modeling methodology for this fire area is contained in Detailed Fire Modeling Technical Evaluation R1900-0411-AA37.

### A2.3 Fire Modeling Methodology

Fire PRA fire modeling results are used as the initial input into this Fire Risk Evaluation. The process consists of conservative bounding analyses using NUREG/CR-6850 methods. As needed, refinements are made to utilize more realistic parameters. The complete fire modeling methodology for this fire area is contained in Detailed Fire Modeling Technical Evaluation R1900-0411-AA37.

### A2.4 Scenario Descriptions and Model Results

Fire Area AA37 was evaluated for the impact of fires originating from both fixed and transient ignition sources. Complete descriptions of each fire scenario is contained within the Detailed Fire Modeling Technical Evaluation R1900-0411-AA37.

#### A2.4.1 Ignition Sources

Fire Area AA37 contains the heat trace panels and boric acid heat trace transformers as well as various other alarm panels. Per discussion with plant personnel, the heat release rates for all switchgear, load centers, and MCC electrical cabinets have been characterized as qualified cable because items of this nature are generally constructed on-site. For other electrical cabinet types, where the internal cable qualification was unknown, the heat release rates have been assumed as non-qualified. Ignition sources in Fire Area AA37 were modeled using the 98th percentile fire as a screening approach. These scenarios were not risk significant enough to require further refinement.

In Fire Area AA37, the 98th percentile HRR was used for all transient fires. The 98th percentile HRR bounds the possible transient ignition sources expected for this fire area, which were fire tested and identified in NUREG/CR-6850, Appendix G, Table G-7.

#### A2.4.2 Scenario Results

A delta risk calculation has been performed to quantify the risk associated with the VFDRs in the fire area.

### A2.5 Fire Risk Evaluation Results

PRA-FIRE-NB-CRE documents scenarios and corresponding impacted VFDRs that were evaluated for



### **Fire Area AA37 – Attachment 2 - Fire Risk Evaluation Results Summary**

delta risk during the transition to NFPA 805 and also all changes to the Fire Protection Program that are currently incorporated into the Fire PRA model. The acceptability of the Cumulative Fire Risk Evaluations was based on calculated delta risk meeting the thresholds of NEI 04-02, RG 1.205 and RG 1.174. (FPCE 2017-0009)

## Fire Area AA37 – Attachment 2 - Fire Risk Evaluation Results Summary

### A-2.6 Impact of VFDR on Defense-in-Depth

Defense-in-Depth has been evaluated for this fire area. The impacts of this evaluation are summarized in the table below:

Defense-in-Depth Impact Review for AA37			
Method of Providing DID	Required to Support Deterministic Analysis or Fire PRA?	Changes or Improvements Necessary for DID?	Basis/Justification
Echelon 1: Prevent fires from starting			
Combustible Control is implemented in accordance with Procedure PMP-2270-CCM-001, Control of Combustible Materials.	Yes	No	• This element is adequate based on no perceived weakness of, or over-reliance on, another echelon of defense-in-depth.
Hot Work Control is implemented in accordance with Procedure PMP-2270-WBG-001, Welding, Burning and Grinding Activities.	Yes	No	
Echelon 2: Rapidly detect, control and extinguish promptly those fires that do occur thereby limiting fire damage			
Fire Detection System	Yes	No	• Suppression and detection are already required and fire fighting activities are not expected to be challenging; therefore, no changes or improvements to Echelon 2 attributes are necessary to maintain defense-in-depth.
Fixed Fire Suppression	Yes	No	
Portable Fire Extinguishers	Yes	No	
Hose stations and hydrants	Yes	No	
Pre-Fire Plan	Yes	No	
Echelon 3: Provide adequate level of fire protection for systems and structures so that a fire will not prevent essential safety functions from being performed			
Walls, floors ceilings and structural elements are rated or have been evaluated as adequate for the hazard.	Yes	No	• Although VFDRs AA37-001, AA37-002 and AA37-003 are not considered a significant contribution to core damage frequency, the variances are considered important enough to the NSCA to retain as recovery actions to ensure that defense-in-depth is maintained.
Penetrations in the fire area barrier are rated or have been evaluated as adequate for the hazard.	Yes	No	
Supplemental barriers (e.g., ERFBS, cable tray covers, etc.)	No	No	• Since VFDRAA37-005 is never affected in a potentially risk significant fire scenario, internal fire area separation is adequate and no changes or improvements to Echelon 3 attributes are necessary to maintain defense-in-depth.
Guidance provided to operations personnel detailing the required success path(s) including recovery actions to achieve nuclear safety performance criteria.	Yes	Yes	
• Defense in Depth actions were credited to remove fuses or open breakers in the Control Room to spurious equipment operation due to internal shorts.			

## Fire Area AA37 – Attachment 2 - Fire Risk Evaluation Results Summary

### A-2.7 Safety Margin Considerations

In accordance with NEI 04-02, the maintenance of adequate Safety Margin is assessed by the consideration categories of analyses utilized by this Fire Risk Evaluation.

Safety margins are considered to be maintained if:

- Codes and Standards or their alternatives accepted for use by the NRC are met.

AND

- Safety analyses acceptance criteria in the licensing basis (e.g., FSAR, supporting analyses) are met, or provides sufficient margin to account for analysis and data uncertainty.

The following summarizes the bases for ensuring the maintenance of safety margins:

- The risk-informed, performance based processes utilized are based upon NFPA 805, 2001 edition, endorsed by the NRC in 10 CFR 50.48(c).
- The Fire Risk Evaluation process is in accordance with NEI 04-02, Revision 2, which is endorsed by the NRC in Regulatory Guide 1.205, Revision 1.
- The Fire PRA is developed in accordance with NUREG/CR-6850, which was developed jointly between the NRC and EPRI.
- The Fire PRA has undergone an industry peer review, in order to ensure the Fire PRA meets the appropriate quality standards of ASME/ANS RA-Sa-2009, "Standard for Level 1/Large Early Release Frequency Probabilistic Risk Assessment for Nuclear Power Plant Applications," Dated February 2, 2009
- The "combined analysis approach" is used during transition (NEI 04-02, Section 5.3.4.3); therefore, MEFS/LFS is not analyzed separately from the Fire PRA results.
- The CNP internal events PRA model received two formal industry peer reviews conducted in accordance with applicable NEI guidelines. The initial peer review was performed in 2001, while a subsequent focused scope (i.e., limited scope) peer review was conducted in 2009. The initial, full-scope WOG peer review covered all aspects of the CNP PRA model and the administrative processes used to maintain and update the model. The CNP PRA model has been revised to address all significant issues (i.e., Category A and B Facts & Observations) identified during the initial peer review. None of the findings from the focused-scope peer review were judged to reach the significance level of a Category A or B Fact & Observation; as a result, no changes to the PRA model have yet been made to include resolutions for these latter issues.
- Fire protection systems and features determined to be required by NFPA 805 Chapter 4 have been confirmed to meet the requirements of NFPA 805 Chapter 3 and their associated referenced codes and listings, or provided with acceptable alternatives using processes accepted for use by the NRC (i.e., FAQ 06-0008, FAQ 06-0004, 07-0033).
- Fire modeling performed in support of the transition has been performed within the Fire PRA utilizing codes and standards developed by industry and NRC staff which have been verified and validated in authoritative publications, such as NUREG 1824, "Verification and Validation of Selected Fire Models for Nuclear Power Plant Applications". In general, the fire modeling performed in support of the Fire Risk Evaluations has been performed using conservative methods and input parameters that are based upon

## Fire Area AA37 – Attachment 2 - Fire Risk Evaluation Results Summary

NUREG/CR-6850 as documented in the AA37 Detailed Fire Modeling Report, section 7.2. While this is generally not ideal in the context of best estimate probabilistic risk analysis, it is a pragmatic approach given the current state of knowledge regarding the uncertainties related to the application of the fire modeling tools and associated input parameters for specific plant configurations.

- In accordance with the requirements of 10 CFR 50.48(c)(2)(iii), the Fire PRA results, including cutsets for the scenarios of concern, have been reviewed and it was verified that the results presented above do not rely solely on feed and bleed as the fire-protected safe shutdown path for maintaining reactor coolant inventory, pressure control, and decay heat removal capability for this fire area.

### A-2.8 Transition Risk Evaluation Conclusions

The transition change evaluation determined that these changes:

- Are acceptable based upon the measured change in CDF and LERF
- Maintained adequate defense-in-depth and safety margins

The results of this evaluation meet the requirements of NFPA 805 Risk Evaluation; therefore, the use of the performance based analysis approach is acceptable.



## 1.0 PURPOSE

This report documents the Fire Safety Analysis (FSA) for Cook Nuclear Plant (CNP) Fire Area AA38, Unit 2 Quadrant 2 Cable Tunnel (El. 612 ft.) which comprises fire zone(s) 39. The purpose of this analysis is to demonstrate the achievement of the nuclear safety and radioactive release performance criteria of NFPA 805 as required by 10 CFR 50.48(c). The Fire Safety Analysis is a key part of compliance with Section 2.7.1.2 Fire Protection Program Design Basis Document of NFPA 805. This analysis also documents results of risk-informed, performance-based Fire Risk Evaluations (FREs). These evaluations are associated with Variances from Deterministic Requirements (VFDRs) of NFPA 805 Chapter 4.

## 2.0 ANALYSIS METHODOLOGY

The FSA is the design basis document as described in NFPA 805 Section 2.7.1.2. The following steps are performed to develop the FSA on a fire area basis:

- Identify significant fire hazards in the fire area. This is based on NFPA 805 approach to analyze the plant from an ignition source and fuel package perspective.
- Summarize Nuclear Safety Capability Analysis (NSCA) compliance strategies. This is the result of the NEI 04-02 B-3 Table review of the Safe Shutdown Analysis.
- Summarize Non-Power Operations Modes compliance strategies.
- Summarize Radioactive Release compliance strategies. The transition review process required per NEI 04-02 is used to develop these results.
- Provide Fire Probabilistic Risk Assessment summary of results. This is based on the results from the plant Fire PRA.
- Perform risk informed, performance based evaluations if needed for the performance based approach.
- Summarize Defense-in-Depth strategy for each fire area.
- Determine key analysis assumptions which are candidates to be included in the NFPA 805 monitoring program.
- Provide conclusions relative to NFPA 805 compliance.

### **3.0 ANALYSIS**

#### **3.1 Classical Fire Protection**

##### **3.1.1 Construction**

Walls, floors and ceilings to adjacent fire areas are reinforced concrete in excess of a 3-hour rating.

A fire area boundary evaluation was performed for the construction features (i.e. fire dampers with only 1-1/2 hour fire ratings) of the cable spreading rooms that have a fire resistance rating of less than 3 hours (Engineering Equivalency Evaluation 11-14.)

Applicable Engineering Equivalency Evaluations are documented in Attachment 1.

##### **3.1.2 Doors and Access Openings**

Fire doors having a 3-hour rating are provided to adjacent Fire Areas AA27, AA31, AA35 and AA36/42 - Fire Zones 22, 27, 34B and 44S, respectively.

##### **3.1.3 Penetrations**

Penetrations in fire barriers between this fire zone and adjacent fire areas are provided with fire seals except as noted below.

A fire area boundary evaluation was performed for the 8-inch thick unrated silicone foam fire seals installed between this fire zone and Fire Area AA30 - Fire Zone 26 (Engineering Equivalency Evaluation 11-3).

A fire area technical evaluation was prepared to evaluate a fire seal design between Fire Zones 27 and 39 (Engineering Equivalency Evaluation 11-31).

Seismic gaps are sealed with a glass fiber reinforced silicone sheeting.

Seismic gap exemption was granted for Fire Zone 39 interface with Fire Areas AA27, AA35 and AA3 - Fire Zones 22, 34B and 50, 69, respectively.

### 3.1.4 Detection

The table below outlines the fire detection system(s) provided in the Fire Area:

Table 3-1, Fire Area AA38 Detection Systems								
Fire Zone	Type of System	Local (L) / Remote (R)	Detection Actuates Suppression?	Required System?				
				S	L	E	R	D
39	Infrared	L/R	N	N	N	Y	Y	N
39	Ionization	L/R	N	N	N	Y	Y	N

**Table 3-1 Legend:**

Table Field: "Required System?"	
S	- Required for Chapter 4 Separation Criteria
L	- Required for NRC Approved Licensing Action
E	- Required for Engineering Equivalency Evaluation
R	- Required for Risk Significance
D	- Required to maintain adequate balance of Defense-in-Depth in a Change Evaluation or Fire Risk Evaluation

Seven cross zoned ionization smoke detectors and four infra-red detectors are provided which alarm in the Unit 2 Control Room.

### 3.1.5 Fixed Suppression

The table below outlines the fixed fire suppression system(s) provided in the Fire Area:

Table 3-2, Fire Area AA38 Suppression Systems							
Fire Zone	Type of System	Full (F) / Partial (P)	Required System?				
			S	L	E	R	D
39	Manual CO2	F	N	N	Y	N	N
Table 3-2 Legend:							
Table Field: "Required System?"							
S	- Required for Chapter 4 Separation Criteria						
L	- Required for NRC Approved Licensing Action						
E	- Required for Engineering Equivalency Evaluation						
R	- Required for Risk Significance						
D	- Required to maintain adequate balance of Defense-in-Depth in a Change Evaluation or Fire Risk Evaluation						

Fire Area AA38 is not provided with automatic fire suppression.

### 3.1.6 Manual Suppression / Response Strategy

A postulated fire will be identified by early detection using ionization type smoke detection or by plant personnel using plant communication system to notify the control room. The automatic detection system alarms in the control room. The Control Room operator will dispatch the fire brigade for initiation of manual fire fighting. A fire in this fire area will be contained by the construction features discussed in Section 3.1.1. Manual suppression is provided by the CNP Fire



Brigade. A low pressure CO2 total flooding system supplied from the 17 ton tank is provided. This system is manually actuated. Operation of this system discharges CO2 into Fire Area AA38.

Fire Zone 39 is equipped with fire extinguishers, one of which is located on the 625 ft. elevation floor slab

Water hose reels are located in adjacent Fire Zones 44S and 34A, and Fire Zone 27 for the 625 ft. elevation Platform.

Fire Area AA38 is equipped with floor drains.

### 3.1.7 Ventilation

A fire in this area will be contained by the fire barriers. Smoke can be removed by venting to the outdoors or to other parts of the Auxiliary Building. The normal building ventilating systems in the Auxiliary Building will then exhaust the smoke via filtered monitored pathways. This fire area is listed as a non-controlled area in the Fire Pre Plans and therefore there is reasonable assurance that products of combustion will not be contaminated.

A fire dampers having a 1 1/2-hour rating is provided to adjacent Fire Area AA35 - Fire Zone 34B. A 3-hour fire damper is located in the wall separating this fire zone from Fire Zone 44S.

### 3.1.8 Other Features

No other fire protection features provided for Fire Area AA38.

## 3.2 Fire Hazards Identification

The fire area contains both ignition sources and combustible fire hazards. The ignition sources consist of the heat trace distribution panels, heat trace transformers and various alarm panels.

Fire Zone 39 contains cable insulation, cellulose, plastics and rubber.

This fire area has a combustible loading classification of low.

## 3.3 NSCA Compliance Summary

Fire Area AA38, Unit 2 Quadrant 2 Cable Tunnel (El. 612'), contains the Unit 2 Boron Injection Tank shutoff motor operated valves as well as Red and Green train cables, conduits and raceways.

Compliance with the nuclear safety performance criteria is achieved using the performance-based approach in accordance with NFPA 805, Section 4.2.4.2.

Safe and stable condition of Unit 2 will be accomplished using Steam Generators 2 and 3 via the Unit 2 East Motor Driven Auxiliary Feedwater Pump, Control Room Process Monitoring, Unit 2 Charging via the West or East Pump, Unit 2 Component Cooling Water via the East or West Pump, Unit 2 Essential Service Water via the East or West Pump. Electrical power is supplied to either Red or Green Trains via offsite power.

The Nuclear Safety Performance Criteria compliance strategy for AA37 is documented within the NSCA Report.

### 3.3.1 Variances

The variances identified for evaluation for this fire area are grouped as follows:

#### 3.3.1.1 VFDR No. AA38-001

2-CLI-113 and 2-CLI-114 – CST level indication is required to be operable to support decay heat removal. Decay heat removal shall be capable of removing sufficient heat from the reactor core such that fuel is maintained in a safe and stable condition. The CST is the primary supply for the AFW system. CST level indication is required to ensure sufficient inventory is available to provide decay heat removal. 2-CLI-113 may fail due to fire induced damage of cable 19867-2. 2-CLI-114 may fail due to fire induced damage of cable 8202Y-2. This condition represents a variance from the deterministic requirements of NFPA 805, Section 4.2.3. This is a separation issue.

This VFDR has been evaluated and it was determined that the risk, safety margin and defense-in-depth meet the acceptance criteria of NFPA 805 Section 4.2.4 with no further action required.

#### 3.3.1.2 VFDR No. AA38-002

2-MRV-223-P and 2-MRV-233-P - SG 2 and 3 PORVs are required to be closed to support main steam isolation. Main steam isolation is required to ensure uncontrolled cooldown does not occur through over-steaming. SGs 2 and 3 are credited for decay heat removal due to a fire within Fire Area AA38. 2-MRV-223-P may fail due to fire induced damage of cable 18132-2. 2-MRV-233-P may fail due to fire induced damage of cable 18133-2. These cable failures could spuriously open the valves. This condition represents a variance from deterministic requirements of NFPA 805, Section 4.2.3. This is a separation issue.

This VFDR has been evaluated and it was determined that the risk, safety margin and defense-in-depth meet the acceptance criteria of NFPA 805 Section 4.2.4 with a recovery action credited.

#### 3.3.1.3 VFDR No. AA38-003

2-QRV-251 - The Charging Flow Control Valve is required to be open to support CVCS. CVCS is required to be operable to maintain inventory, pressure and reactivity control. Loss of 2-QRV-251 will fail Unit 2 seal injection charging. 2-QRV-251 may fail due to fire induced damage of cables 12472Y-2 and 6116-2. This condition represents a variance from deterministic requirements of NFPA 805, Section 4.2.3. This is a separation issue.

This VFDR has been evaluated and it was determined that the risk, safety margin and defense-in-depth meet the acceptance criteria of NFPA 805 Section 4.2.4 with no further action required.

**3.3.1.4 VFDR No. AA38-004**

2-SPURIOUS-SI - The possibility of a spurious SI signal is modeled by analysis of cable failures and loss of power to RPS instrumentation and actuation circuitry. A fire in Fire Area AA38 could damage pressurizer pressure instrumentation cables 8733PO-2 and 9600PY-2 and initiate an SI which in turn could undesirably reposition numerous components required to maintain safe and stable conditions. This condition represents a variance from deterministic requirements of NFPA 805, Section 4.2.3. This is a separation issue.

This VFDR has been evaluated and it was determined that the risk, safety margin and defense-in-depth meet the acceptance criteria of NFPA 805 Section 4.2.4 with no further action required.

**3.3.1.5 VFDR No. AA38-005**

2-DCR-310, 2-DCR-320, 2-DCR-330 and 2-DCR-340 - SG 1 and 4 Blowdown Isolation Valves are required to be closed to support main steam isolation. Main steam isolation is required to prevent uncontrolled cooldown through over-steaming. SG 2 and 3 Blowdown Isolation Valves may fail due to a full area fire within Fire Area AA38. 2-DCR-310 may fail due to fire induced damage of cable 8682G-2. 2-DCR-320 may fail due to fire induced damage of cable 8682R-2. 2-DCR-330 may fail due to fire induced damage of cable 8686R-2. 2-DCR-340 may fail due to fire induced damage of cable 8686G-2. These cable failures could spuriously open the valves. SGs 2 and 3 are credited for decay heat removal for a fire within Fire Area AA38. This condition represents a variance from the deterministic requirements of NFPA 805, Section 4.2.3. This is a separation issue.

This VFDR has been evaluated and it was determined that the risk, safety margin and defense-in-depth meet the acceptance criteria of NFPA 805 Section 4.2.4 with a defense-in-depth action credited.

**3.3.1.6 VFDR No. AA38-006**

2-NRV-152 - Pressurizer PORVs are required to be closed to support RCS integrity. RCS integrity is required to maintain positive control over RCS inventory and pressure. 2-NRV-152 may fail due to fire induced damage of cable 9706PR-2. Failure of this cable could spuriously open the valves. This condition represents a variance from the deterministic requirements of NFPA 805, Section 4.2.3. This is a separation issue.

This VFDR has been evaluated and it was determined that the risk, safety margin and defense-in-depth meet the acceptance criteria of NFPA 805 Section 4.2.4 with a defense-in-depth action credited.

**3.3.1.7 VFDR No. AA38-007**

2-NSO-023 and 2-NSO-024 - RX Head Vent Valves are required to be closed to support RCS integrity. RCS integrity is required to maintain positive control over RCS inventory and pressure. 2-NSO-023 and 2-NSO-024 are in series requiring one of the valves to be closed to maintain RCS integrity. 2-NSO-023 may fail due to fire induced damage of cable 9801PR-2. 2-NSO-024 may fail due to fire induced damage of cable 9807PR-2. Failure of these cables could spuriously open the valves. This condition represents a variance from the deterministic requirements of NFPA 805, Section 4.2.3. This is a separation issue.

This VFDR has been evaluated and it was determined that the risk, safety margin and defense-in-depth meet the acceptance criteria of NFPA 805 Section 4.2.4 with a defense-in-depth action credited.

**3.3.1.8 VFDR No. AA38-008**

2-NSO-063 and 2-NSO-064 - Post Accident Vent Valves are required to be closed to support RCS integrity. RCS integrity is required to maintain positive control over RCS inventory and pressure. 2-NSO-063 and 2-NSO-064 are in series requiring one of the valves to be closed to maintain RCS integrity. 2-NSO-063 may fail due to fire induced damage of cable 9814PR-2. 2-NSO-064 may fail due to fire induced damage of cable 9820PR-2. Failure of these cables could spuriously open the valves. This condition represents a variance from the deterministic requirements of NFPA 805, Section 4.2.3. This is a separation issue.

This VFDR has been evaluated and it was determined that the risk, safety margin and defense-in-depth meet the acceptance criteria of NFPA 805 Section 4.2.4 with a defense-in-depth action credited.

**3.3.1.9 VFDR No. AA38-009**

2-QRV-10 and 2-QRV-40 - RCP Seal Water Return Isolation Valves are required to be open to support RCS integrity by maintaining the RCP seal. RCS integrity is required to maintain positive control over RCS inventory and pressure. 2-QRV-10 may fail due to fire induced damage of cable 4418-2. 2-QRV-40 may fail due to fire induced damage of cable 5002-2. These cables could cause spurious closure of these valves. This condition represents a variance from the deterministic requirements of NFPA 805, Section 4.2.3. This is a separation issue.

This VFDR has been evaluated and it was determined that the risk, safety margin and defense-in-depth meet the acceptance criteria of NFPA 805 Section 4.2.4 with a defense-in-depth action credited.

**3.3.1.10 VFDR No. AA38-010**

2-MRV-213-P and 2-MRV-243-P - SG 1 and 4 PORVs are required to be closed to support main steam isolation. Main steam isolation is required to ensure uncontrolled cooldown does not occur through over-steaming. 2-MRV-213-P may fail due to fire induced damage of cable 9074O-2. 2-MRV-243-P may fail due to fire induced damage of cable 9069O-2. These cable failures could spuriously open the valves. This condition requires a mitigating control room action.

### 3.3.2 Recovery Actions Credited

For each VFDR, a Fire Risk Evaluation has been performed to assess the acceptability of risk, defense-in-depth, and safety margin. This evaluation determined whether or not recovery actions are required to ensure that one success path necessary to achieve and maintain the nuclear safety performance criteria is maintained free of fire damage by a single fire. Table 3-3 identifies the credited recovery actions for this area. Actions retained for DID are identified as “DID Actions” within Table 3-3. Additional information for DID actions is contained within Section 3.8 of this report. Note that, for completeness, all VFDRs are contained within Table 3-3, even if the Fire Risk Evaluation has determined that a recovery action is not required. In those instances where a recovery action has been determined to not be required, the word “None” is provided in the “Action” column in the table.

<b>Table 3-3, Recovery Actions Credited</b>		
<b>VFDR</b>	<b>Component</b>	<b>Action</b>
AA38-001	2-CLI-113 2-CLI-114	None
AA38-002	2-MRV-223-P 2-MRV-233-P	2-MRV-223-P-CLOSE (Manually close 2-MRV-223)  2-MRV-233-P-CLOSE (Manually close 2-MRV-233)
AA38-003	2-QRV-251	None
AA38-004	2-SPURIOUS-SI	None
AA38-005	2-DCR-310 2-DCR-320 2-DCR-330 2-DCR-340	DID ACTION(S) 2-DCR-310-CLOSE 2-DCR-320-CLOSE 2-DCR-330-CLOSE 2-DCR-340-CLOSE (Remove fuses in MCR to fail closed AOVs 2-DCR-310, 2-DCR-320, 2-DCR-330 and 2-DRC-340).
AA38-006	2-NRV-152	DID ACTION(S) 2-NRV-152-CLOSE (Remove fuses in MCR to fail closed PORV 2-NRV-152).
AA38-007	2-NSO-023	DID ACTION(S) 2-NSO-023-CLOSE (Remove fuses in MCR to fail closed AOV 2-NSO-023).
AA38-008	2-NSO-063	DID ACTION(S) 2-NSO-063-CLOSE (Remove fuses in MCR to fail closed AOV 2-NSO-063).

Table 3-3, Recovery Actions Credited		
VFDR	Component	Action
AA38-009	2-QRV-10 2-QRV-40	DID ACTION(S) 2-QRV-10-OPEN 2-QRV-40-OPEN (Remove fuses in MCR to fail open AOVs 2-QRV-10 and 2-QRV-40).
AA38-010	2-MRV-213-P 2-MRV-243-P	2-MRV-213-P-MANUAL (Place 2-MRV-213 controller in MANUAL)  2-MRV-243-P-MANUAL (Place 2-MRV-243 controller in MANUAL)

### 3.4 Non-Power Operational Modes Compliance Summary

A review of CNP for the potential effects of a fire in this Fire Area while in non-power modes of operation (NPO) was conducted. This review was conducted using the guidance provided in NEI 04-02 and FAQ 07-0040, "Non-Power Operations Clarifications".

The review determined that there are potential failures that affect certain Key Safety Functions (KSF) as a result of the fire in this area, and the fire could result in the loss of one or more KSF paths. Compensatory measures are required during high risk evolution periods to provide reasonable assurance a fire will not adversely affect key safety functions and the NFPA 805 performance goal for NPO is therefore satisfied. The results of the NPO analysis are contained within Technical Evaluation R1900-005-001, Non-Power Operation Modes Transition Review Report.

### 3.5 Radioactive Release Compliance Summary

The NFPA 805 radiological release goal is to provide reasonable assurance that a fire will not result in a radiological release that adversely affects the public, plant personnel or the environment. The NFPA 805 requirement is to ensure a radiation release to any unrestricted area due to the direct effects of fire suppression activities (but not involving fuel damage) shall be as low as reasonably achievable and shall not exceed applicable plant Technical Specification limits.

AA38 is within the Radiological Controlled Area (RCA) and has been identified as a potential fire area for radioactive release due to fire fighting activities. In accordance with NFPA 805 FAQ 09-0056, this potential has been reviewed to ensure that engineering controls, fire pre-plans, and fire brigade training materials are provided for containment and monitoring of gaseous and liquid effluents associated with fire suppression agents and products of combustion.

The review concludes that the steps to limit radiation release to other areas due to the direct effects of fire suppression activities, in addition to compliance with NFPA 805, Chapter 4, ensure that any radioactive release will be as low as reasonably achievable and will not exceed limits designated in the CNP Technical Specifications.

The review of this fire area, with respect to radioactive release, is documented in the NFPPM.

### 3.6 Probabilistic Risk Assessment-Summary of Results

A Fire PRA (FPRA) quantification of Fire Area AA38 was performed and is documented in PRA-NB-FIRE-FQ, Fire PRA Model Quantification Notebook. The fire risk quantification for Fire Area AA38 is analyzed using detailed fire modeling to consider risk of fire scenarios of ignition sources. PRA-NB-FIRE-FQ includes a summary of all potentially risk-significant fire scenarios (i.e., CDF > 1.0E-7 or LERF > 1.0E-8). Bounding CDF / LERF per calendar year values are reported that are based on the risk values documented in PRA-NB-FIRE-FSS, Fire PRA Fire Scenario Selection.

Fire Protection features credited in the Fire PRA are documented in R1900-0411-AA38, Detailed Fire Modeling Report: Fire Compartment: AA38 Unit 2 Quadrant 2 Cable Tunnel (EL. 612 FT.). PRA-NB-FIRE-FSS documents the revision level of the fire modeling reports used in the most recent Fire PRA quantification.

### 3.7 Risk-Informed, Performance-Based Evaluations

Fire Risk Evaluations (FREs) have been performed to ensure that variances from the NFPA 805 deterministic requirements are acceptable. The evaluation process consists of an integrated assessment of the acceptability of risk, defense-in-depth, and safety margins.

#### 3.7.1 Transition Risk-Informed, Performance-Based Evaluations

The 'changes' associated with NFPA 805 transition were those variances from the deterministic requirements of NFPA 805 or with the existing fire protection licensing basis that were brought into compliance with the NFPA 805 performance based approach. The change identified for evaluation for Fire Area AA38 is as follows:

- Separation Issues

The Fire Risk Evaluation has determined that the change is acceptable based upon:

- The measured change in CDF and LERF.
- Adequate defense-in-depth and safety margins being maintained.

Refer to Attachment 2 for a summary of results associated with the Fire Risk Evaluations.



### 3.8 Defense-in-Depth

A comprehensive risk-informed, performance-based analysis includes consideration of defense-in-depth (DID) as part of an integrated evaluation of risk considerations. In general, defense-in-depth involves consideration of the extent to which fire protection systems and features are provided within the three echelons of fire-protection:

- Preventing fires from starting,
- Rapidly detecting fires and controlling and extinguishing promptly those fires that do occur, thereby limiting fire damage,
- Providing an adequate level of fire protection for structures, systems, and components important to safety, so that a fire that is not promptly extinguished will not prevent the nuclear safety performance criteria from being met.

Each VFDR was evaluated for DID. The following VFDR manual actions have been retained for DID.

VFDR No. AA38-005: 2-DCR-310, 2-DCR-320, 2-DCR-330 and 2-DCR-340 - SG 1 and 4 Blowdown Isolation Valves are required to be closed to support main steam isolation. Main steam isolation is required to prevent uncontrolled cooldown through over-steaming. SG 2 and 3 Blowdown Isolation Valves may fail due to a full area fire within Fire Area AA38. Loss of Main Steam isolation can be mitigated by removing fuses to ensure valves fail shut. This recovery action is being retained for DID to ensure Main Steam isolation is maintained.

VFDR No. AA38-006: 2-NRV-152 - Pressurizer PORVs are required to be closed to support RCS integrity. RCS integrity is required to maintain positive control over RCS inventory and pressure. The spurious opening can be mitigated by de-energizing the valve to fail it closed. This recovery action is being retained for DID to ensure RCS pressure and inventory control is maintained.

VFDR No. AA38-007: 2-NSO-023 and 2-NSO-024 - RX Head Vent Valves are required to be closed to support RCS integrity. RCS integrity is required to maintain positive control over RCS inventory and pressure. The spurious opening can be mitigated by de-energizing the valve to fail it closed. This recovery action is being retained for DID to ensure RCS pressure and inventory control is maintained.

VFDR No. AA38-008: 2-NSO-063 and 2-NSO-064 - Post Accident Vent Valves are required to be closed to support RCS integrity. RCS integrity is required to maintain positive control over RCS inventory and pressure. 2-NSO-063 and 2-NSO-064 are in series requiring one of the valves to be closed to maintain RCS integrity. The spurious opening can be mitigated by de-energizing the valve to fail it closed. This recovery action is being retained for DID to ensure RCS pressure and inventory control is maintained.

VFDR No. AA38-009: 2-QVR-10 and 2-QVR-40 - RCP Seal Water Return Isolation Valves are required to be open to support RCS integrity by maintaining the RCP seal. RCS integrity is required to maintain positive control over RCS inventory and pressure. The spurious closing can be mitigated by de-energizing the valve to fail it open. This recovery action is being retained for DID to ensure RCS integrity is maintained.

Based on the assessment in support of the Fire Risk Evaluation, defense-in-depth is maintained for fire area AA38. Refer to Attachment 2 for details associated with the Fire Risk Evaluation.



### 3.9 Monitoring Program Input

A Monitoring Program will be developed in accordance with FAQ 10-0059, Rev. 1. Methods to monitor availability, reliability, and performance of fire protection program structures, systems, and components (SSCs), as well as programmatic elements will be provided. Additionally, effectiveness measures are established to review program related performance and trends. For AA38 the following systems and features are candidates for inclusion in the CNP Fire Protection Monitoring Program:

- Fire Area boundary barriers discussed in Section 3.1
- Fire Detection System (infrared and ionization)
- Manual CO2 Suppression System

### 4.0 CONCLUSION

The nuclear safety and radioactive release performance criteria of NFPA 805 are met for a fire in Fire Area AA38. This Fire Risk Evaluation for Fire Area AA38 has demonstrated that

- The change in core damage frequency (delta CDF) is acceptable, and
- The change in large early release frequency (delta LERF) is acceptable, and
- Defense-in-depth and safety margins are maintained.

This is confirmation that a success path effectively remains free of fire damage and that the performance-based approach is acceptable per Section 4.2.4.2 of NFPA 805.

### 5.0 REFERENCES

- 5.1 Calculation PRA-FIRE-NB-CRE, Fire PRA Cumulative Risk Evaluations
- 5.2 CNP Fire Pre-Plans, Volumes I, II, and III, Revisions 17, 14, and 18 respectively
- 5.3 Fire Hazards Analysis
- 5.4 NFPA 805, Performance-Based Standard for Fire Protection for Light Water Reactor Electric Generating Plants
- 5.5 NFPPM, NFPA 805 Fire Protection Program Manual (NFPPM)
- 5.6 Nuclear Energy Institute (NEI) 04-02, Guidance for Implementing a Risk-Informed, Performance-Based Fire Protection Program under 10 CFR 50.48(c), Rev. 2
- 5.7 Nuclear Safety Capability Assessment Report
- 5.8 PRA-NB-FIRE-FQ, Fire PRA Model Quantification Notebook
- 5.9 PRA-NB-FIRE-FSS, Fire PRA Fire Scenario Selection
- 5.10 R1900-0411-AA38, AA38 - Detailed Fire Modeling Report
- 5.11 Regulatory Guide 1.205, Risk-Informed, Performance-Based Fire Protection for Existing Light-Water Nuclear Power Plants, Rev. Revision 1
- 5.12 Technical Evaluation R1900-005-001, Non-Power Operation Modes Transition Review

**Fire Area AA38 – Attachment 1 - Table B-3 - Fire Area Transition**

<u>Unit</u>	<u>Fire Area</u>	<u>Description</u>
2	AA38	Unit 2 Quadrant 2 Cable Tunnel (El. 612 ft.)

<u>Fire Zone</u>	<u>Description</u>
39	Quadrant 2 Penetration Cable Tunnel - El. 612 ft. 0 in. - Unit 2

**Regulatory Basis**

4.2.4.2 - Performance-Based Approach - Fire Risk Evaluation with simplifying deterministic assumptions

<b>Performance Goal</b>	<b>Method of Accomplishment</b>	<b>Comments</b>
Reactivity Control	Unit 2 - Trip the reactor from the Control Room. Borate using Unit 2 East or West Charging Pump supplied from the RWST. Use source range monitoring for indication for Unit 2.	None
Inventory and Pressure Control	Unit 2 - Control inventory using Unit 2 East or West Charging Pump. Control pressure using Unit 2 Pressurizer Safety Relief Valves.	VFDRs identified for CVCS flow control, Pressurizer PORV, RX Head Vent, Post Accident Vent, and RCP seals.
Decay Heat Removal	Unit 2 - Feed SGs 2 & 3 with Unit 2 East MDAFW Pump. The DHR function also requires MS isolation with a steam release path through the Safety Relief Valves.	VFDRs identified for CST level indication and MS isolation.
Process Monitoring	Unit 2 Process Monitoring - Use Unit 2 process monitoring in the Control Room for the following: Pressurizer level, RCS pressure and temperature, and S/G level and Pressure. Unit 2 Source Range Monitoring - Use Unit 2 source range monitoring in the Control Room.	None
Vital Auxiliaries	Unit 2 Electrical - Control Unit 2 Red (AB) Train Electrical Distribution with Unit 2 Red (AB) Train Offsite Power. Control Unit 2 Green (CD) Train Electrical Distribution with U2 Green (CD) Train Offsite Power. Unit 2 ESW - Operate Unit 2 East or West ESW. Unit 2 CCW - Operate Unit 2 East or West CCW. Unit 2 HVAC - Operate Unit 2 Control Room HVAC. Operate Unit 2 Auxiliary Building HVAC. Unit 2 DGs are not available within this fire area. Operate Unit 2 Switchgear HVAC. Operate Unit 2 East MDAFW Room HVAC system. Operate the Unit 2 East and West ESW Room HVAC systems.	VFDR identified for spurious SI.

**Fire Area AA38 – Attachment 1 - Table B-3 - Fire Area Transition**

<u>Unit</u>	<u>Fire Area</u>	<u>Description</u>
2	AA38	Unit 2 Quadrant 2 Cable Tunnel (El. 612 ft.)

**Reference Documents**

Genesis Solution Suite, EDISON / SAFE-PB, DC Cook V 3.4.0

Nuclear Safety Capability Assessment Report

**Licensing Actions**

None

**Existing Engineering Equivalency Evaluations (EEEE)**

**EEEE Title** Engineering Equivalency Evaluation 11-3 - Fire Retention Capability of Nonconforming Fire Seals in Fire Zone 27 (Fire Area AA31) to Fire Zone 39 (Fire Area AA38)

**Summary** The purpose of this engineering equivalency evaluation is to document the acceptability of the 8 in. thick silicone foam fire seals protecting the penetrations between the Quadrant 1 cable tunnel at elevation 596 ft. in Unit 2 of Fire Zone 27 (Fire Area AA31) and the Quadrant 2 cable tunnel at elevation 612 ft. in Unit 2 of Fire Zone 39 (Fire Area AA38).

The existing 8 in. silicone foam fire seals located within the penetrations between Fire Zone 27 and Fire Zone 39 are acceptable for maintaining the rating of the fire area boundary. This engineering equivalency evaluation does not impact engineering equivalency evaluations.

The silicone foam fire seals were evaluated and found to be acceptable based on the fire hazards and fire protection systems within the evaluated areas.

**Fire Area AA38 – Attachment 1 - Table B-3 - Fire Area Transition**

<b><u>Unit</u></b>	<b><u>Fire Area</u></b>	<b><u>Description</u></b>
2	AA38	Unit 2 Quadrant 2 Cable Tunnel (El. 612 ft.)

<b><u>EEEE Title</u></b>	<b>Engineering Equivalency Evaluation 11-9 - Turbine, Auxiliary and Containment Buildings Boundary Evaluation</b>
<b><u>Summary</u></b>	<p>The purpose of this engineering equivalency evaluation is to describe in general, the approach and existence of evaluations performed to determine and reconcile fire area boundaries having components or designs with less than a 3-hr fire rating on preventing the spread of fire. This engineering equivalency evaluation also specifically evaluates the impact of unrated door assemblies on the spread of fire.</p> <p>Reasonable assurance is provided that the fire area boundaries having components or design less than a 3-hr fire rating will not increase the spread of fire or impair the safe shutdown capabilities of Units 1 or 2. In addition, this engineering equivalency evaluation does not adversely impact on other engineering equivalency evaluations or exemption requests.</p> <p>This evaluation supports additional evaluations credited in this fire area.</p>
<b><u>EEEE Title</u></b>	<b>Engineering Equivalency Evaluation 11-14 - Cable Spreading Room Construction Boundary Evaluation (Fire Areas AA3, AA7, AA8, AA9, AA10, AA29, AA30, AA31, AA34, AA35, AA36/42, AA37, AA38, AA48, AA50, AA51 and AA52)</b>
<b><u>Summary</u></b>	<p>The purpose of this engineering equivalency evaluation is to document the acceptability of the construction features of the cable spreading rooms which have a fire resistance rating of less than 3 hours for their impact on the spread. In particular, fire dampers having a 1 1/2-hr fire rating were analyzed by this evaluation. Other unrated construction features have been previously analyzed under separate engineering equivalency evaluations. The applicable fire areas include: AA3, AA7, AA8, AA9, AA10, AA29, AA30, AA31, AA34, AA35, AA36/42, AA37, AA38, AA48, AA50, AA51 and AA52.</p> <p>Reasonable assurance is provided that the construction features of the cable spreading rooms which have a fire resistance rating of less than 3 hours will prevent the spread of fire and not impair the safe shutdown capabilities of Unit 1 and Unit 2. In addition, this engineering equivalency evaluation does not adversely impact other engineering equivalency evaluations.</p> <p>The construction features of the cable spreading room were evaluated and found to be acceptable based on the fire hazards, fire protection systems and construction features within the areas.</p>

**Fire Area AA38 – Attachment 1 - Table B-3 - Fire Area Transition**

<u>Unit</u>	<u>Fire Area</u>	<u>Description</u>
2	AA38	Unit 2 Quadrant 2 Cable Tunnel (El. 612 ft.)

<b><u>EEEE Title</u></b>	<b>Engineering Equivalency Evaluation 11-24 - Fire Retention Capability of Nonconforming Fire Seals in Fire Zones having a Low Combustible Loading Classification</b>
<b><u>Summary</u></b>	<p>The purpose of this engineering equivalency evaluation is to document the acceptability of fire seal designs which do not meet the requirements of the installation specification or fire test data in fire zones having a low combustible loading classification would have on preventing the spread of fire.</p> <p>Reasonable assurance is provided that fire seals which do not meet the requirements of the installation specification or fire test data in fire zones having a low combustible loading classification, will provide adequate fire retention capabilities and will not impair the safe shutdown capabilities of CNP or increase the spread of fire between fire zones. In addition, this engineering equivalency evaluation does not adversely impact other engineering equivalency evaluations or exemptions.</p> <p>Refer to Engineering Equivalency Evaluation 11.31.</p>
<b><u>EEEE Title</u></b>	<b>Engineering Equivalency Evaluation 11-31 - Generic Fire Seal Design 5 (Fire Areas AA31 and AA38)</b>
<b><u>Summary</u></b>	<p>The purpose of this engineering equivalency evaluation is to document the acceptability of deviations to Generic Fire Seal Design 5 (in Fire Areas AA31 and AA38) on preventing the spread of fire.</p> <p>Reasonable assurance is provided that deviations to Generic Fire Seal Design 5, Fire Seals W9134 and W9597, and the attributes discussed in this engineering equivalency evaluation will not impair the safe shutdown capabilities of CNP or increase the spread of fire between fire zones. This engineering equivalency evaluation does not impact other engineering equivalency evaluations.</p> <p>Generic Fire Seal Design 5 deviations, Attribute Numbers 1, 2, 3, 4, 5, 6, 7 and 9, and Fire Seals W9134 and W9597 were evaluated and found to be acceptable based on the fire hazards, fire protection systems and construction features within the evaluated</p>

**Fire Area AA38 – Attachment 1 - Table B-3 - Fire Area Transition**

<u>Unit</u>	<u>Fire Area</u>	<u>Description</u>
2	AA38	Unit 2 Quadrant 2 Cable Tunnel (El. 612 ft.)
<hr/>		
<b><u>EEEE Title</u></b>	<b>Engineering Equivalency Evaluation 11-46 - Seismic Gaps between the Containment and Auxiliary Buildings Boundary Evaluation (Fire Areas AA2, AA3, AA7, AA8, AA9, AA10, AA11, AA27, AA29, AA30, AA31, AA34, AA35, AA37 and AA38)</b>	
<b><u>Summary</u></b>	<p>A seismic gap exists around the Containment Building of each unit that provides an opening of approximately 6 in. between the Containment Building and the walls, ceilings and floors of the structures immediately adjacent to containment. These Fire Areas include AA2, AA3, AA7, AA8, AA9, AA10, AA11, AA27, AA29, AA30, AA31, AA34, AA35, AA37 and AA38. This engineering equivalency evaluation has been performed to document the acceptability of these seismic gaps in the fire boundaries.</p> <p>This seismic gap evaluation shows the safe shutdown capability for CNP Unit 1 and Unit 2 has not been compromised as a result of seismic gaps. The analysis performed and the results presented in the tables indicate, on a system basis, the capability to safely shut down both units when considering fire damage to safe shutdown components and circuits contained in the seismic gap evaluation areas. The method of analysis is conservative when considering the fire hazards involved in the vicinity of the seismic gaps. That is, it is not anticipated that the evaluated areas would be affected to the extent that fire would propagate through the seismic gaps and cause damage throughout the evaluated area. This engineering equivalency evaluation has no impact on the exemption requests contained in other engineering equivalency evaluations.</p> <p>The seismic gaps were evaluated and found to be acceptable based on the fire hazards, fire protection systems and construction features within the evaluated areas.</p>	
<b><u>EEEE Title</u></b>	<b>Engineering Equivalency Evaluation 12-19 - CO2 Fire Suppression System Concentrations (Fire Areas AA7, AA8, AA9, AA10, AA29, AA30, AA31, AA37, AA38, AA39, AA40, AA41, AA43, AA44, AA45, AA48, AA49, AA50, AA51, AA52 and AA53)</b>	
<b><u>Summary</u></b>	<p>The purpose of this engineering equivalency evaluation is to document the acceptability of the CO2 fire suppression systems in fire zones containing concentrations of cable insulation and the potential for deep-seated fires. This engineering equivalency evaluation determines the CO2 system's impact on the spread of fire and previous engineering equivalency evaluations and exemption requests. Although there are other fire zones that use CO2 for fire suppression such as the DG Rooms, they are installed to suppress surface-type, combustible liquid fires and are not included in this analysis, because they do not contain significant concentrations of cable insulation capable of producing deep-seated fires.</p> <p>All of the CO2 systems included in this engineering equivalency evaluation are capable of performing their intended function, containing the fire until the Fire Brigade arrives, preventing fire spread to adjacent fire zones, and ensuring that safe shutdown of CNP can be achieved and maintained.</p> <p>The existing suppression systems were evaluated and found to be acceptable based on the fire hazards and fire protection systems within the evaluated areas.</p>	

**Fire Area AA38 – Attachment 1 - Table B-3 - Fire Area Transition**

<u>Unit</u>	<u>Fire Area</u>	<u>Description</u>
2	AA38	Unit 2 Quadrant 2 Cable Tunnel (El. 612 ft.)

**Fire Suppression Effects on Nuclear Safety Performance Criteria**

The CNP fire brigade is trained to discharge water in a judicious manner and instructed to direct hose streams and portable extinguishers at the base of the fire to limit the amount of overspray beyond the immediate fire zone. For this reason, fire brigade activities are not expected to fail components not already considered damaged by fire. It has been concluded that water impingement on cables is not a concern. Electrical cabinets are provided with a seal at the conduit interface. Per visual inspection any side vents for this equipment are pointed downward to prevent water intrusion. The drainage features of the fire area mitigate the potential for flooding damage due to fire suppression, such that the standing water would not affect credited equipment.

In the event of discharge, the CO2 system will not adversely affect the equipment operating within the fire area. Potential condensation developing on electrical components is a long term issue that would be eliminated by ventilating the fire area after actuation. Per visual inspection, all CO2 nozzles are located greater than 5 ft. away from any credited equipment and therefore, the possibility of thermal shock due to CO2 actuation has been deemed to be a non-issue in this fire area in accordance to EPRI NP-7253 "Effects of Fire Suppressants on Electrical Components in Nuclear Power Plants". Since it is shown that suppression effects will not impact the nuclear safety performance criteria, the fire area configuration is deemed acceptable.

**References:**

Technical Evaluation 12.1, "Fire Suppression Effects Study"

Technical Evaluation 12.1, "Supplemental Information to Fire Suppression Effects Study – Supplement 1"

**Fire Area Comments**

None

## Fire Area AA38 – Attachment 2 - Fire Risk Evaluation Results Summary

### A2.1 Introduction

The ‘changes’ associated with NFPA 805 transition were those variances from the deterministic requirements of NFPA 805. The changes identified for evaluation for fire area AA38 are grouped as follows:

- Separation Issues

This attachment is a summary of the Fire Risk Evaluation for the fire area. The complete results and methodology are contained in the Cumulative Fire Risk Evaluation, PRA-FIRE-NB-CRE. (FPCE 2017-0009)

### A2.2 Inputs/Assumptions

Fire modeling processes and inputs provided in NUREG/CR-6850 are appropriate for use in a risk-informed, performance-based evaluation. The complete list of assumptions used in the fire modeling methodology for this fire area is contained in Detailed Fire Modeling Technical Evaluation R1900-0411-AA38.

### A2.3 Fire Modeling Methodology

Fire PRA fire modeling results are used as the initial input into this Fire Risk Evaluation. The process consists of conservative bounding analyses using NUREG/CR-6850 methods. As needed, refinements are made to utilize more realistic parameters. The complete fire modeling methodology for this fire area is contained in Detailed Fire Modeling Technical Evaluation R1900-0411-AA38.

### A2.4 Scenario Descriptions and Model Results

Fire Area AA38 was evaluated for the impact of fires originating from both fixed and transient ignition sources. Complete descriptions of each fire scenario is contained within the Detailed Fire Modeling Technical Evaluation R1900-0411-AA38.

#### A2.4.1 Ignition Sources

Fire Area AA38 contains the heat trace panels and boric acid heat trace transformers as well as various other alarm panels. Per discussion with plant personnel, the heat release rates for all switchgear, load centers, and MCC electrical cabinets have been characterized as qualified cable because items of this nature are generally constructed on-site. For other electrical cabinet types, where the internal cable qualification was unknown, the heat release rates have been assumed as non-qualified. Ignition sources in Fire Area AA38 were modeled using the 98th percentile fire as a screening approach. These scenarios were not risk significant enough to require further refinement.

In Fire Area AA38, the 98th percentile HRR was used for all transient fires. The 98th percentile HRR bounds the possible transient ignition sources expected for this fire area, which were fire tested and identified in NUREG/CR-6850, Appendix G, Table G-7.

#### A2.4.2 Scenario Results

The PRA analyzed the VFDRs and determined them to be risk insignificant, therefore, a quantitative delta risk calculation was not performed.

### A2.5 Fire Risk Evaluation Results

PRA-FIRE-NB-CRE documents scenarios and corresponding impacted VFDRs that were evaluated for



### **Fire Area AA38 – Attachment 2 - Fire Risk Evaluation Results Summary**

delta risk during the transition to NFPA 805 and also all changes to the Fire Protection Program that are currently incorporated into the Fire PRA model. The acceptability of the Cumulative Fire Risk Evaluations was based on calculated delta risk meeting the thresholds of NEI 04-02, RG 1.205 and RG 1.174. (FPCE 2017-0009)

## Fire Area AA38 – Attachment 2 - Fire Risk Evaluation Results Summary

### A-2.6 Impact of VFDR on Defense-in-Depth

Defense-in-Depth has been evaluated for this fire area. The impacts of this evaluation are summarized in the table below:

Defense-in-Depth Impact Review for AA38			
Method of Providing DID	Required to Support Deterministic Analysis or Fire PRA?	Changes or Improvements Necessary for DID?	Basis/Justification
Echelon 1: Prevent fires from starting			
Combustible Control is implemented in accordance with Procedure PMP-2270-CCM-001, Control of Combustible Materials.	Yes	No	• This element is adequate based on no perceived weakness of, or over-reliance on, another echelon of defense-in-depth.
Hot Work Control is implemented in accordance with Procedure PMP-2270-WBG-001, Welding, Burning and Grinding Activities.	Yes	No	
Echelon 2: Rapidly detect, control and extinguish promptly those fires that do occur thereby limiting fire damage			
Fire Detection System	Yes	No	• Suppression and detection are already required and fire fighting activities are not expected to be challenging; therefore, no changes or improvements to Echelon 2 attributes are necessary to maintain defense-in-depth.
Fixed Fire Suppression	Yes	No	
Portable Fire Extinguishers	Yes	No	
Hose stations and hydrants	Yes	No	
Pre-Fire Plan	Yes	No	
Echelon 3: Provide adequate level of fire protection for systems and structures so that a fire will not prevent essential safety functions from being performed			
Walls, floors ceilings and structural elements are rated or have been evaluated as adequate for the hazard.	Yes	No	• Where a variance can possibly be affected in a potentially high risk scenario, based on a detailed review, the VFDR is either not the cause for the high risk of the scenario or the mitigating recovery action is credited; therefore no changes or improvements to Echelon 3 attributes are necessary to maintain defense-in-depth.
Penetrations in the fire area barrier are rated or have been evaluated as adequate for the hazard.	Yes	No	
Supplemental barriers (e.g., ERFBS, cable tray covers, etc.)	No	No	
Guidance provided to operations personnel detailing the required success path(s) including recovery actions to achieve nuclear safety performance criteria.	Yes	No	• Defense in Depth actions were credited to remove fuses or open breakers in the Control Room to prevent spurious equipment operation due to internal shorts.

## Fire Area AA38 – Attachment 2 - Fire Risk Evaluation Results Summary

### A-2.7 Safety Margin Considerations

In accordance with NEI 04-02, the maintenance of adequate Safety Margin is assessed by the consideration categories of analyses utilized by this Fire Risk Evaluation.

Safety margins are considered to be maintained if:

- Codes and Standards or their alternatives accepted for use by the NRC are met.

AND

- Safety analyses acceptance criteria in the licensing basis (e.g., FSAR, supporting analyses) are met, or provides sufficient margin to account for analysis and data uncertainty.

The following summarizes the bases for ensuring the maintenance of safety margins:

- The risk-informed, performance based processes utilized are based upon NFPA 805, 2001 edition, endorsed by the NRC in 10 CFR 50.48(c).
- The Fire Risk Evaluation process is in accordance with NEI 04-02, Revision 2, which is endorsed by the NRC in Regulatory Guide 1.205, Revision 1.
- The Fire PRA is developed in accordance with NUREG/CR-6850, which was developed jointly between the NRC and EPRI.
- The Fire PRA has undergone an industry peer review, in order to ensure the Fire PRA meets the appropriate quality standards of ASME/ANS RA-Sa-2009, "Standard for Level 1/Large Early Release Frequency Probabilistic Risk Assessment for Nuclear Power Plant Applications," Dated February 2, 2009
- The "combined analysis approach" is used during transition (NEI 04-02, Section 5.3.4.3); therefore, MEFS/LFS is not analyzed separately from the Fire PRA results.
- The CNP internal events PRA model received two formal industry peer reviews conducted in accordance with applicable NEI guidelines. The initial peer review was performed in 2001, while a subsequent focused scope (i.e., limited scope) peer review was conducted in 2009. The initial, full-scope WOG peer review covered all aspects of the CNP PRA model and the administrative processes used to maintain and update the model. The CNP PRA model has been revised to address all significant issues (i.e., Category A and B Facts & Observations) identified during the initial peer review. None of the findings from the focused-scope peer review were judged to reach the significance level of a Category A or B Fact & Observation; as a result, no changes to the PRA model have yet been made to include resolutions for these latter issues.
- Fire protection systems and features determined to be required by NFPA 805 Chapter 4 have been confirmed to meet the requirements of NFPA 805 Chapter 3 and their associated referenced codes and listings, or provided with acceptable alternatives using processes accepted for use by the NRC (i.e., FAQ 06-0008, FAQ 06-0004, 07-0033).
- Fire modeling performed in support of the transition has been performed within the Fire PRA utilizing codes and standards developed by industry and NRC staff which have been verified and validated in authoritative publications, such as NUREG 1824, "Verification and Validation of Selected Fire Models for Nuclear Power Plant Applications". In general, the fire modeling performed in support of the Fire Risk Evaluations has been performed using conservative methods and input parameters that are based upon

## **Fire Area AA38 – Attachment 2 - Fire Risk Evaluation Results Summary**

NUREG/CR-6850 as documented in the AA38 Detailed Fire Modeling Report, section 7.2. While this is generally not ideal in the context of best estimate probabilistic risk analysis, it is a pragmatic approach given the current state of knowledge regarding the uncertainties related to the application of the fire modeling tools and associated input parameters for specific plant configurations.

- In accordance with the requirements of 10 CFR 50.48(c)(2)(iii), the Fire PRA results, including cutsets for the scenarios of concern, have been reviewed and it was verified that the results presented above do not rely solely on feed and bleed as the fire-protected safe shutdown path for maintaining reactor coolant inventory, pressure control, and decay heat removal capability for this fire area.

### **A-2.8 Transition Risk Evaluation Conclusions**

The transition change evaluation determined that these changes:

- Are acceptable based upon the measured change in CDF and LERF
- Maintained adequate defense-in-depth and safety margins

The results of this evaluation meet the requirements of NFPA 805 Risk Evaluation; therefore, the use of the performance based analysis approach is acceptable.



## 1.0 PURPOSE

This report documents the Fire Safety Analysis (FSA) for Cook Nuclear Plant (CNP) Fire Area AA39A, Unit 1 AB Switchgear Room (El. 609 ft. 6 in.) which comprises fire zone(s) 40A. The purpose of this analysis is to demonstrate the achievement of the nuclear safety and radioactive release performance criteria of NFPA 805 as required by 10 CFR 50.48(c). The Fire Safety Analysis is a key part of compliance with Section 2.7.1.2 Fire Protection Program Design Basis Document of NFPA 805. This analysis also documents results of risk-informed, performance-based Fire Risk Evaluations (FREs). These evaluations are associated with Variances from Deterministic Requirements (VFDRs) of NFPA 805 Chapter 4.

## 2.0 ANALYSIS METHODOLOGY

The FSA is the design basis document as described in NFPA 805 Section 2.7.1.2. The following steps are performed to develop the FSA on a fire area basis:

- Identify significant fire hazards in the fire area. This is based on NFPA 805 approach to analyze the plant from an ignition source and fuel package perspective.
- Summarize Nuclear Safety Capability Analysis (NSCA) compliance strategies. This is the result of the NEI 04-02 B-3 Table review of the Safe Shutdown Analysis.
- Summarize Non-Power Operations Modes compliance strategies.
- Summarize Radioactive Release compliance strategies. The transition review process required per NEI 04-02 is used to develop these results.
- Provide Fire Probabilistic Risk Assessment summary of results. This is based on the results from the plant Fire PRA.
- Perform risk informed, performance based evaluations if needed for the performance based approach.
- Summarize Defense-in-Depth strategy for each fire area.
- Determine key analysis assumptions which are candidates to be included in the NFPA 805 monitoring program.
- Provide conclusions relative to NFPA 805 compliance.

### **3.0 ANALYSIS**

#### **3.1 Classical Fire Protection**

##### **3.1.1 Construction**

Walls, floors and ceilings to adjacent fire areas and fire zones are reinforced concrete in excess of a 3-hour rating.

A fire area boundary evaluation was performed for the construction features (i.e. fire doors, undampered ventilation duct, and open penetrations) of the switchgear rooms that have a fire resistance rating of less than 3 hours (Engineering Equivalency Evaluation 11-15).

Applicable Engineering Equivalency Evaluations are documented in Attachment 1.

##### **3.1.2 Doors and Access Openings**

A fire door having a 3-hour rating is provided to adjacent Fire Area AA40 - Fire Zone 41.

##### **3.1.3 Penetrations**

Penetrations in fire barriers between this fire zone and adjacent fire areas, fire zones and the yard are provided with fire seals.

A fire area boundary evaluation was performed for the unrated fire barrier penetration seals installed between Fire Areas AA39A and AA39B -Fire Zones 40A and 40B, Fire Area AA40 - Fire Zone 41, Fire Area AA41 - Fire Zones 42A, 42B, 42C, 42D and Fire Area AA48 - Fire Zone 55 (Engineering Equivalency Evaluation 11-5).

A fire area technical evaluation was prepared to evaluate a fire seal design between Fire Zones 40A and 41. (Engineering Equivalency Evaluation 11-28.)

Seismic expansion gaps are sealed with a glass fiber reinforced silicone sheeting.

### 3.1.4 Detection

The table below outlines the fire detection system(s) provided in the Fire Area:

Table 3-1, Fire Area AA39A Detection Systems								
Fire Zone	Type of System	Local (L) / Remote (R)	Detection Actuates Suppression?	Required System?				
				S	L	E	R	D
40A	Infrared	L/R	Y	Y	N	Y	Y	N
40A	Ionization	L/R	N	Y	N	Y	Y	N
Table 3-1 Legend:								
Table Field: "Required System?"								
S	- Required for Chapter 4 Separation Criteria							
L	- Required for NRC Approved Licensing Action							
E	- Required for Engineering Equivalency Evaluation							
R	- Required for Risk Significance							
D	- Required to maintain adequate balance of Defense-in-Depth in a Change Evaluation or Fire Risk Evaluation							

Cross zoned ionization smoke detectors (2) and infra-red detectors (3) are provided which alarm in the Unit 1 Control Room. The ionization detectors are part of a larger detection circuit that includes Fire Zones 40A and 40B.

### 3.1.5 Fixed Suppression

The table below outlines the fixed fire suppression system(s) provided in the Fire Area:

Table 3-2, Fire Area AA39A Suppression Systems							
Fire Zone	Type of System	Full (F) / Partial (P)	Required System?				
			S	L	E	R	D
40A	Automatic CO2	F	Y	N	Y	N	N

**Table 3-2 Legend:**

Table Field: "Required System?"	
S	- Required for Chapter 4 Separation Criteria
L	- Required for NRC Approved Licensing Action
E	- Required for Engineering Equivalency Evaluation
R	- Required for Risk Significance
D	- Required to maintain adequate balance of Defense-in-Depth in a Change Evaluation or Fire Risk Evaluation

A low pressure CO2 total flooding system supplied from the 17 ton tank is provided. This system is automatically actuated. Operation of this system discharges CO2 simultaneously into Fire Zones 40A and 40B.

### 3.1.6 Manual Suppression / Response Strategy

A postulated fire will be identified by early detection using ionization type smoke detection, infra-red detection or by plant personnel using plant communication system to notify the control room.



The automatic detection systems alarm in the control room. The automatic detection systems alarm in the control room. The Control Room operator will dispatch the fire brigade for initiation of manual fire fighting. A fire in this fire area will be contained by the construction features discussed in Section 3.1.1. Manual suppression is provided by the CNP Fire Brigade.

There are fire extinguishers located in this fire area.

Water hose reels are located in the Turbine Building Fire Zone 90, and in Fire Zone 33A.

Floor drains are available in this fire area.

### 3.1.7 Ventilation

A fire in this area will be contained by the fire barriers. Smoke can be removed by portable fans and flexible ducting to the Turbine Building and outdoors. The normal building ventilating systems in the Auxiliary Building will then exhaust the smoke via filtered monitored pathways]. This fire area is listed as a non-controlled area in the Fire Pre Plans and therefore there is reasonable assurance that products of combustion will not be contaminated.

There are 4-hour rated undampered ventilation shafts in the ceiling that pass through Fire Area AA48 - Fire Zone 55 to the yard.

### 3.1.8 Other Features

For Fire Zone 40A, Electrical Raceway Fire Barrier Systems (ERFBS) with a rating of a 1-hour are provided, where required.

Some cable trays within Fire Area AA39A are provided with bottom covers and/or are fully enclosed.

## 3.2 Fire Hazards Identification

The fire area contains both ignition sources and combustible fire hazards. The ignition sources consist of 4kV busses, plant heater, electric bay miscellaneous power panel and transformers for Bus A and B. Combustibles consist primarily of cable insulation, rubber and plastics.

The exterior fire hazards that are adjacent to exterior walls are the Unit 1 Main, Auxiliary and Start-up Transformers. Water spray suppression systems are provided for the transformers. In addition, reinforced concrete walls and 3 hour rated fire seals provide separation for the Fire Area. The missile barriers around each transformer also provide a measure of fire barrier protection for some of the transformers, limiting radiant heat in the direction of the Fire Area. The fixed suppression and rated construction are sufficient to provide protection for credited equipment within the plant.

The current fire loading classification is considered low.

## 3.3 NSCA Compliance Summary

Fire Area AA39A, the Unit 1 Red Train Switchgear Room (EL. 609'-6"), contains the Unit 1 Red Train (AB) 4kV non-safety and safety buses, their supporting equipment as well as Red and Green train cables, conduits and raceways.

Compliance with the nuclear safety performance criteria is achieved using the performance-based

approach in accordance with NFPA 805, Section 4.2.4.2.

Safe and stable condition of Unit 1 will be accomplished using Steam Generators 2 and 3 via the Unit 1 East Motor Driven Auxiliary Feedwater Pump, Control Room Process Monitoring, Unit 1 Charging via the East Pump, Unit 1 Component Cooling Water via the East Pump, and Unit 1 Essential Service Water via the East Pump. Electrical power is supplied to the Green Train via Emergency Diesel CD with reliance on the Green Train 250VDC Battery for initial component operations.

The Nuclear Safety Performance Criteria compliance strategy for AA39A is documented within the NSCA Report.

### 3.3.1 Variances

The variances identified for evaluation for this fire area are grouped as follows:

#### 3.3.1.1 VFDR No. AA39A-001

1-ILS-950 and 1-ILS-951 - RWST level indication is required to support CVCS. CVCS is required to be operable to maintain inventory, pressure and reactivity control. The RWST is the primary credit borated water source for CVCS. 1-ILS-950 may fail due to fire induced damage of 120V Instrument Distribution Panel 1-CRID-III. 1-ILS-951 may fail due to 120V Instrument Distribution Panel 1-CRID-IV. This condition represents a variance from deterministic requirements of NFPA 805, Section 4.2.3. This is a separation issue.

This VFDR has been evaluated and it was determined that the risk, safety margin and defense-in-depth meet the acceptance criteria of NFPA 805 Section 4.2.4 with no further action required.

### 3.3.2 Recovery Actions Credited

For each VFDR, a Fire Risk Evaluation has been performed to assess the acceptability of risk, defense-in-depth, and safety margin. This evaluation determined whether or not recovery actions are required to ensure that one success path necessary to achieve and maintain the nuclear safety performance criteria is maintained free of fire damage by a single fire. Table 3-3 identifies the credited recovery actions for this area. Actions retained for DID are identified as "DID Actions" within Table 3-3. Additional information for DID actions is contained within Section 3.8 of this report. Note that, for completeness, all VFDRs are contained within Table 3-3, even if the Fire Risk Evaluation has determined that a recovery action is not required. In those instances where a recovery action has been determined to not be required, the word "None" is provided in the "Action" column in the table.

Table 3-3, Recovery Actions Credited		
VFDR	Component	Action
AA39A-001	1-ILS-950	None
	1-ILS-951	

### 3.4 Non-Power Operational Modes Compliance Summary

A review of CNP for the potential effects of a fire in this Fire Area while in non-power modes of operation (NPO) was conducted. This review was conducted using the guidance provided in NEI 04-02 and FAQ 07-0040, "Non-Power Operations Clarifications".

The review determined that there are potential failures that affect certain Key Safety Functions (KSF) as a result of the fire in this area, and the fire could result in the loss of one or more KSF paths. Compensatory measures are required during high risk evolution periods to provide reasonable assurance a fire will not adversely affect key safety functions and the NFPA 805 performance goal for NPO is therefore satisfied. The results of the NPO analysis are contained within Technical Evaluation R1900-005-001, Non-Power Operation Modes Transition Review Report.

### 3.5 Radioactive Release Compliance Summary

The NFPA 805 radiological release goal is to provide reasonable assurance that a fire will not result in a radiological release that adversely affects the public, plant personnel or the environment. The NFPA 805 requirement is to ensure a radiation release to any unrestricted area due to the direct effects of fire suppression activities (but not involving fuel damage) shall be as low as reasonably achievable and shall not exceed applicable plant Technical Specification limits.

AA39A is located outside the Radiological Controlled Area (RCA) and is not a storage location for contaminated materials, therefore there is reasonable assurance a fire in this area will not result in radiation release. The review of this fire area, with respect to radioactive release, is documented in the NFPPM.

### 3.6 Probabilistic Risk Assessment-Summary of Results

A Fire PRA (FPRA) quantification of Fire Area AA39A was performed and is documented in PRA-NB-FIRE-FQ, Fire PRA Model Quantification Notebook. The fire risk quantification for Fire Area AA39A is analyzed using detailed fire modeling to consider risk of fire scenarios of ignition sources. PRA-NB-FIRE-FQ includes a summary of all potentially risk-significant fire scenarios (i.e.,  $CDF > 1.0E-7$  or  $LERF > 1.0E-8$ ). Bounding CDF / LERF per calendar year values are reported that are based on the risk values documented in PRA-NB-FIRE-FSS, Fire PRA Fire Scenario Selection.

Fire Protection features credited in the Fire PRA are documented in R1900-0411-AA39A, Detailed Fire Modeling Report: Fire Compartment: AA39A Unit 1 AB Switchgear Room (EL 609 FT 6 IN). PRA-NB-FIRE-FSS documents the revision level of the fire modeling reports used in the most recent Fire PRA quantification.

### **3.7 Risk-Informed, Performance-Based Evaluations**

Fire Risk Evaluations (FREs) have been performed to ensure that variances from the NFPA 805 deterministic requirements are acceptable. The evaluation process consists of an integrated assessment of the acceptability of risk, defense-in-depth, and safety margins.

#### **3.7.1 Transition Risk-Informed, Performance-Based Evaluations**

The ‘changes’ associated with NFPA 805 transition were those variances from the deterministic requirements of NFPA 805 or with the existing fire protection licensing basis that were brought into compliance with the NFPA 805 performance based approach. The change identified for evaluation for Fire Area AA39A is as follows:

- Separation Issues

The Fire Risk Evaluation has determined that the change is acceptable based upon:

- The measured change in CDF and LERF.
- Adequate defense-in-depth and safety margins being maintained.

Refer to Attachment 2 for a summary of results associated with the Fire Risk Evaluations.

### 3.8 Defense-in-Depth

A comprehensive risk-informed, performance-based analysis includes consideration of defense-in-depth (DID) as part of an integrated evaluation of risk considerations. In general, defense-in-depth involves consideration of the extent to which fire protection systems and features are provided within the three echelons of fire-protection:

- Preventing fires from starting,
- Rapidly detecting fires and controlling and extinguishing promptly those fires that do occur, thereby limiting fire damage,
- Providing an adequate level of fire protection for structures, systems, and components important to safety, so that a fire that is not promptly extinguished will not prevent the nuclear safety performance criteria from being met.

Each VFDR was evaluated for DID. No recovery actions have been retained for DID.

Based on the assessment in support of the Fire Risk Evaluation, defense-in-depth is maintained for fire area AA39A. Refer to Attachment 2 for details associated with the Fire Risk Evaluation.

### 3.9 Monitoring Program Input

A Monitoring Program will be developed in accordance with FAQ 10-0059, Rev. 1. Methods to monitor availability, reliability, and performance of fire protection program structures, systems, and components (SSCs), as well as programmatic elements will be provided. Additionally, effectiveness measures are established to review program related performance and trends. For AA39A the following systems and features are candidates for inclusion in the CNP Fire Protection Monitoring Program:

- Fire Area boundary barriers discussed in Section 3.1
- Fire Detection System (infrared and ionization)
- CO2 Suppression System
- Electrical Raceway Fire Barrier Systems (ERFBS)
- Cable tray covers

## 4.0 CONCLUSION

The nuclear safety and radioactive release performance criteria of NFPA 805 are met for a fire in Fire Area AA39A. This Fire Risk Evaluation for Fire Area AA39A has demonstrated that

- The change in core damage frequency (delta CDF) is acceptable, and
- The change in large early release frequency (delta LERF) is acceptable, and
- Defense-in-depth and safety margins are maintained.

This is confirmation that a success path effectively remains free of fire damage and that the performance-based approach is acceptable per Section 4.2.4.2 of NFPA 805.

## **5.0 REFERENCES**

- 5.1 Calculation PRA-FIRE-NB-CRE, Fire PRA Cumulative Risk Evaluations
- 5.2 CNP Fire Pre-Plans, Volumes I, II, and III, Revisions 17, 14, and 18 respectively
- 5.3 Fire Hazards Analysis
- 5.4 NFPA 805, Performance-Based Standard for Fire Protection for Light Water Reactor Electric Generating Plants
- 5.5 NFPPM, NFPA 805 Fire Protection Program Manual (NFPPM)
- 5.6 Nuclear Energy Institute (NEI) 04-02, Guidance for Implementing a Risk-Informed, Performance-Based Fire Protection Program under 10 CFR 50.48(c), Rev. 2
- 5.7 Nuclear Safety Capability Assessment Report
- 5.8 PRA-NB-FIRE-FQ, Fire PRA Model Quantification Notebook
- 5.9 PRA-NB-FIRE-FSS, Fire PRA Fire Scenario Selection
- 5.10 R1900-0411-AA39A, AA39A - Detailed Fire Modeling Report
- 5.11 Regulatory Guide 1.205, Risk-Informed, Performance-Based Fire Protection for Existing Light-Water Nuclear Power Plants, Rev. Revision 1
- 5.12 Technical Evaluation R1900-005-001, Non-Power Operation Modes Transition Review

**Fire Area AA39A – Attachment 1 - Table B-3 - Fire Area Transition**

<u>Unit</u>	<u>Fire Area</u>	<u>Description</u>
1	AA39A	Unit 1 AB Switchgear Room (El. 609 ft. 6 in.)

<u>Fire Zone</u>	<u>Description</u>
40A	4KV AB Switchgear Room - El. 609 ft. 6 in. - Unit 1

**Regulatory Basis**

4.2.4.2 - Performance-Based Approach - Fire Risk Evaluation with simplifying deterministic assumptions

<b>Performance Goal</b>	<b>Method of Accomplishment</b>	<b>Comments</b>
Reactivity Control	Unit 1 - Trip the reactor from the Control Room. Borate using Unit 1 East Charging Pump supplied from the RWST. Use source range monitoring for indication.	None
Inventory and Pressure Control	Unit 1 - Control inventory using Unit 1 East Charging Pump. Control pressure using Unit 1 Pressurizer Safety Relief Valves.	VFDR identified for RWST level indication.
Decay Heat Removal	Unit 1 - Feed SGs 2 & 3 with Unit 1 East MDAFW Pump. The DHR function also requires MS isolation with a steam release path through the Safety Relief Valves.	None
Process Monitoring	Unit 1 Process Monitoring - Use Unit 1 process monitoring in the Control Room for the following: Pressurizer level, RCS pressure and temperature, and S/G level and Pressure. Unit 1 Source Range Monitoring - Use Unit 1 source range monitoring in the Control Room.	None
Vital Auxiliaries	Unit 1 Electrical - Control Unit 1 Green (CD) Train Electrical Distribution with Unit 1 Green (CD) DG. Unit 1 ESW - Operate Unit 1 East ESW. Unit 1 CCW - Operate Unit 1 East CCW. Unit 1 HVAC - Operate Unit 1 Control Room HVAC. Operate Unit 1 Auxiliary Building HVAC. Operate Unit 1 Green (CD) DG HVAC. Operate Unit 1 Green (CD) Switchgear HVAC. Operate Unit 1 East MDAFW Room HVAC. Operate the Unit 1 East ESW Room HVAC system.	None

**Fire Area AA39A – Attachment 1 - Table B-3 - Fire Area Transition**

<u>Unit</u>	<u>Fire Area</u>	<u>Description</u>
1	AA39A	Unit 1 AB Switchgear Room (El. 609 ft. 6 in.)

**Reference Documents**

Genesis Solution Suite, EDISON / SAFE-PB, DC Cook V 3.4.0

Nuclear Safety Capability Assessment Report

**Licensing Actions**

None

**Existing Engineering Equivalency Evaluations (EEEE)**

**EEEE Title** Engineering Equivalency Evaluation 11-5 - Unit 1 Emergency Power Systems/4 KV Switchgear Complex Ventilation Shaft Boundary Evaluation (Fire Areas AA39A, AA39B, AA40, AA41 and AA48).

**Summary** The purpose of this engineering equivalency evaluation is to document the acceptability of unrated fire barrier penetration seals between the Unit 1 EPS/4KV switchgear complex ventilation shafts in Fire Zones 40A (Fire Area AA39A), 40B (Fire Area AA39B), 41 (Fire Area AA40) and 42A to 42D (Fire Area AA41) and the Unit 1 switchgear cable spreading room in Fire Zone 55 (Fire Area AA48).

Reasonable assurance is provided that a fire in Fire Areas AA39A, AA39B, AA40, AA41 or AA48 would not impair safe shutdown capabilities of Unit 1. This engineering equivalency evaluation does not impact other engineering equivalency evaluations.

The construction features were evaluated and found to be acceptable based on the fire hazards and fire protection systems within the evaluated areas.



**Fire Area AA39A – Attachment 1 - Table B-3 - Fire Area Transition**

<u>Unit</u>	<u>Fire Area</u>	<u>Description</u>
1	AA39A	Unit 1 AB Switchgear Room (El. 609 ft. 6 in.)

<b><u>EEEE Title</u></b>	<b>Engineering Equivalency Evaluation 11-9 - Turbine, Auxiliary and Containment Buildings Boundary Evaluation</b>
<b><u>Summary</u></b>	<p>The purpose of this engineering equivalency evaluation is to describe in general, the approach and existence of evaluations performed to determine and reconcile fire area boundaries having components or designs with less than a 3-hr fire rating on preventing the spread of fire. This engineering equivalency evaluation also specifically evaluates the impact of unrated door assemblies on the spread of fire.</p> <p>Reasonable assurance is provided that the fire area boundaries having components or design less than a 3-hr fire rating will not increase the spread of fire or impair the safe shutdown capabilities of Units 1 or 2. In addition, this engineering equivalency evaluation does not adversely impact on other engineering equivalency evaluations or exemption requests.</p> <p>This evaluation supports additional evaluations credited in this fire area.</p>
<b><u>EEEE Title</u></b>	<b>Engineering Equivalency Evaluation 11-15 - Switchgear Room Construction Boundary Room Evaluation Fire Zones 40A, 40B, 41, 42A, 45, 46A, 47A and 47B (Fire Areas AA39A, AA39B, AA40, AA41, AA43, AA44, AA45A and AA45B)</b>
<b><u>Summary</u></b>	<p>The purpose of this engineering equivalency evaluation is to document the acceptability of the construction features of the switchgear rooms which have a fire resistance rating of less than 3 hours and their impact on the spread of fire. In particular, fire doors having a 1 1/2-hr fire rating and open penetrations are analyzed by this engineering equivalency evaluation, as other unrated construction features have been previously analyzed under separate engineering equivalency evaluations. The applicable Fire Areas in Unit 1 are AA39A, AA39B, AA40 and AA41. The applicable Fire Areas in Unit 2 are AA43, AA45A and AA45B.</p> <p>Reasonable assurance is provided that the construction features of the switchgear rooms which have a fire resistance rating of less than 3 hours will prevent the spread of fire and not impair the safe shutdown capabilities of Unit 1 and Unit 2. This engineering equivalency evaluation does not impact other engineering equivalency evaluations.</p> <p>The switchgear room boundaries were evaluated and found to be acceptable based on the fire hazards and fire protection systems within the areas.</p>

**Fire Area AA39A – Attachment 1 - Table B-3 - Fire Area Transition**

<u>Unit</u>	<u>Fire Area</u>	<u>Description</u>
1	AA39A	Unit 1 AB Switchgear Room (El. 609 ft. 6 in.)
<hr/>		
<b><u>EEEE Title</u></b>	<b>Engineering Equivalency Evaluation 11-24 - Fire Retention Capability of Nonconforming Fire Seals in Fire Zones having a Low Combustible Loading Classification</b>	
<b><u>Summary</u></b>	<p>The purpose of this engineering equivalency evaluation is to document the acceptability of fire seal designs which do not meet the requirements of the installation specification or fire test data in fire zones having a low combustible loading classification would have on preventing the spread of fire.</p> <p>Reasonable assurance is provided that fire seals which do not meet the requirements of the installation specification or fire test data in fire zones having a low combustible loading classification, will provide adequate fire retention capabilities and will not impair the safe shutdown capabilities of CNP or increase the spread of fire between fire zones. In addition, this engineering equivalency evaluation does not adversely impact other engineering equivalency evaluations or exemptions.</p> <p>Refer to Engineering Equivalency Evaluation 11.28.</p>	
<b><u>EEEE Title</u></b>	<b>Engineering Equivalency Evaluation 11-28 - Generic Fire Seal Design 2 (Fire Areas AA7, AA8, AA39A, AA40, AA43, AA45A, AA45B, AA48 and AA52)</b>	
<b><u>Summary</u></b>	<p>The purpose of this engineering equivalency evaluation is to document the acceptability of deviations to Generic Fire Seal Design 2 on preventing the spread of fire. The applicable Fire Areas include AA7, AA8, AA39A, AA40, AA43, AA54A, AA54B, AA48 and AA52.</p> <p>Reasonable assurance is provided that deviations to Generic Fire Seal Design 2, Fire Seals W7109, W7952, F8150, F8152, F8162, F8184, F8859, F8861, F8863, F8887 and W9058, and the attributes discussed in the engineering equivalency evaluation do not impair the safe shutdown capabilities of CNP or increase the ability of fire to spread between fire zones. This engineering equivalency evaluation does not impact other engineering equivalency evaluations.</p> <p>Attribute Nos. 2, 7, 9 and the 11 fire seals of Generic Fire Seal Design 2 were evaluated and found to be acceptable based on the fire hazards and fire protection systems within the evaluated areas.</p>	

**Fire Area AA39A – Attachment 1 - Table B-3 - Fire Area Transition**

<u>Unit</u>	<u>Fire Area</u>	<u>Description</u>
1	AA39A	Unit 1 AB Switchgear Room (El. 609 ft. 6 in.)

<b><u>EEEE Title</u></b>	<b>Engineering Equivalency Evaluation 11-57 - Fire-Wrapped Cable Trays and Conduit Evaluations (Fire Areas AA32, AA39A, AA45A, and AA2)</b>
<b><u>Summary</u></b>	<p>The purpose of this engineering equivalency evaluation is document the acceptability of the fire-wrapped cable trays and conduits that are credited in support of NFPA 805 PRA. This review will include the acceptability of the exposed structural supports that support these trays, as well as review the fire wrap for potential damage from high hazard fire sources.</p> <p>CNP uses fire wrap systems over cable trays and conduits to provide 1-hr protection of cables credited for safe shutdown in the event of a fire in compliance with NFPA 805, Chapter 4 separation requirements. Many of these wrapped trays are supported by exposed structural steel. This engineering equivalency evaluation examines the ability of these exposed supports in Fire Areas AA32, AA39A, AA45A and AA2 to withstand the fire exposure presented by combustibles present in the area.</p> <p>Reasonable assurance is provided that the exposed steel structural supports on raceways wrapped in accordance with the requirements of NFPA 805, Chapter 4, will not be adversely affected by the combustibles or hazards present in the area. In addition, the fire-wrap on these raceways is not subject to mechanical damage by high hazard fire sources.</p> <p>The exposed steel structural supports were evaluated and found to be acceptable based on the fire hazards and fire protection systems within the evaluated areas.</p>
<b><u>EEEE Title</u></b>	<b>Engineering Equivalency Evaluation 12-19 - CO2 Fire Suppression System Concentrations (Fire Areas AA7, AA8, AA9, AA10, AA29, AA30, AA31, AA37, AA38, AA39, AA40, AA41, AA43, AA44, AA45, AA48, AA49, AA50, AA51, AA52 and AA53)</b>
<b><u>Summary</u></b>	<p>The purpose of this engineering equivalency evaluation is to document the acceptability of the CO2 fire suppression systems in fire zones containing concentrations of cable insulation and the potential for deep-seated fires. This engineering equivalency evaluation determines the CO2 system's impact on the spread of fire and previous engineering equivalency evaluations and exemption requests. Although there are other fire zones that use CO2 for fire suppression such as the DG Rooms, they are installed to suppress surface-type, combustible liquid fires and are not included in this analysis, because they do not contain significant concentrations of cable insulation capable of producing deep-seated fires.</p> <p>All of the CO2 systems included in this engineering equivalency evaluation are capable of performing their intended function, containing the fire until the Fire Brigade arrives, preventing fire spread to adjacent fire zones, and ensuring that safe shutdown of CNP can be achieved and maintained.</p> <p>The existing suppression systems were evaluated and found to be acceptable based on the fire hazards and fire protection systems within the evaluated areas.</p>

**Fire Area AA39A – Attachment 1 - Table B-3 - Fire Area Transition**

<u>Unit</u>	<u>Fire Area</u>	<u>Description</u>
1	AA39A	Unit 1 AB Switchgear Room (El. 609 ft. 6 in.)

**Fire Suppression Effects on Nuclear Safety Performance Criteria**

The CNP fire brigade is trained to discharge water in a judicious manner and instructed to direct hose streams and portable extinguishers at the base of the fire to limit the amount of overspray beyond the immediate fire zone. For this reason, fire brigade activities are not expected to fail components not already considered damaged by fire. It has been concluded that water impingement on cables is not a concern. Electrical cabinets are provided with a seal at the conduit interface. Per visual inspection any side vents for this equipment are pointed downward to prevent water intrusion. The drainage features of the fire area mitigate the potential for flooding damage due to fire suppression, such that the standing water would not affect credited equipment.

In the event of discharge, the CO2 system will not adversely affect equipment operating within this fire area or in AA39B (which will also discharge). Potential condensation developing on electrical components is a long term issue that would be eliminated by ventilating the fire area after actuation. Per visual inspection, all CO2 nozzles in both fire areas are located greater than 5 ft. away from any credited equipment and therefore, the possibility of thermal shock due to CO2 actuation has been deemed to be a non-issue in this fire area in accordance to EPRI NP-7253 "Effects of Fire Suppressants on Electrical Components in Nuclear Power Plants". Since it is shown that suppression effects will not impact the nuclear safety performance criteria, the fire area configuration is deemed acceptable.

**References:**

Technical Evaluation 12.1, "Fire Suppression Effects Study"

Technical Evaluation 12.1, "Supplemental Information to Fire Suppression Effects Study – Supplement 1"

**Fire Area Comments**

None

## Fire Area AA39A – Attachment 2 - Fire Risk Evaluation Results Summary

### A2.1 Introduction

The ‘changes’ associated with NFPA 805 transition were those variances from the deterministic requirements of NFPA 805. The changes identified for evaluation for fire area AA39A are grouped as follows:

- Separation Issues

This attachment is a summary of the Fire Risk Evaluation for the fire area. The complete results and methodology are contained in the Cumulative Fire Risk Evaluation, PRA-FIRE-NB-CRE. (FPCE 2017-0009)

### A2.2 Inputs/Assumptions

Fire modeling processes and inputs provided in NUREG/CR-6850 are appropriate for use in a risk-informed, performance-based evaluation. The complete list of assumptions used in the fire modeling methodology for this fire area is contained in Detailed Fire Modeling Technical Evaluation R1900-0411-AA39A.

### A2.3 Fire Modeling Methodology

Fire PRA fire modeling results are used as the initial input into this Fire Risk Evaluation. The process consists of conservative bounding analyses using NUREG/CR-6850 methods. As needed, refinements are made to utilize more realistic parameters. The complete fire modeling methodology for this fire area is contained in Detailed Fire Modeling Technical Evaluation R1900-0411-AA39A.

### A2.4 Scenario Descriptions and Model Results

Fire Area AA39A was evaluated for the impact of fires originating from both fixed and transient ignition sources. Complete descriptions of each fire scenario is contained within the Detailed Fire Modeling Technical Evaluation R1900-0411-AA39A.

#### A2.4.1 Ignition Sources

Fire Area AA39A contains 4kV switchgear bus 1A and 1B as well as associated transformers. The fire area also contains a miscellaneous power panel and ventilation supply and exhaust fans. Per discussion with plant personnel, the heat release rates for all switchgear, load centers, and MCC electrical cabinets have been characterized as qualified cable because items of this nature are generally constructed on-site. For other electrical cabinet types, where the internal cable qualification was unknown, the heat release rates have been assumed as non-qualified. Ignition sources in Fire Area AA39A were modeled using the 98th percentile fire as a screening approach. For the high voltage load center, both an electrical fire and a high energy arcing fault (HEAF) fire scenario have been developed.

In Fire Area AA39A, the 98th percentile HRR was used for all transient fires. The 98th percentile HRR bounds the possible transient ignition sources expected for this fire area, which were fire tested and identified in NUREG/CR-6850, Appendix G, Table G-7.

#### A2.4.2 Scenario Results

The PRA analyzed the VFDRs and determined them to be risk insignificant, therefore, a quantitative delta risk calculation was not performed.

### A2.5 Fire Risk Evaluation Results

### **Fire Area AA39A – Attachment 2 - Fire Risk Evaluation Results Summary**

PRA-FIRE-NB-CRE documents scenarios and corresponding impacted VFDRs that were evaluated for delta risk during the transition to NFPA 805 and also all changes to the Fire Protection Program that are currently incorporated into the Fire PRA model. The acceptability of the Cumulative Fire Risk Evaluations was based on calculated delta risk meeting the thresholds of NEI 04-02, RG 1.205 and RG 1.174. (FPCE 2017-0009)

**Fire Area AA39A – Attachment 2 - Fire Risk Evaluation Results Summary****A-2.6 Impact of VFDR on Defense-in-Depth**

Defense-in-Depth has been evaluated for this fire area. The impacts of this evaluation are summarized in the table below:

Defense-in-Depth Impact Review for AA39A			
Method of Providing DID	Required to Support Deterministic Analysis or Fire PRA?	Changes or Improvements Necessary for DID?	Basis/Justification
Echelon 1: Prevent fires from starting			
Combustible Control is implemented in accordance with Procedure PMP-2270-CCM-001, Control of Combustible Materials.	Yes	No	• This element is adequate based on no perceived weakness of, or over-reliance on, another echelon of defense-in-depth.
Hot Work Control is implemented in accordance with Procedure PMP-2270-WBG-001, Welding, Burning and Grinding Activities.	Yes	No	
Echelon 2: Rapidly detect, control and extinguish promptly those fires that do occur thereby limiting fire damage			
Fire Detection System	Yes	No	• Suppression and detection are already required and fire fighting activities are not expected to be challenging; therefore, no changes or improvements to Echelon 2 attributes are necessary to maintain defense-in-depth.
Fixed Fire Suppression	Yes	No	
Portable Fire Extinguishers	Yes	No	
Hose stations and hydrants	Yes	No	
Pre-Fire Plan	Yes	No	
Echelon 3: Provide adequate level of fire protection for systems and structures so that a fire will not prevent essential safety functions from being performed			
Walls, floors ceilings and structural elements are rated or have been evaluated as adequate for the hazard.	Yes	No	• Although VFDR AA39A-001 is affected in a potentially high risk scenario, based on a detailed review, the VFDR is not the cause for the high risk of the scenario, therefore implementing additional DID echelon 3 attributes for this VFDR would provide negligible risk improvement.
Penetrations in the fire area barrier are rated or have been evaluated as adequate for the hazard.	Yes	No	
Supplemental barriers (e.g., ERFBS, cable tray covers, etc.)	Yes	No	
Guidance provided to operations personnel detailing the required success path(s) including recovery actions to achieve nuclear safety performance criteria.	No	No	

## Fire Area AA39A – Attachment 2 - Fire Risk Evaluation Results Summary

### A-2.7 Safety Margin Considerations

In accordance with NEI 04-02, the maintenance of adequate Safety Margin is assessed by the consideration categories of analyses utilized by this Fire Risk Evaluation.

Safety margins are considered to be maintained if:

- Codes and Standards or their alternatives accepted for use by the NRC are met.

AND

- Safety analyses acceptance criteria in the licensing basis (e.g., FSAR, supporting analyses) are met, or provides sufficient margin to account for analysis and data uncertainty.

The following summarizes the bases for ensuring the maintenance of safety margins:

- The risk-informed, performance based processes utilized are based upon NFPA 805, 2001 edition, endorsed by the NRC in 10 CFR 50.48(c).
- The Fire Risk Evaluation process is in accordance with NEI 04-02, Revision 2, which is endorsed by the NRC in Regulatory Guide 1.205, Revision 1.
- The Fire PRA is developed in accordance with NUREG/CR-6850, which was developed jointly between the NRC and EPRI.
- The Fire PRA has undergone an industry peer review, in order to ensure the Fire PRA meets the appropriate quality standards of ASME/ANS RA-Sa-2009, "Standard for Level 1/Large Early Release Frequency Probabilistic Risk Assessment for Nuclear Power Plant Applications," Dated February 2, 2009
- The "combined analysis approach" is used during transition (NEI 04-02, Section 5.3.4.3); therefore, MEFS/LFS is not analyzed separately from the Fire PRA results.
- The CNP internal events PRA model received two formal industry peer reviews conducted in accordance with applicable NEI guidelines. The initial peer review was performed in 2001, while a subsequent focused scope (i.e., limited scope) peer review was conducted in 2009. The initial, full-scope WOG peer review covered all aspects of the CNP PRA model and the administrative processes used to maintain and update the model. The CNP PRA model has been revised to address all significant issues (i.e., Category A and B Facts & Observations) identified during the initial peer review. None of the findings from the focused-scope peer review were judged to reach the significance level of a Category A or B Fact & Observation; as a result, no changes to the PRA model have yet been made to include resolutions for these latter issues.
- Fire protection systems and features determined to be required by NFPA 805 Chapter 4 have been confirmed to meet the requirements of NFPA 805 Chapter 3 and their associated referenced codes and listings, or provided with acceptable alternatives using processes accepted for use by the NRC (i.e., FAQ 06-0008, FAQ 06-0004, 07-0033).
- Fire modeling performed in support of the transition has been performed within the Fire PRA utilizing codes and standards developed by industry and NRC staff which have been verified and validated in authoritative publications, such as NUREG 1824, "Verification and Validation of Selected Fire Models for Nuclear Power Plant Applications". In general, the fire modeling performed in support of the Fire Risk Evaluations has been performed using conservative methods and input parameters that are based upon



### **Fire Area AA39A – Attachment 2 - Fire Risk Evaluation Results Summary**

NUREG/CR-6850 as documented in the AA39A Detailed Fire Modeling Report, section 7.2. While this is generally not ideal in the context of best estimate probabilistic risk analysis, it is a pragmatic approach given the current state of knowledge regarding the uncertainties related to the application of the fire modeling tools and associated input parameters for specific plant configurations.

- In accordance with the requirements of 10 CFR 50.48(c)(2)(iii), the Fire PRA results, including cutsets for the scenarios of concern, have been reviewed and it was verified that the results presented above do not rely solely on feed and bleed as the fire-protected safe shutdown path for maintaining reactor coolant inventory, pressure control, and decay heat removal capability for this fire area.

#### **A-2.8 Transition Risk Evaluation Conclusions**

The transition change evaluation determined that these changes:

- Are acceptable based upon the measured change in CDF and LERF
- Maintained adequate defense-in-depth and safety margins

The results of this evaluation meet the requirements of NFPA 805 Risk Evaluation; therefore, the use of the performance based analysis approach is acceptable.



## **1.0 PURPOSE**

This report documents the Fire Safety Analysis (FSA) for Cook Nuclear Plant (CNP) Fire Area AA39B, Unit 1 CD Switchgear Room (El. 609 ft. 6 in.) which comprises fire zone(s) 40B. The purpose of this analysis is to demonstrate the achievement of the nuclear safety and radioactive release performance criteria of NFPA 805 as required by 10 CFR 50.48(c). The Fire Safety Analysis is a key part of compliance with Section 2.7.1.2 Fire Protection Program Design Basis Document of NFPA 805.

## **2.0 ANALYSIS METHODOLOGY**

The FSA is the design basis document as described in NFPA 805 Section 2.7.1.2. The following steps are performed to develop the FSA on a fire area basis:

- Identify significant fire hazards in the fire area. This is based on NFPA 805 approach to analyze the plant from an ignition source and fuel package perspective.
- Summarize Nuclear Safety Capability Analysis (NSCA) compliance strategies. This is the result of the NEI 04-02 B-3 Table review of the Safe Shutdown Analysis.
- Summarize Non-Power Operations Modes compliance strategies.
- Summarize Radioactive Release compliance strategies. The transition review process required per NEI 04-02 is used to develop these results.
- Provide Fire Probabilistic Risk Assessment summary of results. This is based on the results from the plant Fire PRA.
- Perform risk informed, performance based evaluations if needed for the performance based approach.
- Summarize Defense-in-Depth strategy for each fire area.
- Determine key analysis assumptions which are candidates to be included in the NFPA 805 monitoring program.
- Provide conclusions relative to NFPA 805 compliance.

### **3.0 ANALYSIS**

#### **3.1 Classical Fire Protection**

##### **3.1.1 Construction**

Walls, floors and ceilings to adjacent fire areas and fire zones are reinforced concrete in excess of a 3-hour rating.

A fire area boundary evaluation was performed for the construction features (i.e. fire doors, undampered ventilation duct, and open penetrations) of the switchgear rooms that have a fire resistance rating of less than 3 hours (Engineering Equivalency Evaluation 11-15).

Applicable Engineering Equivalency Evaluations are documented in Attachment 1.

##### **3.1.2 Doors and Access Openings**

A fire door having a 3-hour rating is provided to adjacent Fire Area AA40 and AA2 - Fire Zones 41 and 90.

A fire area boundary evaluation was performed for an unrated ceiling hatch to Fire Area AA48 - Fire Zone 55 (Engineering Equivalency Evaluation 9-15).

##### **3.1.3 Penetrations**

Penetrations in fire barriers between this fire zone and adjacent fire areas, fire zones and the yard are provided with fire seals.

A fire area boundary evaluation was performed for the unrated fire barrier penetration seals installed between Fire Areas AA39A and AA39B - Fire Zones 40A and 40B, Fire Area AA40 - Fire Zone 41, Fire Area AA41 - Fire Zones 42A, 42B, 42C, 42D and Fire Area AA48 - Fire Zone 55 (Engineering Equivalency Evaluation 11-5).

Seismic expansion gaps are sealed with a glass fiber reinforced silicone sheeting.

### 3.1.4 Detection

The table below outlines the fire detection system(s) provided in the Fire Area:

Table 3-1, Fire Area AA39B Detection Systems								
Fire Zone	Type of System	Local (L) / Remote (R)	Detection Actuates Suppression?	Required System?				
				S	L	E	R	D
40B	Infrared	L/R	Y	N	N	Y	N	N
40B	Ionization	L/R	N	N	N	Y	N	N

**Table 3-1 Legend:**

Table Field: "Required System?"	
S	- Required for Chapter 4 Separation Criteria
L	- Required for NRC Approved Licensing Action
E	- Required for Engineering Equivalency Evaluation
R	- Required for Risk Significance
D	- Required to maintain adequate balance of Defense-in-Depth in a Change Evaluation or Fire Risk Evaluation

Cross zoned ionization smoke detectors (2) and infra-red detectors (3) are provided which alarm in the Unit 1 Control Room. The ionization detectors are part of a larger detection circuit that includes Fire Zones 40A and 40B.

### 3.1.5 Fixed Suppression

The table below outlines the fixed fire suppression system(s) provided in the Fire Area:

Table 3-2, Fire Area AA39B Suppression Systems							
Fire Zone	Type of System	Full (F) / Partial (P)	Required System?				
			S	L	E	R	D
40B	Automatic CO2	F	N	N	Y	N	N
Table 3-2 Legend:							
Table Field: "Required System?"							
S	- Required for Chapter 4 Separation Criteria						
L	- Required for NRC Approved Licensing Action						
E	- Required for Engineering Equivalency Evaluation						
R	- Required for Risk Significance						
D	- Required to maintain adequate balance of Defense-in-Depth in a Change Evaluation or Fire Risk Evaluation						

A low pressure CO2 total flooding system supplied from the 17 ton tank is provided. This system is automatically actuated. Operation of this system discharges CO2 simultaneously into Fire Zones 40A and 40B.

### 3.1.6 Manual Suppression / Response Strategy

A postulated fire will be identified by early detection using ionization type smoke detection, infra-red detection or by plant personnel using plant communication system to notify the control room.

The automatic detection systems alarm in the control room. The Control Room operator will dispatch the fire brigade for initiation of manual fire fighting. A fire in this fire area will be contained by the construction features discussed in Section 3.1.1. Manual suppression is provided by the CNP Fire Brigade.

There are fire extinguishers in this fire area, with additional extinguishers located in adjacent Turbine Building Fire Zone 90.

Water hose reels are located in the Turbine Building Fire Zone 90.

Floor drains are available in this fire area.

### 3.1.7 Ventilation

A fire in this area will be contained by the fire barriers. Smoke can be removed by portable fans and flexible ducting to the Turbine Building and outdoors. The normal building ventilating systems in the Auxiliary Building will then exhaust the smoke via filtered monitored pathways. This fire area is listed as a non-controlled area in the Fire Pre Plans and therefore there is reasonable assurance that products of combustion will not be contaminated.

There are 4-hour rated undampered ventilation shafts in the ceiling that pass through Fire Area AA48 - Fire Zone 55 to the yard.

### 3.1.8 Other Features

Some cable trays within Fire Area AA39B are provided with bottom covers and/or are fully enclosed.

## 3.2 Fire Hazards Identification

The fire area contains both ignition sources and combustible fire hazards. The ignition sources consist of 4kV busses, plant heater and transformers for Bus C and D. Combustibles consist primarily of cable insulation, rubber and plastics.

The exterior fire hazards that are adjacent to exterior walls are the Unit 1 Main, Auxiliary and Start-up Transformers. Water spray suppression systems are provided for the transformers. In addition, reinforced concrete walls and 3 hour rated fire seals provide separation for the Fire Area. The missile barriers around each transformer also provide a measure of fire barrier protection for some of the transformers, limiting radiant heat in the direction of the Fire Area. The fixed suppression and rated construction are sufficient to provide protection for credited equipment within the plant.

The current fire loading classification is considered low.

## 3.3 NSCA Compliance Summary

Fire Area AA39B, the Unit 1 Green Train Switchgear Room (EL. 609'-6"), contains the Unit 1 Green Train (CD) 4kV non-safety and safety buses, supporting equipment and Red and Green train cables, conduits and raceways.

Compliance with the nuclear safety performance criteria is achieved using the deterministic approach in accordance with NFPA 805, Section 4.2.3.2.

Safe and stable condition of Unit 1 will be accomplished using Steam Generators 1 and 4 via the Unit 1 West Motor Driven Auxiliary Feedwater Pump, Control Room Process Monitoring, Unit 1 Charging via the West Pump, Unit 1 Component Cooling Water via the West Pump, Unit 1 ESW via the West Pump. Electrical power is supplied to the Red Train via Offsite Power. Additionally, Red Train Emergency Diesel (AB) is also available.

The Nuclear Safety Performance Criteria compliance strategy for AA39B is documented within the NSCA Report.

### **3.3.1 Variances**

There are no variances for this fire area.

### **3.3.2 Recovery Actions Credited**

There are no recovery actions for this fire area.

### **3.4 Non-Power Operational Modes Compliance Summary**

A review of CNP for the potential effects of a fire in this Fire Area while in non-power modes of operation (NPO) was conducted. This review was conducted using the guidance provided in NEI 04-02 and FAQ 07-0040, "Non-Power Operations Clarifications".

The review determined that there are potential failures that affect certain Key Safety Functions (KSF) as a result of the fire in this area, and the fire could result in the loss of one or more KSF paths. Compensatory measures are required during high risk evolution periods to provide reasonable assurance a fire will not adversely affect key safety functions and the NFPA 805 performance goal for NPO is therefore satisfied. The results of the NPO analysis are contained within Technical Evaluation R1900-005-001, Non-Power Operation Modes Transition Review Report.

### **3.5 Radioactive Release Compliance Summary**

The NFPA 805 radiological release goal is to provide reasonable assurance that a fire will not result in a radiological release that adversely affects the public, plant personnel or the environment. The NFPA 805 requirement is to ensure a radiation release to any unrestricted area due to the direct effects of fire suppression activities (but not involving fuel damage) shall be as low as reasonably achievable and shall not exceed applicable plant Technical Specification limits.

AA39B is located outside the Radiological Controlled Area (RCA) and is not a storage location for contaminated materials, therefore there is reasonable assurance a fire in this area will not result in radiation release. The review of this fire area, with respect to radioactive release, is documented in the NFPPM.

### 3.6 Probabilistic Risk Assessment-Summary of Results

A Fire PRA (FPRA) quantification of Fire Area AA39B was performed and is documented in PRA-NB-FIRE-FQ, Fire PRA Model Quantification Notebook. The fire risk quantification for Fire Area AA39B is analyzed using detailed fire modeling to consider risk of fire scenarios of ignition sources. PRA-NB-FIRE-FQ includes a summary of all potentially risk-significant fire scenarios (i.e., CDF > 1.0E-7 or LERF > 1.0E-8). Bounding CDF / LERF per calendar year values are reported that are based on the risk values documented in PRA-NB-FIRE-FSS, Fire PRA Fire Scenario Selection.

Fire Protection features credited in the Fire PRA are documented in R1900-0411-AA39B, Detailed Fire Modeling Report: Fire Compartment: AA39B Unit 1 CD Switchgear Room (EL 609 FT 6 IN). PRA-NB-FIRE-FSS documents the revision level of the fire modeling reports used in the most recent Fire PRA quantification.

### 3.7 Risk-Informed, Performance-Based Evaluations

There are no VFDRs for this fire area, and therefore, no Fire Risk Evaluations have been performed.

#### 3.7.1 Transition Risk-Informed, Performance-Based Evaluations

There are no VFDRs for this fire area, and therefore this section is not applicable to Fire Area AA39B.

### 3.8 Defense-in-Depth

Per NFPA 805, section 2.4.4.2, "Defense-in-Depth": The deterministic approach for meeting the performance criteria shall be deemed to satisfy this defense-in-depth requirement.

### 3.9 Monitoring Program Input

A Monitoring Program will be developed in accordance with FAQ 10-0059, Rev. 1. Methods to monitor availability, reliability, and performance of fire protection program structures, systems, and components (SSCs), as well as programmatic elements will be provided. Additionally, effectiveness measures are established to review program related performance and trends. For AA39B the following systems and features are candidates for inclusion in the CNP Fire Protection Monitoring Program:

- Fire Area boundary barriers discussed in Section 3.1
- Fire Detection System (infrared and ionization)
- CO2 Suppression System

## 4.0 CONCLUSION

The nuclear safety and radioactive release performance criteria of NFPA 805 are met for a fire in Fire Area AA39B. This Fire Safety Analysis has demonstrated that for Fire Area AA39B a success path remains free of fire damage using the deterministic approach per Section 4.2.3 of NFPA 805.



## **5.0 REFERENCES**

- 5.1 CNP Fire Pre-Plans, Volumes I, II, and III, Revisions 17, 14, and 18 respectively
- 5.2 Fire Hazards Analysis
- 5.3 NFPA 805, Performance-Based Standard for Fire Protection for Light Water Reactor Electric Generating Plants
- 5.4 NFPPM, NFPA 805 Fire Protection Program Manual (NFPPM)
- 5.5 Nuclear Energy Institute (NEI) 04-02, Guidance for Implementing a Risk-Informed, Performance-Based Fire Protection Program under 10 CFR 50.48(c), Rev. 2
- 5.6 Nuclear Safety Capability Assessment Report
- 5.7 PRA-NB-FIRE-FQ, Fire PRA Model Quantification Notebook
- 5.8 PRA-NB-FIRE-FSS, Fire PRA Fire Scenario Selection
- 5.9 Regulatory Guide 1.205, Risk-Informed, Performance-Based Fire Protection for Existing Light-Water Nuclear Power Plants, Rev. Revision 1
- 5.10 Technical Evaluation R1900-005-001, Non-Power Operation Modes Transition Review

**Fire Area AA39B – Attachment 1 - Table B-3 - Fire Area Transition**

<u>Unit</u>	<u>Fire Area</u>	<u>Description</u>
1	AA39B	Unit 1 CD Switchgear Room (El. 609 ft. 6 in.)

<u>Fire Zone</u>	<u>Description</u>
40B	4KV CD Switchgear Room - El. 609 ft. 6 in. - Unit 1

**Regulatory Basis**

4.2.3.2 - Deterministic Approach

<b>Performance Goal</b>	<b>Method of Accomplishment</b>	<b>Comments</b>
Reactivity Control	Unit 1 - Trip the reactor from the Control Room. Borate using Unit 1 West Charging Pump supplied from the RWST. Use source range monitoring for indication.	None
Inventory and Pressure Control	Unit 1 - Control inventory using Unit 1 West Charging Pump. Control pressure using Unit 1 Pressurizer Safety Relief Valves.	None
Decay Heat Removal	Unit 1 - Feed SGs 1 & 4 with Unit 1 West MDAFW Pump. The DHR function also requires MS isolation with a steam release path through the Safety Relief Valves.	None
Process Monitoring	Unit 1 Process Monitoring - Use Unit 1 process monitoring in the Control Room for the following: Pressurizer level, RCS pressure and temperature, and S/G level and Pressure. Unit 1 Source Range Monitoring - Use Unit 1 source range monitoring in the Control Room powered from Unit 2.	None
Vital Auxiliaries	Unit 1 Electrical - Control Unit 1 Red (AB) Train Electrical Distribution with Unit 1 Red (AB) Train Offsite Power or Unit 1 Red (AB) DG. Unit 1 ESW - Operate Unit 1 West ESW. Unit 1 CCW - Operate Unit 1 West CCW. Unit 1 HVAC - Operate Unit 1 Control Room HVAC. Operate Unit 1 Auxiliary Building HVAC. Operate Unit 1 Red (AB) DG HVAC. Unit 1 Red (AB) Switchgear HVAC is not available. Operate Unit 1 West MDAFW Room HVAC system. Operate the Unit 1 West ESW Room HVAC system.	None

**Fire Area AA39B – Attachment 1 - Table B-3 - Fire Area Transition**

<u>Unit</u>	<u>Fire Area</u>	<u>Description</u>
1	AA39B	Unit 1 CD Switchgear Room (El. 609 ft. 6 in.)

**Reference Documents**

Genesis Solution Suite, EDISON / SAFE-PB, DC Cook V 3.4.0

Nuclear Safety Capability Assessment Report

**Licensing Actions**

None

**Existing Engineering Equivalency Evaluations (EEEE)****EEEE Title Engineering Equivalency Evaluation 9-15 - Fire Zone 40B (Fire Area AA39B) and Fire Zone 55 (Fire Area AA48) Hatch Evaluation**

**Summary** The purpose of this engineering equivalency evaluation is to document the acceptability of an unrated steel plate floor hatch located between the Unit 1 4kV Switchgear Room and the Unit 1 Switchgear Room Cable Vault in Fire Zones 40B (Fire Area AA39B) and 55 (Fire Area AA48) respectively. A 3-hr fire-rated hatch assembly is not commercially available for use in this location.

Note: This engineering equivalency evaluation has been reviewed by the NRC. Refer to NRC SER dated June 17, 1988, for acceptance of unrated fire hatches in fire area boundaries. The NRC concluded that the level of fire safety is equivalent to that achieved by conformance with the guidelines of Section D.1.j of Appendix A to BTP APCSB 9.5-1, and, therefore, the deviations for the unrated fire hatches were found acceptable.

Reasonable assurance is provided that a fire in Fire Zone 40B or Fire Zone 55 would not impair safe shutdown capabilities of Unit 1. This engineering equivalency evaluation does not adversely impact other engineering equivalency evaluations.

The hatch was evaluated and found to be acceptable based on the fire hazards and fire protection systems within the evaluated areas.

**Fire Area AA39B – Attachment 1 - Table B-3 - Fire Area Transition**

<u>Unit</u>	<u>Fire Area</u>	<u>Description</u>
1	AA39B	Unit 1 CD Switchgear Room (El. 609 ft. 6 in.)

<b><u>EEEE Title</u></b>	<b>Engineering Equivalency Evaluation 11-5 - Unit 1 Emergency Power Systems/4 KV Switchgear Complex Ventilation Shaft Boundary Evaluation (Fire Areas AA39A, AA39B, AA40, AA41 and AA48).</b>
<b><u>Summary</u></b>	<p>The purpose of this engineering equivalency evaluation is to document the acceptability of unrated fire barrier penetration seals between the Unit 1 EPS/4KV switchgear complex ventilation shafts in Fire Zones 40A (Fire Area AA39A), 40B (Fire Area AA39B), 41 (Fire Area AA40) and 42A to 42D (Fire Area AA41) and the Unit 1 switchgear cable spreading room in Fire Zone 55 (Fire Area AA48).</p> <p>Reasonable assurance is provided that a fire in Fire Areas AA39A, AA39B, AA40, AA41 or AA48 would not impair safe shutdown capabilities of Unit 1. This engineering equivalency evaluation does not impact other engineering equivalency evaluations.</p> <p>The construction features were evaluated and found to be acceptable based on the fire hazards and fire protection systems within the evaluated areas.</p>
<b><u>EEEE Title</u></b>	<b>Engineering Equivalency Evaluation 11-9 - Turbine, Auxiliary and Containment Buildings Boundary Evaluation</b>
<b><u>Summary</u></b>	<p>The purpose of this engineering equivalency evaluation is to describe in general, the approach and existence of evaluations performed to determine and reconcile fire area boundaries having components or designs with less than a 3-hr fire rating on preventing the spread of fire. This engineering equivalency evaluation also specifically evaluates the impact of unrated door assemblies on the spread of fire.</p> <p>Reasonable assurance is provided that the fire area boundaries having components or design less than a 3-hr fire rating will not increase the spread of fire or impair the safe shutdown capabilities of Units 1 or 2. In addition, this engineering equivalency evaluation does not adversely impact on other engineering equivalency evaluations or exemption requests.</p> <p>This evaluation supports additional evaluations credited in this fire area.</p>

**Fire Area AA39B – Attachment 1 - Table B-3 - Fire Area Transition**

<u>Unit</u>	<u>Fire Area</u>	<u>Description</u>
1	AA39B	Unit 1 CD Switchgear Room (El. 609 ft. 6 in.)
<b><u>EEEE Title</u></b>	<b>Engineering Equivalency Evaluation 11-15 - Switchgear Room Construction Boundary Room Evaluation Fire Zones 40A, 40B, 41, 42A, 45, 46A, 47A and 47B (Fire Areas AA39A, AA39B, AA40, AA41, AA43, AA44, AA45A and AA45B)</b>	
<b><u>Summary</u></b>	<p>The purpose of this engineering equivalency evaluation is to document the acceptability of the construction features of the switchgear rooms which have a fire resistance rating of less than 3 hours and their impact on the spread of fire. In particular, fire doors having a 1 1/2-hr fire rating and open penetrations are analyzed by this engineering equivalency evaluation, as other unrated construction features have been previously analyzed under separate engineering equivalency evaluations. The applicable Fire Areas in Unit 1 are AA39A, AA39B, AA40 and AA41. The applicable Fire Areas in Unit 2 are AA43, AA45A and AA45B.</p> <p>Reasonable assurance is provided that the construction features of the switchgear rooms which have a fire resistance rating of less than 3 hours will prevent the spread of fire and not impair the safe shutdown capabilities of Unit 1 and Unit 2. This engineering equivalency evaluation does not impact other engineering equivalency evaluations.</p> <p>The switchgear room boundaries were evaluated and found to be acceptable based on the fire hazards and fire protection systems within the areas.</p>	
<b><u>EEEE Title</u></b>	<b>Engineering Equivalency Evaluation 12-19 - CO2 Fire Suppression System Concentrations (Fire Areas AA7, AA8, AA9, AA10, AA29, AA30, AA31, AA37, AA38, AA39, AA40, AA41, AA43, AA44, AA45, AA48, AA49, AA50, AA51, AA52 and AA53)</b>	
<b><u>Summary</u></b>	<p>The purpose of this engineering equivalency evaluation is to document the acceptability of the CO2 fire suppression systems in fire zones containing concentrations of cable insulation and the potential for deep-seated fires. This engineering equivalency evaluation determines the CO2 system's impact on the spread of fire and previous engineering equivalency evaluations and exemption requests. Although there are other fire zones that use CO2 for fire suppression such as the DG Rooms, they are installed to suppress surface-type, combustible liquid fires and are not included in this analysis, because they do not contain significant concentrations of cable insulation capable of producing deep-seated fires.</p> <p>All of the CO2 systems included in this engineering equivalency evaluation are capable of performing their intended function, containing the fire until the Fire Brigade arrives, preventing fire spread to adjacent fire zones, and ensuring that safe shutdown of CNP can be achieved and maintained.</p> <p>The existing suppression systems were evaluated and found to be acceptable based on the fire hazards and fire protection systems within the evaluated areas.</p>	

**Fire Area AA39B – Attachment 1 - Table B-3 - Fire Area Transition**

<u>Unit</u>	<u>Fire Area</u>	<u>Description</u>
1	AA39B	Unit 1 CD Switchgear Room (El. 609 ft. 6 in.)

**Fire Suppression Effects on Nuclear Safety Performance Criteria**

The CNP fire brigade is trained to discharge water in a judicious manner and instructed to direct hose streams and portable extinguishers at the base of the fire to limit the amount of overspray beyond the immediate fire zone. For this reason, fire brigade activities are not expected to fail components not already considered damaged by fire. It has been concluded that water impingement on cables is not a concern. Electrical cabinets are provided with a seal at the conduit interface. Per visual inspection any side vents for this equipment are pointed downward to prevent water intrusion. The drainage features of the fire area mitigate the potential for flooding damage due to fire suppression, such that the standing water would not affect credited equipment.

In the event of discharge, the CO2 system will not adversely affect equipment operating within this fire area or in AA39A (which will also discharge). Potential condensation developing on electrical components is a long term issue that would be eliminated by ventilating the fire area after actuation. Per visual inspection, all CO2 nozzles in both fire areas are located greater than 5 ft. away from any credited equipment and therefore, the possibility of thermal shock due to CO2 actuation has been deemed to be a non-issue in this fire area in accordance to EPRI NP-7253 "Effects of Fire Suppressants on Electrical Components in Nuclear Power Plants". Since it is shown that suppression effects will not impact the nuclear safety performance criteria, the fire area configuration is deemed acceptable.

**References:**

Technical Evaluation 12.1, "Fire Suppression Effects Study"

Technical Evaluation 12.1, "Supplemental Information to Fire Suppression Effects Study – Supplement 1"

**Fire Area Comments**

None

## D. C. Cook Nuclear Plant Fire Safety Analysis

## Fire Area: AA40

Unit 1 Engineered Safeguards Systems and Motor Control Center Room  
(El. 609 ft. 6 in.)

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## Attachments

Fire Area AA40 – Attachment 1 - Table B-3 - Fire Area Transition

## Fire Area AA40 – Attachment 2 - Fire Risk Evaluation Results Summary

## 1.0 PURPOSE

This report documents the Fire Safety Analysis (FSA) for Cook Nuclear Plant (CNP) Fire Area AA40, Unit 1 Engineered Safeguards Systems and Motor Control Center Room (El. 609 ft. 6 in.) which comprises fire zone(s) 41. The purpose of this analysis is to demonstrate the achievement of the nuclear safety and radioactive release performance criteria of NFPA 805 as required by 10 CFR 50.48(c). The Fire Safety Analysis is a key part of compliance with Section 2.7.1.2 Fire Protection Program Design Basis Document of NFPA 805. This analysis also documents results of risk-informed, performance-based Fire Risk Evaluations (FREs). These evaluations are associated with Variances from Deterministic Requirements (VFDRs) of NFPA 805 Chapter 4.

## 2.0 ANALYSIS METHODOLOGY

The FSA is the design basis document as described in NFPA 805 Section 2.7.1.2. The following steps are performed to develop the FSA on a fire area basis:

- Identify significant fire hazards in the fire area. This is based on NFPA 805 approach to analyze the plant from an ignition source and fuel package perspective.
- Summarize Nuclear Safety Capability Analysis (NSCA) compliance strategies. This is the result of the NEI 04-02 B-3 Table review of the Safe Shutdown Analysis.
- Summarize Non-Power Operations Modes compliance strategies.
- Summarize Radioactive Release compliance strategies. The transition review process required per NEI 04-02 is used to develop these results.
- Provide Fire Probabilistic Risk Assessment summary of results. This is based on the results from the plant Fire PRA.
- Perform risk informed, performance based evaluations if needed for the performance based approach.
- Summarize Defense-in-Depth strategy for each fire area.
- Determine key analysis assumptions which are candidates to be included in the NFPA 805 monitoring program.
- Provide conclusions relative to NFPA 805 compliance.



### 3.0 ANALYSIS

#### 3.1 Classical Fire Protection

##### 3.1.1 Construction

Walls, floors and ceilings to adjacent fire areas are reinforced concrete in excess of a 3-hour rating.

A 12-inch concrete block wall having a 4-hour rating provides a flame and heat shield between the 4kV/600V transformers.

A fire area boundary evaluation was performed for the construction features (i.e. an unrated steel plate hatch, fire doors having a 1 1/2-hour fire rating, and open penetrations) of the switchgear rooms that have a fire resistance rating of less than 3 hours (Engineering Equivalency Evaluations 9-16 and 11-15).

There are no combustibles that span the boundaries between adjacent fire areas.

Applicable Engineering Equivalency Evaluations are documented in Attachment 1.

##### 3.1.2 Doors and Access Openings

A fire area boundary evaluation was performed for an unrated ceiling hatch to Fire Area AA48 - Fire Zone 55.

Fire doors having a 3-hour rating are provided to adjacent Fire Areas AA34, AA48, AA39A and AA39B - Fire Zones 33A, 55 and 40A and 40B, respectively.

The access/ventilation opening between this fire zone and adjacent Fire Zone 42A (Fire Area AA41) is provided with a combined multi-section fire damper assembly and personnel access door. The fire dampers, door, doorframe and supporting structures are installed as a 3-hour rated assembly. The dampers are furnished with electro-thermal links (ETLs). The links are temperature rated for 165°F and are electrically actuated through the CO2 system in adjacent Fire Zone 42A. Actuation of the ETLs is accomplished through existing relays in the CO2 control cabinets. The CO2 actuation is a automatic function. (AR-2016-9339 / EC-0000053523)

##### 3.1.3 Penetrations

Note: Statements regarding fire resistance rating of penetration seals are not applicable to seals in barriers to Analysis Area YD.

Penetrations in fire barriers between this fire zone and adjacent fire areas are provided with fire seals.

A fire area boundary evaluation was performed for the unrated fire barrier penetration seals installed between Fire Areas AA39A and AA39B - Fire Zones 40A and 40B, Fire Area AA40 - Fire Zone 41, Fire Area AA41 - Fire Zones 42A, 42B, 42C, 42D and Fire Area AA48 - Fire Zone 55 (Engineering Equivalency Evaluation 11-5).

A fire area engineering equivalency evaluation was prepared to evaluate a fire seal design between Fire Zones 40A and 41 (Engineering Equivalency Evaluation 11-28).

Seismic expansion gaps are sealed with a glass fiber reinforced silicone sheeting.

### 3.1.4 Detection

The table below outlines the fire detection system(s) provided in the Fire Area:

Table 3-1, Fire Area AA40 Detection Systems								
Fire Zone	Type of System	Local (L) / Remote (R)	Detection Actuates Suppression?	Required System?				
				S	L	E	R	D
41	Infrared	L/R	Y	N	N	Y	Y	N
41	Ionization	L/R	N	N	N	Y	Y	N

**Table 3-1 Legend:**

Table Field: "Required System?"	
S	- Required for Chapter 4 Separation Criteria
L	- Required for NRC Approved Licensing Action
E	- Required for Engineering Equivalency Evaluation
R	- Required for Risk Significance
D	- Required to maintain adequate balance of Defense-in-Depth in a Change Evaluation or Fire Risk Evaluation

This area has a cross zoned ionization smoke detection system as well as an infra-red detection system. Both systems alarm in the Unit 1 Control Room. Four of the ionization and three of the flame detectors are located in the cable spreading area of this fire zone.

### 3.1.5 Fixed Suppression

The table below outlines the fixed fire suppression system(s) provided in the Fire Area:

Table 3-2, Fire Area AA40 Suppression Systems							
Fire Zone	Type of System	Full (F) / Partial (P)	Required System?				
			S	L	E	R	D
41	Automatic CO2	F	N	N	Y	Y	N

**Table 3-2 Legend:**

Table Field: "Required System?"	
S	- Required for Chapter 4 Separation Criteria
L	- Required for NRC Approved Licensing Action
E	- Required for Engineering Equivalency Evaluation
R	- Required for Risk Significance
D	- Required to maintain adequate balance of Defense-in-Depth in a Change Evaluation or Fire Risk Evaluation

An automatic suppression is provided in Fire Zone 41. A low pressure CO2 total flooding system supplied from the 17 ton tank is provided. This system is actuated by the infra-red detectors discussed in section 3.1.5. Operation of this system discharges CO2 into Fire Zone 41.

### 3.1.6 Manual Suppression / Response Strategy

A postulated fire will be identified by early detection using ionization type smoke detection, infra-red detection or by plant personnel using plant communication system to notify the control room. The automatic detection systems alarm in the control room. The Control Room operator will dispatch the fire brigade for initiation of manual fire fighting. A fire in this fire area will be contained by the construction features discussed in Section 3.1.1.

Fire extinguishers are located in Fire Zone 41 for the fire brigade's use, with additional extinguishers located in adjacent Fire Zone 42A, 40A and 40B.

Water hose reels are located in adjacent Fire Zones 90, 91, and 55 (upstairs 4KV). Water hose reels are located in the adjacent Fire Zones 33A.

Floor drains are available in Fire Zone 41.

### 3.1.7 Ventilation

A fire in this area will be contained by the fire barriers. Smoke can be removed by portable fans and flexible ducting to other areas of the Auxiliary Building and outdoors. This fire area is listed as a non-controlled area in the Fire Pre Plans and therefore there is reasonable assurance that products of combustion will not be contaminated.

For Fire Zone 41, there are undampered ventilation shafts in the ceiling that pass through Fire Area AA48 - Fire Zone 55 to the Yard. A fire damper having a 3-hour rating is provided to adjacent Fire Area AA41 - Fire Zone 42A. A fire damper having a 3-hour rating is provided in the stairway to adjacent Fire Area AA48 - Fire Zone 55.

### 3.1.8 Other Features

Some cable trays within Fire Area AA40 are provided with bottom covers and/or are fully enclosed.

This fire area is procedurally controlled as a transient combustible and hot work free zone.

## 3.2 Fire Hazards Identification

The fire area contains both ignition sources and combustible fire hazards. The ignition sources consist of 600V switchgear, Inverters, 250VDC cabinets, and transformers. Combustibles consist primarily of exposed electrical cables in trays, cellulose, rubber, plastics and Thermo-Lag.

The exterior fire hazards that are adjacent to exterior walls are the Start-up Transformers. However, water spray suppression systems are provided for the transformers. In addition, this Fire Area is constructed of reinforced concrete. The missile barriers around each transformer also provide a measure of fire barrier protection, limiting radiant heat in the direction of the Fire Area.

The exterior wall penetrations of this Fire Area do not require a rating for protection. The orientation of the Fire Area prevents direct impact from radiant heat, as well as the spatial separation between the yard equipment and fire hazards to this Fire Area is sufficient to provide protection against heat damage. The impact of a fire in the yard on AA40 would be limited to radiant heat with no ceiling to contain the fire plume. Spatial separation, fixed suppression as well as the reinforced concrete construction of the Fire Area is sufficient to prevent an exposure to credited equipment

inside the plant through unrated exterior wall penetrations of this Fire Area.

The current fire loading classification is considered low.

### 3.3 NSCA Compliance Summary

Fire Area AA40 contains safe shutdown Unit 1 Red and Green Train 600V Bus and MCC power supplies and transformers and Red and Green train cables.

Compliance with the nuclear safety performance criteria is achieved using the performance-based approach in accordance with NFPA 805, Section 4.2.4.2.

Safe and stable for Unit 1 is accomplished by crediting crossties to the unaffected Unit 2 via the following: Alternate AFW to Steam Generators 1 and 4 via Unit 2 East Motor Driven Auxiliary Feedwater Pump, Alternate CVCS via Unit 2 East or West Pump, and ESW crosstie via normally available crosstie lineup. Unit 2 CCW is credited to support the required Unit 2 crosstie systems. Local Shutdown Indicating Panels are credited to provide process and source range monitoring with Unit 2 power crosstie.

The Nuclear Safety Performance Criteria compliance strategy for AA40 is documented within the NSCA Report.

#### 3.3.1 Variances

The variances identified for evaluation for this fire area are grouped as follows:

##### 3.3.1.1 VFDR No. AA40-001

1-PP-50E and 1-PP-50W - The Unit 1 East or West Charging Pump is required to be operable to support CVCS for inventory control, reactivity control and seal cooling. The Unit 1 Charging Pumps may fail due to a full area fire within Fire Area AA40. 1-PP-50E may fail due to fire induced damage of its power supply, cooling and cables 8378G-1 and 8874G-1. 1-PP-50W P may fail due to fire induced damage of its power supply, cooling and cable 8377R-1. Failure of both Unit 1 charging pumps requires cross-tying to the Unit 2 charging pumps to provide charging. This condition represents a variance from the deterministic requirements of NFPA 805, Section 4.2.3. This is a separation issue.

This VFDR has been evaluated and it was determined that the risk, safety margin and defense-in-depth meet the acceptance criteria of NFPA 805 Section 4.2.4 with a recovery action credited and plant modifications to implement transient free areas and an automatic CO2 suppression system.

**3.3.1.2 VFDR No. AA40-002**

1-FMO-212 and 1-FMO-242- SG 1 and 4 AFW Supply Valves are required to be operable to support decay heat removal for Unit 1. Decay heat removal shall be capable of removing heat from the reactor core such that the fuel is maintained in a safe and stable condition. Decay heat removal requires a set of 2 supply valves be operable with their corresponding AFW pump. The following sets of Unit 1 SG AFW supply valves may fail due to a full area fire within AA40; 1-FMO-212 and 1-FMO-242, 1-FMO-222 and 1-FMO-232, 1-FMO-221 and 1-FMO-231. These failures require a set of valves be manually operated to restore Unit 1 decay heat removal. The Unit 2 East AFW Pump is credited through the Unit 1 cross-tie to provide decay heat removal. This requires 1-FMO-212 and 1-FMO-242 be operable. 1-FMO-212 and 1-FMO-242 may fail due to fire induced damage of 600V VCC 1-AZV-A. This condition represents a variance from the deterministic requirements of NFPA 805, Section 4.2.3. This is a separation issue.

This VFDR has been evaluated and it was determined that the risk, safety margin and defense-in-depth meet the acceptance criteria of NFPA 805 Section 4.2.4 with a recovery action credited and plant modifications to implement transient free areas and an automatic CO2 suppression system.

**3.3.1.3 VFDR No. AA40-003**

1-ICM-129.P and 1-IMO-128.P - RHR Boundary Isolation Valves are required closed to support RCS integrity. RCS integrity is required to control coolant level such that inventory and pressure control is maintained. 1-ICM-129.P or 1-IMO-128.P are in series and one of the valves is required to be closed to support RCS integrity. 1-ICM-129.P may fail due to fire induced damage of cables 9082G-1 and 9188PG-1. 1-IMO-128.P may fail due to fire induced damage of cables 8086PR-1 and 8871R-1. These cable failures could spuriously open the valves. This condition represents a variance from the deterministic requirements of NFPA 805, Section 4.2.3. This is a separation issue.

This VFDR has been evaluated and it was determined that the risk, safety margin and defense-in-depth meet the acceptance criteria of NFPA 805 Section 4.2.4 with plant modifications to implement transient free areas and an automatic CO2 suppression system.

**3.3.1.4 VFDR No. AA40-004**

1-ICM-250 - The BIT Outlet Shutoff Valve is required to be open to support Unit 1 alternate CVCS. CVCS is required for inventory and reactivity control. The Unit 1 alternate charging flow path injects borated water from the Unit 2 RWST, via the Unit 2 pumps, through the Unit 1 BIT and into the Unit 1 cold leg loops. This valve is normally closed and fails as-is on the loss of power. 1-ICM-250 may fail due to fire induced damage of 600V MCC 1-AM-D. This condition represents a variance from the deterministic requirements of NFPA 805, Section 4.2.3. This is a separation issue.

This VFDR has been evaluated and it was determined that the risk, safety margin and defense-in-depth meet the acceptance criteria of NFPA 805 Section 4.2.4 with a recovery action credited and plant modifications to implement transient free areas and an automatic CO2 suppression system.

**3.3.1.5 VFDR No. AA40-005**

1-IMO-51, 1-IMO-52, 1-IMO-53 and 1-IMO-54 - The Boron Injection Line Shutoff Valves are required to be open to support Unit 1 alternate CVCS. CVCS is required for inventory and reactivity control. There are 4 boron injection line valves and 1 is required to be open to support Unit 1 alternate CVCS. Alternate CVCS is required within this area due to the failure of the Unit 1 charging pumps. The Unit 1 alternate charging flow path injects borated water from the Unit 2 RWST, via the Unit 2 pumps, through the Unit 1 BIT and into the cold leg loops. These valves are normally open and fails as-is on the loss of power. 1-IMO-51 may fail due to fire induced damage of cable 8370G-1. 1-IMO-52 may fail due to fire induced damage of cable 8372R-1. 1-IMO-53 may fail due to fire induced damage of cable 8384G-1. 1-IMO-54 may fail due to fire induced damage of cable 8314R-1. These cable failures could spuriously close the valves. This condition represents a variance from the deterministic requirements of NFPA 805, Section 4.2.3. This is a separation issue.

This VFDR has been evaluated and it was determined that the risk, safety margin and defense-in-depth meet the acceptance criteria of NFPA 805 Section 4.2.4 with plant modifications to implement transient free areas and an automatic CO2 suppression system.

**3.3.1.6 VFDR No. AA40-006**

1-MRV-210 and 1-MRV-240 – The SG 1 and 4 Main Steam Stop Valves are required to be closed to support main steam isolation. Main steam isolation is required to prevent the uncontrolled cooldown through over-steaming. SGs 1 and 4 are credited for decay heat removal due to a fire within Fire Area AA40. 1-MRV-210 may fail due to fire induced damage of 1-MMO-210, 1-MRV-211 and 1-MRV-212. 1-MMO-210, 3 Way Air Open Valve for Steam Generator 1 Stop Valve vents air from the main steam stop valve to either 1-MRV-211 or 1-MRV-212. Cable failures to the 3 way stop valve will spuriously operate it to either position. Failure of 1-MRV-211 and 1-MRV-212 will require either valve to be manually failed to the open position dependent upon the 3 way valve's position. 1-MRV-240 may fail due to fire induced damage of 1-MMO-240, 1-MRV-241 and 1-MRV-242. 1-MMO-240, 3 Way Air Open Valve for Steam Generator 4 Stop Valve vents air from the main steam stop valve to either 1-MRV-241 or 1-MRV-242. Cable failures to the 3 way stop valve will spuriously operate it to either position. Failure of 1-MRV-241 and 1-MRV-242 will require either valve to be manually failed to the open position dependent upon the 3 way valve's position. This condition represents a variance from the deterministic requirements of NFPA 805, Section 4.2.3. This is a separation issue.

This VFDR has been evaluated and it was determined that the risk, safety margin and defense-in-depth meet the acceptance criteria of NFPA 805 Section 4.2.4 with plant modifications to implement transient free areas and an automatic CO2 suppression system.

**3.3.1.7 VFDR No. AA40-007**

1-MRV-220 and 1-MRV-230 - The SG 2 and 3 Main Steam Stop Valves are required to be closed to support main steam isolation. Main steam isolation is required to prevent the uncontrolled cooldown through over-steaming. SGs 2 and 3 are not credited for decay heat removal due to a fire within Fire Area AA40. 1-MRV-220 may fail due to fire induced damage of 1-MRV-221 and 1-MRV-222. Failure of 1-MRV-221 and 1-MRV-222 will require either valve to be manually failed to the open position to close 1-MRV-220. 1-MRV-230 is required to be closed to support main steam isolation. 1-MRV-230 may fail due to fire induced damage of 1-MMO-230, 1-MRV-231 and 1-MRV-232. 1-MMO-230, 3 Way Air Open Valve for Steam Generator 3 Stop Valve vents air from the main steam stop valve to either 1-MRV-231 or 1-MRV-232. Cable failures to the 3 way stop valve will spuriously operate it to either position. Failure of 1-MRV-231 and 1-MRV-232 will require either valve to be manually failed to the open position dependent upon the 3 way valve's position. This condition represents a variance from the deterministic requirements of NFPA 805, Section 4.2.3. This is a separation issue.

This VFDR has been evaluated and it was determined that the risk, safety margin and defense-in-depth meet the acceptance criteria of NFPA 805 Section 4.2.4 with plant modifications to implement transient free areas and an automatic CO2 suppression system.

**3.3.1.8 VFDR No. AA40-008**

1-MRV-213-P and 1-MRV-243-P – SG 1 and 4 PORVs are required to be closed to support main steam isolation. Main steam isolation is required to prevent uncontrolled cooldown through over-steaming. SGs 1 and 4 are credited for decay heat removal for a fire within Fire Area AA40. 1-MRV-213-P may fail due to fire induced damage of cables 6841-1 and 9050W-1. 1-MRV-243-P may fail due to fire induced damage of cables 6842-1 and 9051W-1. Failure of these cables could spuriously open the valves. This condition represents a variance from the deterministic requirements of NFPA 805, Section 4.2.3. This is a separation issue.

This VFDR has been evaluated and it was determined that the risk, safety margin and defense-in-depth meet the acceptance criteria of NFPA 805 Section 4.2.4 with a defense-in-depth action credited and plant modifications to implement transient free areas and an automatic CO2 suppression system.



**3.3.1.9 VFDR No. AA40-009**

1-PP-45-1, 1-PP-45-2, 1-PP-45-3 and 1-PP-45-4 – The reactor coolant pumps are required to be tripped to prevent a loss of coolant accident if seal cooling and thermal barrier cooling are lost. A full area fire within Fire Area AA40 may cause the loss of seal cooling, thermal barrier cooling and Control Room trip capability of the RCPs. 1-PP-45-1 may lose Control Room trip capability due to fire induced damage of cable 14321R-1. 1-PP-45-2 may lose Control Room trip capability due to fire induced damage of cables 12364G-1, 3496G-1 and 7960PG-1. 1-PP-45-3 may lose Control Room trip capability due to fire induced damage of cables 14621G-1, 3497G-1 and 7957PG-1. 1-PP-45-4 may lose Control Room trip capability due to fire induced damage of cable 12884R-1. This condition represents a variance from the deterministic requirements of NFPA 805, Section 4.2.3. This is a separation issue.

This VFDR has been evaluated and it was determined that the risk, safety margin and defense-in-depth meet the acceptance criteria of NFPA 805 Section 4.2.4 with a recovery action credited and plant modifications to implement transient free areas and an automatic CO2 suppression system.

**3.3.1.10 VFDR No. AA40-010**

1-PP-3E, 1-PP-3W and 1-PP-4 - A Unit 1 AFW Pump is required to be operable to support decay heat removal. Decay heat removal is required to be capable of removing sufficient heat from the reactor core such that the fuel is maintained in a safe and stable condition. A full area fire within Fire Area AA40 may cause the loss of the Unit 1 East and West MDAFW Pumps and the Unit 1 TDAFW Pump. The East MDAFW Pump, 1-PP-3E may fail due to fire induced damage of 250VDC Cabinet 1-MCCD, 4kv Bus 1-T11D and cables 8378G-1 and 9290G-1. The West MDAFW Pump, 1-PP-3W may fail due to fire induced damage of 250VDC Cabinet 1-MCAB, 4kv Bus 1-T11A and cables 8377R-1 and 9861R-1. The TDAFW Pump, 1-PP-4 may not be available due to fire induced damage of support equipment which includes the room coolers, flow control valve, ESW pump and SG supply valves. These failures require the use of alternate feedwater cross-tied from Unit 2 to Unit 1. This condition represents a variance from the deterministic requirements of NFPA 805, Section 4.2.3. This is a separation issue.

This VFDR has been evaluated and it was determined that the risk, safety margin and defense-in-depth meet the acceptance criteria of NFPA 805 Section 4.2.4 with a recovery action credited and plant modifications to implement transient free areas and an automatic CO2 suppression system.



**3.3.1.11 VFDR No. AA40-011**

1-BLI-110-CRI, 1-BLI-140-CRI, 1-MPP-210-CRI, 1-MPP-240-CRI, 1-NTR-140, 1-NTR-240, 1-NLP-151-CRI, 1-NPS-110-CRI and 1-NRI-1 – Control Room process monitoring and source range monitoring may not be available due to a full area fire within Fire Area AA40. Process monitoring is required to be available to monitor key primary and secondary parameters. Source range monitoring is required to provide indication of fission activity to ensure sub-criticality. The instrumentation may not be available within the Unit 1 Control Room due to the loss of Unit 1 power distribution. Alternate process and source range monitoring powered from Unit 2 is required at the Unit 1 LSI panels. The LSI panels require manual actions to transfer to the Unit 2 power supply. A transfer switch at 1-LSI-6 feeds both 1-LSI-6 and 1-LSI-2. A transfer switch at 1-LSI-5 feeds both 1-LSI-5 and 1-LSI-1. A transfer switch at 1-LSI-4 feeds both 1-LSI-4 and 1-LSI-3. Local monitoring of steam generator 1 and 4 level indication is required at 1-LSI-1 and 1-LSI-4. Local monitoring of steam generator 1 and 4 pressure indication is required at 1-LSI-4 and 1-LSI-5. Local monitoring of RCS loop temperature is required at 1-LSI-4. Local monitoring of pressurizer level and pressure indication is required at 1-LSI-3. This set of instruments has been credited due to SGs 1 and 4 being credited for AFW. It is to be noted that source range monitoring at the LSI panel is credited, despite the availability of the Control Room Indicator, since all other LSI indication is required and the loss of Control Room HVAC. This condition represents a variance from the deterministic requirements of NFPA 805, Section 4.2.3. This is a separation issue.

This VFDR has been evaluated and it was determined that the risk, safety margin and defense-in-depth meet the acceptance criteria of NFPA 805 Section 4.2.4 with a recovery action credited and plant modifications to implement transient free areas and an automatic CO2 suppression system.

**3.3.1.12 VFDR No. AA40-012**

1-DCR-310 and 1-DCR-340 - SG 1 and 4 Blowdown Isolation Valves are required to be closed to support main steam isolation. Main steam isolation is required to prevent uncontrolled cooldown through over-steaming. SG 1 and 4 Blowdown Isolation Valves may fail due to a full area fire within Fire Area AA40. 1-DCR-310 may fail due to fire induced damage of cable 8682G-1. 1-DCR-340 may fail due to fire induced damage of cable 8686G-1. These cable failures could spuriously open the valves. SGs 1 and 4 are credited for decay heat removal for a fire within Fire Area AA40. This condition represents a variance from the deterministic requirements of NFPA 805, Section 4.2.3. This is a separation issue.

This VFDR has been evaluated and it was determined that the risk, safety margin and defense-in-depth meet the acceptance criteria of NFPA 805 Section 4.2.4 with a defense-in-depth action credited.

**3.3.1.13 VFDR No. AA40-013**

1-NRV-153 - Pressurizer PORVs are required to be closed to support RCS integrity. RCS integrity is required to maintain positive control over RCS inventory and pressure. 1-NRV-153 may fail due to fire induced damage of cable 8757G-1. Failure of this cable could spuriously open the valve. This condition represents a variance from the deterministic requirements of NFPA 805, Section 4.2.3. This is a separation issue.

This VFDR has been evaluated and it was determined that the risk, safety margin and defense-in-depth meet the acceptance criteria of NFPA 805 Section 4.2.4 with a defense-in-depth action credited.

**3.3.1.14 VFDR No. AA40-014**

1-NSO-021 and 1-NSO-022 - RX Head Vent Valves are required to be closed to support RCS Integrity. RCS integrity is required to maintain positive control over RCS inventory and pressure. 1-NSO-021 and 1-NSO-022 are in series requiring one of the valves to remain closed to provide RCS integrity. 1-NSO-021 may fail due to cable 9914PG-1. 1-NSO-022 may fail due to fire induce damage of cable 9914PG-1. Failure of these cables could spuriously open the valves. This condition represents a variance from the deterministic requirements of NFPA 805, Section 4.2.3. This is a separation issue.

This VFDR has been evaluated and it was determined that the risk, safety margin and defense-in-depth meet the acceptance criteria of NFPA 805 Section 4.2.4 with a defense-in-depth action credited.

**3.3.1.15 VFDR No. AA40-015**

1-NSO-061 and 1-NSO-062 - Post Accident Vent Valves are required to be closed to support RCS integrity. RCS integrity is required to maintain positive control over RCS inventory and pressure. 1-NSO-061 and 1-NSO-062 are in series requiring one of the valves to remain closed to provide RCS integrity. 1-NSO-061 may fail due to fire induced damage of cable 9901PG-1. 1-NSO-062 may fail due to fire induced damage of cable 9907PG-1. Failure of these cables could spuriously open the valves. This condition represents a variance from the deterministic requirements of NFPA 805, Section 4.2.3. This is a separation issue.

This VFDR has been evaluated and it was determined that the risk, safety margin and defense-in-depth meet the acceptance criteria of NFPA 805 Section 4.2.4 with a defense-in-depth action credited.

**3.3.1.16 VFDR No. AA40-016**

1-QRV-20 and 1-QRV-30 - RCP Seal Water Return Isolation Valves are required to be open to support RCS integrity by maintaining the RCP seal. RCS integrity is required to maintain positive control over RCS inventory and pressure. 1-QRV-20 may fail due to fire induced damage of cable 4955PG-1. 1-QRV30 may fail due to fire induced damage of cable 5654PG-1. These cables could cause spurious closure of these valves. This condition represents a variance from the deterministic requirements of NFPA 805, Section 4.2.3. This is a separation issue.

This VFDR has been evaluated and it was determined that the risk, safety margin and defense-in-depth meet the acceptance criteria of NFPA 805 Section 4.2.4 with a defense-in-depth action credited.

### 3.3.2 Recovery Actions Credited

For each VFDR, a Fire Risk Evaluation has been performed to assess the acceptability of risk, defense-in-depth, and safety margin. This evaluation determined whether or not recovery actions are required to ensure that one success path necessary to achieve and maintain the nuclear safety performance criteria is maintained free of fire damage by a single fire. Table 3-3 identifies the credited recovery actions for this area. Actions retained for DID are identified as “DID Actions” within Table 3-3. Additional information for DID actions is contained within Section 3.8 of this report. Note that, for completeness, all VFDRs are contained within Table 3-3, even if the Fire Risk Evaluation has determined that a recovery action is not required. In those instances where a recovery action has been determined to not be required, the word “None” is provided in the “Action” column in the table.

Table 3-3, Recovery Actions Credited		
VFDR	Component	Action
AA40-001	1-PP-50E 1-PP-50W	1-CS-302-CLOSE (Close Manual Valve 1-CS-302)  1-CS-534-OPEN (Open Manual Valve 1-CS-534)  2-CS-536-OPEN (Open Manual Valve 2-CS-536)
AA40-002	1-FMO-212 1-FMO-242	1-FMO-212-OPERATE (De-energize and manually operate 1-FMO-212)  1-FMO-242-OPERATE (De-energize and manually operate 1-FMO-242)
AA40-003	1-ICM-129.P 1-IMO-128.P	None
AA40-004	1-ICM-250	1-ICM-250-OPEN (De-energize and Manually Open 1-ICM-250)
AA40-005	1-IMO-51 1-IMO-52 1-IMO-53 1-IMO-54	None
AA40-006	1-MRV-210 1-MRV-240	None
AA40-007	1-MRV-220 1-MRV-230	None

Table 3-3, Recovery Actions Credited		
VFDR	Component	Action
AA40-008	1-MRV-213-P 1-MRV-243-P	DID ACTION 1-MRV-213-P-CLOSE (Manually vent air to close 1-MRV-213)  1-MRV-243-P-CLOSE (Manually vent air to close 1-MRV-243)
AA40-009	1-PP-45-1 1-PP-45-2 1-PP-45-3 1-PP-45-4	1-PP-45-1-TRIP (Locally trip RCP 1)  1-PP-45-2-TRIP (Locally trip RCP 2)  1-PP-45-3-TRIP (Locally trip RCP 3)  1-PP-45-4-TRIP (Locally trip RCP 4)
AA40-010	1-PP-3E 1-PP-3W 1-PP-4	2-FW-129-OPEN (Open manual valve 2-FW-129)  2-FW-262-CLOSE (Close manual valve 2-FW-262)
AA40-011	1-BLI-110-CRI 1-BLI-140-CRI 1-MPP-210-CRI 1-MPP-240-CRI 1-NTR-140 1-NTR-240 1-NLP-151-CRI 1-NPS-110-CRI 1-NRI-1	1-LSI-4-ALT-PWR (Align unaffected Unit Power to LSI Panel)  1-LSI-5-ALT-PWR (Align unaffected Unit Power to LSI Panel)  1-LSI-1-LOCAL (Locally monitor 1-LSI-1)  1-LSI-3-LOCAL (Locally monitor 1-LSI-3)  1-LSI-4-LOCAL (Locally monitor 1-LSI-4)  1-LSI-5-LOCAL (Locally monitor 1-LSI-5)

Table 3-3, Recovery Actions Credited		
VFDR	Component	Action
AA40-012	1-DCR-310 1-DCR-340	DID ACTION(S) 1-DCR-310-CLOSE 1-DCR-340-CLOSE (Remove fuses in MCR to fail closed AOVs 1-DRC-310 and 1-DCR-340).
AA40-013	1-NRV-153	DID ACTION(S) 1-NRV-153-CLOSE (Remove fuses in MCR to fail closed PORV 1-NRV-153).
AA40-014	1-NSO-021	DID ACTION(S)1-NSO-021-CLOSE (Remove fuses in MCR to fail closed AOV 1-NSO-021)
AA40-015	1-NSO-061	DID ACTION(S)1-NSO-061-CLOSE (Remove fuses in MCR to fail closed AOV 1-NSO-061)
AA40-016	1-QRV-20 1-QRV-30	DID ACTION(S) 1-QRV-20-OPEN 1-QRV-30-OPEN (Remove fuses in MCR to fail open AOVs 1-QRV-20 and 1-QRV-30)

### 3.4 Non-Power Operational Modes Compliance Summary

A review of CNP for the potential effects of a fire in this Fire Area while in non-power modes of operation (NPO) was conducted. This review was conducted using the guidance provided in NEI 04-02 and FAQ 07-0040, "Non-Power Operations Clarifications".

The review determined that there are potential failures that affect certain Key Safety Functions (KSF) as a result of the fire in this area, and the fire could result in the loss of one or more KSF paths. Compensatory measures are required during high risk evolution periods to provide reasonable assurance a fire will not adversely affect key safety functions and the NFPA 805 performance goal for NPO is therefore satisfied. The results of the NPO analysis are contained within Technical Evaluation R1900-005-001, Non-Power Operation Modes Transition Review Report.

### 3.5 Radioactive Release Compliance Summary

The NFPA 805 radiological release goal is to provide reasonable assurance that a fire will not result in a radiological release that adversely affects the public, plant personnel or the environment. The NFPA 805 requirement is to ensure a radiation release to any unrestricted area due to the direct effects of fire suppression activities (but not involving fuel damage) shall be as low as reasonably achievable and shall not exceed applicable plant Technical Specification limits.

AA40 is located outside the Radiological Controlled Area (RCA) and is not a storage location for contaminated materials, therefore there is reasonable assurance a fire in this area will not result in radiation release. The review of this fire area, with respect to radioactive release, is documented in the NFPPM.

### 3.6 Probabilistic Risk Assessment-Summary of Results

A Fire PRA (FPRA) quantification of Fire Area AA40 was performed and is documented in PRA-NB-FIRE-FQ, Fire PRA Model Quantification Notebook. The fire risk quantification for Fire Area AA40 is analyzed using detailed fire modeling to consider risk of fire scenarios of ignition sources. PRA-NB-FIRE-FQ includes a summary of all potentially risk-significant fire scenarios (i.e., CDF > 1.0E-7 or LERF > 1.0E-8). Bounding CDF / LERF per calendar year values are reported that are based on the risk values documented in PRA-NB-FIRE-FSS, Fire PRA Fire Scenario Selection.

Transient combustible and hot work free zones were credited in the FPRA for this fire area.

Fire Protection features credited in the Fire PRA are documented in R1900-0411-AA40, Detailed Fire Modeling Report: Fire Compartment: AA40 Unit 1 Engineered Safeguards Systems and Motor Control Center Room (609' 6"). PRA-NB-FIRE-FSS documents the revision level of the fire modeling reports used in the most recent Fire PRA quantification.

### 3.7 Risk-Informed, Performance-Based Evaluations

Fire Risk Evaluations (FREs) have been performed to ensure that variances from the NFPA 805 deterministic requirements are acceptable. The evaluation process consists of an integrated assessment of the acceptability of risk, defense-in-depth, and safety margins.

#### 3.7.1 Transition Risk-Informed, Performance-Based Evaluations

The 'changes' associated with NFPA 805 transition were those variances from the deterministic requirements of NFPA 805 or with the existing fire protection licensing basis that were brought into compliance with the NFPA 805 performance based approach. The change identified for evaluation for Fire Area AA40 is as follows:

- Separation Issues

The Fire Risk Evaluation has determined that the change is acceptable based upon:

- The measured change in CDF and LERF.
- Adequate defense-in-depth and safety margins being maintained.

Refer to Attachment 2 for a summary of results associated with the Fire Risk Evaluations.

### 3.8 Defense-in-Depth

A comprehensive risk-informed, performance-based analysis includes consideration of defense-in-depth (DID) as part of an integrated evaluation of risk considerations. In general, defense-in-depth involves consideration of the extent to which fire protection systems and features are provided within the three echelons of fire-protection:

- Preventing fires from starting,
- Rapidly detecting fires and controlling and extinguishing promptly those fires that do occur, thereby limiting fire damage,
- Providing an adequate level of fire protection for structures, systems, and components important to safety, so that a fire that is not promptly extinguished will not prevent the nuclear safety performance criteria from being met.

Each VFDR was evaluated for DID. The following recovery actions have been retained for DID.

VFDR No. AA40-008: 1-MRV-213-P and 1-MRV-243-P - SG 1 and 4 PORVs are required to be closed to support main steam isolation. Main steam isolation provides integrity of the secondary side of the SGs to prevent uncontrolled cooldown through over-steaming. SG 1 and 4 PORVs could spuriously open due cable failures cause by a full area fire within Fire Area AA40. These failures can be mitigated by locally venting air to close to the SG 1 and 4 PORVs. This recovery action is being retained for DID to ensure main steam isolation is maintained.

VFDR No. AA40-012: 1-DCR-310 and 1-DCR-340 - SG 1 and 4 Blowdown Isolation Valves are required to be closed to support main steam isolation. Main steam isolation is required to prevent uncontrolled cooldown through over-steaming. SG 1 and 4 Blowdown Isolation Valves may fail due to a full area fire within Fire Area AA40. Loss of Main Steam isolation can be mitigated by removing fuses to ensure valves fail shut. This recovery action is being retained for DID to ensure Main Steam isolation is maintained.

VFDR No. AA40-013: 1-NRV-153 - Pressurizer PORVs are required to be closed to support RCS integrity. RCS integrity is required to maintain positive control over RCS inventory and pressure. The spurious opening can be mitigated by de-energizing the valve to fail it closed. This recovery action is being retained for DID to ensure RCS pressure and inventory control is maintained.

VFDR No. AA40-014: 1-NSO-021 and 1-NSO-022 - RX Head Vent Valves are required to be closed to support

RCS Integrity. RCS integrity is required to maintain positive control over RCS inventory and pressure. 1-NSO-021 and 1-NSO-022 are in series requiring one of the valves to remain closed to provide RCS integrity. The spurious opening can be mitigated by de-energizing the valve to fail it closed. This recovery action is being retained for DID to ensure RCS pressure and inventory control is maintained.

VFDR No. AA40-015: 1-NSO-061 and 1-NSO-062 - Post Accident Vent Valves are required to be closed to support

RCS integrity. RCS integrity is required to maintain positive control over RCS inventory and pressure. 1-NSO-061 and 1-NSO-062 are in series requiring one of the valves to remain closed to provide RCS integrity. The spurious opening can be mitigated by de-energizing the valve to fail it closed. This recovery action is being retained for DID to ensure RCS pressure and inventory control is maintained.

VFDR No. AA40-016: 1-QVR-20 and 1-QVR-30 - RCP Seal Water Return Isolation Valves are required to be open to support RCS integrity by maintaining the RCP seal. RCS integrity is required to maintain positive control over RCS inventory and pressure. The spurious closing can be mitigated by de-energizing the valve to fail it open. This recovery action is being retained for DID to ensure RCS integrity is maintained.

Based on the assessment in support of the Fire Risk Evaluation, defense-in-depth is maintained for fire area AA40. Refer to Attachment 2 for details associated with the Fire Risk Evaluation.

### 3.9 Monitoring Program Input

A Monitoring Program will be developed in accordance with FAQ 10-0059, Rev. 1. Methods to monitor availability, reliability, and performance of fire protection program structures, systems, and components (SSCs), as well as programmatic elements will be provided. Additionally, effectiveness measures are established to review program related performance and trends. For AA40 the following systems and features are candidates for inclusion in the CNP Fire Protection Monitoring Program:

- Fire Area boundary barriers discussed in Section 3.1
- Fire Detection System (Ionization and Infrared)
- Automatic Fire Suppression System (CO<sub>2</sub>)
- Transient Combustible and Hot Work Free Zone
- Cable tray covers

### 4.0 CONCLUSION

The nuclear safety and radioactive release performance criteria of NFPA 805 are met for a fire in Fire Area AA40. This Fire Risk Evaluation for Fire Area AA40 has demonstrated that

- The change in core damage frequency (delta CDF) is acceptable, and
- The change in large early release frequency (delta LERF) is acceptable, and
- Defense-in-depth and safety margins are maintained.

This is confirmation that a success path effectively remains free of fire damage and that the performance-based approach is acceptable per Section 4.2.4.2 of NFPA 805.



## **5.0 REFERENCES**

- 5.1 Calculation PRA-FIRE-NB-CRE, Fire PRA Cumulative Risk Evaluations
- 5.2 CNP Fire Pre-Plans, Volumes I, II, and III, Revisions 17, 14, and 18 respectively
- 5.3 Fire Hazards Analysis
- 5.4 NFPA 805, Performance-Based Standard for Fire Protection for Light Water Reactor Electric Generating Plants
- 5.5 NFPPM, NFPA 805 Fire Protection Program Manual (NFPPM)
- 5.6 Nuclear Energy Institute (NEI) 04-02, Guidance for Implementing a Risk-Informed, Performance-Based Fire Protection Program under 10 CFR 50.48(c), Rev. 2
- 5.7 Nuclear Safety Capability Assessment Report
- 5.8 PRA-NB-FIRE-FQ, Fire PRA Model Quantification Notebook
- 5.9 PRA-NB-FIRE-FSS, Fire PRA Fire Scenario Selection
- 5.10 R1900-0411-AA40, AA40 - Detailed Fire Modeling Report
- 5.11 Regulatory Guide 1.205, Risk-Informed, Performance-Based Fire Protection for Existing Light-Water Nuclear Power Plants, Rev. Revision 1
- 5.12 Technical Evaluation R1900-005-001, Non-Power Operation Modes Transition Review

**Fire Area AA40 – Attachment 1 - Table B-3 - Fire Area Transition**

<u>Unit</u>	<u>Fire Area</u>	<u>Description</u>
1	AA40	Unit 1 Engineered Safeguards Systems and Motor Control Center Room (El. 609 ft. 6 in.)

<u>Fire Zone</u>	<u>Description</u>
41	Eng Safety System & MCC Room - El. 609 ft. 6 in. (& under floor) - Unit 1

**Regulatory Basis**

4.2.4.2 - Performance-Based Approach - Fire Risk Evaluation with simplifying deterministic assumptions

<b>Performance Goal</b>	<b>Method of Accomplishment</b>	<b>Comments</b>
Reactivity Control	Unit 1 - Trip the reactor from the Control Room. Borate using the Unit 2 East or West Charging Pump supplied from the Unit 2 RWST injecting through the Unit 1 BIT. Use source range monitoring for indication at the LSI panel.	None
Inventory and Pressure Control	Unit 1 - Control inventory using the Unit 2 East or West Charging Pump injecting through the Unit 1 BIT. Control pressure using Unit 1 Pressurizer Safety Relief Valves.	VFDRs identified for CVCS and RCS integrity.
Decay Heat Removal	Unit 1 - Feed SGs 1 & 4 with Unit 2 East MDAFW Pump. The DHR function also requires MS isolation with a steam release path through the Safety Relief Valves.	VFDRs identified for AFW and Main Steam Isolation.
Process Monitoring	Unit 1 Process Monitoring - Use Unit 1 alternate process monitoring powered from Unit 2 at the local shutdown panels for the following: Pressurizer level, RCS pressure and temperature, and S/G level and Pressure. Unit 1 Source Range Monitoring - Use Unit 1 alternate source range monitoring powered from Unit 2 at the local shutdown panels.	VFDRs identified for process monitoring and source range monitoring.
Vital Auxiliaries	Unit 1 Electrical - Control Unit 2 Red (AB) Train Electrical Distribution with Unit 2 Red (AB) Train Offsite Power or Unit 2 Red (AB) DG to support alternate shutdown for Unit 1. Control Unit 2 Green (CD) Train Distribution with Unit 2 Green (CD) Train Offsite Power or Unit 2 Green (CD) DG to support alternate shutdown for Unit 1. Unit 1 ESW - Operate Unit 2 East or West ESW Pump to provide cooling to the Unit 2 CCW Heat Exchangers and the Unit 2 Red (AB) and Green (CD) DGs for alternate shutdown for Unit 1. Unit 1 CCW - Operate Unit 2 East or West CCW Pump to provide cooling to	None

**Fire Area AA40 – Attachment 1 - Table B-3 - Fire Area Transition**

<u>Unit</u>	<u>Fire Area</u>	<u>Description</u>
1	AA40	Unit 1 Engineered Safeguards Systems and Motor Control Center Room (El. 609 ft. 6 in.)

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the Unit 2 Charging Pumps for alternate shutdown for Unit 1.  
Unit 1 HVAC - Unit 1 Control Room HVAC is not required as alternate shutdown is utilized for this area. Unit 1 Auxiliary Building HVAC is not operational, Unit 2 Auxiliary Building HVAC remains available and provides adequate cooling. Operate Unit 2 Red (AB) and Green (CD) DG HVAC. Operate Unit 2 Red (AB) and Green (CD) Switchgear HVAC. Operate Unit 2 East AFW Pump Room HVAC. Operate Unit 2 East and West ESW Pump Room HVAC systems.

**Reference Documents**

Genesis Solution Suite, EDISON / SAFE-PB, DC Cook V 3.4.0

Nuclear Safety Capability Assessment Report

**Licensing Actions**

None

**Existing Engineering Equivalency Evaluations (EEEE)****EEEE Title Engineering Equivalency Evaluation 9-16 - Fire Zone 41 (Fire Area AA40) and Fire Zone 55 (Fire Area AA48) Hatch Evaluation**

**Summary** The purpose of this engineering equivalency evaluation is to document the acceptability of an unrated steel plate hatch located between the Unit 1 ESS and MCC Room and the Unit 1 Switchgear Room Cable Vault in Fire Zones 41 (Fire Area AA40) and 55 (Fire Area AA48). A 3-hr fire-rated hatch assembly is not commercially available for use in this location.

Reasonable assurance is provided that a fire in Fire Zone 41 or Fire Zone 55 would not impair safe shutdown capabilities of Unit 1. This engineering equivalency evaluation does not adversely impact other engineering equivalency evaluations.

The hatch was evaluated and found to be acceptable based on the fire hazards and fire protection systems within the evaluated areas.

**Fire Area AA40 – Attachment 1 - Table B-3 - Fire Area Transition**

<b><u>Unit</u></b>	<b><u>Fire Area</u></b>	<b><u>Description</u></b>
1	AA40	Unit 1 Engineered Safeguards Systems and Motor Control Center Room (El. 609 ft. 6 in.)
<hr/>		
<b><u>EEEE Title</u></b>	<b>Engineering Equivalency Evaluation 11-5 - Unit 1 Emergency Power Systems/4 KV Switchgear Complex Ventilation Shaft Boundary Evaluation (Fire Areas AA39A, AA39B, AA40, AA41 and AA48).</b>	
<b><u>Summary</u></b>	<p>The purpose of this engineering equivalency evaluation is to document the acceptability of unrated fire barrier penetration seals between the Unit 1 EPS/4KV switchgear complex ventilation shafts in Fire Zones 40A (Fire Area AA39A), 40B (Fire Area AA39B), 41 (Fire Area AA40) and 42A to 42D (Fire Area AA41) and the Unit 1 switchgear cable spreading room in Fire Zone 55 (Fire Area AA48).</p> <p>Reasonable assurance is provided that a fire in Fire Areas AA39A, AA39B, AA40, AA41 or AA48 would not impair safe shutdown capabilities of Unit 1. This engineering equivalency evaluation does not impact other engineering equivalency evaluations.</p> <p>The construction features were evaluated and found to be acceptable based on the fire hazards and fire protection systems within the evaluated areas.</p>	
<b><u>EEEE Title</u></b>	<b>Engineering Equivalency Evaluation 11-9 - Turbine, Auxiliary and Containment Buildings Boundary Evaluation</b>	
<b><u>Summary</u></b>	<p>The purpose of this engineering equivalency evaluation is to describe in general, the approach and existence of evaluations performed to determine and reconcile fire area boundaries having components or designs with less than a 3-hr fire rating on preventing the spread of fire. This engineering equivalency evaluation also specifically evaluates the impact of unrated door assemblies on the spread of fire.</p> <p>Reasonable assurance is provided that the fire area boundaries having components or design less than a 3-hr fire rating will not increase the spread of fire or impair the safe shutdown capabilities of Units 1 or 2. In addition, this engineering equivalency evaluation does not adversely impact on other engineering equivalency evaluations or exemption requests.</p> <p>This evaluation supports additional evaluations credited in this fire area.</p>	

**Fire Area AA40 – Attachment 1 - Table B-3 - Fire Area Transition**

<b><u>Unit</u></b>	<b><u>Fire Area</u></b>	<b><u>Description</u></b>
1	AA40	Unit 1 Engineered Safeguards Systems and Motor Control Center Room (El. 609 ft. 6 in.)
<b><u>EEEE Title</u></b>	<b>Engineering Equivalency Evaluation 11-15 - Switchgear Room Construction Boundary Room Evaluation Fire Zones 40A, 40B, 41, 42A, 45, 46A, 47A and 47B (Fire Areas AA39A, AA39B, AA40, AA41, AA43, AA44, AA45A and AA45B)</b>	
<b><u>Summary</u></b>	<p>The purpose of this engineering equivalency evaluation is to document the acceptability of the construction features of the switchgear rooms which have a fire resistance rating of less than 3 hours and their impact on the spread of fire. In particular, fire doors having a 1 1/2-hr fire rating and open penetrations are analyzed by this engineering equivalency evaluation, as other unrated construction features have been previously analyzed under separate engineering equivalency evaluations. The applicable Fire Areas in Unit 1 are AA39A, AA39B, AA40 and AA41. The applicable Fire Areas in Unit 2 are AA43, AA45A and AA45B.</p> <p>Reasonable assurance is provided that the construction features of the switchgear rooms which have a fire resistance rating of less than 3 hours will prevent the spread of fire and not impair the safe shutdown capabilities of Unit 1 and Unit 2. This engineering equivalency evaluation does not impact other engineering equivalency evaluations.</p> <p>The switchgear room boundaries were evaluated and found to be acceptable based on the fire hazards and fire protection systems within the areas.</p>	
<b><u>EEEE Title</u></b>	<b>Engineering Equivalency Evaluation 11-24 - Fire Retention Capability of Nonconforming Fire Seals in Fire Zones having a Low Combustible Loading Classification</b>	
<b><u>Summary</u></b>	<p>The purpose of this engineering equivalency evaluation is to document the acceptability of fire seal designs which do not meet the requirements of the installation specification or fire test data in fire zones having a low combustible loading classification would have on preventing the spread of fire.</p> <p>Reasonable assurance is provided that fire seals which do not meet the requirements of the installation specification or fire test data in fire zones having a low combustible loading classification, will provide adequate fire retention capabilities and will not impair the safe shutdown capabilities of CNP or increase the spread of fire between fire zones. In addition, this engineering equivalency evaluation does not adversely impact other engineering equivalency evaluations or exemptions.</p> <p>Refer to Engineering Equivalency Evaluation 11.28.</p>	

**Fire Area AA40 – Attachment 1 - Table B-3 - Fire Area Transition**

<u>Unit</u>	<u>Fire Area</u>	<u>Description</u>
1	AA40	Unit 1 Engineered Safeguards Systems and Motor Control Center Room (El. 609 ft. 6 in.)
<b><u>EEEE Title</u></b>	<b>Engineering Equivalency Evaluation 11-28 - Generic Fire Seal Design 2 (Fire Areas AA7, AA8, AA39A, AA40, AA43, AA45A, AA45B, AA48 and AA52)</b>	
<b><u>Summary</u></b>	<p>The purpose of this engineering equivalency evaluation is to document the acceptability of deviations to Generic Fire Seal Design 2 on preventing the spread of fire. The applicable Fire Areas include AA7, AA8, AA39A, AA40, AA43, AA54A, AA54B, AA48 and AA52.</p> <p>Reasonable assurance is provided that deviations to Generic Fire Seal Design 2, Fire Seals W7109, W7952, F8150, F8152, F8162, F8184, F8859, F8861, F8863, F8887 and W9058, and the attributes discussed in the engineering equivalency evaluation do not impair the safe shutdown capabilities of CNP or increase the ability of fire to spread between fire zones. This engineering equivalency evaluation does not impact other engineering equivalency evaluations.</p> <p>Attribute Nos. 2, 7, 9 and the 11 fire seals of Generic Fire Seal Design 2 were evaluated and found to be acceptable based on the fire hazards and fire protection systems within the evaluated areas.</p>	
<b><u>EEEE Title</u></b>	<b>Engineering Equivalency Evaluation 12-19 - CO2 Fire Suppression System Concentrations (Fire Areas AA7, AA8, AA9, AA10, AA29, AA30, AA31, AA37, AA38, AA39, AA40, AA41, AA43, AA44, AA45, AA48, AA49, AA50, AA51, AA52 and AA53)</b>	
<b><u>Summary</u></b>	<p>The purpose of this engineering equivalency evaluation is to document the acceptability of the CO2 fire suppression systems in fire zones containing concentrations of cable insulation and the potential for deep-seated fires. This engineering equivalency evaluation determines the CO2 system's impact on the spread of fire and previous engineering equivalency evaluations and exemption requests. Although there are other fire zones that use CO2 for fire suppression such as the DG Rooms, they are installed to suppress surface-type, combustible liquid fires and are not included in this analysis, because they do not contain significant concentrations of cable insulation capable of producing deep-seated fires.</p> <p>All of the CO2 systems included in this engineering equivalency evaluation are capable of performing their intended function, containing the fire until the Fire Brigade arrives, preventing fire spread to adjacent fire zones, and ensuring that safe shutdown of CNP can be achieved and maintained.</p> <p>The existing suppression systems were evaluated and found to be acceptable based on the fire hazards and fire protection systems within the evaluated areas.</p>	

**Fire Area AA40 – Attachment 1 - Table B-3 - Fire Area Transition**

<u>Unit</u>	<u>Fire Area</u>	<u>Description</u>
1	AA40	Unit 1 Engineered Safeguards Systems and Motor Control Center Room (El. 609 ft. 6 in.)

**Fire Suppression Effects on Nuclear Safety Performance Criteria**

The CNP fire brigade is trained to discharge water in a judicious manner and instructed to direct hose streams and portable extinguishers at the base of the fire to limit the amount of overspray beyond the immediate fire zone. For this reason, fire brigade activities are not expected to fail components not already considered damaged by fire. It has been concluded that water impingement on cables is not a concern. Electrical cabinets are provided with a seal at the conduit interface. Per visual inspection any side vents for this equipment are pointed downward to prevent water intrusion. The drainage features of the fire area mitigate the potential for flooding damage due to fire suppression, such that the standing water would not affect credited equipment.

In the event of discharge, the CO2 system will not adversely affect the equipment operating within the fire area. Potential condensation developing on electrical components is a long term issue that would be eliminated by ventilating the fire area after actuation. Per visual inspection, all CO2 nozzles are located greater than 5 ft. away from any credited equipment and therefore, the possibility of thermal shock due to CO2 actuation has been deemed to be a non-issue in this fire area in accordance to EPRI NP-7253 "Effects of Fire Suppressants on Electrical Components in Nuclear Power Plants". Since it is shown that suppression effects will not impact the nuclear safety performance criteria, the fire area configuration is deemed acceptable.

**References:**

Technical Evaluation 12.1, "Fire Suppression Effects Study"

Technical Evaluation 12.1, "Supplemental Information to Fire Suppression Effects Study – Supplement 1"

**Fire Area Comments**

Revise time requirement \ time basis per AR 2015-14147 for VFDR AA40-009.

Revised AA40-009 to require Control Room trip of Reserve Feed breaker 12AB per AR 2016-14442-5.

## Fire Area AA40 – Attachment 2 - Fire Risk Evaluation Results Summary

### A2.1 Introduction

The ‘changes’ associated with NFPA 805 transition were those variances from the deterministic requirements of NFPA 805. The changes identified for evaluation for fire area AA40 are grouped as follows:

- Separation Issues

This attachment is a summary of the Fire Risk Evaluation for the fire area. The complete results and methodology are contained in the Cumulative Fire Risk Evaluation, PRA-FIRE-NB-CRE. (FPCE 2017-0009)

### A2.2 Inputs/Assumptions

Fire modeling processes and inputs provided in NUREG/CR-6850 are appropriate for use in a risk-informed, performance-based evaluation. The complete list of assumptions used in the fire modeling methodology for this fire area is contained in Detailed Fire Modeling Technical Evaluation R1900-0411-AA40.

### A2.3 Fire Modeling Methodology

Fire PRA fire modeling results are used as the initial input into this Fire Risk Evaluation. The process consists of conservative bounding analyses using NUREG/CR-6850 methods. As needed, refinements are made to utilize more realistic parameters. The complete fire modeling methodology for this fire area is contained in Detailed Fire Modeling Technical Evaluation R1900-0411-AA40.

### A2.4 Scenario Descriptions and Model Results

Fire Area AA40 was evaluated for the impact of fires originating from both fixed and transient ignition sources. Complete descriptions of each fire scenario is contained within the Detailed Fire Modeling Technical Evaluation R1900-0411-AA40.

#### A2.4.1 Ignition Sources

Fire Area AA40 contains 600V switchgear bus 11B and 11D, battery chargers, the 4160/600V bus supply transformers 11B and 11D and various other 600V MCCs. Per discussion with plant personnel, the heat release rates for all switchgear, load centers, and MCC electrical cabinets have been characterized as qualified cable because items of this nature are generally constructed on-site. For other electrical cabinet types, where the internal cable qualification was unknown, the heat release rates have been assumed as non-qualified. Ignition sources in Fire Area AA40 were modeled using the 98th percentile fire as a screening approach and later refined based on the risk significance of the scenario. 75th percentile fires were also postulated for the following ignition sources: 1-CRID-4-CVT, 1-TR11D, 1-BC-AB1, 1-TR11B, 1-BC-AB2, 11PHA, 11PHC, Bus 11B, Bus 11D, 1-CRID-1-CVT, 1-CRID-2-CVT and 1-CRID-3-CVT. For the high voltage load center, both an electrical fire and a high energy arcing fault (HEAF) fire scenario have been developed.

In Fire Area AA40, the 98th percentile HRR was used for all transient fires. The 98th percentile HRR bounds the possible transient ignition sources expected for this fire area, which were fire tested and identified in NUREG/CR-6850, Appendix G, Table G-7.

#### A2.4.2 Scenario Results

A delta risk calculation has been performed to quantify the risk associated with the VFDRs in the fire area.



## **Fire Area AA40 – Attachment 2 - Fire Risk Evaluation Results Summary**

### **A2.5 Fire Risk Evaluation Results**

PRA-FIRE-NB-CRE documents scenarios and corresponding impacted VFDRs that were evaluated for delta risk during the transition to NFPA 805 and also all changes to the Fire Protection Program that are currently incorporated into the Fire PRA model. The acceptability of the Cumulative Fire Risk Evaluations was based on calculated delta risk meeting the thresholds of NEI 04-02, RG 1.205 and RG 1.174. (FPCE 2017-0009)

## Fire Area AA40 – Attachment 2 - Fire Risk Evaluation Results Summary

### A-2.6 Impact of VFDR on Defense-in-Depth

Defense-in-Depth has been evaluated for this fire area. The impacts of this evaluation are summarized in the table below:

Defense-in-Depth Impact Review for AA40			
Method of Providing DID	Required to Support Deterministic Analysis or Fire PRA?	Changes or Improvements Necessary for DID?	Basis/Justification
Echelon 1: Prevent fires from starting			
Combustible Control is implemented in accordance with Procedure PMP-2270-CCM-001, Control of Combustible Materials.	Yes	No	• Transient combustible and hot work free zone have been implemented for this Fire Area for risk reduction. This element is adequate based on no perceived weakness of, or over-reliance on, another echelon of defense-in-depth.
Hot Work Control is implemented in accordance with Procedure PMP-2270-WBG-001, Welding, Burning and Grinding Activities.	Yes	No	
Echelon 2: Rapidly detect, control and extinguish promptly those fires that do occur thereby limiting fire damage			
Fire Detection System	Yes	No	• Suppression and detection are already required and fire fighting activities are not expected to be challenging; therefore, no changes or improvements to Echelon 2 attributes are necessary to maintain defense-in-depth.
Fixed Fire Suppression	Yes	No	
Portable Fire Extinguishers	Yes	No	
Hose stations and hydrants	Yes	No	
Pre-Fire Plan	Yes	No	
Echelon 3: Provide adequate level of fire protection for systems and structures so that a fire will not prevent essential safety functions from being performed			
Walls, floors ceilings and structural elements are rated or have been evaluated as adequate for the hazard.	Yes	No	• There are significant modeling differences between the Fire PRA and nuclear safety capability assessment (i.e., due to different success criteria, end states, etc.) and therefore a recovery action for VFDR AA40-008 has been credited to ensure that defense-in-depth is maintained.  • Where a variance can possibly be affected in a potentially high risk scenario, based on a detailed review, the VFDR is either not the cause for the high risk of the scenario or the mitigating recovery action is credited; therefore no changes or improvements to Echelon 3 attributes are necessary to maintain defense-in-depth.
Penetrations in the fire area barrier are rated or have been evaluated as adequate for the hazard.	Yes	No	
Supplemental barriers (e.g., ERFBS, cable tray covers, etc.)	Yes	No	
Guidance provided to operations personnel detailing the required success path(s) including recovery actions to achieve nuclear safety performance criteria.	Yes	Yes	
			• Defense in Depth actions were credited to remove fuses or open breakers in the Control Room to prevent spurious equipment operation due to internal shorts.

## Fire Area AA40 – Attachment 2 - Fire Risk Evaluation Results Summary

### A-2.7 Safety Margin Considerations

In accordance with NEI 04-02, the maintenance of adequate Safety Margin is assessed by the consideration categories of analyses utilized by this Fire Risk Evaluation.

Safety margins are considered to be maintained if:

- Codes and Standards or their alternatives accepted for use by the NRC are met.

AND

- Safety analyses acceptance criteria in the licensing basis (e.g., FSAR, supporting analyses) are met, or provides sufficient margin to account for analysis and data uncertainty.

The following summarizes the bases for ensuring the maintenance of safety margins:

- The risk-informed, performance based processes utilized are based upon NFPA 805, 2001 edition, endorsed by the NRC in 10 CFR 50.48(c).
- The Fire Risk Evaluation process is in accordance with NEI 04-02, Revision 2, which is endorsed by the NRC in Regulatory Guide 1.205, Revision 1.
- The Fire PRA is developed in accordance with NUREG/CR-6850, which was developed jointly between the NRC and EPRI.
- The Fire PRA has undergone an industry peer review, in order to ensure the Fire PRA meets the appropriate quality standards of ASME/ANS RA-Sa-2009, "Standard for Level 1/Large Early Release Frequency Probabilistic Risk Assessment for Nuclear Power Plant Applications," Dated February 2, 2009
- The "combined analysis approach" is used during transition (NEI 04-02, Section 5.3.4.3); therefore, MEFS/LFS is not analyzed separately from the Fire PRA results.
- The CNP internal events PRA model received two formal industry peer reviews conducted in accordance with applicable NEI guidelines. The initial peer review was performed in 2001, while a subsequent focused scope (i.e., limited scope) peer review was conducted in 2009. The initial, full-scope WOG peer review covered all aspects of the CNP PRA model and the administrative processes used to maintain and update the model. The CNP PRA model has been revised to address all significant issues (i.e., Category A and B Facts & Observations) identified during the initial peer review. None of the findings from the focused-scope peer review were judged to reach the significance level of a Category A or B Fact & Observation; as a result, no changes to the PRA model have yet been made to include resolutions for these latter issues.
- Fire protection systems and features determined to be required by NFPA 805 Chapter 4 have been confirmed to meet the requirements of NFPA 805 Chapter 3 and their associated referenced codes and listings, or provided with acceptable alternatives using processes accepted for use by the NRC (i.e., FAQ 06-0008, FAQ 06-0004, 07-0033).
- Fire modeling performed in support of the transition has been performed within the Fire PRA utilizing codes and standards developed by industry and NRC staff which have been verified and validated in authoritative publications, such as NUREG 1824, "Verification and Validation of Selected Fire Models for Nuclear Power Plant Applications". In general, the fire modeling performed in support of the Fire Risk Evaluations has been performed using conservative methods and input parameters that are based upon

## Fire Area AA40 – Attachment 2 - Fire Risk Evaluation Results Summary

NUREG/CR-6850 as documented in the AA40 Detailed Fire Modeling Report, section 7.2. While this is generally not ideal in the context of best estimate probabilistic risk analysis, it is a pragmatic approach given the current state of knowledge regarding the uncertainties related to the application of the fire modeling tools and associated input parameters for specific plant configurations.

- In accordance with the requirements of 10 CFR 50.48(c)(2)(iii), the Fire PRA results, including cutsets for the scenarios of concern, have been reviewed and it was verified that the results presented above do not rely solely on feed and bleed as the fire-protected safe shutdown path for maintaining reactor coolant inventory, pressure control, and decay heat removal capability for this fire area.

### A-2.8 Transition Risk Evaluation Conclusions

The transition change evaluation determined that these changes:

- Are acceptable based upon the measured change in CDF and LERF
- Maintained adequate defense-in-depth and safety margins

The results of this evaluation meet the requirements of NFPA 805 Risk Evaluation; therefore, the use of the performance based analysis approach is acceptable.

## D. C. Cook Nuclear Plant Fire Safety Analysis

## Fire Area: AA41

Unit 1 Emergency Power Systems Area (El. 609 ft. 6 in.)

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## Attachments

Fire Area AA41 – Attachment 1 - Table B-3 - Fire Area Transition

## Fire Area AA41 – Attachment 2 - Fire Risk Evaluation Results Summary

## 1.0 PURPOSE

This report documents the Fire Safety Analysis (FSA) for Cook Nuclear Plant (CNP) Fire Area AA41, Unit 1 Emergency Power Systems Area (El. 609 ft. 6 in.) which comprises fire zone(s) 42A, 42B, 42C, 42D. The purpose of this analysis is to demonstrate the achievement of the nuclear safety and radioactive release performance criteria of NFPA 805 as required by 10 CFR 50.48(c). The Fire Safety Analysis is a key part of compliance with Section 2.7.1.2 Fire Protection Program Design Basis Document of NFPA 805. This analysis also documents results of risk-informed, performance-based Fire Risk Evaluations (FREs). These evaluations are associated with Variances from Deterministic Requirements (VFDRs) of NFPA 805 Chapter 4.

## 2.0 ANALYSIS METHODOLOGY

The FSA is the design basis document as described in NFPA 805 Section 2.7.1.2. The following steps are performed to develop the FSA on a fire area basis:

- Identify significant fire hazards in the fire area. This is based on NFPA 805 approach to analyze the plant from an ignition source and fuel package perspective.
- Summarize Nuclear Safety Capability Analysis (NSCA) compliance strategies. This is the result of the NEI 04-02 B-3 Table review of the Safe Shutdown Analysis.
- Summarize Non-Power Operations Modes compliance strategies.
- Summarize Radioactive Release compliance strategies. The transition review process required per NEI 04-02 is used to develop these results.
- Provide Fire Probabilistic Risk Assessment summary of results. This is based on the results from the plant Fire PRA.
- Perform risk informed, performance based evaluations if needed for the performance based approach.
- Summarize Defense-in-Depth strategy for each fire area.
- Determine key analysis assumptions which are candidates to be included in the NFPA 805 monitoring program.
- Provide conclusions relative to NFPA 805 compliance.

### 3.0 ANALYSIS

#### 3.1 Classical Fire Protection

##### 3.1.1 Construction

Walls, floors and ceilings to adjacent fire areas are reinforced concrete in excess of a 3-hour rating.

For Fire Zone 42A, a fire area boundary evaluation was performed for the construction features of the switchgear rooms that have a fire resistance rating of less than 3 hours. A 12-inch concrete block wall having a 4-hour rating provides a flame and heat shield between the 4kV/600v transformers. A 22" x 22" undampened ventilation duct passes through this wall.

For Fire Zone 42B, 42C and 42D, walls, floors and ceilings to adjacent fire areas are reinforced concrete in excess of a 3-hour rating.

Applicable Engineering Equivalency Evaluations are documented in Attachment 1.

##### 3.1.2 Doors and Access Openings

For Fire Zone 42A, A fire door having a 1 1/2-hour rating is provided to adjacent Fire Zone 41. An unlabeled Class A (3-hour) roll-up fire door is provided to adjacent Fire Zone 90. An unlabeled Class A (3-hour) overhead roll-up fire door is also provided to adjacent Fire Zone 41. An access opening is provided from this fire zone into Fire Zone 42C. An access opening is provided from this fire zone into Fire Zone 42C.

Due to High Energy Line Break (HELB) considerations, the access/ventilation opening between Fire Zone 42A and adjacent Fire Zone 90 is provided with a combined multi-section fire damper assembly and personnel access door. The fire dampers, door, doorframe and supporting structures are installed as a 3-hour rated assembly. The dampers are furnished with electro-thermal links (ETLs). The links are temperature rated for 286°F to preclude the possibility of inadvertent closure during a high energy line break (HELB) in the turbine building. The design for this opening also incorporates non-rated HELB dampers on the West Side of the fire damper assembly and security barrier. Similarly, the access/ventilation opening between Fire Zone 42A and adjacent Fire Zone 41 is provided with a combined multi-section fire damper assembly and personnel access door. The fire dampers, door, doorframe and supporting structures are installed as a 3-hour rated assembly. The opening does not include HELB dampers or a security barrier. The dampers are furnished with ETLs. The links are temperature rated for 165°F. The ETLs for both of the fire damper assemblies described above are actuated through the existing CO2 system in this fire zone. The CO2 actuation is a manual function.

For Fire Zone 42B, a fire door having a 3-hour rating is provided to adjacent Fire Zone 41.

For Fire Zone 42C, there are no door openings to adjacent fire areas. An access opening is provided into this fire zone from Fire Zone 42A. A fire door having a 1 1/2-hour rating is provided to adjacent Fire Zone 42D.

For Fire Zone 42D, there are no door openings to adjacent fire areas. A fire door having a 1 1/2-hour rating is provided to adjacent Fire Zone 42C.

##### 3.1.3 Penetrations

For Fire Zone 42A, penetrations in fire barriers between this fire zone and adjacent fire areas are provided with fire seals. However, barriers between this fire zone and adjacent Fire Zone 42C are not fire sealed.

For Fire Zone 42B, penetrations in fire barriers between this fire zone and adjacent fire areas are provided with fire seals. However, barriers between this fire zone and adjacent Fire Zone 42C are not fire sealed.

For Fire Zone 42C, penetrations in fire barriers between this fire zone and adjacent fire areas are provided with fire seals. Additionally, penetrations in the fire barriers between Fire Zones 42C and 42D are provided with fire seals. However, barriers between this fire zone and adjacent fire zone 42A and 42B are not fire sealed.

For Fire Area 42D, penetrations in fire barriers between this fire zone and adjacent fire areas are provided with fire seals. Additionally, penetrations in the fire barriers between Fire Zones 42D and 42C are provided with fire seals.

A fire area boundary evaluation was performed for the unrated fire barrier penetration seals installed between Fire Area AA39A and AA39B, Fire Zones 40A and 40B, respectively and Fire Area AA40 - Fire Zone 41, Fire Area AA41 - Fire Zones 42A, 42B, 42C, 42D and Fire Area AA48 - Fire Zone 55 (Engineering Equivalency Evaluation 11-5).

For Fire Zones 42B, 42C and 42D, seismic gaps are sealed with a glass fiber reinforced silicone sheeting.



### 3.1.4 Detection

The table below outlines the fire detection system(s) provided in the Fire Area:

Table 3-1, Fire Area AA41 Detection Systems								
Fire Zone	Type of System	Local (L) / Remote (R)	Detection Actuates Suppression?	Required System?				
				S	L	E	R	D
42A	Infrared	L/R	No Auto Supp. (N/A)	N	N	Y	Y	N
42A	Ionization	L/R	No Auto Supp. (N/A)	N	N	Y	Y	N
42B	Infrared	L/R	No Auto Supp. (N/A)	N	N	Y	Y	N
42B	Ionization	L/R	No Auto Supp. (N/A)	N	N	Y	Y	N
42C	Infrared	L/R	No Auto Supp. (N/A)	N	N	Y	Y	N
42C	Ionization	L/R	No Auto Supp. (N/A)	N	N	Y	Y	N
42D	Ionization	L/R	No Auto Supp. (N/A)	N	N	Y	Y	N

**Table 3-1 Legend:**

Table Field: "Required System?"	
S	- Required for Chapter 4 Separation Criteria
L	- Required for NRC Approved Licensing Action
E	- Required for Engineering Equivalency Evaluation
R	- Required for Risk Significance
D	- Required to maintain adequate balance of Defense-in-Depth in a Change Evaluation or Fire Risk Evaluation

For Fire Zone 42A, cross zoned ionization smoke detectors (10) and infra-red detectors (2) which alarm in the Unit 1 Control Room. Each detector type is part of a larger detection circuit which includes Fire Zones 42A, 42B, 42C and 42D for ionization detectors and Fire Zones 42A, 42B and 42C for infra-red detectors. Two of the ionization detectors, serving Fire Zone 42A are located on the West side of the ventilation / access opening to adjacent Fire Zone 90.

For Fire Zone 42B, cross zoned ionization smoke detectors (2) and infra-red detectors (1) which alarm in the Unit 1 Control Room are provided. Each detector type is part of a larger detection circuit which includes Fire Zones 42A, 42B, 42C and 42D for ionization detectors and Fire Zones 42A, 42B and 42C for infra-red detectors.

For Fire Zone 42C, cross zoned ionization smoke detectors (3) and infra-red detectors (2) which alarm in the Unit 1 Control Room are provided. Each detector type is part of a larger detection circuit which includes Fire Zones 42A, 42B, 42C and 42D for ionization detectors and Fire Zones 42A, 42B and 42C for infra-red detectors.

For Fire Zone 42D, two ionization smoke detectors which alarm in the Unit 1 Control Room are provided. These detectors are part of a larger detection circuit which includes Fire Zones 42A, 42B, 42C and 42D

### 3.1.5 Fixed Suppression

The table below outlines the fixed fire suppression system(s) provided in the Fire Area:

Table 3-2, Fire Area AA41 Suppression Systems								
Fire Zone	Type of System	Full (F) / Partial (P)	Required System?					
			S	L	E	R	D	
42A	Manual CO2	F	N	N	Y	N	N	
42B	Manual CO2	F	N	N	Y	N	N	
42C	Manual CO2	F	N	N	Y	N	N	
42D	None	N/A	N/A	N/A	N/A	N/A	N/A	

**Table 3-2 Legend:**

Table Field: "Required System?"	
S	- Required for Chapter 4 Separation Criteria
L	- Required for NRC Approved Licensing Action
E	- Required for Engineering Equivalency Evaluation
R	- Required for Risk Significance
D	- Required to maintain adequate balance of Defense-in-Depth in a Change Evaluation or Fire Risk Evaluation

Fire Area AA41 is not provided with automatic fire suppression.

### 3.1.6 Manual Suppression / Response Strategy

A postulated fire will be identified by early detection using ionization type smoke detection, infrared detection or by plant personnel using plant communication system to notify the control room. The automatic detection systems alarm in the control room. The Control Room operator will dispatch the fire brigade for initiation of manual fire fighting. A fire in this fire area will be contained by the construction features discussed in Section 3.1.1. Manual suppression is provided by the CNP Fire Brigade. A low pressure CO2 total flooding system supplied from the 17 ton tank is provided. This system is manually actuated. Operation of this system discharges CO2 simultaneously into Fire Zones 42A, 42B, and 42C.

Fire extinguishers are located in Fire Zone 42A for the fire brigade's use, with additional extinguishers located in adjacent Fire Zone 41 and 90.

Water hose reels are located in the adjacent Fire Zones 33A and 90.

Floor drains are available in Fire Zones 42A. Drainage for Fire Zones 42B, 42C and 42D is provided via Fire Zone 42A.

### 3.1.7 Ventilation

A fire in this area will be contained by the fire barriers. Smoke can be removed by portable fans and flexible ducting to the Turbine Building and outdoors. This fire area is listed as a non-controlled area in the Fire Pre Plans and therefore there is reasonable assurance that products of combustion will not be contaminated.

For Fire Zone 42A, there are undampened ventilation shafts in the ceiling that pass through Fire

Area AA48 Fire Zone 55 to the Yard. A fire damper having a 3-hour rating is provided to adjacent Fire Area AA40 - Fire Zone 41. There is a ventilation penetration to the adjacent Fire Zone 42C.

For Fire Zone 42B, there are no ventilation penetrations to adjacent fire areas. There are undampered ventilation penetrations to adjacent Fire Zone 42C.

For Fire Zone 42C, there are undampered ventilation penetrations to adjacent Fire Zones 42A and 42B. A fire damper having a 3-hour rating is provided to adjacent Fire Zone 42D.

For Fire Zone 42D, there is a 4-hour rated undampered ventilation shaft in the ceiling that passes through Fire Area AA48 - Fire Zone 55 to the Yard. A fire damper having a 3-hour rating is provided to adjacent Fire Zone 42C.

### 3.1.8 Other Features

Some cable trays within Fire Area AA41 are provided with bottom covers and/or are fully enclosed.

## 3.2 Fire Hazards Identification

The fire area contains both ignition sources and combustible fire hazards. The ignition sources consist of 600V switchgear, 250Vdc batteries, Inverters, 250Vdc cabinets, and transformers. Combustibles consist primarily of exposed electrical cables in trays, rubber and plastics. Fire Zone 42D contains battery cells. The current fire loading classification is considered low.

## 3.3 NSCA Compliance Summary

Fire Area AA41 contains Unit 1 Red Train B and Green Train A 600V bus power supplies, Control Room Indicating Panel Inverters, Red Train B 250V DC supplies, Red Train B and Green Train A cables.

Compliance with the nuclear safety performance criteria is achieved using the performance-based approach in accordance with NFPA 805, Section 4.2.4.2.

Safe and stable for Unit 1 will be accomplished with a combination of Unit 1 systems and crossties to the unaffected Unit 2 via the following: Steam Generators 2 and 3 via the Unit 1 East Motor Driven Auxiliary Feedwater Pump, Unit 2 Charging Crosstie with Unit 2 support systems (Unit 2 Component Cooling Water, Unit 2 Essential Service Water) Offsite Power to Unit 1 Green Train A 4kV Bus T11D (to support Unit 1 AFW), Unit 2 Power to the Local Shutdown Indicating panels and Unit 2 support power systems.

The Nuclear Safety Performance Criteria compliance strategy for AA41 is documented within the NSCA Report.

### 3.3.1 Variances

The variances identified for evaluation for this fire area are grouped as follows:

#### 3.3.1.1 VFDR No. AA41-001

1-CLI-113 and 1-CLI-114 - CST level indication is required to be operable to support AFW for decay heat removal. Decay heat removal is required to remove sufficient heat from the reactor core such that the fuel is maintained in a safe and stable condition. The CST level

indicators provide indication of the initial water source for AFW. 1-CLI-113 may fail due to fire induced damage of 120V Instrument Panel 1-CRID-II. 1-CLI-114 may fail due to fire induced damage of 120V Instrument Panel 1-CRID-III. This condition represents a variance from deterministic requirements of NFPA 805, Section 4.2.3. This is a separation issue.

This VFDR has been evaluated and it was determined that the risk, safety margin and defense-in-depth meet the acceptance criteria of NFPA 805 Section 4.2.4 with no further action required.

### **3.3.1.2 VFDR No. AA41-002**

1-PP-50E and 1-PP-50W - The Unit 1 East or West Charging Pump is required to be operable to support CVCS for inventory control, reactivity control and seal cooling. The Unit 1 Charging Pumps may fail due to a full area fire within Fire Area AA41. 1-PP-50E may fail due to fire induced damage of its cooling. 1-PP-50W may fail due to fire induced damage of its power supply, cooling and cables 8377R-1 and 8874R-1. Failure of both Unit 1 charging pumps requires cross-tying to the Unit 2 charging pumps to provide charging. This condition represents a variance from the deterministic requirements of NFPA 805, Section 4.2.3. This is a separation issue.

This VFDR has been evaluated and it was determined that the risk, safety margin and defense-in-depth meet the acceptance criteria of NFPA 805 Section 4.2.4 with a recovery action credited.

### **3.3.1.3 VFDR No. AA41-003**

1-PP-45-1 and 1-PP-45-4 – The RCPs are required to be tripped to prevent a loss of coolant accident if seal cooling and thermal barrier cooling are lost. A full area fire within Fire Area AA41 may cause the loss of seal cooling, thermal barrier cooling and Control Room trip capability of RCP 1 and 4. 1-PP-45-1 may lose Control Room trip capability due to fire induced damage of cable 3422R-1. 1-PP-45-4 may may lose Control Room trip capability due to fire induced damage of cable 3421R-1. RCPs 2 and 3 are not affected and can be tripped from the Control Room. This condition represents a variance from the deterministic requirements of NFPA 805, Section 4.2.3. This is a separation issue.

This VFDR has been evaluated and it was determined that the risk, safety margin and defense-in-depth meet the acceptance criteria of NFPA 805 Section 4.2.4 with no further action required.

**3.3.1.4 VFDR No. AA41-004**

1-BLI-120-CRI, 1-BLI-130-CRI, 1-MPP-220-CRI, 1-MPP-230-CRI, 1-NTR-120, 1-NTR-220, 1-NLP-151-CRI, 1-NPS-110-CRI – Control Room process monitoring may not be available due to a full area fire within Fire Area AA41. Process monitoring is required to be available to monitor key primary and secondary parameters. The instrumentation may not be available within the Unit 1 Control Room due to the loss of Unit 1 power distribution. Alternate process monitoring powered from Unit 2 is required at the Unit 1 LSI panels. The LSI panels require manual actions to transfer to the Unit 2 power supply. A transfer switch at 1-LSI-6 feeds both 1-LSI-6 and 1-LSI-2. A transfer switch at 1-LSI-5 feeds both 1-LSI-5 and 1-LSI-1. A transfer switch at 1-LSI-4 feeds both 1-LSI-4 and 1-LSI-3. Local monitoring of SG 2 and 3 level indication is required at 1-LSI-2. Local monitoring of SG 2 and 3 pressure indication is required at 1-LSI-4 and 1-LSI-6. Local monitoring of RCS loop temperature is required at 1-LSI-4. Local monitoring of pressurizer level and pressure indication is required at 1-LSI-3. This set of instruments has been credited due to SG 2 and 3 being credited for AFW. This condition represents a variance from the deterministic requirements of NFPA 805, Section 4.2.3. This is a separation issue.

This VFDR has been evaluated and it was determined that the risk, safety margin and defense-in-depth meet the acceptance criteria of NFPA 805 Section 4.2.4 with a defense-in-depth action credited.

**3.3.2 Recovery Actions Credited**

For each VFDR, a Fire Risk Evaluation has been performed to assess the acceptability of risk, defense-in-depth, and safety margin. This evaluation determined whether or not recovery actions are required to ensure that one success path necessary to achieve and maintain the nuclear safety performance criteria is maintained free of fire damage by a single fire. Table 3-3 identifies the credited recovery actions for this area. Actions retained for DID are identified as “DID Actions” within Table 3-3. Additional information for DID actions is contained within Section 3.8 of this report. Note that, for completeness, all VFDRs are contained within Table 3-3, even if the Fire Risk Evaluation has determined that a recovery action is not required. In those instances where a recovery action has been determined to not be required, the word “None” is provided in the “Action” column in the table.

<b>Table 3-3, Recovery Actions Credited</b>		
<b>VFDR</b>	<b>Component</b>	<b>Action</b>
AA41-001	1-CLI-113 1-CLI-114	None
AA41-002	1-PP-50E 1-PP-50W	1-CS-302-CLOSE (Close manual valve 1-CS-302)  1-CS-534-OPEN (Open manual valve 1-CS-534)  2-CS-536-OPEN (Open manual valve 2-CS-536)
AA41-003	1-PP-45-1 1-PP-45-4	None

Table 3-3, Recovery Actions Credited		
VFDR	Component	Action
AA41-004	1-BLI-120-CRI	DID ACTION
	1-BLI-130-CRI	1-LSI-4-ALT-PWR
	1-MPP-220-CRI	(Align unaffected Unit Power to
	1-MPP-230-CRI	LSI Panel)
	1-NTR-120	
	1-NTR-220	1-LSI-6-ALT-PWR
	1-NLP-151-CRI	(Align unaffected Unit Power to
	1-NPS-110-CRI	LSI Panel)
		1-LSI-2-LOCAL
		(Locally monitor 1-LSI-2)
		1-LSI-3-LOCAL
		(Locally monitor 1-LSI-3)
		1-LSI-4-LOCAL
		(Locally monitor 1-LSI-4)
		1-LSI-6-LOCAL
		(Locally monitor 1-LSI-6)

### 3.4 Non-Power Operational Modes Compliance Summary

A review of CNP for the potential effects of a fire in this Fire Area while in non-power modes of operation (NPO) was conducted. This review was conducted using the guidance provided in NEI 04-02 and FAQ 07-0040, "Non-Power Operations Clarifications". The review determined that there are potential failures that affect certain Key Safety Functions (KSF) as a result of the fire in this area, and the fire could result in the loss of one or more KSF paths. Compensatory measures are required during high risk evolution periods to provide reasonable assurance a fire will not adversely affect key safety functions and the NFPA 805 performance goal for NPO is therefore satisfied. The results of the NPO analysis are contained within Technical Evaluation R1900-005-001, Non-Power Operation Modes Transition Review Report.

### 3.5 Radioactive Release Compliance Summary

The NFPA 805 radiological release goal is to provide reasonable assurance that a fire will not result in a radiological release that adversely affects the public, plant personnel or the environment. The NFPA 805 requirement is to ensure a radiation release to any unrestricted area due to the direct effects of fire suppression activities (but not involving fuel damage) shall be as low as reasonably achievable and shall not exceed applicable plant Technical Specification limits.

AA41 is located outside the Radiological Controlled Area (RCA) and is not a storage location for contaminated materials, therefore there is reasonable assurance a fire in this area will not result in radiation release. The review of this fire area, with respect to radioactive release, is documented in the NFPPM.

### 3.6 Probabilistic Risk Assessment-Summary of Results

A Fire PRA (FPRA) quantification of Fire Area AA41 was performed and is documented in PRA-NB-FIRE-FQ, Fire PRA Model Quantification Notebook. The fire risk quantification for Fire Area AA41 is analyzed using detailed fire modeling to consider risk of fire scenarios of ignition sources. PRA-NB-FIRE-FQ includes a summary of all potentially risk-significant fire scenarios (i.e., CDF > 1.0E-7 or LERF > 1.0E-8). Bounding CDF / LERF per calendar year values are reported that are based on the risk values documented in PRA-NB-FIRE-FSS, Fire PRA Fire Scenario Selection.

Fire Protection features credited in the Fire PRA are documented in R1900-0411-AA41, Detailed Fire Modeling Report: Fire Compartment: AA41 Unit 1 Emergency Power Systems Area (EL. 609 FT 6 IN). PRA-NB-FIRE-FSS documents the revision level of the fire modeling reports used in the most recent Fire PRA quantification.

### 3.7 Risk-Informed, Performance-Based Evaluations

Fire Risk Evaluations (FREs) have been performed to ensure that variances from the NFPA 805 deterministic requirements are acceptable. The evaluation process consists of an integrated assessment of the acceptability of risk, defense-in-depth, and safety margins.

#### 3.7.1 Transition Risk-Informed, Performance-Based Evaluations

The ‘changes’ associated with NFPA 805 transition were those variances from the deterministic requirements of NFPA 805 or with the existing fire protection licensing basis that were brought into compliance with the NFPA 805 performance based approach. The change identified for evaluation for Fire Area AA41 is as follows:

- Separation Issues

The Fire Risk Evaluation has determined that the change is acceptable based upon:

- The measured change in CDF and LERF.
- Adequate defense-in-depth and safety margins being maintained.

Refer to Attachment 2 for a summary of results associated with the Fire Risk Evaluations.

### 3.8 Defense-in-Depth

A comprehensive risk-informed, performance-based analysis includes consideration of defense-in-depth (DID) as part of an integrated evaluation of risk considerations. In general, defense-in-depth involves consideration of the extent to which fire protection systems and features are provided within the three echelons of fire-protection:

- Preventing fires from starting,
- Rapidly detecting fires and controlling and extinguishing promptly those fires that do occur, thereby limiting fire damage,
- Providing an adequate level of fire protection for structures, systems, and components important to safety, so that a fire that is not promptly extinguished will not prevent the nuclear safety performance criteria from being met.

Each VFDR was evaluated for DID. The following recovery actions have been retained for DID.

VFDR No. AA41-004: 1-BLI-120-CRI, 1-BLI-130-CRI, 1-MPP-220-CRI, 1-MPP-230-CRI, 1-NTR-120, 1-NTR-220, 1-NLP-151-CRI, 1-NPS-110-CRI – Control Room process monitoring may not be available due a fire within Fire Area AA41. Process monitoring is required to be available to monitor key primary and secondary parameters. The instrumentation may not be available within the Unit 1 Control Room due to the loss of Unit 1 power distribution. These failures can be mitigated by transferring power and monitoring the instrumentation at the LSI panels. These recovery actions are being retained to ensure process monitoring is maintained.

Based on the assessment in support of the Fire Risk Evaluation, defense-in-depth is maintained for fire area AA41. Refer to Attachment 2 for details associated with the Fire Risk Evaluation.

### 3.9 Monitoring Program Input

A Monitoring Program will be developed in accordance with FAQ 10-0059, Rev. 1. Methods to monitor availability, reliability, and performance of fire protection program structures, systems, and components (SSCs), as well as programmatic elements will be provided. Additionally, effectiveness measures are established to review program related performance and trends. For AA41 the following systems and features are candidates for inclusion in the CNP Fire Protection Monitoring Program:

- Fire Area boundary barriers discussed in Section 3.1
- Fire Detection System
- Manual Fire Suppression System
- Cable tray covers

### 4.0 CONCLUSION

The nuclear safety and radioactive release performance criteria of NFPA 805 are met for a fire in Fire Area AA41. This Fire Risk Evaluation for Fire Area AA41 has demonstrated that

- The change in core damage frequency (delta CDF) is acceptable, and
- The change in large early release frequency (delta LERF) is acceptable, and
- Defense-in-depth and safety margins are maintained.

This is confirmation that a success path effectively remains free of fire damage and that the performance-based approach is acceptable per Section 4.2.4.2 of NFPA 805.



## **5.0 REFERENCES**

- 5.1 Calculation PRA-FIRE-NB-CRE, Fire PRA Cumulative Risk Evaluations
- 5.2 CNP Fire Pre-Plans, Volumes I, II, and III, Revisions 17, 14, and 18 respectively
- 5.3 Fire Hazards Analysis
- 5.4 NFPA 805, Performance-Based Standard for Fire Protection for Light Water Reactor Electric Generating Plants
- 5.5 NFPPM, NFPA 805 Fire Protection Program Manual (NFPPM)
- 5.6 Nuclear Energy Institute (NEI) 04-02, Guidance for Implementing a Risk-Informed, Performance-Based Fire Protection Program under 10 CFR 50.48(c), Rev. 2
- 5.7 Nuclear Safety Capability Assessment Report
- 5.8 PRA-NB-FIRE-FQ, Fire PRA Model Quantification Notebook
- 5.9 PRA-NB-FIRE-FSS, Fire PRA Fire Scenario Selection
- 5.10 R1900-0411-AA41, AA41 - Detailed Fire Modeling Report
- 5.11 Regulatory Guide 1.205, Risk-Informed, Performance-Based Fire Protection for Existing Light-Water Nuclear Power Plants, Rev. Revision 1
- 5.12 Technical Evaluation R1900-005-001, Non-Power Operation Modes Transition Review

**Fire Area AA41 – Attachment 1 - Table B-3 - Fire Area Transition**

<u>Unit</u>	<u>Fire Area</u>	<u>Description</u>
1	AA41	Unit 1 Emergency Power Systems Area (El. 609 ft. 6 in.)

**Fire Zone Description**

42A	E.P.S. Transformer Room - El. 609 ft. 6 in. - Unit 1
42B	E.P.S. Control Rod Drive Room - El. 609 ft. 6 in. - Unit 1
42C	E.P.S. Motor Control Room - El. 609 ft. 6 in. - Unit 1
42D	E.P.S. (AB) Battery Room - El. 609 ft. 6 in. - Unit 1

**Regulatory Basis**

4.2.4.2 - Performance-Based Approach - Fire Risk Evaluation with simplifying deterministic assumptions

<b>Performance Goal</b>	<b>Method of Accomplishment</b>	<b>Comments</b>
Reactivity Control	Unit 1 - Trip the reactor from the Control Room. Borate using Unit 2 East or West Charging Pump supplied from the Unit 2 RWST injecting through the Unit 1 BIT. Use source range monitoring for indication for Unit 1.	None
Inventory and Pressure Control	Unit 1 - Control inventory using Unit 2 East or West Charging Pump. Control pressure using Unit 1 Pressurizer Safety Relief Valves.	VFDRs identified for CVCS.
Decay Heat Removal	Unit 1 - Feed SGs 2 & 3 with Unit 1 East MDAFW Pump. The DHR function also requires MS isolation with a steam release path through the Safety Relief Valves.	VFDRs identified for CST level indication.
Process Monitoring	Unit 1 Process Monitoring - Use Unit 1 alternate process monitoring powered from Unit 2 at the local shutdown panels for the following: Pressurizer level, RCS pressure and temperature, and S/G level and Pressure. Unit 1 Source Range Monitoring - Use Unit 1 source range monitoring in the Control Room powered from Unit 2.	VFDRs identified for process monitoring.
Vital Auxiliaries	Unit 1 Electrical - Control Unit 1 Green (CD) Train Electrical Distribution with Unit 1 Green (CD) Train Offsite Power (to support U1 AFW). Control Unit 2 Red (AB) Train Electrical Distribution with Unit 2 Red (AB) Train Offsite Power or Unit 2 Red (AB) DG to support alternate charging and cooling. Control Unit 2 Green (CD) Train Electrical Distribution with Unit 2 Green (CD) Train Offsite Power or Unit 2 Green (CD) DG to support alternate	None

**Fire Area AA41 – Attachment 1 - Table B-3 - Fire Area Transition**

<u>Unit</u>	<u>Fire Area</u>	<u>Description</u>
1	AA41	Unit 1 Emergency Power Systems Area (El. 609 ft. 6 in.)

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shutdown.  
Unit 1 ESW - Operate Unit 1 East ESW and operate Unit 2 East or West ESW to support alternate shutdown.  
Unit 1 CCW - Operate Unit 2 East or West CCW to support alternate shutdown.  
Unit 1 HVAC - Operate Unit 1 Control Room HVAC. Operate Unit 1 Auxiliary Building HVAC. Operate Unit 1 Red (AB) and Green (CD) DG HVAC. Operate Unit 1 Red (AB) and Green (CD) HVAC. Operate Unit 1 East AFW Room HVAC. Operate the Unit 1 East ESW HVAC. The following Unit 2 HVAC systems are required to support alternate shutdown for Unit 1. Operate Unit 2 Auxiliary Building HVAC. Operate Unit 2 Red (AB) and Green (CD) DG HVAC. Operate Unit 2 Red (AB) and Green (CD) Switchgear HVAC. Operate the Unit 2 East and West ESW HVAC.

**Reference Documents**

Genesis Solution Suite, EDISON / SAFE-PB, DC Cook V 3.4.0

Nuclear Safety Capability Assessment Report

**Licensing Actions**

None

**Existing Engineering Equivalency Evaluations (EEEE)**

**EEEE Title** Engineering Equivalency Evaluation 11-5 - Unit 1 Emergency Power Systems/4 KV Switchgear Complex Ventilation Shaft Boundary Evaluation (Fire Areas AA39A, AA39B, AA40, AA41 and AA48).

**Summary** The purpose of this engineering equivalency evaluation is to document the acceptability of unrated fire barrier penetration seals between the Unit 1 EPS/4KV switchgear complex ventilation shafts in Fire Zones 40A (Fire Area AA39A), 40B (Fire Area AA39B), 41 (Fire Area AA40) and 42A to 42D (Fire Area AA41) and the Unit 1 switchgear cable spreading room in Fire Zone 55 (Fire Area AA48).

Reasonable assurance is provided that a fire in Fire Areas AA39A, AA39B, AA40, AA41 or AA48 would not impair safe shutdown capabilities of Unit 1. This engineering equivalency evaluation does not impact other engineering equivalency evaluations.

**Fire Area AA41 – Attachment 1 - Table B-3 - Fire Area Transition**

<u>Unit</u>	<u>Fire Area</u>	<u>Description</u>
1	AA41	Unit 1 Emergency Power Systems Area (El. 609 ft. 6 in.)

The construction features were evaluated and found to be acceptable based on the fire hazards and fire protection systems within the evaluated areas.

**EEEE Title Engineering Equivalency Evaluation 11-9 - Turbine, Auxiliary and Containment Buildings Boundary Evaluation**

**Summary** The purpose of this engineering equivalency evaluation is to describe in general, the approach and existence of evaluations performed to determine and reconcile fire area boundaries having components or designs with less than a 3-hr fire rating on preventing the spread of fire. This engineering equivalency evaluation also specifically evaluates the impact of unrated door assemblies on the spread of fire.

Reasonable assurance is provided that the fire area boundaries having components or design less than a 3-hr fire rating will not increase the spread of fire or impair the safe shutdown capabilities of Units 1 or 2. In addition, this engineering equivalency evaluation does not adversely impact on other engineering equivalency evaluations or exemption requests.

This evaluation supports additional evaluations credited in this fire area.

**EEEE Title Engineering Equivalency Evaluation 11-15 - Switchgear Room Construction Boundary Room Evaluation Fire Zones 40A, 40B, 41, 42A, 45, 46A, 47A and 47B (Fire Areas AA39A, AA39B, AA40, AA41, AA43, AA44, AA45A and AA45B)**

**Summary** The purpose of this engineering equivalency evaluation is to document the acceptability of the construction features of the switchgear rooms which have a fire resistance rating of less than 3 hours and their impact on the spread of fire. In particular, fire doors having a 1 1/2-hr fire rating and open penetrations are analyzed by this engineering equivalency evaluation, as other unrated construction features have been previously analyzed under separate engineering equivalency evaluations. The applicable Fire Areas in Unit 1 are AA39A, AA39B, AA40 and AA41. The applicable Fire Areas in Unit 2 are AA43, AA45A and AA45B.

Reasonable assurance is provided that the construction features of the switchgear rooms which have a fire resistance rating of less than 3 hours will prevent the spread of fire and not impair the safe shutdown capabilities of Unit 1 and Unit 2. This engineering equivalency evaluation does not impact other engineering equivalency evaluations.

The switchgear room boundaries were evaluated and found to be acceptable based on the fire hazards and fire protection systems within the areas.

**Fire Area AA41 – Attachment 1 - Table B-3 - Fire Area Transition**

<u>Unit</u>	<u>Fire Area</u>	<u>Description</u>
1	AA41	Unit 1 Emergency Power Systems Area (El. 609 ft. 6 in.)

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**EEEE Title** **Engineering Equivalency Evaluation 12-19 - CO2 Fire Suppression System Concentrations (Fire Areas AA7, AA8, AA9, AA10, AA29, AA30, AA31, AA37, AA38, AA39, AA40, AA41, AA43, AA44, AA45, AA48, AA49, AA50, AA51, AA52 and AA53)**

**Summary** The purpose of this engineering equivalency evaluation is to document the acceptability of the CO2 fire suppression systems in fire zones containing concentrations of cable insulation and the potential for deep-seated fires. This engineering equivalency evaluation determines the CO2 system's impact on the spread of fire and previous engineering equivalency evaluations and exemption requests. Although there are other fire zones that use CO2 for fire suppression such as the DG Rooms, they are installed to suppress surface-type, combustible liquid fires and are not included in this analysis, because they do not contain significant concentrations of cable insulation capable of producing deep-seated fires.

All of the CO2 systems included in this engineering equivalency evaluation are capable of performing their intended function, containing the fire until the Fire Brigade arrives, preventing fire spread to adjacent fire zones, and ensuring that safe shutdown of CNP can be achieved and maintained.

The existing suppression systems were evaluated and found to be acceptable based on the fire hazards and fire protection systems within the evaluated areas.

**Fire Suppression Effects on Nuclear Safety Performance Criteria**

The CNP fire brigade is trained to discharge water in a judicious manner and instructed to direct hose streams and portable extinguishers at the base of the fire to limit the amount of overspray beyond the immediate fire zone. For this reason, fire brigade activities are not expected to fail components not already considered damaged by fire. It has been concluded that water impingement on cables is not a concern. Electrical cabinets are provided with a seal at the conduit interface. Per visual inspection any side vents for this equipment are pointed downward to prevent water intrusion. The drainage features of the fire area mitigate the potential for flooding damage due to fire suppression, such that the standing water would not affect credited equipment.

In the event of discharge, the CO2 system will not adversely affect the equipment operating within the fire area. Potential condensation developing on electrical components is a long term issue that would be eliminated by ventilating the fire area after actuation. Per visual inspection, all CO2 nozzles are located greater than 5 ft. away from any credited equipment and therefore, the possibility of thermal shock due to CO2 actuation has been deemed to be a non-issue in this fire area in accordance to EPRI NP-7253 "Effects of Fire Suppressants on Electrical Components in Nuclear Power Plants". Since it is shown that suppression effects will not impact the nuclear safety performance criteria, the fire area configuration is deemed acceptable.

**References:**

Technical Evaluation 12.1, "Fire Suppression Effects Study"

Technical Evaluation 12.1, "Supplemental Information to Fire Suppression Effects Study – Supplement 1"

**Fire Area AA41 – Attachment 1 - Table B-3 - Fire Area Transition**

<u>Unit</u>	<u>Fire Area</u>	<u>Description</u>
1	AA41	Unit 1 Emergency Power Systems Area (El. 609 ft. 6 in.)

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**Fire Area Comments**

None

## Fire Area AA41 – Attachment 2 - Fire Risk Evaluation Results Summary

### A2.1 Introduction

The ‘changes’ associated with NFPA 805 transition were those variances from the deterministic requirements of NFPA 805. The changes identified for evaluation for fire area AA41 are grouped as follows:

- Separation Issues

This attachment is a summary of the Fire Risk Evaluation for the fire area. The complete results and methodology are contained in the Cumulative Fire Risk Evaluation, PRA-FIRE-NB-CRE. (FPCE 2017-0009)

### A2.2 Inputs/Assumptions

Fire modeling processes and inputs provided in NUREG/CR-6850 are appropriate for use in a risk-informed, performance-based evaluation. The complete list of assumptions used in the fire modeling methodology for this fire area is contained in Detailed Fire Modeling Technical Evaluation R1900-0411-AA41.

### A2.3 Fire Modeling Methodology

Fire PRA fire modeling results are used as the initial input into this Fire Risk Evaluation. The process consists of conservative bounding analyses using NUREG/CR-6850 methods. As needed, refinements are made to utilize more realistic parameters. The complete fire modeling methodology for this fire area is contained in Detailed Fire Modeling Technical Evaluation R1900-0411-AA41.

### A2.4 Scenario Descriptions and Model Results

Fire Area AA41 was evaluated for the impact of fires originating from both fixed and transient ignition sources. Complete descriptions of each fire scenario is contained within the Detailed Fire Modeling Technical Evaluation R1900-0411-AA41.

#### A2.4.1 Ignition Sources

Fire Area AA41 contains 600V switchgear bus 11A and 11C, 250Vdc batteries, the North and South MG sets and various rod control and distribution cabinets. Per discussion with plant personnel, the heat release rates for all switchgear, load centers, and MCC electrical cabinets have been characterized as qualified cable because items of this nature are generally constructed on-site. For other electrical cabinet types, where the internal cable qualification was unknown, the heat release rates have been assumed as non-qualified. All ignition sources were modeled using a 98th heat release rate percentile fire scenario. For the high voltage load center, both an electrical fire and a high energy arcing fault (HEAF) fire scenario have been developed.

In Fire Area AA41, the 98th percentile HRR was used for all transient fires. The 98th percentile HRR bounds the possible transient ignition sources expected for this fire area, which were fire tested and identified in NUREG/CR-6850, Appendix G, Table G-7.

#### A2.4.2 Scenario Results

A delta risk calculation has been performed to quantify the risk associated with the VFDRs in the fire area.

### A2.5 Fire Risk Evaluation Results

PRA-FIRE-NB-CRE documents scenarios and corresponding impacted VFDRs that were evaluated for

### **Fire Area AA41 – Attachment 2 - Fire Risk Evaluation Results Summary**

delta risk during the transition to NFPA 805 and also all changes to the Fire Protection Program that are currently incorporated into the Fire PRA model. The acceptability of the Cumulative Fire Risk Evaluations was based on calculated delta risk meeting the thresholds of NEI 04-02, RG 1.205 and RG 1.174. (FPCE 2017-0009)



## Fire Area AA41 – Attachment 2 - Fire Risk Evaluation Results Summary

### A-2.6 Impact of VFDR on Defense-in-Depth

Defense-in-Depth has been evaluated for this fire area. The impacts of this evaluation are summarized in the table below:

Defense-in-Depth Impact Review for AA41			
Method of Providing DID	Required to Support Deterministic Analysis or Fire PRA?	Changes or Improvements Necessary for DID?	Basis/Justification
Echelon 1: Prevent fires from starting			
Combustible Control is implemented in accordance with Procedure PMP-2270-CCM-001, Control of Combustible Materials.	Yes	No	• This element is adequate based on no perceived weakness of, or over-reliance on, another echelon of defense-in-depth.
Hot Work Control is implemented in accordance with Procedure PMP-2270-WBG-001, Welding, Burning and Grinding Activities.	Yes	No	
Echelon 2: Rapidly detect, control and extinguish promptly those fires that do occur thereby limiting fire damage			
Fire Detection System	Yes	No	• Since fire fighting activities are not expected to be challenging, suppression is not required. Detection is already required. Therefore, no changes or improvements to Echelon 2 attributes are necessary to maintain defense-in-depth.
Fixed Fire Suppression	No	No	
Portable Fire Extinguishers	Yes	No	
Hose stations and hydrants	Yes	No	
Pre-Fire Plan	Yes	No	
Echelon 3: Provide adequate level of fire protection for systems and structures so that a fire will not prevent essential safety functions from being performed			
Walls, floors ceilings and structural elements are rated or have been evaluated as adequate for the hazard.	Yes	No	• There are significant modeling differences between the Fire PRA and nuclear safety capability assessment (i.e., due to different success criteria, end states, etc.) and therefore recovery actions for VFDR AA41-002 and AA41-004 have been credited to ensure that defense-in-depth is maintained.
Penetrations in the fire area barrier are rated or have been evaluated as adequate for the hazard.	Yes	No	
Supplemental barriers (e.g., ERFBS, cable tray covers, etc.)	Yes	No	
Guidance provided to operations personnel detailing the required success path(s) including recovery actions to achieve nuclear safety performance criteria.	Yes	Yes	• Other variances do not require changes or improvements to Echelon 3 attributes because the variances are not affected in a potentially risk significant scenario.

## Fire Area AA41 – Attachment 2 - Fire Risk Evaluation Results Summary

### A-2.7 Safety Margin Considerations

In accordance with NEI 04-02, the maintenance of adequate Safety Margin is assessed by the consideration categories of analyses utilized by this Fire Risk Evaluation.

Safety margins are considered to be maintained if:

- Codes and Standards or their alternatives accepted for use by the NRC are met.

AND

- Safety analyses acceptance criteria in the licensing basis (e.g., FSAR, supporting analyses) are met, or provides sufficient margin to account for analysis and data uncertainty.

The following summarizes the bases for ensuring the maintenance of safety margins:

- The risk-informed, performance based processes utilized are based upon NFPA 805, 2001 edition, endorsed by the NRC in 10 CFR 50.48(c).
- The Fire Risk Evaluation process is in accordance with NEI 04-02, Revision 2, which is endorsed by the NRC in Regulatory Guide 1.205, Revision 1.
- The Fire PRA is developed in accordance with NUREG/CR-6850, which was developed jointly between the NRC and EPRI.
- The Fire PRA has undergone an industry peer review, in order to ensure the Fire PRA meets the appropriate quality standards of ASME/ANS RA-Sa-2009, "Standard for Level 1/Large Early Release Frequency Probabilistic Risk Assessment for Nuclear Power Plant Applications," Dated February 2, 2009
- The "combined analysis approach" is used during transition (NEI 04-02, Section 5.3.4.3); therefore, MEFS/LFS is not analyzed separately from the Fire PRA results.
- The CNP internal events PRA model received two formal industry peer reviews conducted in accordance with applicable NEI guidelines. The initial peer review was performed in 2001, while a subsequent focused scope (i.e., limited scope) peer review was conducted in 2009. The initial, full-scope WOG peer review covered all aspects of the CNP PRA model and the administrative processes used to maintain and update the model. The CNP PRA model has been revised to address all significant issues (i.e., Category A and B Facts & Observations) identified during the initial peer review. None of the findings from the focused-scope peer review were judged to reach the significance level of a Category A or B Fact & Observation; as a result, no changes to the PRA model have yet been made to include resolutions for these latter issues.
- Fire protection systems and features determined to be required by NFPA 805 Chapter 4 have been confirmed to meet the requirements of NFPA 805 Chapter 3 and their associated referenced codes and listings, or provided with acceptable alternatives using processes accepted for use by the NRC (i.e., FAQ 06-0008, FAQ 06-0004, 07-0033).
- Fire modeling performed in support of the transition has been performed within the Fire PRA utilizing codes and standards developed by industry and NRC staff which have been verified and validated in authoritative publications, such as NUREG 1824, "Verification and Validation of Selected Fire Models for Nuclear Power Plant Applications". In general, the fire modeling performed in support of the Fire Risk Evaluations has been performed using conservative methods and input parameters that are based upon

## **Fire Area AA41 – Attachment 2 - Fire Risk Evaluation Results Summary**

NUREG/CR-6850 as documented in the AA41 Detailed Fire Modeling Report, section 7.2. While this is generally not ideal in the context of best estimate probabilistic risk analysis, it is a pragmatic approach given the current state of knowledge regarding the uncertainties related to the application of the fire modeling tools and associated input parameters for specific plant configurations.

- In accordance with the requirements of 10 CFR 50.48(c)(2)(iii), the Fire PRA results, including cutsets for the scenarios of concern, have been reviewed and it was verified that the results presented above do not rely solely on feed and bleed as the fire-protected safe shutdown path for maintaining reactor coolant inventory, pressure control, and decay heat removal capability for this fire area.

### **A-2.8 Transition Risk Evaluation Conclusions**

The transition change evaluation determined that these changes:

- Are acceptable based upon the measured change in CDF and LERF
- Maintained adequate defense-in-depth and safety margins

The results of this evaluation meet the requirements of NFPA 805 Risk Evaluation; therefore, the use of the performance based analysis approach is acceptable.

## D. C. Cook Nuclear Plant Fire Safety Analysis

## Fire Area: AA43

Unit 2 Engineered Safeguards Systems and Motor Control Center Room  
(El. 609 ft. 6 in.)

## Table of Contents

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<b>Analysis Methodology</b> .....	Section 2.0
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## Attachments

Fire Area AA43 – Attachment 1 - Table B-3 - Fire Area Transition

## Fire Area AA43 – Attachment 2 - Fire Risk Evaluation Results Summary

## 1.0 PURPOSE

This report documents the Fire Safety Analysis (FSA) for Cook Nuclear Plant (CNP) Fire Area AA43, Unit 2 Engineered Safeguards Systems and Motor Control Center Room (El. 609 ft. 6 in.) which comprises fire zone(s) 45. The purpose of this analysis is to demonstrate the achievement of the nuclear safety and radioactive release performance criteria of NFPA 805 as required by 10 CFR 50.48(c). The Fire Safety Analysis is a key part of compliance with Section 2.7.1.2 Fire Protection Program Design Basis Document of NFPA 805. This analysis also documents results of risk-informed, performance-based Fire Risk Evaluations (FREs). These evaluations are associated with Variances from Deterministic Requirements (VFDRs) of NFPA 805 Chapter 4.

## 2.0 ANALYSIS METHODOLOGY

The FSA is the design basis document as described in NFPA 805 Section 2.7.1.2. The following steps are performed to develop the FSA on a fire area basis:

- Identify significant fire hazards in the fire area. This is based on NFPA 805 approach to analyze the plant from an ignition source and fuel package perspective.
- Summarize Nuclear Safety Capability Analysis (NSCA) compliance strategies. This is the result of the NEI 04-02 B-3 Table review of the Safe Shutdown Analysis.
- Summarize Non-Power Operations Modes compliance strategies.
- Summarize Radioactive Release compliance strategies. The transition review process required per NEI 04-02 is used to develop these results.
- Provide Fire Probabilistic Risk Assessment summary of results. This is based on the results from the plant Fire PRA.
- Perform risk informed, performance based evaluations if needed for the performance based approach.
- Summarize Defense-in-Depth strategy for each fire area.
- Determine key analysis assumptions which are candidates to be included in the NFPA 805 monitoring program.
- Provide conclusions relative to NFPA 805 compliance.

### 3.0 ANALYSIS

#### 3.1 Classical Fire Protection

##### 3.1.1 Construction

Walls, floors and ceilings to adjacent fire areas are reinforced concrete in excess of a 3-hour rating.

A 12-inch concrete block wall having a 4-hour rating provides a flame and heat shield between the 4kv/600V transformers.

A fire area boundary evaluation was performed for the construction features (i.e. fire doors having a 1 1/2-hour fire rating and open penetrations) of the switchgear rooms which have a fire resistance rating of less than 3 hours (Engineering Equivalency Evaluation 11-15).

Applicable Engineering Equivalency Evaluations are documented in Attachment 1.

##### 3.1.2 Doors and Access Openings

A fire area boundary evaluation was performed for an unrated ceiling hatch to Fire Area AA52 - Fire Zone 60 (Engineering Equivalency Evaluation 9-19).

Fire doors having a 1 1/2-rating are provided to adjacent Fire Area AA44 - Fire Zones 46A and 46B. Fire doors having a 3-hour rating are provided to adjacent Fire Areas AA35, AA52 and AA45A - Fire Zones 34A, 60 and 47A and 47B, respectively.

The access / ventilation opening between this fire zone and adjacent Fire Zone 46A (Fire Area AA44) is provided with a combined multi-section fire damper assembly and personnel access door. The fire dampers, door, door frame, and supporting structure are installed as a 3-hour rated assembly. The dampers are furnished with fusible electro-thermal links (ETLs). The links are temperature rated for 165°F and are electrically actuated through the existing CO2 system in this fire zone or the CO2 system in adjacent Fire Zone 46A. Actuation of the ETLs is accomplished through existing relays in the CO2 control cabinets.

##### 3.1.3 Penetrations

Note: Statements regarding fire resistance rating of penetration seals are not applicable to seals in barriers to Analysis Area YD.

Penetrations in fire barriers between this fire zone and adjacent fire areas are provided with fire seals.

A fire area boundary evaluation was performed for the unrated fire barrier penetrations between Fire Area AA43 - Fire Zone 45, Fire Area AA44 - Fire Zones 46A, 46B, 46C, 46D, Fire Area AA45A - Fire Zones 47A, 47B and Fire Area AA52 - Fire Zone 60 (Engineering Equivalency Evaluation 11-6).

A fire area engineering equivalency evaluation was prepared to evaluate a fire seal design between Fire Zones 45 and 60 (Engineering Equivalency Evaluation 11-28).

Seismic expansion gaps are sealed with a glass fiber reinforced silicone sheeting.

### 3.1.4 Detection

The table below outlines the fire detection system(s) provided in the Fire Area:

Table 3-1, Fire Area AA43 Detection Systems								
Fire Zone	Type of System	Local (L) / Remote (R)	Detection Actuates Suppression?	Required System?				
				S	L	E	R	D
45	Infrared	L/R	Y	N	N	Y	Y	N
45	Ionization	L/R	N	N	N	Y	Y	N

**Table 3-1 Legend:**

Table Field: "Required System?"	
S	- Required for Chapter 4 Separation Criteria
L	- Required for NRC Approved Licensing Action
E	- Required for Engineering Equivalency Evaluation
R	- Required for Risk Significance
D	- Required to maintain adequate balance of Defense-in-Depth in a Change Evaluation or Fire Risk Evaluation

Cross-zoned ionization smoke detectors (14) and infra-red detectors (5) which alarm in the Unit 2 Control Room are provided. Three of the ionization and three of the infra-red detectors are located in the cable spreading area of this fire zone.

### 3.1.5 Fixed Suppression

The table below outlines the fixed fire suppression system(s) provided in the Fire Area:

Table 3-2, Fire Area AA43 Suppression Systems							
Fire Zone	Type of System	Full (F) / Partial (P)	Required System?				
			S	L	E	R	D
45	Automatic CO2	F	N	N	Y	Y	N
Table 3-2 Legend:							
Table Field: "Required System?"							
S	- Required for Chapter 4 Separation Criteria						
L	- Required for NRC Approved Licensing Action						
E	- Required for Engineering Equivalency Evaluation						
R	- Required for Risk Significance						
D	- Required to maintain adequate balance of Defense-in-Depth in a Change Evaluation or Fire Risk Evaluation						

An automatic suppression is provided in Fire Zone 45. A low pressure CO2 total flooding system supplied from the 17 ton tank is provided. This system is actuated by the infra-red detectors. Operation of this system discharges CO2 into Fire Zone 45.

### 3.1.6 Manual Suppression / Response Strategy

A postulated fire will be identified by early detection using ionization type smoke detection, infra-red detection or by plant personnel using plant communication system to notify the control room.

The automatic detection systems alarm in the control room. The Control Room operator will dispatch the fire brigade for initiation of manual fire fighting. A fire in this fire area will be contained by the construction features discussed in Section 3.1.1.

Fire extinguishers are located in Fire Zone 45 for the fire brigade's use, with additional extinguishers located in adjacent Fire Zones 34A, 46A, 47A, and 47B

Water hose reels are located in the Turbine Building Fire Zone 97, and in adjacent Fire Zone 34A.

Floor drains are available in Fire Zone 45.

### 3.1.7 Ventilation

A fire in this area will be contained by the fire barriers. Smoke can be removed by portable fans and flexible ducting to other areas of the Auxiliary Building and outdoors. This fire area is listed as a non-controlled area in the Fire Pre Plans and therefore there is reasonable assurance that products of combustion will not be contaminated.

There are 4-hour rated undampered ventilation shafts in the ceiling which pass through Fire Area AA52 - Fire Zone 60 to the yard. A fire damper having a 3-hour rating is provided to adjacent Fire Area AA44 - Fire Zone 46A. A fire damper having a 3-hour rating is provided in the stairway to adjacent Fire Area AA52 - Fire Zone 60. A 20" by 34" undampered penetration exists in the 12" block wall separating the 4KV/600V transformers.

### 3.1.8 Other Features

Some cable trays within Fire Area AA43 are provided with bottom covers and/or are fully enclosed.

This fire area is procedurally controlled as a transient combustible and hot work free zone.

## 3.2 Fire Hazards Identification

The fire area contains both ignition sources and combustible fire hazards. The ignition sources consist of 600V switchgear, Inverters, 250Vdc cabinets, and transformers. Combustibles consist primarily of exposed electrical cables in trays, cellulose, rubber, plastics and Thermo-Lag.

The exterior fire hazards that are adjacent to exterior walls are the Auxiliary Transformers. However, water spray suppression systems are provided for the transformers. In addition, this Fire Area is constructed of reinforced concrete. The missile barriers around each transformer also provide a measure of fire barrier protection, limiting radiant heat in the direction of the Fire Area.

The exterior wall penetrations of this Fire Area do not require a rating for protection. The missile barriers prevents direct impact from radiant heat, as well as the spatial separation between the yard equipment and fire hazards to this Fire Area is sufficient to provide protection against heat damage. The impact of a fire in the yard on AA43 would be limited to radiant heat with no ceiling to contain the fire plume. Spatial separation, fixed suppression as well as the reinforced concrete construction of the Fire Area is sufficient to prevent an exposure to credited equipment inside the plant through unrated exterior wall penetrations of this Fire Area.

The current fire loading classification is considered low.



### 3.3 NSCA Compliance Summary

Fire Area AA43, the Unit 2 ESS and MCC Room (El. 609'-6") contains Unit 2 Red and Green train cables as well as 600V Motor Control Centers, 250V Red Train Battery Chargers, and supporting equipment.

Compliance with the nuclear safety performance criteria is achieved using the performance-based approach in accordance with NFPA 805, Section 4.2.4.2.

Safe and stable of Unit 2 will be accomplished using Steam Generators 1 and 4 via the Unit 1 East Motor Driven Auxiliary Feedwater Pump, Unit 2 Local Shutdown Indicating Panel are credited to provide process monitoring using Unit 1 power, Unit 2 Alternate Charging via the Unit 1 West or East Pump, Component Cooling Water via the Unit 1 East or West Pump to support Unit 1 systems credited for Unit 2 crosstie, ESW via the Unit 1 East or West Pump to support Unit 1 systems credited for Unit 2 crosstie. Either train of Unit 1 electrical power is credited available to support Unit 1 system crossties to Unit 2. Unit 2 electrical distribution is not credited to be available.

The Nuclear Safety Performance Criteria compliance strategy for AA43 is documented within the NSCA Report.

#### 3.3.1 Variances

The variances identified for evaluation for this fire area are grouped as follows:

##### 3.3.1.1 VFDR No. AA43-001

2-PP-50E and 2-PP-50W - The Unit 2 East and West Charging Pumps are required to be operable to support CVCS for inventory and pressure control and seal cooling. Unit 2 Charging Pumps may fail due to a full area fire within Fire Area AA43. 2-PP-50E may fail due to fire induced damage of 250VDC Cabinet 2-MCCD, 4kV Bus 2-T21D and cables 8007G-2, 8875G-2 and 8876G-2. 2-PP-50W may fail due to fire induced damage of 250VDC Cabinet 2-MCAB, 4kV Bus 2-T21A and cables 8377R-2 and 8874R-2. This condition represents a variance from the deterministic requirements of NFPA 805, Section 4.2.3. This is a separation issue.

This VFDR has been evaluated and it was determined that the risk, safety margin and defense-in-depth meet the acceptance criteria of NFPA 805 Section 4.2.4 with a recovery action credited and plant modifications to implement transient free areas and an automatic CO2 suppression system.

**3.3.1.2 VFDR No. AA43-002**

2-PP-3E, 2-PP-3W and 2-PP-4 - A Unit 2 AFW Pump is required to be operable to support decay heat removal. Decay heat removal is required to be capable of removing sufficient heat from the reactor core such that the fuel is maintained in a safe and stable condition. A full area fire in Fire Area AA43 could cause the loss of the Unit 2 East and West MDAFW Pumps and the Unit 2 TDAFW Pump. The East MDAFW Pump, 2-PP-3E may fail due to fire induced damage of 250VDC Cabinet 2-MCCD, 4kV Bus 2-T21D and cables 9288G-2 and 9289G-2. The West MDAFW Pump, 2-PP-3W may fail due to fire induced damage of 250VDC Cabinet 2-MCAB, 4kV Bus 2-T21A and cables 8377R-2, 8488R-2, 8723R-2, 8739R-2 and 8743R-2. The TDAFW Pump 2-PP-4 may fail due to fire induced damage of its trip and throttle valve 2-QT-506 and supporting ESW system. This condition represents a variance from the deterministic requirements of NFPA 805, Section 4.2.3. This is a separation issue.

This VFDR has been evaluated and it was determined that the risk, safety margin and defense-in-depth meet the acceptance criteria of NFPA 805 Section 4.2.4 with a recovery action credited and plant modifications to implement transient free areas and an automatic CO2 suppression system.

**3.3.1.3 VFDR No. AA43-003**

2-FMO-212 and 2-FMO-242 - SG 1 and 4 AFW Supply Valves are required to be operable to support decay heat removal for Unit 2. Decay heat removal shall be capable of removing heat from the reactor core such that the fuel is maintained in a safe and stable condition. Decay heat removal requires a set of 2 supply valves be operable with their corresponding AFW pump. The following sets of Unit 2 SG AFW supply valves may fail due to a full area fire within Fire Area AA43; 2-FMO-212 and 2-FMO-242, 2-FMO-222 and 2-FMO-232, 2-FMO-221 and 2-FMO-231. The Unit 1 East MDAFW Pump is credited through the Unit 2 cross-tie to provide decay heat removal. This requires 2-FMO-212 and 2-FMO-242 be operable. 2-FMO-212 may fail due to fire induced damage of 600V VCC 2-AZV-A. 2-FMO-242 may fail due to fire induced damage of 600V VCC 2-AZV-A. This condition represents a variance from the deterministic requirements of NFPA 805, Section 4.2.3. This is a separation issue.

This VFDR has been evaluated and it was determined that the risk, safety margin and defense-in-depth meet the acceptance criteria of NFPA 805 Section 4.2.4 with a defense-in-depth action credited and plant modifications to implement transient free areas and an automatic CO2 suppression system.

**3.3.1.4 VFDR No. AA43-004**

2-ICM-250 - BIT Outlet Shutoff Valve is required to be open to support alternate CVCS for Unit 2. CVCS is required to provide inventory, pressure and reactivity control. Alternate CVCS is credited for a fire within Fire Area AA43 due to the loss of both Unit 2 charging pumps. Alternate CVCS requires injection through the BIT, thus requiring either 2-ICM-250 or 2-ICM-251 be open. Both of these valves are normally closed and fail as is due to the loss of power. 2-ICM-250 may fail due to fire induced damage of 600V MCC 2-AM-D and 2-ICM-251 may fail due to fire induced damage of 600V VCC 2-AZV-A. This condition represents a variance from the deterministic requirements of NFPA 805, Section 4.2.3. This is a separation issue.

This VFDR has been evaluated and it was determined that the risk, safety margin and defense-in-depth meet the acceptance criteria of NFPA 805 Section 4.2.4 with a recovery action credited and plant modifications to implement transient free areas and an automatic CO2 suppression system.

**3.3.1.5 VFDR No. AA43-005**

2-IMO-51, 2-IMO-52, 2-IMO-53 and 2-IMO-54 - The Boron Injection Line to Cold Leg Shutoff Valves are required to be open to support alternate CVCS for Unit 2. CVCS is required to provide inventory, pressure and reactivity control. Alternate CVCS is credited within Fire Area AA43 due to the loss of both Unit 2 charging pumps. Alternate CVCS requires injection through the BIT, thus requiring either 2-IMO-51 or 2-IMO-52 or 2-IMO-53 or 2-IMO-54 be open. These valves are normally open. 2-IMO-51 may fail due to fire induced damage of cable 8370G-2. 2-IMO-52 may fail due to fire induced damage of cable 8372R-2. 2-IMO-53 may fail due to fire induced damage of cable 8396G-2. 2-IMO-54 may fail due to fire induced damage of cable 8314R-2. These cable failures could spuriously close the valves. This condition represents a variance from the deterministic requirements of NFPA 805, Section 4.2.3. This is a separation issue.

This VFDR has been evaluated and it was determined that the risk, safety margin and defense-in-depth meet the acceptance criteria of NFPA 805 Section 4.2.4 with plant modifications to implement transient free areas and an automatic CO2 suppression system.

**3.3.1.6 VFDR No. AA43-006**

2-MRV-210 and 2-MRV-240 – The SG 1 and 4 Main Steam Stop Valves are required to be closed to support main steam isolation. Main steam isolation is required to prevent the uncontrolled cooldown through over-steaming. SGs 1 and 4 are not credited for decay heat removal due to a fire within Fire Area AA43. 2-MRV-210 may fail due to fire induced damage of 2-MMO-210, 2-MRV-211 and 2-MRV-212. Failure of the Steam Dump Valves 2-MRV-211 and 2-MRV-212 will prevent the air being vented for 2-MRV-210. The air is required to be vented to close 2-MRV-210. 2-MMO-210 is a three way valve that vents to either 2-MRV-211 or 2-MRV-212. Spurious operation of 2-MMO-210 will position the valve to either of the two vent valves. A manual action will be required for either 2-MRV-211 or 2-MRV-212 dependent upon the position of 2-MMO-210. 2-MMO-210 may fail due to fire induced damage of cables 14367R-2 and 5693-2. 2-MRV-211 may fail due to fire induced damage of Critical Solenoid Valve Panel 2-CCV-CD and cable 9000G-2. 2-MRV-212 may fail due to fire induced damage of Critical Solenoid Valve Panel 2-CCV-AB. 2-MRV-240 may fail due to fire induced damage of 2-MMO-240, 2-MRV-241 and 2-MRV-242. Failure of the Steam Dump Valves 2-MRV-241 and 2-MRV-242 will prevent the air being vented for 2-MRV-240. The air is required to be vented to close 2-MRV-240. 2-MMO-240 is a three way valve that vents to either 2-MRV-241 or 2-MRV-242. Spurious operation of 2-MMO-240 will position the valve to either of the two vent valves. A manual action will be required for either 2-MRV-241 or 2-MRV-242 dependent upon the position of 2-MMO-240. 2-MMO-240 may fail due to fire induced damage of cables 14386R-2. 2-MRV-241 may fail due to fire induced damage of Critical Solenoid Valve Panel 2-CCV-CD and cable 9017G-2. 2-MRV-242 may fail due to fire induced damage of Critical Solenoid Valve Panel 2-CCV-AB. This condition represents a variance from the deterministic requirements of NFPA 805, Section 4.2.3. This is a separation issue.

This VFDR has been evaluated and it was determined that the risk, safety margin and defense-in-depth meet the acceptance criteria of NFPA 805 Section 4.2.4 with plant modifications to implement transient free areas and an automatic CO2 suppression system.

**3.3.1.7 VFDR No. AA43-007**

2-MRV-220 and 2-MRV-230 – The SG 2 and 3 Main Steam Stop Valves are required to be closed to support main steam isolation. Main steam isolation is required to prevent the uncontrolled cooldown through over-steaming. SGs 2 and 3 are credited for decay heat removal due to a fire within Fire Area AA43. 2-MRV-220 requires 2-MRV-221 or 2-MRV-222 be operable in order to close. 2-MRV-221 may fail due to fire induced damage of Critical Solenoid Valve Panel 2-CCV-CD and 2-MRV-222 may fail due to fire induced damage of Critical Solenoid Valve Panel 2-CCV-AB. 2-MRV-230 may fail due to fire induced damage of 2-MMO-230, 2-MRV-231 and 2-MRV-232. Failure of the Steam Dump Valves 2-MRV-231 and 2-MRV-232 will prevent the air being vented for 2-MRV-230. The air is required to be vented to close 2-MRV-230. 2-MMO-230 is a three way valve that vents to either 2-MRV-231 or 2-MRV-232. Spurious operation of 2-MMO-230 will position the valve to either of the two vent valves. A manual action will be required for either 2-MRV-231 or 2-MRV-232 dependent upon the position of 2-MMO-230. 2-MMO-230 may fail due to fire induced damage of cables 14379G-2 and 5697-2. 2-MRV-231 may fail due to fire induced damage of Critical Solenoid Valve Panel 2-CCV-CD. 2-MRV-232 may fail due to fire induced damage of Critical Solenoid Valve Panel 2-CCV-AB. This condition represents a variance from the deterministic requirements of NFPA 805, Section 4.2.3. This is a separation issue.

This VFDR has been evaluated and it was determined that the risk, safety margin and defense-in-depth meet the acceptance criteria of NFPA 805 Section 4.2.4 with plant modifications to implement transient free areas and an automatic CO2 suppression system.

**3.3.1.8 VFDR No. AA43-008**

2-PP-45-1, 2-PP-45-2, 2-PP-45-3 and 2-PP-45-4 – The RCPs are required to be tripped to prevent a loss of coolant accident if seal cooling and thermal barrier cooling are lost. A full area fire within Fire Area AA43 may cause the loss of seal cooling, thermal barrier cooling and the Control Room trip capability of the RCPs. 2-PP-45-1 may lose Control Room trip capability due to fire induced damage of 14321-2. 2-PP-45-2 may lose Control Room trip capability due to fire induced damage of cables 12364G-2 and 7960P-2. 2-PP-45-3 may lose Control Room trip capability due to fire induced damage of cables 14621-2 and 7957P-2. 2-PP-45-4 may lose Control Room trip capability due to fire induced damage of cable 12884-2. This condition represents a variance from the deterministic requirements of NFPA 805, Section 4.2.3. This is a separation issue.

This VFDR has been evaluated and it was determined that the risk, safety margin and defense-in-depth meet the acceptance criteria of NFPA 805 Section 4.2.4 with plant modifications to implement transient free areas and an automatic CO2 suppression system.

**3.3.1.9 VFDR No. AA43-009**

2-BLI-110-CRI, 2-BLI-140-CRI, 2-MPP-210-CRI, 2-MPP-240-CRI, 2-NLP-151-CRI, 2-NPS-110-CRI, 2-NTR-140, 2-NTR-240 and 2-NRI-1 - Control Room process monitoring and source range monitoring may not be available due to a fire in Fire Area AA43. Process monitoring is required to be available to monitor key primary and secondary parameters. Source Range is required to provide indication of fission activity to ensure sub-criticality. The instrumentation is not available within the Unit 2 Control Room due a fire within Fire Area AA52. Alternate process and source range monitoring powered from Unit 1 is required at the Unit 2 LSI panels. The LSI panels require manual actions to transfer to the Unit 1 power supply. A transfer switch at 2-LSI-6XX feeds both 1-LSI-6XX and 2-LSI-2. A transfer switch at 2-LSI-5XX feeds both 2-LSI-5XX and 2-LSI-1. A transfer switch at 2-LSI-4 feeds both 2-LSI-4 and 2-LSI-3. Local monitoring of instruments in support of SGs 1 and 4 is required because SGs 1 and 4 are credited for decay heat removal due to a fire within Fire Area AA52. This condition represents a variance from the deterministic requirements of NFPA 805, Section 4.2.3. This is a separation issue.

This VFDR has been evaluated and it was determined that the risk, safety margin and defense-in-depth meet the acceptance criteria of NFPA 805 Section 4.2.4 with a recovery action credited and plant modifications to implement transient free areas and an automatic CO2 suppression system.

**3.3.1.10 VFDR No. AA43-010**

2-NRV-153 - Pressurizer PORVs are required to be closed to support RCS integrity. RCS integrity is required to maintain positive control over RCS inventory and pressure. 2-NRV-153 may fail due to fire induced damage of cable 8757PG-2. Failure of this cables could spuriously open the valve. This condition represents a variance from the deterministic requirements of NFPA 805, Section 4.2.3. This is a separation issue.

This VFDR has been evaluated and it was determined that the risk, safety margin and defense-in-depth meet the acceptance criteria of NFPA 805 Section 4.2.4 with a defense-in-depth action credited.

**3.3.1.11 VFDR No. AA43-011**

2-NSO-021 and 2-NSO-022 - The RX Head Vent Valves are required to be closed to support RCS integrity. RCS integrity is required to maintain positive control over RCS inventory and pressure. 2-NSO-021 and 2-NSO-022 are in series, requiring 1 of the valves to remain closed to provide RCS integrity. 2-NSO-021 may fail due to fire induced damage of cable 9801PG-2. 2-NSO-022 may fail due to fire induced damage of cable 9807PG-2. These cable failures could spuriously open the valves. This condition represents a variance from the deterministic requirements of NFPA 805, Section 4.2.3. This is a separation issue.

This VFDR has been evaluated and it was determined that the risk, safety margin and defense-in-depth meet the acceptance criteria of NFPA 805 Section 4.2.4 with a defense-in-depth action credited.

**3.3.1.12 VFDR No. AA43-012**

2-NSO-061 and 2-NSO-062 - The Post Accident Valves are required to be closed to support RCS integrity. RCS integrity is required to maintain positive control over RCS inventory and pressure. 2-NSO-061 and 2-NSO-062 are in series, requiring 1 of the valves to remain closed to provide RCS integrity. 2-NSO-061 may fail due to fire induced damage of cable 9814PG-2. 2-NSO-062 may fail due to fire induced damage of cable 9820PG-2. These cable failures could spuriously open the valves. This condition represents a variance from the deterministic requirements of NFPA 805, Section 4.2.3. This is a separation issue.

This VFDR has been evaluated and it was determined that the risk, safety margin and defense-in-depth meet the acceptance criteria of NFPA 805 Section 4.2.4 with a defense-in-depth action credited.

**3.3.1.13 VFDR No. AA43-013**

2-QRV-20 and 2-QRV-30 - RCP Seal Water Return Isolation Valves are required to be open to support RCS integrity by maintaining the RCP seal. RCS integrity is required to maintain positive control over RCS inventory and pressure. 2-QRV-20 may fail due to fire induced damage of cable 4955-2. 2-QRV-30 may fail due to fire induced damage of cable 5654-2. These cables could cause spurious closure of these valves. This condition represents a variance from the deterministic requirements of NFPA 805, Section 4.2.3. This is a separation issue.

This VFDR has been evaluated and it was determined that the risk, safety margin and defense-in-depth meet the acceptance criteria of NFPA 805 Section 4.2.4 with a defense-in-depth action credited.

**3.3.2 Recovery Actions Credited**

For each VFDR, a Fire Risk Evaluation has been performed to assess the acceptability of risk, defense-in-depth, and safety margin. This evaluation determined whether or not recovery actions are required to ensure that one success path necessary to achieve and maintain the nuclear safety performance criteria is maintained free of fire damage by a single fire. Table 3-3 identifies the credited recovery actions for this area. Actions retained for DID are identified as “DID Actions” within Table 3-3. Additional information for DID actions is contained within Section 3.8 of this report. Note that, for completeness, all VFDRs are contained within Table 3-3, even if the Fire Risk Evaluation has determined that a recovery action is not required. In those instances where a recovery action has been determined to not be required, the word “None” is provided in the “Action” column in the table.

<b>Table 3-3, Recovery Actions Credited</b>		
<b>VFDR</b>	<b>Component</b>	<b>Action</b>
AA43-001	2-PP-50E	1-CS-536-OPEN (Open manual valve 1-CS-536)
	2-PP-50W	2-CS-302-CLOSE (Close manual valve 2-CS-302)
		2-CS-534-OPEN (Open manual valve 2-CS-534)

Table 3-3, Recovery Actions Credited		
VFDR	Component	Action
AA43-002	2-PP-3E 2-PP-3W 2-PP-4	1-FW-129-OPEN (Open manual valve 1-FW-129)  1-FW-262-CLOSE (Close manual valve 1-FW-262)
AA43-003	2-FMO-212 2-FMO-242	DID ACTION 2-FMO-212-OPERATE (De-energize and manually operate 2-FMO-212)  2-FMO-242-OPERATE (De-energize and manually operate 2-FMO-242)
AA43-004	2-ICM-250	2-ICM-250-OPEN (De-energize and manually open 2- ICM-250)
AA43-005	2-IMO-51 2-IMO-52 2-IMO-53 2-IMO-54	None
AA43-006	2-MRV-210 2-MRV-240	None
AA43-007	2-MRV-220 2-MRV-230	None
AA43-008	2-PP-45-1 2-PP-45-2 2-PP-45-3 2-PP-45-4	None



Table 3-3, Recovery Actions Credited		
VFDR	Component	Action
AA43-009	2-BLI-110-CRI 2-BLI-140-CRI 2-MPP-210-CRI 2-MPP-240-CRI 2-NLP-151-CRI 2-NPS-110-CRI 2-NTR-140 2-NTR-240 2-NRI-1	2-LSI-4-ALT-PWR (Align unaffected Unit Power to LSI Panel)  2-LSI-5XX-ALT-PWR (Align unaffected Unit Power to LSI Panel)  2-LSI-1-LOCAL (Locally monitor 2-LSI-1)  2-LSI-3-LOCAL (Locally monitor 2-LSI-3)  2-LSI-4-LOCAL (Locally monitor 2-LSI-4)  2-LSI-5XX-LOCAL (Locally monitor 2-LSI-5)
AA43-010	2-NRV-153	DID ACTION(S) 2-NRV-153-CLOSE (Remove fuses in MCR to fail closed PORV 2-NRV-153)
AA43-011	2-NSO-021	DID ACTION(S) 2-NSO-021-CLOSE (Remove fuses in MCR to fail closed AOV 2-NSO-021)
AA43-012	2-NSO-061	DID ACTION(S) 2-NSO-061-CLOSE (Remove fuses in MCR to fail closed AOV 2-NSO-061)
AA43-013	2-QRV-20 2-QRV-30	DID ACTION(S) 2-QRV-20-OPEN 2-QRV-30-OPEN (Remove fuses in MCR to fail open AOVs 2-QRV-20 and 2-QRV-30)

### 3.4 Non-Power Operational Modes Compliance Summary

A review of CNP for the potential effects of a fire in this Fire Area while in non-power modes of operation (NPO) was conducted. This review was conducted using the guidance provided in NEI 04-02 and FAQ 07-0040, "Non-Power Operations Clarifications".

The review determined that there are potential failures that affect certain Key Safety Functions (KSF) as a result of the fire in this area, and the fire could result in the loss of one or more KSF paths. Compensatory measures are required during high risk evolution periods to provide reasonable

assurance a fire will not adversely affect key safety functions and the NFPA 805 performance goal for NPO is therefore satisfied. The results of the NPO analysis are contained within Technical Evaluation R1900-005-001, Non-Power Operation Modes Transition Review Report.

### **3.5 Radioactive Release Compliance Summary**

The NFPA 805 radiological release goal is to provide reasonable assurance that a fire will not result in a radiological release that adversely affects the public, plant personnel or the environment. The NFPA 805 requirement is to ensure a radiation release to any unrestricted area due to the direct effects of fire suppression activities (but not involving fuel damage) shall be as low as reasonably achievable and shall not exceed applicable plant Technical Specification limits.

AA43 is located outside the Radiological Controlled Area (RCA) and is not a storage location for contaminated materials, therefore there is reasonable assurance a fire in this area will not result in radiation release. The review of this fire area, with respect to radioactive release, is documented in the NFPPM.

### **3.6 Probabilistic Risk Assessment-Summary of Results**

A Fire PRA (FPRA) quantification of Fire Area AA43 was performed and is documented in PRA-NB-FIRE-FQ, Fire PRA Model Quantification Notebook. The fire risk quantification for Fire Area AA43 is analyzed using detailed fire modeling to consider risk of fire scenarios of ignition sources. PRA-NB-FIRE-FQ includes a summary of all potentially risk-significant fire scenarios (i.e., CDF > 1.0E-7 or LERF > 1.0E-8). Bounding CDF / LERF per calendar year values are reported that are based on the risk values documented in PRA-NB-FIRE-FSS, Fire PRA Fire Scenario Selection.

Transient combustible and hot work free zones were credited in the FPRA for this fire area.

Fire Protection features credited in the Fire PRA are documented in R1900-0411-AA43, Detailed Fire Modeling Report: Fire Compartment: AA43 Unit 2 Engineered Safeguards Systems and Motor Control Center Room (EL. 609 FT. 6 IN.). PRA-NB-FIRE-FSS documents the revision level of the fire modeling reports used in the most recent Fire PRA quantification.

### 3.7 Risk-Informed, Performance-Based Evaluations

Fire Risk Evaluations (FREs) have been performed to ensure that variances from the NFPA 805 deterministic requirements are acceptable. The evaluation process consists of an integrated assessment of the acceptability of risk, defense-in-depth, and safety margins.

#### 3.7.1 Transition Risk-Informed, Performance-Based Evaluations

The ‘changes’ associated with NFPA 805 transition were those variances from the deterministic requirements of NFPA 805 or with the existing fire protection licensing basis that were brought into compliance with the NFPA 805 performance based approach. The change identified for evaluation for Fire Area AA43 is as follows:

- Separation Issues

The Fire Risk Evaluation has determined that the change is acceptable based upon:

- The measured change in CDF and LERF.
- Adequate defense-in-depth and safety margins being maintained.

Refer to Attachment 2 for a summary of results associated with the Fire Risk Evaluations.

### 3.8 Defense-in-Depth

A comprehensive risk-informed, performance-based analysis includes consideration of defense-in-depth (DID) as part of an integrated evaluation of risk considerations. In general, defense-in-depth involves consideration of the extent to which fire protection systems and features are provided within the three echelons of fire-protection:

- Preventing fires from starting,
- Rapidly detecting fires and controlling and extinguishing promptly those fires that do occur, thereby limiting fire damage,
- Providing an adequate level of fire protection for structures, systems, and components important to safety, so that a fire that is not promptly extinguished will not prevent the nuclear safety performance criteria from being met.

Each VFDR was evaluated for DID. The following recovery actions have been retained for DID.

VFDR No. AA43-003: 2-FMO-212 and 2-FMO-242 - SG 1 and 4 AFW Supply Valves are required to be operable for decay heat removal. 2-FMO-212 and 2-FMO-242 may not be available due to a fire within AA43. These failures can be mitigated by de-energizing and manually operating the valves. These actions are being retained to ensure decay heat removal is maintained through SGs 1 and 4.

VFDR No. AA43-010: 2-NRV-153 - Pressurizer PORVs are required to be closed to support RCS integrity. RCS integrity is required to maintain positive control over RCS inventory and pressure. The spurious opening can be mitigated by de-energizing the valve to fail it closed. This recovery action is being retained for DID to ensure RCS pressure and inventory control is maintained.

VFDR No. AA43-011: 2-NSO-021 and 2-NSO-022 - The RX Head Vent Valves are required to be closed to support RCS integrity. RCS integrity is required to maintain positive control over RCS inventory and pressure. 2-NSO-021 and 2-NSO-022 are in series, requiring 1 of the valves to remain closed to provide RCS integrity. The spurious opening can be mitigated by de-energizing the valve to fail it closed. This recovery action is being retained for DID to ensure RCS pressure and inventory control is maintained.

VFDR No. AA43-012: 2-NSO-061 and 2-NSO-062 - The Post Accident Valves are required to be closed to support RCS integrity. RCS integrity is required to maintain positive control over RCS inventory and pressure. 2-NSO-061 and 2-NSO-062 are in series, requiring 1 of the valves to remain closed to provide RCS integrity. The spurious opening can be mitigated by de-energizing the valve to fail it closed. This recovery action is being retained for DID to ensure RCS pressure and inventory control is maintained.

VFDR No. AA43-013: 2-QVR-20 and 2-QVR-30 - RCP Seal Water Return Isolation Valves are required to be open to support RCS integrity by maintaining the RCP seal. RCS integrity is required to maintain positive control over RCS inventory and pressure. The spurious closing can be mitigated by de-energizing the valve to fail it open. This recovery action is being retained for DID to ensure RCS integrity is maintained.

Based on the assessment in support of the Fire Risk Evaluation, defense-in-depth is maintained for fire area AA43. Refer to Attachment 2 for details associated with the Fire Risk Evaluation.

### 3.9 Monitoring Program Input

A Monitoring Program will be developed in accordance with FAQ 10-0059, Rev. 1. Methods to monitor availability, reliability, and performance of fire protection program structures, systems, and components (SSCs), as well as programmatic elements will be provided. Additionally, effectiveness measures are established to review program related performance and trends. For AA43 the following systems and features are candidates for inclusion in the CNP Fire Protection Monitoring Program:

- Fire Area Boundary Barriers discussed in Section 3.1
- Fire Detection System
- Automatic Fire Suppression System
- Transient Combustible and Hot Work Free Zone
- Cable Tray Covers

#### 4.0 CONCLUSION

The nuclear safety and radioactive release performance criteria of NFPA 805 are met for a fire in Fire Area AA43. This Fire Risk Evaluation for Fire Area AA43 has demonstrated that

- The change in core damage frequency (delta CDF) is acceptable, and
- The change in large early release frequency (delta LERF) is acceptable, and
- Defense-in-depth and safety margins are maintained.

This is confirmation that a success path effectively remains free of fire damage and that the performance-based approach is acceptable per Section 4.2.4.2 of NFPA 805.

#### 5.0 REFERENCES

- 5.1 Calculation PRA-FIRE-NB-CRE, Fire PRA Cumulative Risk Evaluations
- 5.2 CNP Fire Pre-Plans, Volumes I, II, and III, Revisions 17, 14, and 18 respectively
- 5.3 Fire Hazards Analysis
- 5.4 NFPA 805, Performance-Based Standard for Fire Protection for Light Water Reactor Electric Generating Plants
- 5.5 NFPPM, NFPA 805 Fire Protection Program Manual (NFPPM)
- 5.6 Nuclear Energy Institute (NEI) 04-02, Guidance for Implementing a Risk-Informed, Performance-Based Fire Protection Program under 10 CFR 50.48(c), Rev. 2
- 5.7 Nuclear Safety Capability Assessment Report
- 5.8 PRA-NB-FIRE-FQ, Fire PRA Model Quantification Notebook
- 5.9 PRA-NB-FIRE-FSS, Fire PRA Fire Scenario Selection
- 5.10 R1900-0411-AA43, AA43 - Detailed Fire Modeling Report
- 5.11 Regulatory Guide 1.205, Risk-Informed, Performance-Based Fire Protection for Existing Light-Water Nuclear Power Plants, Rev. Revision 1
- 5.12 Technical Evaluation R1900-005-001, Non-Power Operation Modes Transition Review

**Fire Area AA43 – Attachment 1 - Table B-3 - Fire Area Transition**

<u>Unit</u>	<u>Fire Area</u>	<u>Description</u>
2	AA43	Unit 2 Engineered Safeguards Systems and Motor Control Center Room (El. 609 ft. 6 in.)

<u>Fire Zone</u>	<u>Description</u>
45	Eng Safety System. & MCC Room - El. 609 ft. 6 in. (& Underfloor) - Unit 2

**Regulatory Basis**

4.2.4.2 - Performance-Based Approach - Fire Risk Evaluation with simplifying deterministic assumptions

<b>Performance Goal</b>	<b>Method of Accomplishment</b>	<b>Comments</b>
Reactivity Control	Unit 2 - Trip the reactor from the Control Room. Borate using Unit 1 East or West Charging Pump supplied from the Unit 1 RWST injecting through the Unit 2 BIT. Use alternate source range monitoring for indication.	None
Inventory and Pressure Control	Unit 2 - Control inventory using Unit 1 East or West Charging Pumps injecting through the Unit 2 BIT. Control pressure using Unit 2 Pressurizer Safety Relief Valves with allowable manual actions.	VFDRs identified for CVCS and RCS integrity.
Decay Heat Removal	Unit 2 - Feed SGs 1 & 4 with Unit 1 East MDAFW Pump. The DHR function also requires MS isolation with a steam release path through the Safety Relief Valves.	VFDRs identified for AFW and MS isolation.
Process Monitoring	Unit 2 Process Monitoring - Use Unit 2 alternate process monitoring powered from Unit 1 at the local shutdown panels for the following: Pressurizer level, RCS pressure and temperature, and S/G level and Pressure. Unit 2 Source Range Monitoring - Use Unit 2 alternate source range monitoring powered from Unit 1 at the local shutdown panels.	VFDRs identified for process monitoring and source range monitoring.
Vital Auxiliaries	Unit 2 Electrical - Unit 2 Power not available requiring alternate shutdown power from Unit 1. Control Unit 1 Red (AB) Train Electrical Distribution with Unit 1 Red (AB) Train Offsite Power or Unit 1 Red (AB) DG. Control Unit 1 Green (CD) Train Electrical Distribution with Unit 1 Green (CD) Train Offsite Power or Unit 1 Green (CD) DG. Unit 2 ESW - Operate Unit 1 East or West ESW. Unit 2 CCW - Operate Unit 1 East or West CCW. Unit 2 HVAC - Unit 2 Control Room HVAC is not required as alternate shutdown is utilized for this area. Operate Unit 1 Control Room HVAC. Unit	None

**Fire Area AA43 – Attachment 1 - Table B-3 - Fire Area Transition**

<u>Unit</u>	<u>Fire Area</u>	<u>Description</u>
2	AA43	Unit 2 Engineered Safeguards Systems and Motor Control Center Room (El. 609 ft. 6 in.)
<p>2 Auxiliary Building HVAC in not operational, Unit 1 Auxiliary Building HVAC remains available and provides adequate cooling. Operate Unit 1 Red (AB) and Green (CD) DG HVAC systems. Operate Unit 1 Red (AB) and Green (CD) Switchgear HVAC systems. Operate Unit 1 AFW Room HVAC systems. Operate Unit 1 ESW HVAC systems.</p>		

**Reference Documents**

Genesis Solution Suite, EDISON / SAFE-PB, DC Cook V 3.4.0

Nuclear Safety Capability Assessment Report

**Licensing Actions**

None

**Existing Engineering Equivalency Evaluations (EEEE)****EEEE Title Engineering Equivalency Evaluation 9-19 - Fire Zone 45 (Fire Area AA43) and Fire Zone 60 (Fire Area AA52) Hatch Evaluation**

**Summary** The purpose of this engineering equivalency evaluation is to document the acceptability of an unrated steel plate hatch located between the Unit 2 ESS and MCC Room and the Unit 2 Switchgear Room Cable Vault in Fire Zones 45 (Fire Area AA43) and 60 (Fire Area AA52) respectively. A 3-hr fire-rated hatch assembly is not commercially available for use in this location.

Reasonable assurance is provided that a fire in Fire Zone 45 or Fire Zone 60 would not impair safe shutdown capabilities of Unit 2. This engineering equivalency evaluation does not adversely impact other engineering equivalency evaluations.

The hatch was evaluated and found to be acceptable based on the fire hazards and fire protection systems within the evaluated areas.

**Fire Area AA43 – Attachment 1 - Table B-3 - Fire Area Transition**

<b><u>Unit</u></b>	<b><u>Fire Area</u></b>	<b><u>Description</u></b>
2	AA43	Unit 2 Engineered Safeguards Systems and Motor Control Center Room (El. 609 ft. 6 in.)
<hr/>		
<b><u>EEEE Title</u></b>	<b>Engineering Equivalency Evaluation 11-6 - Unit 2 Emergency Power Systems/4 KV Switchgear Complex Ventilation Shaft Boundary Evaluation (Fire Areas AA45A, AA45B, AA43, AA44 and AA52).</b>	
<b><u>Summary</u></b>	<p>The purpose of this engineering equivalency evaluation is to document the acceptability of unrated fire barrier penetration seals between the Unit 2 EPS/4KV switchgear complex ventilation shafts in Fire Zones 45 (Fire Area AA43), 46A through 46D (Fire Area AA44), 47A (Fire Area AA45A) and 47B (Fire Area AA45B), and the Unit 2 switchgear cable spreading room in Fire Zone 60 (Fire Area AA52).</p> <p>Reasonable assurance is provided that a fire in Fire Areas AA43, AA44, AA45A, AA45B or AA52 would not impair safe shutdown capabilities of Unit 2. This engineering equivalency evaluation does not impact other engineering equivalency evaluations.</p> <p>The fire barrier penetration seals were evaluated and found to be acceptable based on the fire hazards, fire protection systems and construction features within the evaluated areas.</p>	
<b><u>EEEE Title</u></b>	<b>Engineering Equivalency Evaluation 11-9 - Turbine, Auxiliary and Containment Buildings Boundary Evaluation</b>	
<b><u>Summary</u></b>	<p>The purpose of this engineering equivalency evaluation is to describe in general, the approach and existence of evaluations performed to determine and reconcile fire area boundaries having components or designs with less than a 3-hr fire rating on preventing the spread of fire. This engineering equivalency evaluation also specifically evaluates the impact of unrated door assemblies on the spread of fire.</p> <p>Reasonable assurance is provided that the fire area boundaries having components or design less than a 3-hr fire rating will not increase the spread of fire or impair the safe shutdown capabilities of Units 1 or 2. In addition, this engineering equivalency evaluation does not adversely impact on other engineering equivalency evaluations or exemption requests.</p> <p>This evaluation supports additional evaluations credited in this fire area.</p>	



**Fire Area AA43 – Attachment 1 - Table B-3 - Fire Area Transition**

<u>Unit</u>	<u>Fire Area</u>	<u>Description</u>
2	AA43	Unit 2 Engineered Safeguards Systems and Motor Control Center Room (El. 609 ft. 6 in.)
<b><u>EEEE Title</u></b>	<b>Engineering Equivalency Evaluation 11-15 - Switchgear Room Construction Boundary Room Evaluation Fire Zones 40A, 40B, 41, 42A, 45, 46A, 47A and 47B (Fire Areas AA39A, AA39B, AA40, AA41, AA43, AA44, AA45A and AA45B)</b>	
<b><u>Summary</u></b>	<p>The purpose of this engineering equivalency evaluation is to document the acceptability of the construction features of the switchgear rooms which have a fire resistance rating of less than 3 hours and their impact on the spread of fire. In particular, fire doors having a 1 1/2-hr fire rating and open penetrations are analyzed by this engineering equivalency evaluation, as other unrated construction features have been previously analyzed under separate engineering equivalency evaluations. The applicable Fire Areas in Unit 1 are AA39A, AA39B, AA40 and AA41. The applicable Fire Areas in Unit 2 are AA43, AA45A and AA45B.</p> <p>Reasonable assurance is provided that the construction features of the switchgear rooms which have a fire resistance rating of less than 3 hours will prevent the spread of fire and not impair the safe shutdown capabilities of Unit 1 and Unit 2. This engineering equivalency evaluation does not impact other engineering equivalency evaluations.</p> <p>The switchgear room boundaries were evaluated and found to be acceptable based on the fire hazards and fire protection systems within the areas.</p>	
<b><u>EEEE Title</u></b>	<b>Engineering Equivalency Evaluation 11-24 - Fire Retention Capability of Nonconforming Fire Seals in Fire Zones having a Low Combustible Loading Classification</b>	
<b><u>Summary</u></b>	<p>The purpose of this engineering equivalency evaluation is to document the acceptability of fire seal designs which do not meet the requirements of the installation specification or fire test data in fire zones having a low combustible loading classification would have on preventing the spread of fire.</p> <p>Reasonable assurance is provided that fire seals which do not meet the requirements of the installation specification or fire test data in fire zones having a low combustible loading classification, will provide adequate fire retention capabilities and will not impair the safe shutdown capabilities of CNP or increase the spread of fire between fire zones. In addition, this engineering equivalency evaluation does not adversely impact other engineering equivalency evaluations or exemptions.</p> <p>Refer to Engineering Equivalency Evaluation 11.28.</p>	

**Fire Area AA43 – Attachment 1 - Table B-3 - Fire Area Transition**

<u>Unit</u>	<u>Fire Area</u>	<u>Description</u>
2	AA43	Unit 2 Engineered Safeguards Systems and Motor Control Center Room (El. 609 ft. 6 in.)
<b><u>EEEE Title</u></b>	<b>Engineering Equivalency Evaluation 11-28 - Generic Fire Seal Design 2 (Fire Areas AA7, AA8, AA39A, AA40, AA43, AA45A, AA45B, AA48 and AA52)</b>	
<b><u>Summary</u></b>	<p>The purpose of this engineering equivalency evaluation is to document the acceptability of deviations to Generic Fire Seal Design 2 on preventing the spread of fire. The applicable Fire Areas include AA7, AA8, AA39A, AA40, AA43, AA54A, AA54B, AA48 and AA52.</p> <p>Reasonable assurance is provided that deviations to Generic Fire Seal Design 2, Fire Seals W7109, W7952, F8150, F8152, F8162, F8184, F8859, F8861, F8863, F8887 and W9058, and the attributes discussed in the engineering equivalency evaluation do not impair the safe shutdown capabilities of CNP or increase the ability of fire to spread between fire zones. This engineering equivalency evaluation does not impact other engineering equivalency evaluations.</p> <p>Attribute Nos. 2, 7, 9 and the 11 fire seals of Generic Fire Seal Design 2 were evaluated and found to be acceptable based on the fire hazards and fire protection systems within the evaluated areas.</p>	
<b><u>EEEE Title</u></b>	<b>Engineering Equivalency Evaluation 12-19 - CO2 Fire Suppression System Concentrations (Fire Areas AA7, AA8, AA9, AA10, AA29, AA30, AA31, AA37, AA38, AA39, AA40, AA41, AA43, AA44, AA45, AA48, AA49, AA50, AA51, AA52 and AA53)</b>	
<b><u>Summary</u></b>	<p>The purpose of this engineering equivalency evaluation is to document the acceptability of the CO2 fire suppression systems in fire zones containing concentrations of cable insulation and the potential for deep-seated fires. This engineering equivalency evaluation determines the CO2 system's impact on the spread of fire and previous engineering equivalency evaluations and exemption requests. Although there are other fire zones that use CO2 for fire suppression such as the DG Rooms, they are installed to suppress surface-type, combustible liquid fires and are not included in this analysis, because they do not contain significant concentrations of cable insulation capable of producing deep-seated fires.</p> <p>All of the CO2 systems included in this engineering equivalency evaluation are capable of performing their intended function, containing the fire until the Fire Brigade arrives, preventing fire spread to adjacent fire zones, and ensuring that safe shutdown of CNP can be achieved and maintained.</p> <p>The existing suppression systems were evaluated and found to be acceptable based on the fire hazards and fire protection systems within the evaluated areas.</p>	

**Fire Area AA43 – Attachment 1 - Table B-3 - Fire Area Transition**

<u>Unit</u>	<u>Fire Area</u>	<u>Description</u>
2	AA43	Unit 2 Engineered Safeguards Systems and Motor Control Center Room (El. 609 ft. 6 in.)

**Fire Suppression Effects on Nuclear Safety Performance Criteria**

The CNP fire brigade is trained to discharge water in a judicious manner and instructed to direct hose streams and portable extinguishers at the base of the fire to limit the amount of overspray beyond the immediate fire zone. For this reason, fire brigade activities are not expected to fail components not already considered damaged by fire. It has been concluded that water impingement on cables is not a concern. Electrical cabinets are provided with a seal at the conduit interface. Per visual inspection any side vents for this equipment are pointed downward to prevent water intrusion. The drainage features of the fire area mitigate the potential for flooding damage due to fire suppression, such that the standing water would not affect credited equipment.

In the event of discharge, the CO2 system will not adversely affect the equipment operating within the fire area. Potential condensation developing on electrical components is a long term issue that would be eliminated by ventilating the fire area after actuation. Per visual inspection, all CO2 nozzles are located greater than 5 ft. away from any credited equipment and therefore, the possibility of thermal shock due to CO2 actuation has been deemed to be a non-issue in this fire area in accordance to EPRI NP-7253 "Effects of Fire Suppressants on Electrical Components in Nuclear Power Plants". Since it is shown that suppression effects will not impact the nuclear safety performance criteria, the fire area configuration is deemed acceptable.

**References:**

Technical Evaluation 12.1, "Fire Suppression Effects Study"

Technical Evaluation 12.1, "Supplemental Information to Fire Suppression Effects Study – Supplement 1"

**Fire Area Comments**

None

## Fire Area AA43 – Attachment 2 - Fire Risk Evaluation Results Summary

### A2.1 Introduction

The ‘changes’ associated with NFPA 805 transition were those variances from the deterministic requirements of NFPA 805. The changes identified for evaluation for fire area AA43 are grouped as follows:

- Separation Issues

This attachment is a summary of the Fire Risk Evaluation for the fire area. The complete results and methodology are contained in the Cumulative Fire Risk Evaluation, PRA-FIRE-NB-CRE. (FPCE 2017-0009)

### A2.2 Inputs/Assumptions

Fire modeling processes and inputs provided in NUREG/CR-6850 are appropriate for use in a risk-informed, performance-based evaluation. The complete list of assumptions used in the fire modeling methodology for this fire area is contained in Detailed Fire Modeling Technical Evaluation R1900-0411-AA43.

### A2.3 Fire Modeling Methodology

Fire PRA fire modeling results are used as the initial input into this Fire Risk Evaluation. The process consists of conservative bounding analyses using NUREG/CR-6850 methods. As needed, refinements are made to utilize more realistic parameters. The complete fire modeling methodology for this fire area is contained in Detailed Fire Modeling Technical Evaluation R1900-0411-AA43.

### A2.4 Scenario Descriptions and Model Results

Fire Area AA43 was evaluated for the impact of fires originating from both fixed and transient ignition sources. Complete descriptions of each fire scenario is contained within the Detailed Fire Modeling Technical Evaluation R1900-0411-AA43.

#### A2.4.1 Ignition Sources

Fire Area AA43 contains 600V switchgear bus 21B and 21D, battery chargers, the 4160/600V bus supply transformers 21B and 21D and various other 600V MCCs. Per discussion with plant personnel, the heat release rates for all switchgear, load centers, and MCC electrical cabinets have been characterized as qualified cable because items of this nature are generally constructed on-site. For other electrical cabinet types, where the internal cable qualification was unknown, the heat release rates have been assumed as non-qualified. Ignition sources in Fire Area AA43 were modeled using the 98th percentile fire as a screening approach and later refined based on the risk significance of the scenario. 75th percentile fires were postulated for 2-BC-AB1 and 2-BC-AB2. For the high voltage load center, both an electrical fire and a high energy arcing fault (HEAF) fire scenario have been developed.

In Fire Area AA43, the 98th percentile HRR was used for all transient fires. The 98th percentile HRR bounds the possible transient ignition sources expected for this fire area, which were fire tested and identified in NUREG/CR-6850, Appendix G, Table G-7.

#### A2.4.2 Scenario Results

A delta risk calculation has been performed to quantify the risk associated with the VFDRs in the fire area.

### A2.5 Fire Risk Evaluation Results

### **Fire Area AA43 – Attachment 2 - Fire Risk Evaluation Results Summary**

PRA-FIRE-NB-CRE documents scenarios and corresponding impacted VFDRs that were evaluated for delta risk during the transition to NFPA 805 and also all changes to the Fire Protection Program that are currently incorporated into the Fire PRA model. The acceptability of the Cumulative Fire Risk Evaluations was based on calculated delta risk meeting the thresholds of NEI 04-02, RG 1.205 and RG 1.174. (FPCE 2017-0009)

## Fire Area AA43 – Attachment 2 - Fire Risk Evaluation Results Summary

### A-2.6 Impact of VFDR on Defense-in-Depth

Defense-in-Depth has been evaluated for this fire area. The impacts of this evaluation are summarized in the table below:

Defense-in-Depth Impact Review for AA43			
Method of Providing DID	Required to Support Deterministic Analysis or Fire PRA?	Changes or Improvements Necessary for DID?	Basis/Justification
Echelon 1: Prevent fires from starting			
Combustible Control is implemented in accordance with Procedure PMP-2270-CCM-001, Control of Combustible Materials.	Yes	No	• Transient combustible and hot work free zone have been implemented for this Fire Area for risk reduction. This element is adequate based on no perceived weakness of, or over-reliance on, another echelon of defense-in-depth.
Hot Work Control is implemented in accordance with Procedure PMP-2270-WBG-001, Welding, Burning and Grinding Activities.	Yes	No	
Echelon 2: Rapidly detect, control and extinguish promptly those fires that do occur thereby limiting fire damage			
Fire Detection System	Yes	No	• Suppression and detection are already required and fire fighting activities are not expected to be challenging; therefore, no changes or improvements to Echelon 2 attributes are necessary to maintain defense-in-depth.
Fixed Fire Suppression	Yes	No	
Portable Fire Extinguishers	Yes	No	
Hose stations and hydrants	Yes	No	
Pre-Fire Plan	Yes	No	
Echelon 3: Provide adequate level of fire protection for systems and structures so that a fire will not prevent essential safety functions from being performed			
Walls, floors ceilings and structural elements are rated or have been evaluated as adequate for the hazard.	Yes	No	• Although VFDR AA43-003 is not considered a significant contribution to core damage frequency, the variance is considered important enough to the NSCA to retain as a recovery action to ensure that defense-in-depth is maintained.  • Where the remaining variances can possibly be affected in a potentially high risk scenario, based on a detailed review, the VFDRs are either not the cause for the high risk of the scenario or the mitigating recovery action is credited; therefore no changes or improvements to Echelon 3 attributes are necessary to maintain defense-in-depth.
Penetrations in the fire area barrier are rated or have been evaluated as adequate for the hazard.	Yes	No	
Supplemental barriers (e.g., ERFBS, cable tray covers, etc.)	Yes	No	
Guidance provided to operations personnel detailing the required success path(s) including recovery actions to achieve nuclear safety performance criteria.	Yes	Yes	
			• Defense in Depth actions were credited to remove fuses or open breakers in the Control Room to prevent spurious equipment operation due to internal shorts.

## Fire Area AA43 – Attachment 2 - Fire Risk Evaluation Results Summary

### A-2.7 Safety Margin Considerations

In accordance with NEI 04-02, the maintenance of adequate Safety Margin is assessed by the consideration categories of analyses utilized by this Fire Risk Evaluation.

Safety margins are considered to be maintained if:

- Codes and Standards or their alternatives accepted for use by the NRC are met.

AND

- Safety analyses acceptance criteria in the licensing basis (e.g., FSAR, supporting analyses) are met, or provides sufficient margin to account for analysis and data uncertainty.

The following summarizes the bases for ensuring the maintenance of safety margins:

- The risk-informed, performance based processes utilized are based upon NFPA 805, 2001 edition, endorsed by the NRC in 10 CFR 50.48(c).
- The Fire Risk Evaluation process is in accordance with NEI 04-02, Revision 2, which is endorsed by the NRC in Regulatory Guide 1.205, Revision 1.
- The Fire PRA is developed in accordance with NUREG/CR-6850, which was developed jointly between the NRC and EPRI.
- The Fire PRA has undergone an industry peer review, in order to ensure the Fire PRA meets the appropriate quality standards of ASME/ANS RA-Sa-2009, "Standard for Level 1/Large Early Release Frequency Probabilistic Risk Assessment for Nuclear Power Plant Applications," Dated February 2, 2009
- The "combined analysis approach" is used during transition (NEI 04-02, Section 5.3.4.3); therefore, MEFS/LFS is not analyzed separately from the Fire PRA results.
- The CNP internal events PRA model received two formal industry peer reviews conducted in accordance with applicable NEI guidelines. The initial peer review was performed in 2001, while a subsequent focused scope (i.e., limited scope) peer review was conducted in 2009. The initial, full-scope WOG peer review covered all aspects of the CNP PRA model and the administrative processes used to maintain and update the model. The CNP PRA model has been revised to address all significant issues (i.e., Category A and B Facts & Observations) identified during the initial peer review. None of the findings from the focused-scope peer review were judged to reach the significance level of a Category A or B Fact & Observation; as a result, no changes to the PRA model have yet been made to include resolutions for these latter issues.
- Fire protection systems and features determined to be required by NFPA 805 Chapter 4 have been confirmed to meet the requirements of NFPA 805 Chapter 3 and their associated referenced codes and listings, or provided with acceptable alternatives using processes accepted for use by the NRC (i.e., FAQ 06-0008, FAQ 06-0004, 07-0033).
- Fire modeling performed in support of the transition has been performed within the Fire PRA utilizing codes and standards developed by industry and NRC staff which have been verified and validated in authoritative publications, such as NUREG 1824, "Verification and Validation of Selected Fire Models for Nuclear Power Plant Applications". In general, the fire modeling performed in support of the Fire Risk Evaluations has been performed using conservative methods and input parameters that are based upon

### Fire Area AA43 – Attachment 2 - Fire Risk Evaluation Results Summary

NUREG/CR-6850 as documented in the AA43 Detailed Fire Modeling Report, section 7.2. While this is generally not ideal in the context of best estimate probabilistic risk analysis, it is a pragmatic approach given the current state of knowledge regarding the uncertainties related to the application of the fire modeling tools and associated input parameters for specific plant configurations.

- In accordance with the requirements of 10 CFR 50.48(c)(2)(iii), the Fire PRA results, including cutsets for the scenarios of concern, have been reviewed and it was verified that the results presented above do not rely solely on feed and bleed as the fire-protected safe shutdown path for maintaining reactor coolant inventory, pressure control, and decay heat removal capability for this fire area.

#### A-2.8 Transition Risk Evaluation Conclusions

The transition change evaluation determined that these changes:

- Are acceptable based upon the measured change in CDF and LERF
- Maintained adequate defense-in-depth and safety margins

The results of this evaluation meet the requirements of NFPA 805 Risk Evaluation; therefore, the use of the performance based analysis approach is acceptable.



## D. C. Cook Nuclear Plant Fire Safety Analysis

## Fire Area: AA44

## Unit 2 Emergency Power Systems Area (El. 609 ft. 6 in.)

## Table of Contents

<b>Purpose</b> .....	Section 1.0
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## Attachments

Fire Area AA44 – Attachment 1 - Table B-3 - Fire Area Transition

## Fire Area AA44 – Attachment 2 - Fire Risk Evaluation Results Summary

## 1.0 PURPOSE

This report documents the Fire Safety Analysis (FSA) for Cook Nuclear Plant (CNP) Fire Area AA44, Unit 2 Emergency Power Systems Area (El. 609 ft. 6 in.) which comprises fire zone(s) 46A, 46B, 46C, 46D. The purpose of this analysis is to demonstrate the achievement of the nuclear safety and radioactive release performance criteria of NFPA 805 as required by 10 CFR 50.48(c). The Fire Safety Analysis is a key part of compliance with Section 2.7.1.2 Fire Protection Program Design Basis Document of NFPA 805. This analysis also documents results of risk-informed, performance-based Fire Risk Evaluations (FREs). These evaluations are associated with Variances from Deterministic Requirements (VFDRs) of NFPA 805 Chapter 4.

## 2.0 ANALYSIS METHODOLOGY

The FSA is the design basis document as described in NFPA 805 Section 2.7.1.2. The following steps are performed to develop the FSA on a fire area basis:

- Identify significant fire hazards in the fire area. This is based on NFPA 805 approach to analyze the plant from an ignition source and fuel package perspective.
- Summarize Nuclear Safety Capability Analysis (NSCA) compliance strategies. This is the result of the NEI 04-02 B-3 Table review of the Safe Shutdown Analysis.
- Summarize Non-Power Operations Modes compliance strategies.
- Summarize Radioactive Release compliance strategies. The transition review process required per NEI 04-02 is used to develop these results.
- Provide Fire Probabilistic Risk Assessment summary of results. This is based on the results from the plant Fire PRA.
- Perform risk informed, performance based evaluations if needed for the performance based approach.
- Summarize Defense-in-Depth strategy for each fire area.
- Determine key analysis assumptions which are candidates to be included in the NFPA 805 monitoring program.
- Provide conclusions relative to NFPA 805 compliance.

### 3.0 ANALYSIS

#### 3.1 Classical Fire Protection

##### 3.1.1 Construction

Walls, floors and ceilings to adjacent fire areas are reinforced concrete in excess of a 3-hour rating.

For Fire Zone 46A, A 12-inch concrete block wall having a 4-hour rating provides a flame and heat shield between the 4KV/600V transformers. A 22" x 22" undampened ventilation duct passes through this wall. A fire area boundary evaluation was performed for the construction features (i.e. fire doors having a 1 1/2-hour fire rating and open penetrations) of the switchgear rooms which have a fire resistance rating of less than 3 hours (Engineering Equivalency Evaluation 11-15).

For Fire Zone 46B, A fire area boundary evaluation was performed for the construction features (i.e. unrated fire barrier penetration seals) of the switchgear rooms that have a fire resistance rating of less than 3 hours (Engineering Equivalency Evaluation 11-5). A 12-inch concrete block wall having a 4-hour rating provides a flame and heat shield between the 4kV/600v transformers. A 22" x 22" undampened ventilation duct passes through this wall.

Applicable Engineering Equivalency Evaluations are documented in Attachment 1.

##### 3.1.2 Doors and Access Openings

For Fire Zone 46A, A fire door having a 1 1/2-hour rating is provided to adjacent Fire Area AA43 - Fire Zone 45.

The access / ventilation opening between this fire zone and adjacent Fire Zone 97 (Fire Area AA2) is provided with a combined multi-section fire damper assembly and personnel access door. The fire dampers, door, door frame, and supporting structure are installed as a 3-hour rated assembly. The dampers are furnished with fusible electro-thermal links (ETLs). The links are temperature rated for 286°F to preclude the possibility of inadvertent closure during a high energy line break (HELB) in the Turbine Building. The design for this opening also incorporates non-rated HELB dampers on the West side of the fire damper assembly and a security barrier. Similarly, the access / ventilation opening between this fire zone and adjacent Fire Zone 45 (Fire Area AA43) is provided with a combined multi-section fire damper assembly and personnel access door. The fire dampers, door, doorframe, and supporting structure are installed as a 3-hour rated assembly. This opening does not include HELB dampers or a security barrier. The dampers are furnished with fusible electro-thermal links (ETLs). The links are temperature rated for 165°F. The ETLs for both of the fire damper assemblies described above are actuated through the existing CO2 system in this fire zone. Actuation of the ETLs is accomplished through existing relays in the CO2 control cabinets. An access opening is provided from this fire zone into Fire Zone 46C.

For Fire Zone 46B, a fire door having a 1 1/2-hour rating is provided to adjacent Fire Area AA43 - Fire Zone 45.

For Fire Zone 46C, there are no door openings to adjacent fire areas. An access opening is provided into this fire zone from Fire Zone 46A. A fire door having a 1 1/2-hour rating is provided to adjacent Fire Zone 46D.

For Fire Zone 46D, there are no door openings to adjacent fire areas. Fire doors having a 1 1/2-rating is provided to adjacent Fire Zone 46C.

### 3.1.3 Penetrations

For Fire Zone 46A, penetrations in fire barriers between this fire zone and adjacent fire areas are provided with fire seals. However, barriers between this fire zone and adjacent fire zone 46C are not fire sealed.

For Fire Zone 46B, penetrations in fire barriers between this fire zone and adjacent fire areas are provided with fire seals. However, barriers between this fire zone and adjacent fire zone 46C are not fire sealed. Seismic gaps are sealed with a glass fiber reinforced silicone sheeting.

For Fire Zone 46C, penetrations in fire barriers between this fire zone and adjacent fire areas are provided with fire seals. Additionally, penetrations in the fire barriers between Fire Zone 46C and 46D are provided with fire seals. However, barriers between this fire zone and adjacent fire zones 46A and 46B are not fire sealed. Seismic gaps are sealed with a glass fiber reinforced silicone sheeting.

For Fire Zone 46D, Penetrations in fire barriers between this fire zone and adjacent fire areas are provided with fire seals. Additionally, penetrations in the fire barriers between Fire Zones 46D and 46C are provided with fire seals. Seismic gaps are sealed with a glass fiber reinforced silicone sheeting.

For Fire Zones 46A, 46B, 46C and 46D, a fire area boundary evaluation was performed for the unrated fire barrier penetrations between Fire Area AA43 - Fire Zone 45, Fire Area AA44 - Fire Zones 46A, 46B, 46C, 46D, Fire Area AA45A and AA45B - Fire Zones 47A, 47B and Fire Area AA52 - Fire Zone 60 (Engineering Equivalency Evaluation 11-6).

### 3.1.4 Detection

The table below outlines the fire detection system(s) provided in the Fire Area:

Table 3-1, Fire Area AA44 Detection Systems								
Fire Zone	Type of System	Local (L) / Remote (R)	Detection Actuates Suppression?	Required System?				
				S	L	E	R	D
46A	Infrared	L/R	No Auto Supp. (N/A)	N	N	Y	Y	N
46A	Ionization	L/R	No Auto Supp. (N/A)	N	N	Y	Y	N
46B	Infrared	L/R	No Auto Supp. (N/A)	N	N	Y	Y	N
46B	Ionization	L/R	No Auto Supp. (N/A)	N	N	Y	Y	N
46C	Infrared	L/R	No Auto Supp. (N/A)	N	N	Y	Y	N
46C	Ionization	L/R	No Auto Supp. (N/A)	N	N	Y	Y	N
46D	Ionization	L/R	No Auto Supp. (N/A)	N	N	Y	Y	N

**Table 3-1 Legend:**

Table Field: "Required System?"	
S	- Required for Chapter 4 Separation Criteria
L	- Required for NRC Approved Licensing Action
E	- Required for Engineering Equivalency Evaluation
R	- Required for Risk Significance
D	- Required to maintain adequate balance of Defense-in-Depth in a Change Evaluation or Fire Risk Evaluation

For Fire Zone 46A, cross zoned ionization smoke detectors (10) and infra-red detectors (2) which alarm in the Unit 2 Control Room. Each detector type is part of a larger detection circuit which includes Fire Zones 46A, 46B, 46C and 46D for ionization detectors and Fire Zones 46A, 46B and 46C for infra-red detectors. Note that two of the ionization detectors, serving Fire Zone 46A are located on the West side of the ventilation / access opening to adjacent Fire Zone 97.

For Fire Zone 46B, cross zoned ionization smoke detectors (2) and infra-red detectors (1) which alarm in the Unit 2 Control Room are provided. Each detector type is part of a larger detection circuit which includes Fire Zones 46A, 46B, 46C and 46D for ionization detectors and Fire Zones 46A, 46B and 46C for infra-red detectors.

For Fire Zone 46C, cross zoned ionization smoke detectors (3) and infra-red detectors (2) which alarm in the Unit 2 Control Room are provided. Each detector type is part of a larger detection circuit which includes Fire Zones 46A, 46B, 46C and 46D for ionization detectors and Fire Zones 46A, 46B and 46C for infra-red detectors.

For Fire Zone 46D, two ionization smoke detectors which alarm in the Unit 2 Control Room are provided. These detectors are part of a larger detection circuit which includes Fire Zones 46A, 46B, 46C and 46D.

### 3.1.5 Fixed Suppression

The table below outlines the fixed fire suppression system(s) provided in the Fire Area:

Table 3-2, Fire Area AA44 Suppression Systems								
Fire Zone	Type of System	Full (F) / Partial (P)	Required System?					
			S	L	E	R	D	
46A	Manual CO2	F	N	N	Y	N	N	
46B	Manual CO2	F	N	N	Y	N	N	
46C	Manual CO2	F	N	N	Y	N	N	
46D	None	N/A	N/A	N/A	N/A	N/A	N/A	

**Table 3-2 Legend:**

Table Field: "Required System?"	
S	- Required for Chapter 4 Separation Criteria
L	- Required for NRC Approved Licensing Action
E	- Required for Engineering Equivalency Evaluation
R	- Required for Risk Significance
D	- Required to maintain adequate balance of Defense-in-Depth in a Change Evaluation or Fire Risk Evaluation

Fire Area AA44 is not provided with automatic fire suppression.

### 3.1.6 Manual Suppression / Response Strategy

A postulated fire will be identified by early detection using ionization type smoke detection, infrared detection or by plant personnel using plant communication system to notify the control room. The automatic detection systems alarm in the control room. The Control Room operator will dispatch the fire brigade for initiation of manual fire fighting. A fire in this fire area will be contained by the construction features discussed in Section 3.1.1. Manual suppression is provided by the CNP Fire Brigade. A low pressure CO2 total flooding system supplied from the 17 ton tank is provided for Fire Zones 46A, 46B and 46C. This system is manually actuated. Operation of this system discharges CO2 simultaneously into Fire Zones 46A, 46B, and 46C.

Fire extinguishers are located in Fire Zone 46A for the fire brigade's use, with additional extinguishers located in adjacent Fire Zones 45 and 97.

Water hose reels are located in the adjacent Fire Zones 34A and 97.

Floor drains are available in Fire Zones 46A and 46B. Drainage for Fire Zones 46C and 46D is provided via Fire Zone 46A.

### 3.1.7 Ventilation

A fire in this area will be contained by the fire barriers. Smoke can be removed by portable fans and flexible ducting to the Turbine Building and outdoors. This fire area is listed as a non-controlled area in the Fire Pre Plans and therefore there is reasonable assurance that products of combustion will not be contaminated.

For Fire Zone 46A, there are 4-hour rated undampered ventilation shafts in the ceiling which pass

through Fire Area AA52 - Fire Zone 60 to the yard. A fire damper having a 3-hour rating is provided to adjacent Fire Area AA43 - Fire Zone 45. There is a ventilation penetration to the adjacent Fire Zone 46C.

For Fire Zone 46B, there are no ventilation penetrations to adjacent fire areas. There are undampered ventilation penetrations to the adjacent Fire Zone 46C.

For Fire Zone 46C, there are no ventilation penetrations to adjacent fire areas. There are undampered ventilation penetrations to adjacent Fire Zones 46A and 46B. A fire damper having a 3-hour rating is provided to adjacent Fire Zone 46D.

For Fire Zone 46D, there is a 4-hour rated undampered ventilation shaft in the ceiling which passes through Fire Area AA52 - Fire Zone 60 to the yard. A fire damper having a 3-hour rating is provided to adjacent Fire Zone 46C.

### 3.1.8 Other Features

Some cable trays within Fire Area AA44 are provided with bottom covers and/or are fully enclosed.

### 3.2 Fire Hazards Identification

The fire area contains both ignition sources and combustible fire hazards. The ignition sources consist of 600V switchgear, 250Vdc batteries, Inverters, 250Vdc cabinets, and transformers. Combustibles consist primarily of exposed electrical cables in trays, rubber and plastics. Fire Zone 46D contains battery cells. The current fire loading classification is considered low.

### 3.3 NSCA Compliance Summary

Fire Area AA44, the Unit 2 Emergency Power Systems Area (El. 609'-6") contains Unit 2 Red and Green train cables, conduits and raceways as well as 600V Motor Control Centers, Red Train 250V DC supplies, 120V CRID inverters and supporting equipment.

Compliance with the nuclear safety performance criteria is achieved using the performance-based approach in accordance with NFPA 805, Section 4.2.4.2.

Safe and stable of Unit 2 will be accomplished using Steam Generators 2 and 3 via the Unit 1 West Motor Driven Auxiliary Feedwater Pump, Unit 2 Local Shutdown Indicating Panel are credited to provide process monitoring using Unit 1 power, Unit 2 Alternate Charging via the Unit 1 West or East Pump, Component Cooling Water via the Unit 1 East or West Pump to support Unit 1 systems credited for Unit 2 crosstie, ESW via the Unit 1 East or West Pump to support Unit 1 systems credited for Unit 2 crosstie. Either train of Unit 1 electrical power is credited available to support Unit 1 system crossties to Unit 2. Unit 2 electrical distribution is not credited to be available.

The Nuclear Safety Performance Criteria compliance strategy for AA44 is documented within the NSCA Report.

#### 3.3.1 Variances

The variances identified for evaluation for this fire area are grouped as follows:

##### 3.3.1.1 VFDR No. AA44-001

2-PP-50E, 2-PP-50W and 2-ICM-250 – CVCS is required to be operable to provide

inventory control, reactivity control, pressure control and seal cooling. The Unit 2 East and West Charging Pumps may fail due to a full area fire within Fire Area AA44. This results in the need to use alternate CVCS and cross-tie to the Unit 1 Charging Pumps. 2-PP-50E may fail due to fire induced damage of 250VDC Cabinet 2-MCCD, 4kV Bus 2-T21D, CCW cooling and cable 8874G-2. 2-PP-50W may fail due to fire induced damage of 250VDC Cabinet 2-MCAB, 4kV Bus 2-T21A, CCW cooling and cables 8007R-2, 8377R-2 and 8874R-2. Alternate CVCS requires injection through the BIT, thus requiring either 2-ICM-250 or 2-ICM-251 be open. Both of these valves are normally closed and fail as is due to the loss of power. 2-ICM-250 may fail due to fire induced damage of 600V MCC 2-AM-D. 2-ICM-251 may fail due to fire induced damage of 600V VCC 2-AZV-A. These failures require manual operation of either of the valves to restore alternate CVCS. This condition represents a variance from the deterministic requirements of NFPA 805, Section 4.2.3. This is a separation issue.

This VFDR has been evaluated and it was determined that the risk, safety margin and defense-in-depth meet the acceptance criteria of NFPA 805 Section 4.2.4 with a defense-in-depth action credited.

### 3.3.1.2 VFDR No. AA44-002

2-PP-3E, 2-PP-3W, 2-PP-4, 2-FMO-222 and 2-FMO-232 - Unit 2 AFW is required to be operable to support decay heat removal. Decay heat removal is required to be capable of removing sufficient heat from the reactor core such that the fuel is maintained in a safe and stable condition. A full area fire within Fire Area AA44 may cause the loss of the Unit 2 East and West MDAFW Pumps and the Unit 2 TDAFW Pump. The East MDAFW Pump, 2-PP-3E may fail due to fire induced damage of 250VDC Cabinet 2-MCCD, 4kV Bus 2-T21D and cable 9290G-2. The West MDAFW Pump, 2-PP-3W may fail due to fire induced damage of 250VDC Cabinet 2-MCAB, 4kV Bus 2-T21A and cables 8377R-2, 8488R-2, 8723R-2 and 8743R-2. The TDAFW Pump 2-PP-4 may fail due to fire induced damage of the Turbine Driven Trip and Throttle Valve 2-QT-506. 2-QT-506 may fail due to fire induced damage of 250VDC VCC 2-AB-N. These failures require the use of alternate AFW cross-tied from Unit 1 to Unit 2. This area credits the Unit 1 West MDAFW Pump feeding Unit 2 SGs 2 and 3. Manual valve 1-FW-261 is required to be closed and manual valve 2-FW-129 is required to be opened to enable this cross-tie. In addition, decay heat removal requires a set of 2 supply valves be operable with their corresponding AFW pump. The following sets of Unit 2 steam generator AFW supply valves may fail due to a full area fire within Fire Area AA44; 2-FMO-212 and 2-FMO-242, 2-FMO-222 and 2-FMO-232, 2-FMO-221 and 2-FMO-231. These failures require a set of valves be manually operated to restore Unit 2 decay heat removal. Since the Unit 1 West MDAFW Pump feeding Unit 2 SGs 2 and 3 are credited for decay heat removal within this area, 2-FMO-222 and 2-FMO-232 are required be operable. 2-FMO-222 may fail due to fire induced damage of 600V MCC 2-EZC-D. 2-FMO-232 may fail due to fire induced damage of 600V MCC 2-EZC-D. This condition represents a variance from the deterministic requirements of NFPA 805, Section 4.2.3. This is a separation issue.

This VFDR has been evaluated and it was determined that the risk, safety margin and defense-in-depth meet the acceptance criteria of NFPA 805 Section 4.2.4 with no further action required.



**3.3.1.3 VFDR No. AA44-003**

2-BLI-120-CRI, 2-BLI-130-CRI, 2-MPP-220-CRI, 2-MPP-230-CRI, 2-NTR-210, 2-NTR-220, 2-NLP-151-CRI, 2-NPS-110-CRI and 2-NRI-1 - Control Room process monitoring and source range monitoring may not be available due to a full area fire within Fire Area AA44. Process monitoring is required to be available to monitor key primary and secondary parameters. Source Range is required to provide indication of fission activity to ensure sub-criticality. The instrumentation may not be available within the Unit 2 Control Room due to the loss of Unit 2 power distribution. Alternate process and source range monitoring powered from Unit 1 is required at the Unit 2 LSI panels. The LSI panels require manual actions to transfer to the Unit 1 power supply. A transfer switch at 2-LSI-6XX feeds both 2-LSI-6XX and 2-LSI-2. A transfer switch at 2-LSI-5XX feeds both 2-LSI-5XX and 2-LSI-1. A transfer switch at 2-LSI-4 feeds both 2-LSI-4 and 2-LSI-3. Process monitoring of SGs 2 and 3 is required for this area due to NSCA crediting the use of Unit 1 West MDAFW Pump to supply Unit 2 SGs 2 and 3 to achieve decay heat removal. Local monitoring of SGs 2 and 3 is required at 2-LSI-2. Local monitoring of pressurizer level indication is required at 2-LSI-3. Local monitoring of SG 2 and 3 pressure indication, RCS loop 2 temperature and source range monitoring is required at 2-LSI-4. Local monitoring of SG 2 and 3 pressure is also available at 2-LSI-6. This condition represents a variance from the deterministic requirements of NFPA 805, Section 4.2.3. This is a separation issue.

This VFDR has been evaluated and it was determined that the risk, safety margin and defense-in-depth meet the acceptance criteria of NFPA 805 Section 4.2.4 with a defense-in-depth action credited.

**3.3.1.4 VFDR No. AA44-004**

2-PP-45-1 and 2-PP-45-4 - The RCPs are required to be tripped to prevent a loss of coolant accident if seal cooling and thermal barrier cooling are lost. A full area fire within Fire Area AA44 will cause the loss of seal cooling, thermal barrier cooling and Control Room trip capability of RCP 1 and 4. 2-PP-45-1 may lose Control Room trip capability due to fire induced damage of cable 3422R-2. 2-PP-45-4 may lose Control Room trip capability due to fire induced damage of cable 3421R-2. These cable failures could prevent the ability to trip the RCPs from the Control Room. This condition represents a variance from the deterministic requirements of NFPA 805, Section 4.2.3. This is a separation issue.

This VFDR has been evaluated and it was determined that the risk, safety margin and defense-in-depth meet the acceptance criteria of NFPA 805 Section 4.2.4 with no further action required.

**3.3.2 Recovery Actions Credited**

For each VFDR, a Fire Risk Evaluation has been performed to assess the acceptability of risk, defense-in-depth, and safety margin. This evaluation determined whether or not recovery actions are required to ensure that one success path necessary to achieve and maintain the nuclear safety performance criteria is maintained free of fire damage by a single fire. Table 3-3 identifies the credited recovery actions for this area. Actions retained for DID are identified as "DID Actions" within Table 3-3. Additional information for DID actions is contained within Section 3.8 of this report. Note that, for completeness, all VFDRs are contained within Table 3-3, even if the Fire Risk Evaluation has determined that a recovery action is not required. In those instances where a recovery action has been determined to not be required, the word "None" is provided in the "Action" column in the table.

Table 3-3, Recovery Actions Credited		
VFDR	Component	Action
AA44-001	2-PP-50E 2-PP-50W 2-ICM-250	DID ACTION 2-CS-302-CLOSE (Close manual valve 2-CS-302)  2-CS-534-OPEN (Open manual valve 2-CS-534)  1-CS-536-OPEN (Open manual valve 1-CS-536)  2-ICM-250-OPEN (De-energize and manually open 2-ICM-250)
AA44-002	2-PP-3E 2-PP-3W 2-PP-4 2-FMO-222 2-FMO-232	None
AA44-003	2-BLI-120-CRI 2-BLI-130-CRI 2-MPP-220-CRI 2-MPP-230-CRI 2-NTR-120 2-NTR-220 2-NLP-151-CRI 2-NPS-110-CRI 2-NRI-1	DID ACTION 2-LSI-4-ALT-PWR (Align unaffected Unit Power to LSI Panel)  2-LSI-6XX-ALT-PWR (Align unaffected Unit Power to LSI Panel)  2-LSI-2-LOCAL (Locally monitor 2-LSI-2)  2-LSI-3-LOCAL (Locally monitor 2-LSI-3)  2-LSI-4-LOCAL (Locally monitor 2-LSI-4)  2-LSI-6XX-LOCAL (Locally monitor 2-LSI-6XX)
AA44-004	2-PP-45-1 2-PP-45-4	None

### 3.4 Non-Power Operational Modes Compliance Summary

A review of CNP for the potential effects of a fire in this Fire Area while in non-power modes of operation (NPO) was conducted. This review was conducted using the guidance provided in NEI 04-02 and FAQ 07-0040, "Non-Power Operations Clarifications".

The review determined that there are potential failures that affect certain Key Safety Functions

(KSF) as a result of the fire in this area, and the fire could result in the loss of one or more KSF paths. Compensatory measures are required during high risk evolution periods to provide reasonable assurance a fire will not adversely affect key safety functions and the NFPA 805 performance goal for NPO is therefore satisfied. The results of the NPO analysis are contained within Technical Evaluation R1900-005-001, Non-Power Operation Modes Transition Review Report.

### 3.5 Radioactive Release Compliance Summary

The NFPA 805 radiological release goal is to provide reasonable assurance that a fire will not result in a radiological release that adversely affects the public, plant personnel or the environment. The NFPA 805 requirement is to ensure a radiation release to any unrestricted area due to the direct effects of fire suppression activities (but not involving fuel damage) shall be as low as reasonably achievable and shall not exceed applicable plant Technical Specification limits.

AA44 is located outside the Radiological Controlled Area (RCA) and is not a storage location for contaminated materials, therefore there is reasonable assurance a fire in this area will not result in radiation release. The review of this fire area, with respect to radioactive release, is documented in the NFPPM.

### 3.6 Probabilistic Risk Assessment-Summary of Results

A Fire PRA (FPRA) quantification of Fire Area AA44 was performed and is documented in PRA-NB-FIRE-FQ, Fire PRA Model Quantification Notebook. The fire risk quantification for Fire Area AA44 is analyzed using detailed fire modeling to consider risk of fire scenarios of ignition sources. PRA-NB-FIRE-FQ includes a summary of all potentially risk-significant fire scenarios (i.e., CDF > 1.0E-7 or LERF > 1.0E-8). Bounding CDF / LERF per calendar year values are reported that are based on the risk values documented in PRA-NB-FIRE-FSS, Fire PRA Fire Scenario Selection.

Fire Protection features credited in the Fire PRA are documented in R1900-0411-AA44, Detailed Fire Modeling Report: Fire Compartment: AA44 Unit 2 Emergency Power Systems Area (EL. 609 FT 6 IN). PRA-NB-FIRE-FSS documents the revision level of the fire modeling reports used in the most recent Fire PRA quantification.

### 3.7 Risk-Informed, Performance-Based Evaluations

Fire Risk Evaluations (FREs) have been performed to ensure that variances from the NFPA 805 deterministic requirements are acceptable. The evaluation process consists of an integrated assessment of the acceptability of risk, defense-in-depth, and safety margins.

#### 3.7.1 Transition Risk-Informed, Performance-Based Evaluations

The ‘changes’ associated with NFPA 805 transition were those variances from the deterministic requirements of NFPA 805 or with the existing fire protection licensing basis that were brought into compliance with the NFPA 805 performance based approach. The change identified for evaluation for Fire Area AA44 is as follows:

- Separation Issues

The Fire Risk Evaluation has determined that the change is acceptable based upon:

- The measured change in CDF and LERF.
- Adequate defense-in-depth and safety margins being maintained.

Refer to Attachment 2 for a summary of results associated with the Fire Risk Evaluations.

### 3.8 Defense-in-Depth

A comprehensive risk-informed, performance-based analysis includes consideration of defense-in-depth (DID) as part of an integrated evaluation of risk considerations. In general, defense-in-depth involves consideration of the extent to which fire protection systems and features are provided within the three echelons of fire-protection:

- Preventing fires from starting,
- Rapidly detecting fires and controlling and extinguishing promptly those fires that do occur, thereby limiting fire damage,
- Providing an adequate level of fire protection for structures, systems, and components important to safety, so that a fire that is not promptly extinguished will not prevent the nuclear safety performance criteria from being met.

Each VFDR was evaluated for DID. The following recovery actions have been retained for DID.

VFDR No. AA44-001: 2-PP-50E, 2-PP-50W and 2-ICM-250 – CVCS is required to be operable to provide inventory control, reactivity control, pressure control and seal cooling. Unit 2 CVCS may not be available to failures of the Unit 2 Charging Pumps. Failure of the Unit 2 Charging Pumps can be mitigated by manually aligning the Unit 1 Charging Pumps to inject through the Unit 2 BIT. This requires manual valve 2-CS-302 be closed and manual valves 2-CS-534 and 1-CS-536 be opened. When injecting through the Unit 2 BIT either 2-ICM-250 or 2-ICM-251 need to be open. Both of these valves could fail closed due to a fire within AA44. Failure of the valves to open can be mitigated by de-energizing and manually opening one of them. These actions are being retained to ensure Unit 2 CVCS is maintained.

Based on the assessment in support of the Fire Risk Evaluation, defense-in-depth is maintained for fire area AA44. Refer to Attachment 2 for details associated with the Fire Risk Evaluation.

### 3.9 Monitoring Program Input

A Monitoring Program will be developed in accordance with FAQ 10-0059, Rev. 1. Methods to monitor availability, reliability, and performance of fire protection program structures, systems, and components (SSCs), as well as programmatic elements will be provided. Additionally, effectiveness measures are established to review program related performance and trends. For AA44 the following systems and features are candidates for inclusion in the CNP Fire Protection Monitoring Program:

- Fire Area boundary barriers discussed in Section 3.1
- Fire Detection System
- Manual Fire Suppression System
- Cable tray covers

### 4.0 CONCLUSION

The nuclear safety and radioactive release performance criteria of NFPA 805 are met for a fire in Fire Area AA44. This Fire Risk Evaluation for Fire Area AA44 has demonstrated that

- The change in core damage frequency (delta CDF) is acceptable, and
- The change in large early release frequency (delta LERF) is acceptable, and
- Defense-in-depth and safety margins are maintained.

This is confirmation that a success path effectively remains free of fire damage and that the

performance-based approach is acceptable per Section 4.2.4.2 of NFPA 805.

## **5.0 REFERENCES**

- 5.1 Calculation PRA-FIRE-NB-CRE, Fire PRA Cumulative Risk Evaluations
- 5.2 CNP Fire Pre-Plans, Volumes I, II, and III, Revisions 17, 14, and 18 respectively
- 5.3 Fire Hazards Analysis
- 5.4 NFPA 805, Performance-Based Standard for Fire Protection for Light Water Reactor Electric Generating Plants
- 5.5 NFPPM, NFPA 805 Fire Protection Program Manual (NFPPM)
- 5.6 Nuclear Energy Institute (NEI) 04-02, Guidance for Implementing a Risk-Informed, Performance-Based Fire Protection Program under 10 CFR 50.48(c), Rev. 2
- 5.7 Nuclear Safety Capability Assessment Report
- 5.8 PRA-NB-FIRE-FQ, Fire PRA Model Quantification Notebook
- 5.9 PRA-NB-FIRE-FSS, Fire PRA Fire Scenario Selection
- 5.10 R1900-0411-AA44, AA44 - Detailed Fire Modeling Report
- 5.11 Regulatory Guide 1.205, Risk-Informed, Performance-Based Fire Protection for Existing Light-Water Nuclear Power Plants, Rev. Revision 1
- 5.12 Technical Evaluation R1900-005-001, Non-Power Operation Modes Transition Review

**Fire Area AA44 – Attachment 1 - Table B-3 - Fire Area Transition**

<u>Unit</u>	<u>Fire Area</u>	<u>Description</u>
2	AA44	Unit 2 Emergency Power Systems Area (El. 609 ft. 6 in.)

**Fire Zone Description**

46A	EPS Transformer Room - El. 609 ft. 6 in. - Unit 2
46B	EPS Control Rod Drive Room - El. 609 ft. 6 in. - Unit 2
46C	EPS Motor Control Room - El. 609 ft. 6 in. - Unit 2
46D	EPS (AB) Battery Room - El. 609 ft. 6 in. - Unit 2

**Regulatory Basis**

4.2.4.2 - Performance-Based Approach - Fire Risk Evaluation with simplifying deterministic assumptions

<b>Performance Goal</b>	<b>Method of Accomplishment</b>	<b>Comments</b>
Reactivity Control	Unit 2 - Trip the reactor from the Control Room. Borate using Unit 1 East or West Charging Pump supplied from the Unit 1 RWST. Use alternate source range monitoring for indication.	None
Inventory and Pressure Control	Unit 2 - Control inventory using Unit 1 East or West Charging Pump. Control pressure using Unit 2 Pressurizer Safety Relief Valves.	VFDRs identified for CVCS and RCS integrity.
Decay Heat Removal	Unit 2 - Feed SGs 2 & 3 with Unit 1 West MDAFW Pump. The DHR function also requires MS isolation with a steam release path through the Safety Relief Valves.	VFDRs identified for AFW.
Process Monitoring	Unit 2 Process Monitoring - Use Unit 2 alternate process monitoring powered from Unit 1 at the local shutdown panels for the following: Pressurizer level, RCS pressure and temperature, and S/G level and Pressure. Unit 2 Source Range Monitoring - Use Unit 2 alternate source range monitoring powered from Unit 1 at the local shutdown panels.	VFDRs identified for process monitoring and source range monitoring.
Vital Auxiliaries	Unit 2 Electrical - Unit 2 Power not available requiring alternate shutdown power from Unit 1. Control Unit 1 Red (AB) Train Electrical Distribution with Unit 1 Red (AB) Train Offsite Power or Unit 1 Red (AB) DG. Control Unit 1 Green (CD) Train Electrical Distribution with Unit 1 Green (CD) Train Offsite Power to Unit 1 Green (CD) DG. Unit 2 ESW - Operate Unit 1 East or West ESW to support alternate	None

**Fire Area AA44 – Attachment 1 - Table B-3 - Fire Area Transition**

<u>Unit</u>	<u>Fire Area</u>	<u>Description</u>
2	AA44	Unit 2 Emergency Power Systems Area (El. 609 ft. 6 in.)
		shutdown of Unit 2. Unit 2 CCW - Operate Unit 1 East or West CCW to support alternate shutdown of Unit 2. Unit 2 HVAC - Unit 2 Control Room HVAC is not required as alternate shutdown is utilized for this area. Operate Unit 1 Control Room HVAC. Unit 2 Auxiliary Building HVAC in not operational, Unit 1 Auxiliary Building HVAC remains available and provides adequate cooling. Operate Unit 1 Red (AB) and Green (CD) DG HVAC. Operate Unit 1 Red (AB) and Green (CD) Switchgear HVAC. Operate Unit 1 West AFW Room HVAC. Operate Unit 1 ESW HVAC.

**Reference Documents**

Genesis Solution Suite, EDISON / SAFE-PB, DC Cook V 3.4.0

Nuclear Safety Capability Assessment Report

**Licensing Actions**

None

**Existing Engineering Equivalency Evaluations (EEEE)**

**EEEE Title** Engineering Equivalency Evaluation 11-6 - Unit 2 Emergency Power Systems/4 KV Switchgear Complex Ventilation Shaft Boundary Evaluation (Fire Areas AA45A, AA45B, AA43, AA44 and AA52).

**Summary** The purpose of this engineering equivalency evaluation is to document the acceptability of unrated fire barrier penetration seals between the Unit 2 EPS/4KV switchgear complex ventilation shafts in Fire Zones 45 (Fire Area AA43), 46A through 46D (Fire Area AA44), 47A (Fire Area AA45A) and 47B (Fire Area AA45B), and the Unit 2 switchgear cable spreading room in Fire Zone 60 (Fire Area AA52).

Reasonable assurance is provided that a fire in Fire Areas AA43, AA44, AA45A, AA45B or AA52 would not impair safe shutdown capabilities of Unit 2. This engineering equivalency evaluation does not impact other engineering equivalency evaluations.

The fire barrier penetration seals were evaluated and found to be acceptable based on the fire hazards, fire protection systems and construction features within the evaluated areas.



**Fire Area AA44 – Attachment 1 - Table B-3 - Fire Area Transition**

<u>Unit</u>	<u>Fire Area</u>	<u>Description</u>
2	AA44	Unit 2 Emergency Power Systems Area (El. 609 ft. 6 in.)

<b><u>EEEE Title</u></b>	<b>Engineering Equivalency Evaluation 11-9 - Turbine, Auxiliary and Containment Buildings Boundary Evaluation</b>
<b><u>Summary</u></b>	<p>The purpose of this engineering equivalency evaluation is to describe in general, the approach and existence of evaluations performed to determine and reconcile fire area boundaries having components or designs with less than a 3-hr fire rating on preventing the spread of fire. This engineering equivalency evaluation also specifically evaluates the impact of unrated door assemblies on the spread of fire.</p> <p>Reasonable assurance is provided that the fire area boundaries having components or design less than a 3-hr fire rating will not increase the spread of fire or impair the safe shutdown capabilities of Units 1 or 2. In addition, this engineering equivalency evaluation does not adversely impact on other engineering equivalency evaluations or exemption requests.</p> <p>This evaluation supports additional evaluations credited in this fire area.</p>
<b><u>EEEE Title</u></b>	<b>Engineering Equivalency Evaluation 11-15 - Switchgear Room Construction Boundary Room Evaluation Fire Zones 40A, 40B, 41, 42A, 45, 46A, 47A and 47B (Fire Areas AA39A, AA39B, AA40, AA41, AA43, AA44, AA45A and AA45B)</b>
<b><u>Summary</u></b>	<p>The purpose of this engineering equivalency evaluation is to document the acceptability of the construction features of the switchgear rooms which have a fire resistance rating of less than 3 hours and their impact on the spread of fire. In particular, fire doors having a 1 1/2-hr fire rating and open penetrations are analyzed by this engineering equivalency evaluation, as other unrated construction features have been previously analyzed under separate engineering equivalency evaluations. The applicable Fire Areas in Unit 1 are AA39A, AA39B, AA40 and AA41. The applicable Fire Areas in Unit 2 are AA43, AA45A and AA45B.</p> <p>Reasonable assurance is provided that the construction features of the switchgear rooms which have a fire resistance rating of less than 3 hours will prevent the spread of fire and not impair the safe shutdown capabilities of Unit 1 and Unit 2. This engineering equivalency evaluation does not impact other engineering equivalency evaluations.</p> <p>The switchgear room boundaries were evaluated and found to be acceptable based on the fire hazards and fire protection systems within the areas.</p>

**Fire Area AA44 – Attachment 1 - Table B-3 - Fire Area Transition**

<u>Unit</u>	<u>Fire Area</u>	<u>Description</u>
2	AA44	Unit 2 Emergency Power Systems Area (El. 609 ft. 6 in.)

<b><u>EEEE Title</u></b>	<b>Engineering Equivalency Evaluation 12-19 - CO2 Fire Suppression System Concentrations (Fire Areas AA7, AA8, AA9, AA10, AA29, AA30, AA31, AA37, AA38, AA39, AA40, AA41, AA43, AA44, AA45, AA48, AA49, AA50, AA51, AA52 and AA53)</b>
<b><u>Summary</u></b>	<p>The purpose of this engineering equivalency evaluation is to document the acceptability of the CO2 fire suppression systems in fire zones containing concentrations of cable insulation and the potential for deep-seated fires. This engineering equivalency evaluation determines the CO2 system's impact on the spread of fire and previous engineering equivalency evaluations and exemption requests. Although there are other fire zones that use CO2 for fire suppression such as the DG Rooms, they are installed to suppress surface-type, combustible liquid fires and are not included in this analysis, because they do not contain significant concentrations of cable insulation capable of producing deep-seated fires.</p> <p>All of the CO2 systems included in this engineering equivalency evaluation are capable of performing their intended function, containing the fire until the Fire Brigade arrives, preventing fire spread to adjacent fire zones, and ensuring that safe shutdown of CNP can be achieved and maintained.</p> <p>The existing suppression systems were evaluated and found to be acceptable based on the fire hazards and fire protection systems within the evaluated areas.</p>

**Fire Suppression Effects on Nuclear Safety Performance Criteria**

The CNP fire brigade is trained to discharge water in a judicious manner and instructed to direct hose streams and portable extinguishers at the base of the fire to limit the amount of overspray beyond the immediate fire zone. For this reason, fire brigade activities are not expected to fail components not already considered damaged by fire. It has been concluded that water impingement on cables is not a concern. Electrical cabinets are provided with a seal at the conduit interface. Per visual inspection any side vents for this equipment are pointed downward to prevent water intrusion. The drainage features of the fire area mitigate the potential for flooding damage due to fire suppression, such that the standing water would not affect credited equipment.

In the event of discharge, the CO2 system will not adversely affect the equipment operating within the fire area. Potential condensation developing on electrical components is a long term issue that would be eliminated by ventilating the fire area after actuation. Per visual inspection, all CO2 nozzles are located greater than 5 ft. away from any credited equipment and therefore, the possibility of thermal shock due to CO2 actuation has been deemed to be a non-issue in this fire area in accordance to EPRI NP-7253 "Effects of Fire Suppressants on Electrical Components in Nuclear Power Plants". Since it is shown that suppression effects will not impact the nuclear safety performance criteria, the fire area configuration is deemed acceptable.

**References:**

Technical Evaluation 12.1, "Fire Suppression Effects Study"

Technical Evaluation 12.1, "Supplemental Information to Fire Suppression Effects Study – Supplement 1"

**Fire Area AA44 – Attachment 1 - Table B-3 - Fire Area Transition**

<u>Unit</u>	<u>Fire Area</u>	<u>Description</u>
2	AA44	Unit 2 Emergency Power Systems Area (El. 609 ft. 6 in.)

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**Fire Area Comments**

None

## Fire Area AA44 – Attachment 2 - Fire Risk Evaluation Results Summary

### A2.1 Introduction

The ‘changes’ associated with NFPA 805 transition were those variances from the deterministic requirements of NFPA 805. The changes identified for evaluation for fire area AA44 are grouped as follows:

- Separation Issues

This attachment is a summary of the Fire Risk Evaluation for the fire area. The complete results and methodology are contained in the Cumulative Fire Risk Evaluation, PRA-FIRE-NB-CRE. (FPCE 2017-0009)

### A2.2 Inputs/Assumptions

Fire modeling processes and inputs provided in NUREG/CR-6850 are appropriate for use in a risk-informed, performance-based evaluation. The complete list of assumptions used in the fire modeling methodology for this fire area is contained in Detailed Fire Modeling Technical Evaluation R1900-0411-AA44.

### A2.3 Fire Modeling Methodology

Fire PRA fire modeling results are used as the initial input into this Fire Risk Evaluation. The process consists of conservative bounding analyses using NUREG/CR-6850 methods. As needed, refinements are made to utilize more realistic parameters. The complete fire modeling methodology for this fire area is contained in Detailed Fire Modeling Technical Evaluation R1900-0411-AA44.

### A2.4 Scenario Descriptions and Model Results

Fire Area AA44 was evaluated for the impact of fires originating from both fixed and transient ignition sources. Complete descriptions of each fire scenario is contained within the Detailed Fire Modeling Technical Evaluation R1900-0411-AA44.

#### A2.4.1 Ignition Sources

Fire Area AA44 contains 600V switchgear bus 21A and 21C, 250Vdc batteries, the North and South MG sets and various rod control and distribution cabinets. Per discussion with plant personnel, the heat release rates for all switchgear, load centers, and MCC electrical cabinets have been characterized as qualified cable because items of this nature are generally constructed on-site. For other electrical cabinet types, where the internal cable qualification was unknown, the heat release rates have been assumed as non-qualified. Ignition sources in Fire Area AA44 were modeled using the 98th percentile fire as a screening approach and later refined based on the risk significance of the scenario. 75th percentile fires were postulated for 21A, 21C, 2-TR-LTG-8, 2-AB2E, 2-TR-LTG-9N, 2-TR-LTG-9S, 2-DAB, 2-MCAB, 2-MDAB, 2-CRID-3-INV, 2-TDAB and 2-TE2E. For the high voltage load center, both an electrical fire and a high energy arcing fault (HEAF) fire scenario have been developed.

In Fire Area AA44, the 98th percentile HRR was used for all transient fires. The 98th percentile HRR bounds the possible transient ignition sources expected for this fire area, which were fire tested and identified in NUREG/CR-6850, Appendix G, Table G-7.

#### A2.4.2 Scenario Results

A delta risk calculation has been performed to quantify the risk associated with the VFDRs in the fire area.

## **Fire Area AA44 – Attachment 2 - Fire Risk Evaluation Results Summary**

### **A2.5 Fire Risk Evaluation Results**

PRA-FIRE-NB-CRE documents scenarios and corresponding impacted VFDRs that were evaluated for delta risk during the transition to NFPA 805 and also all changes to the Fire Protection Program that are currently incorporated into the Fire PRA model. The acceptability of the Cumulative Fire Risk Evaluations was based on calculated delta risk meeting the thresholds of NEI 04-02, RG 1.205 and RG 1.174. (FPCE 2017-0009)

## Fire Area AA44 – Attachment 2 - Fire Risk Evaluation Results Summary

### A-2.6 Impact of VFDR on Defense-in-Depth

Defense-in-Depth has been evaluated for this fire area. The impacts of this evaluation are summarized in the table below:

Defense-in-Depth Impact Review for AA44			
Method of Providing DID	Required to Support Deterministic Analysis or Fire PRA?	Changes or Improvements Necessary for DID?	Basis/Justification
Echelon 1: Prevent fires from starting			
Combustible Control is implemented in accordance with Procedure PMP-2270-CCM-001, Control of Combustible Materials.	Yes	No	• This element is adequate based on no perceived weakness of, or over-reliance on, another echelon of defense-in-depth.
Hot Work Control is implemented in accordance with Procedure PMP-2270-WBG-001, Welding, Burning and Grinding Activities.	Yes	No	
Echelon 2: Rapidly detect, control and extinguish promptly those fires that do occur thereby limiting fire damage			
Fire Detection System	Yes	No	• Since fire fighting activities are not expected to be challenging, suppression is not required. Detection is already required. Therefore, no changes or improvements to Echelon 2 attributes are necessary to maintain defense-in-depth.
Fixed Fire Suppression	No	No	
Portable Fire Extinguishers	Yes	No	
Hose stations and hydrants	Yes	No	
Pre-Fire Plan	Yes	No	
Echelon 3: Provide adequate level of fire protection for systems and structures so that a fire will not prevent essential safety functions from being performed			
Walls, floors ceilings and structural elements are rated or have been evaluated as adequate for the hazard.	Yes	No	• Although VFDR AA44-001 and 003 are not considered a significant contribution to core damage frequency, the variance is considered important enough to the NSCA to retain as a recovery action to ensure that defense-in-depth is maintained.  • Where the remaining variances can possibly be affected in a potentially high risk scenario, based on a detailed review, the VFDRs are either not the cause for the high risk of the scenario or the mitigating recovery action is credited; therefore no changes or improvements to Echelon 3 attributes are necessary to maintain defense-in-depth.
Penetrations in the fire area barrier are rated or have been evaluated as adequate for the hazard.	Yes	No	
Supplemental barriers (e.g., ERFBS, cable tray covers, etc.)	Yes	No	
Guidance provided to operations personnel detailing the required success path(s) including recovery actions to achieve nuclear safety performance criteria.	Yes	Yes	

## Fire Area AA44 – Attachment 2 - Fire Risk Evaluation Results Summary

### A-2.7 Safety Margin Considerations

In accordance with NEI 04-02, the maintenance of adequate Safety Margin is assessed by the consideration categories of analyses utilized by this Fire Risk Evaluation.

Safety margins are considered to be maintained if:

- Codes and Standards or their alternatives accepted for use by the NRC are met.

AND

- Safety analyses acceptance criteria in the licensing basis (e.g., FSAR, supporting analyses) are met, or provides sufficient margin to account for analysis and data uncertainty.

The following summarizes the bases for ensuring the maintenance of safety margins:

- The risk-informed, performance based processes utilized are based upon NFPA 805, 2001 edition, endorsed by the NRC in 10 CFR 50.48(c).
- The Fire Risk Evaluation process is in accordance with NEI 04-02, Revision 2, which is endorsed by the NRC in Regulatory Guide 1.205, Revision 1.
- The Fire PRA is developed in accordance with NUREG/CR-6850, which was developed jointly between the NRC and EPRI.
- The Fire PRA has undergone an industry peer review, in order to ensure the Fire PRA meets the appropriate quality standards of ASME/ANS RA-Sa-2009, "Standard for Level 1/Large Early Release Frequency Probabilistic Risk Assessment for Nuclear Power Plant Applications," Dated February 2, 2009
- The "combined analysis approach" is used during transition (NEI 04-02, Section 5.3.4.3); therefore, MEFS/LFS is not analyzed separately from the Fire PRA results.
- The CNP internal events PRA model received two formal industry peer reviews conducted in accordance with applicable NEI guidelines. The initial peer review was performed in 2001, while a subsequent focused scope (i.e., limited scope) peer review was conducted in 2009. The initial, full-scope WOG peer review covered all aspects of the CNP PRA model and the administrative processes used to maintain and update the model. The CNP PRA model has been revised to address all significant issues (i.e., Category A and B Facts & Observations) identified during the initial peer review. None of the findings from the focused-scope peer review were judged to reach the significance level of a Category A or B Fact & Observation; as a result, no changes to the PRA model have yet been made to include resolutions for these latter issues.
- Fire protection systems and features determined to be required by NFPA 805 Chapter 4 have been confirmed to meet the requirements of NFPA 805 Chapter 3 and their associated referenced codes and listings, or provided with acceptable alternatives using processes accepted for use by the NRC (i.e., FAQ 06-0008, FAQ 06-0004, 07-0033).
- Fire modeling performed in support of the transition has been performed within the Fire PRA utilizing codes and standards developed by industry and NRC staff which have been verified and validated in authoritative publications, such as NUREG 1824, "Verification and Validation of Selected Fire Models for Nuclear Power Plant Applications". In general, the fire modeling performed in support of the Fire Risk Evaluations has been performed using conservative methods and input parameters that are based upon

## **Fire Area AA44 – Attachment 2 - Fire Risk Evaluation Results Summary**

NUREG/CR-6850 as documented in the AA44 Detailed Fire Modeling Report, section 7.2. While this is generally not ideal in the context of best estimate probabilistic risk analysis, it is a pragmatic approach given the current state of knowledge regarding the uncertainties related to the application of the fire modeling tools and associated input parameters for specific plant configurations.

- In accordance with the requirements of 10 CFR 50.48(c)(2)(iii), the Fire PRA results, including cutsets for the scenarios of concern, have been reviewed and it was verified that the results presented above do not rely solely on feed and bleed as the fire-protected safe shutdown path for maintaining reactor coolant inventory, pressure control, and decay heat removal capability for this fire area.

### **A-2.8 Transition Risk Evaluation Conclusions**

The transition change evaluation determined that these changes:

- Are acceptable based upon the measured change in CDF and LERF
- Maintained adequate defense-in-depth and safety margins

The results of this evaluation meet the requirements of NFPA 805 Risk Evaluation; therefore, the use of the performance based analysis approach is acceptable.





## 1.0 PURPOSE

This report documents the Fire Safety Analysis (FSA) for Cook Nuclear Plant (CNP) Fire Area AA45A, Unit 2 AB Switchgear Room (El. 609 ft. 6 in.) which comprises fire zone(s) 47A. The purpose of this analysis is to demonstrate the achievement of the nuclear safety and radioactive release performance criteria of NFPA 805 as required by 10 CFR 50.48(c). The Fire Safety Analysis is a key part of compliance with Section 2.7.1.2 Fire Protection Program Design Basis Document of NFPA 805. This analysis also documents results of risk-informed, performance-based Fire Risk Evaluations (FREs). These evaluations are associated with Variances from Deterministic Requirements (VFDRs) of NFPA 805 Chapter 4.

## 2.0 ANALYSIS METHODOLOGY

The FSA is the design basis document as described in NFPA 805 Section 2.7.1.2. The following steps are performed to develop the FSA on a fire area basis:

- Identify significant fire hazards in the fire area. This is based on NFPA 805 approach to analyze the plant from an ignition source and fuel package perspective.
- Summarize Nuclear Safety Capability Analysis (NSCA) compliance strategies. This is the result of the NEI 04-02 B-3 Table review of the Safe Shutdown Analysis.
- Summarize Non-Power Operations Modes compliance strategies.
- Summarize Radioactive Release compliance strategies. The transition review process required per NEI 04-02 is used to develop these results.
- Provide Fire Probabilistic Risk Assessment summary of results. This is based on the results from the plant Fire PRA.
- Perform risk informed, performance based evaluations if needed for the performance based approach.
- Summarize Defense-in-Depth strategy for each fire area.
- Determine key analysis assumptions which are candidates to be included in the NFPA 805 monitoring program.
- Provide conclusions relative to NFPA 805 compliance.

### **3.0 ANALYSIS**

#### **3.1 Classical Fire Protection**

##### **3.1.1 Construction**

Walls, floors and ceilings to adjacent fire areas and fire zones areas are reinforced concrete in excess of a 3-hour rating.

A fire area boundary evaluation was performed for the construction features (i.e. fire doors, undampered ventilation duct, and open penetrations) of the switchgear rooms which have a fire resistance rating of less than 3 hours (Engineering Equivalency Evaluation 11-15).

Applicable Engineering Equivalency Evaluations are documented in Attachment 1.

##### **3.1.2 Doors and Access Openings**

A fire door having a 3-hour rating is provided to adjacent Fire Area AA43 - Fire Zone 45.

##### **3.1.3 Penetrations**

Penetrations in fire barriers between this fire zone and adjacent fire areas, fire zones and the yard are provided with fire seals.

A fire area boundary evaluation was performed for the unrated fire barrier penetrations between Fire Area AA43 - Fire Zone 45, Fire Area AA44 - Fire Zones 46A, 46B, 46C, 46D, Fire Areas AA45A and AA45B - Fire Zones 47A, 47B and Fire Area AA52 - Fire Zone 60 (Engineering Equivalency Evaluation 11-6).

A fire area technical evaluation was prepared to evaluate a fire seal design between Fire Zones 47A and 47B. (Engineering Equivalency Evaluation 11-28.)

Seismic expansion gaps are sealed with a glass fiber reinforced silicone sheeting.

### 3.1.4 Detection

The table below outlines the fire detection system(s) provided in the Fire Area:

Table 3-1, Fire Area AA45A Detection Systems								
Fire Zone	Type of System	Local (L) / Remote (R)	Detection Actuates Suppression?	Required System?				
				S	L	E	R	D
47A	Infrared	L/R	Y	Y	N	Y	Y	N
47A	Ionization	L/R	N	Y	N	Y	Y	N

**Table 3-1 Legend:**

Table Field: "Required System?"	
S	- Required for Chapter 4 Separation Criteria
L	- Required for NRC Approved Licensing Action
E	- Required for Engineering Equivalency Evaluation
R	- Required for Risk Significance
D	- Required to maintain adequate balance of Defense-in-Depth in a Change Evaluation or Fire Risk Evaluation

Cross zoned ionization smoke detectors (2) and infra-red detectors (3) which alarm in the Unit 2 Control Room are provided. The ionization detectors are part of a larger detection circuit which includes Fire Zones 47A and 47B.

### 3.1.5 Fixed Suppression

The table below outlines the fixed fire suppression system(s) provided in the Fire Area:

Table 3-2, Fire Area AA45A Suppression Systems							
Fire Zone	Type of System	Full (F) / Partial (P)	Required System?				
			S	L	E	R	D
47A	Automatic CO2	F	Y	N	Y	N	N
Table 3-2 Legend:							
Table Field: "Required System?"							
S	- Required for Chapter 4 Separation Criteria						
L	- Required for NRC Approved Licensing Action						
E	- Required for Engineering Equivalency Evaluation						
R	- Required for Risk Significance						
D	- Required to maintain adequate balance of Defense-in-Depth in a Change Evaluation or Fire Risk Evaluation						

A low pressure CO2 total flooding system supplied from the 17 ton tank is provided. This system is automatically actuated. Operation of this system discharges CO2 simultaneously into Fire Zones 47A and 47B.

### 3.1.6 Manual Suppression / Response Strategy

A postulated fire will be identified by early detection using ionization type smoke detection, infra-red detection or by plant personnel using plant communication system to notify the control room.

The automatic detection systems alarm in the control room. The Control Room operator will dispatch the fire brigade for initiation of manual fire fighting. A fire in this fire area will be contained by the construction features discussed in Section 3.1.1. Manual suppression is provided by the CNP Fire Brigade.

There are fire extinguishers located in this fire zone.

Water hose reels are also located in adjacent areas, Turbine Building Fire Zone 97, and in Fire Zone 34A.

Floor drains are available in this fire area.

### 3.1.7 Ventilation

A fire in this area will be contained by the fire barriers. Smoke can be removed by portable fans and flexible ducting to the Turbine Building and outdoors. The normal building ventilating systems in the Auxiliary Building will then exhaust the smoke via filtered monitored pathways. This fire area is listed as a non-controlled area in the Fire Pre Plans and therefore there is reasonable assurance that products of combustion will not be contaminated.

There are 4-hour rated undampered ventilation shafts in the ceiling which pass through Fire Area AA52 - Fire Zone 60 to the yard.

### 3.1.8 Other Features

For Fire Zone 47A, Electrical Raceway Fire Barrier Systems (ERFBS) with a rating of a 1-hour are provided, where required.

Some cable trays within Fire Area AA45A are provided with bottom covers and/or are fully enclosed.

## 3.2 Fire Hazards Identification

The fire area contains both ignition sources and combustible fire hazards. The ignition sources consist of 4kV busses, plant heater, electric bay miscellaneous power panel and transformers for Bus A and B. Combustibles consist primarily of cable insulation, rubber and plastics.

The exterior fire hazards that are adjacent to exterior walls are the Unit 2 Main and Auxiliary Transformers. The Main Transformers are approximately 25ft away and the Auxiliary Transformers are approximately 10ft away and provided with missile barriers. Water spray suppression systems are provided for the transformers. In addition, reinforced concrete walls and 3 hour rated fire seals provide separation for the Fire Area. The missile barriers the Auxiliary Transformers also provide a measure of fire barrier protection, limiting radiant heat in the direction of the Fire Area. The fixed suppression, spatial separation and rated construction are sufficient to provide protection for credited equipment within the plant.

The current fire loading classification is considered low.

## 3.3 NSCA Compliance Summary

Fire Area AA45A, the Unit 2 Red Train Switchgear Room (EL. 609'-6"), contains the Unit 2 Red Train (AB) 4kV non-safety and safety buses, supporting equipment and Red and Green train cables,

conduits and raceways.

Compliance with the nuclear safety performance criteria is achieved using the performance-based approach in accordance with NFPA 805, Section 4.2.4.2.

Safe and stable condition of Unit 2 will be accomplished using Steam Generators 2 and 3 via the Unit 2 East Motor Driven Auxiliary Feedwater Pump, Control Room Process Monitoring, Unit 2 Charging via the East Pump, Unit 2 Component Cooling Water via the East Pump and Unit 2 Essential Service Water via the East Pump. Electrical power is supplied to the Green Train via Emergency Diesel CD with reliance on the Green Train 250VDC Battery for initial component operations.

The Nuclear Safety Performance Criteria compliance strategy for AA45A is documented within the NSCA Report.

### 3.3.1 Variances

The variances identified for evaluation for this fire area are grouped as follows:

#### 3.3.1.1 VFDR No. AA45A-001

2-ILS-950 and 2-ILS-951 - RWST level indication is required to support CVCS. CVCS is required to be operable to maintain inventory, pressure and reactivity control. The RWST is the primary credit borated water source for CVCS. 2-ILS-950 may fail due to fire induced damage of 120V Instrument Distribution Panel 2-CRID-III. 2-ILS-951 may fail due to fire induced damage of 120V Instrument Distribution Panel 2-CRID-IV. This condition represents a variance from deterministic requirements of NFPA 805, Section 4.2.3. This is a separation issue.

This VFDR has been evaluated and it was determined that the risk, safety margin and defense-in-depth meet the acceptance criteria of NFPA 805 Section 4.2.4 with no further action required.

### 3.3.2 Recovery Actions Credited

For each VFDR, a Fire Risk Evaluation has been performed to assess the acceptability of risk, defense-in-depth, and safety margin. This evaluation determined whether or not recovery actions are required to ensure that one success path necessary to achieve and maintain the nuclear safety performance criteria is maintained free of fire damage by a single fire. Table 3-3 identifies the credited recovery actions for this area. Actions retained for DID are identified as “DID Actions” within Table 3-3. Additional information for DID actions is contained within Section 3.8 of this report. Note that, for completeness, all VFDRs are contained within Table 3-3, even if the Fire Risk Evaluation has determined that a recovery action is not required. In those instances where a recovery action has been determined to not be required, the word “None” is provided in the “Action” column in the table.

Table 3-3, Recovery Actions Credited		
VFDR	Component	Action
AA45A-001	2-ILS-950	None
	2-ILS-951	

### 3.4 Non-Power Operational Modes Compliance Summary

A review of CNP for the potential effects of a fire in this Fire Area while in non-power modes of operation (NPO) was conducted. This review was conducted using the guidance provided in NEI 04-02 and FAQ 07-0040, "Non-Power Operations Clarifications".

The review determined that there are potential failures that affect certain Key Safety Functions (KSF) as a result of the fire in this area, and the fire could result in the loss of one or more KSF paths. Compensatory measures are required during high risk evolution periods to provide reasonable assurance a fire will not adversely affect key safety functions and the NFPA 805 performance goal for NPO is therefore satisfied. The results of the NPO analysis are contained within Technical Evaluation R1900-005-001, Non-Power Operation Modes Transition Review Report.

### **3.5 Radioactive Release Compliance Summary**

The NFPA 805 radiological release goal is to provide reasonable assurance that a fire will not result in a radiological release that adversely affects the public, plant personnel or the environment. The NFPA 805 requirement is to ensure a radiation release to any unrestricted area due to the direct effects of fire suppression activities (but not involving fuel damage) shall be as low as reasonably achievable and shall not exceed applicable plant Technical Specification limits.

AA45A is located outside the Radiological Controlled Area (RCA) and is not a storage location for contaminated materials, therefore there is reasonable assurance a fire in this area will not result in radiation release. The review of this fire area, with respect to radioactive release, is documented in the NFPPM.

### **3.6 Probabilistic Risk Assessment-Summary of Results**

A Fire PRA (FPRA) quantification of Fire Area AA45A was performed and is documented in PRA-NB-FIRE-FQ, Fire PRA Model Quantification Notebook. The fire risk quantification for Fire Area AA45A is analyzed using detailed fire modeling to consider risk of fire scenarios of ignition sources. PRA-NB-FIRE-FQ includes a summary of all potentially risk-significant fire scenarios (i.e., CDF > 1.0E-7 or LERF > 1.0E-8). Bounding CDF / LERF per calendar year values are reported that are based on the risk values documented in PRA-NB-FIRE-FSS, Fire PRA Fire Scenario Selection.

Fire Protection features credited in the Fire PRA are documented in R1900-0411-AA45A, Detailed Fire Modeling Report: Fire Compartment: AA45A Unit 2 AB Switchgear Room (EL. 609 FT. 6 IN.). PRA-NB-FIRE-FSS documents the revision level of the fire modeling reports used in the most recent Fire PRA quantification.

### **3.7 Risk-Informed, Performance-Based Evaluations**

Fire Risk Evaluations (FREs) have been performed to ensure that variances from the NFPA 805 deterministic requirements are acceptable. The evaluation process consists of an integrated assessment of the acceptability of risk, defense-in-depth, and safety margins.

#### **3.7.1 Transition Risk-Informed, Performance-Based Evaluations**

The ‘changes’ associated with NFPA 805 transition were those variances from the deterministic requirements of NFPA 805 or with the existing fire protection licensing basis that were brought into compliance with the NFPA 805 performance based approach. The change identified for evaluation for Fire Area AA45A is as follows:

- Separation Issues

The Fire Risk Evaluation has determined that the change is acceptable based upon:

- The measured change in CDF and LERF.
- Adequate defense-in-depth and safety margins being maintained.

Refer to Attachment 2 for a summary of results associated with the Fire Risk Evaluations.



### 3.8 Defense-in-Depth

A comprehensive risk-informed, performance-based analysis includes consideration of defense-in-depth (DID) as part of an integrated evaluation of risk considerations. In general, defense-in-depth involves consideration of the extent to which fire protection systems and features are provided within the three echelons of fire-protection:

- Preventing fires from starting,
- Rapidly detecting fires and controlling and extinguishing promptly those fires that do occur, thereby limiting fire damage,
- Providing an adequate level of fire protection for structures, systems, and components important to safety, so that a fire that is not promptly extinguished will not prevent the nuclear safety performance criteria from being met.

Each VFDR was evaluated for DID. No recovery actions have been retained for DID.

Based on the assessment in support of the Fire Risk Evaluation, defense-in-depth is maintained for fire area AA45A. Refer to Attachment 2 for details associated with the Fire Risk Evaluation.

### 3.9 Monitoring Program Input

A Monitoring Program will be developed in accordance with FAQ 10-0059, Rev. 1. Methods to monitor availability, reliability, and performance of fire protection program structures, systems, and components (SSCs), as well as programmatic elements will be provided. Additionally, effectiveness measures are established to review program related performance and trends. For AA45A the following systems and features are candidates for inclusion in the CNP Fire Protection Monitoring Program:

- Fire Area boundary barriers discussed in Section 3.1
- Fire Detection System (infrared and ionization)
- CO2 Suppression System
- Electrical Raceway Fire Barrier Systems (ERFBS)
- Cable tray covers

## 4.0 CONCLUSION

The nuclear safety and radioactive release performance criteria of NFPA 805 are met for a fire in Fire Area AA45A. This Fire Risk Evaluation for Fire Area AA45A has demonstrated that

- The change in core damage frequency (delta CDF) is acceptable, and
- The change in large early release frequency (delta LERF) is acceptable, and
- Defense-in-depth and safety margins are maintained.

This is confirmation that a success path effectively remains free of fire damage and that the performance-based approach is acceptable per Section 4.2.4.2 of NFPA 805.

## **5.0 REFERENCES**

- 5.1 Calculation PRA-FIRE-NB-CRE, Fire PRA Cumulative Risk Evaluations
- 5.2 CNP Fire Pre-Plans, Volumes I, II, and III, Revisions 17, 14, and 18 respectively
- 5.3 Fire Hazards Analysis
- 5.4 NFPA 805, Performance-Based Standard for Fire Protection for Light Water Reactor Electric Generating Plants
- 5.5 NFPPM, NFPA 805 Fire Protection Program Manual (NFPPM)
- 5.6 Nuclear Energy Institute (NEI) 04-02, Guidance for Implementing a Risk-Informed, Performance-Based Fire Protection Program under 10 CFR 50.48(c), Rev. 2
- 5.7 Nuclear Safety Capability Assessment Report
- 5.8 PRA-NB-FIRE-FQ, Fire PRA Model Quantification Notebook
- 5.9 PRA-NB-FIRE-FSS, Fire PRA Fire Scenario Selection
- 5.10 R1900-0411-AA45A, AA45A - Detailed Fire Modeling Report
- 5.11 Regulatory Guide 1.205, Risk-Informed, Performance-Based Fire Protection for Existing Light-Water Nuclear Power Plants, Rev. Revision 1
- 5.12 Technical Evaluation R1900-005-001, Non-Power Operation Modes Transition Review

**Fire Area AA45A – Attachment 1 - Table B-3 - Fire Area Transition**

<u>Unit</u>	<u>Fire Area</u>	<u>Description</u>
2	AA45A	Unit 2 AB Switchgear Room (El. 609 ft. 6 in.)

<u>Fire Zone</u>	<u>Description</u>
47A	4KV AB Switchgear Room - El. 609 ft. 6 in. - Unit 2

**Regulatory Basis**

4.2.4.2 - Performance-Based Approach - Fire Risk Evaluation with simplifying deterministic assumptions

<b>Performance Goal</b>	<b>Method of Accomplishment</b>	<b>Comments</b>
Reactivity Control	Unit 2 - Trip the reactor from the Control Room. Borate using Unit 2 East Charging Pump supplied from the RWST. Use source range monitoring for indication.	None
Inventory and Pressure Control	Unit 2 - Control inventory using Unit 2 East Charging Pump. Control pressure using Unit 2 Pressurizer Safety Relief Valves.	VFDR identified for RWST level indication.
Decay Heat Removal	Unit 2 - Feed SGs 2 & 3 with Unit 2 East MDAFW Pump. The DHR function also requires MS isolation with a steam release path through the Safety Relief Valves.	None
Process Monitoring	Unit 2 Process Monitoring - Use Unit 2 process monitoring in the Control Room for the following: Pressurizer level, RCS pressure and temperature, and S/G level and Pressure. Unit 2 Source Range Monitoring - Use Unit 2 source range monitoring in the Control Room.	None
Vital Auxiliaries	Unit 2 Electrical - Control Unit 2 Green (CD) Train Electrical Distribution with Unit 2 Green (CD) DG. Unit 2 ESW - Operate Unit 2 East ESW. Unit 2 CCW - Operate Unit 2 East CCW. Unit 2 HVAC - Operate Unit 2 Control Room HVAC. Operate Unit 2 Auxiliary Building HVAC. Operate Unit 2 Green (CD) DG HVAC. Operate Unit 2 Green (CD) Switchgear HVAC. Operate Unit 2 East MDAFW Room HVAC system. Operate the Unit 2 East ESW Room HVAC system.	None

**Fire Area AA45A – Attachment 1 - Table B-3 - Fire Area Transition**

<u>Unit</u>	<u>Fire Area</u>	<u>Description</u>
2	AA45A	Unit 2 AB Switchgear Room (El. 609 ft. 6 in.)

**Reference Documents**

Genesis Solution Suite, EDISON / SAFE-PB, DC Cook V 3.4.0

Nuclear Safety Capability Assessment Report

**Licensing Actions**

None

**Existing Engineering Equivalency Evaluations (EEEE)**

**EEEE Title** Engineering Equivalency Evaluation 11-6 - Unit 2 Emergency Power Systems/4 KV Switchgear Complex Ventilation Shaft Boundary Evaluation (Fire Areas AA45A, AA45B, AA43, AA44 and AA52).

**Summary** The purpose of this engineering equivalency evaluation is to document the acceptability of unrated fire barrier penetration seals between the Unit 2 EPS/4KV switchgear complex ventilation shafts in Fire Zones 45 (Fire Area AA43), 46A through 46D (Fire Area AA44), 47A (Fire Area AA45A) and 47B (Fire Area AA45B), and the Unit 2 switchgear cable spreading room in Fire Zone 60 (Fire Area AA52).

Reasonable assurance is provided that a fire in Fire Areas AA43, AA44, AA45A, AA45B or AA52 would not impair safe shutdown capabilities of Unit 2. This engineering equivalency evaluation does not impact other engineering equivalency evaluations.

The fire barrier penetration seals were evaluated and found to be acceptable based on the fire hazards, fire protection systems and construction features within the evaluated areas.

**Fire Area AA45A – Attachment 1 - Table B-3 - Fire Area Transition**

<u>Unit</u>	<u>Fire Area</u>	<u>Description</u>
2	AA45A	Unit 2 AB Switchgear Room (El. 609 ft. 6 in.)

**EEEE Title Engineering Equivalency Evaluation 11-9 - Turbine, Auxiliary and Containment Buildings Boundary Evaluation**

**Summary** The purpose of this engineering equivalency evaluation is to describe in general, the approach and existence of evaluations performed to determine and reconcile fire area boundaries having components or designs with less than a 3-hr fire rating on preventing the spread of fire. This engineering equivalency evaluation also specifically evaluates the impact of unrated door assemblies on the spread of fire.

Reasonable assurance is provided that the fire area boundaries having components or design less than a 3-hr fire rating will not increase the spread of fire or impair the safe shutdown capabilities of Units 1 or 2. In addition, this engineering equivalency evaluation does not adversely impact on other engineering equivalency evaluations or exemption requests.

This evaluation supports additional evaluations credited in this fire area.

**EEEE Title Engineering Equivalency Evaluation 11-15 - Switchgear Room Construction Boundary Room Evaluation Fire Zones 40A, 40B, 41, 42A, 45, 46A, 47A and 47B (Fire Areas AA39A, AA39B, AA40, AA41, AA43, AA44, AA45A and AA45B)**

**Summary** The purpose of this engineering equivalency evaluation is to document the acceptability of the construction features of the switchgear rooms which have a fire resistance rating of less than 3 hours and their impact on the spread of fire. In particular, fire doors having a 1 1/2-hr fire rating and open penetrations are analyzed by this engineering equivalency evaluation, as other unrated construction features have been previously analyzed under separate engineering equivalency evaluations. The applicable Fire Areas in Unit 1 are AA39A, AA39B, AA40 and AA41. The applicable Fire Areas in Unit 2 are AA43, AA45A and AA45B.

Reasonable assurance is provided that the construction features of the switchgear rooms which have a fire resistance rating of less than 3 hours will prevent the spread of fire and not impair the safe shutdown capabilities of Unit 1 and Unit 2. This engineering equivalency evaluation does not impact other engineering equivalency evaluations.

The switchgear room boundaries were evaluated and found to be acceptable based on the fire hazards and fire protection systems within the areas.

**Fire Area AA45A – Attachment 1 - Table B-3 - Fire Area Transition**

<u>Unit</u>	<u>Fire Area</u>	<u>Description</u>
2	AA45A	Unit 2 AB Switchgear Room (El. 609 ft. 6 in.)

<b><u>EEEE Title</u></b>	<b>Engineering Equivalency Evaluation 11-24 - Fire Retention Capability of Nonconforming Fire Seals in Fire Zones having a Low Combustible Loading Classification</b>
<b><u>Summary</u></b>	<p>The purpose of this engineering equivalency evaluation is to document the acceptability of fire seal designs which do not meet the requirements of the installation specification or fire test data in fire zones having a low combustible loading classification would have on preventing the spread of fire.</p> <p>Reasonable assurance is provided that fire seals which do not meet the requirements of the installation specification or fire test data in fire zones having a low combustible loading classification, will provide adequate fire retention capabilities and will not impair the safe shutdown capabilities of CNP or increase the spread of fire between fire zones. In addition, this engineering equivalency evaluation does not adversely impact other engineering equivalency evaluations or exemptions.</p> <p>Refer to Engineering Equivalency Evaluation 11.28.</p>
<b><u>EEEE Title</u></b>	<b>Engineering Equivalency Evaluation 11-28 - Generic Fire Seal Design 2 (Fire Areas AA7, AA8, AA39A, AA40, AA43, AA45A, AA45B, AA48 and AA52)</b>
<b><u>Summary</u></b>	<p>The purpose of this engineering equivalency evaluation is to document the acceptability of deviations to Generic Fire Seal Design 2 on preventing the spread of fire. The applicable Fire Areas include AA7, AA8, AA39A, AA40, AA43, AA54A, AA54B, AA48 and AA52.</p> <p>Reasonable assurance is provided that deviations to Generic Fire Seal Design 2, Fire Seals W7109, W7952, F8150, F8152, F8162, F8184, F8859, F8861, F8863, F8887 and W9058, and the attributes discussed in the engineering equivalency evaluation do not impair the safe shutdown capabilities of CNP or increase the ability of fire to spread between fire zones. This engineering equivalency evaluation does not impact other engineering equivalency evaluations.</p> <p>Attribute Nos. 2, 7, 9 and the 11 fire seals of Generic Fire Seal Design 2 were evaluated and found to be acceptable based on the fire hazards and fire protection systems within the evaluated areas.</p>

**Fire Area AA45A – Attachment 1 - Table B-3 - Fire Area Transition**

<u>Unit</u>	<u>Fire Area</u>	<u>Description</u>
2	AA45A	Unit 2 AB Switchgear Room (El. 609 ft. 6 in.)
<hr/>		
<b><u>EEEE Title</u></b>	<b>Engineering Equivalency Evaluation 11-57 - Fire-Wrapped Cable Trays and Conduit Evaluations (Fire Areas AA32, AA39A, AA45A, and AA2)</b>	
<b><u>Summary</u></b>	<p>The purpose of this engineering equivalency evaluation is document the acceptability of the fire-wrapped cable trays and conduits that are credited in support of NFPA 805 PRA. This review will include the acceptability of the exposed structural supports that support these trays, as well as review the fire wrap for potential damage from high hazard fire sources.</p> <p>CNP uses fire wrap systems over cable trays and conduits to provide 1-hr protection of cables credited for safe shutdown in the event of a fire in compliance with NFPA 805, Chapter 4 separation requirements. Many of these wrapped trays are supported by exposed structural steel. This engineering equivalency evaluation examines the ability of these exposed supports in Fire Areas AA32, AA39A, AA45A and AA2 to withstand the fire exposure presented by combustibles present in the area.</p> <p>Reasonable assurance is provided that the exposed steel structural supports on raceways wrapped in accordance with the requirements of NFPA 805, Chapter 4, will not be adversely affected by the combustibles or hazards present in the area. In addition, the fire-wrap on these raceways is not subject to mechanical damage by high hazard fire sources.</p> <p>The exposed steel structural supports were evaluated and found to be acceptable based on the fire hazards and fire protection systems within the evaluated areas.</p>	
<b><u>EEEE Title</u></b>	<b>Engineering Equivalency Evaluation 12-19 - CO2 Fire Suppression System Concentrations (Fire Areas AA7, AA8, AA9, AA10, AA29, AA30, AA31, AA37, AA38, AA39, AA40, AA41, AA43, AA44, AA45, AA48, AA49, AA50, AA51, AA52 and AA53)</b>	
<b><u>Summary</u></b>	<p>The purpose of this engineering equivalency evaluation is to document the acceptability of the CO2 fire suppression systems in fire zones containing concentrations of cable insulation and the potential for deep-seated fires. This engineering equivalency evaluation determines the CO2 system's impact on the spread of fire and previous engineering equivalency evaluations and exemption requests. Although there are other fire zones that use CO2 for fire suppression such as the DG Rooms, they are installed to suppress surface-type, combustible liquid fires and are not included in this analysis, because they do not contain significant concentrations of cable insulation capable of producing deep-seated fires.</p> <p>All of the CO2 systems included in this engineering equivalency evaluation are capable of performing their intended function, containing the fire until the Fire Brigade arrives, preventing fire spread to adjacent fire zones, and ensuring that safe shutdown of CNP can be achieved and maintained.</p> <p>The existing suppression systems were evaluated and found to be acceptable based on the fire hazards and fire protection systems within the evaluated areas.</p>	

**Fire Area AA45A – Attachment 1 - Table B-3 - Fire Area Transition**

<u>Unit</u>	<u>Fire Area</u>	<u>Description</u>
2	AA45A	Unit 2 AB Switchgear Room (El. 609 ft. 6 in.)

**Fire Suppression Effects on Nuclear Safety Performance Criteria**

The CNP fire brigade is trained to discharge water in a judicious manner and instructed to direct hose streams and portable extinguishers at the base of the fire to limit the amount of overspray beyond the immediate fire zone. For this reason, fire brigade activities are not expected to fail components not already considered damaged by fire. It has been concluded that water impingement on cables is not a concern. Electrical cabinets are provided with a seal at the conduit interface. Per visual inspection any side vents for this equipment are pointed downward to prevent water intrusion. The drainage features of the fire area mitigate the potential for flooding damage due to fire suppression, such that the standing water would not affect credited equipment.

In the event of discharge, the CO2 system will not adversely affect equipment operating within this fire area or in AA45B (which will also discharge). Potential condensation developing on electrical components is a long term issue that would be eliminated by ventilating the fire area after actuation. Per visual inspection, all CO2 nozzles in both fire areas are located greater than 5 ft. away from any credited equipment and therefore, the possibility of thermal shock due to CO2 actuation has been deemed to be a non-issue in this fire area in accordance to EPRI NP-7253 "Effects of Fire Suppressants on Electrical Components in Nuclear Power Plants". Since it is shown that suppression effects will not impact the nuclear safety performance criteria, the fire area configuration is deemed acceptable.

**References:**

Technical Evaluation 12.1, "Fire Suppression Effects Study"

Technical Evaluation 12.1, "Supplemental Information to Fire Suppression Effects Study – Supplement 1"

**Fire Area Comments**

None



## Fire Area AA45A – Attachment 2 - Fire Risk Evaluation Results Summary

### A2.1 Introduction

The ‘changes’ associated with NFPA 805 transition were those variances from the deterministic requirements of NFPA 805. The changes identified for evaluation for fire area AA45A are grouped as follows:

- Separation Issues

This attachment is a summary of the Fire Risk Evaluation for the fire area. The complete results and methodology are contained in the Cumulative Fire Risk Evaluation, PRA-FIRE-NB-CRE. (FPCE 2017-0009)

### A2.2 Inputs/Assumptions

Fire modeling processes and inputs provided in NUREG/CR-6850 are appropriate for use in a risk-informed, performance-based evaluation. The complete list of assumptions used in the fire modeling methodology for this fire area is contained in Detailed Fire Modeling Technical Evaluation R1900-0411-AA45A.

### A2.3 Fire Modeling Methodology

Fire PRA fire modeling results are used as the initial input into this Fire Risk Evaluation. The process consists of conservative bounding analyses using NUREG/CR-6850 methods. As needed, refinements are made to utilize more realistic parameters. The complete fire modeling methodology for this fire area is contained in Detailed Fire Modeling Technical Evaluation R1900-0411-AA45A.

### A2.4 Scenario Descriptions and Model Results

Fire Area AA45A was evaluated for the impact of fires originating from both fixed and transient ignition sources. Complete descriptions of each fire scenario is contained within the Detailed Fire Modeling Technical Evaluation R1900-0411-AA45A.

#### A2.4.1 Ignition Sources

Fire Area AA45A contains 4kV switchgear bus 2A and 2B as well as associated transformers. The fire area also contains a miscellaneous power panel and ventilation supply and exhaust fans. Per discussion with plant personnel, the heat release rates for all switchgear, load centers, and MCC electrical cabinets have been characterized as qualified cable because items of this nature are generally constructed on-site. For other electrical cabinet types, where the internal cable qualification was unknown, the heat release rates have been assumed as non-qualified. Ignition sources in Fire Area AA45A were modeled using the 98th percentile fire as a screening approach. For the high voltage load center, both an electrical fire and a high energy arcing fault (HEAF) fire scenario have been developed.

In Fire Area AA45A, the 98th percentile HRR was used for all transient fires. The 98th percentile HRR bounds the possible transient ignition sources expected for this fire area, which were fire tested and identified in NUREG/CR-6850, Appendix G, Table G-7.

#### A2.4.2 Scenario Results

The PRA analyzed the VFDRs and determined them to be risk insignificant, therefore, a quantitative delta risk calculation was not performed.

### A2.5 Fire Risk Evaluation Results

### **Fire Area AA45A – Attachment 2 - Fire Risk Evaluation Results Summary**

PRA-FIRE-NB-CRE documents scenarios and corresponding impacted VFDRs that were evaluated for delta risk during the transition to NFPA 805 and also all changes to the Fire Protection Program that are currently incorporated into the Fire PRA model. The acceptability of the Cumulative Fire Risk Evaluations was based on calculated delta risk meeting the thresholds of NEI 04-02, RG 1.205 and RG 1.174. (FPCE 2017-0009)

**Fire Area AA45A – Attachment 2 - Fire Risk Evaluation Results Summary****A-2.6 Impact of VFDR on Defense-in-Depth**

Defense-in-Depth has been evaluated for this fire area. The impacts of this evaluation are summarized in the table below:

Defense-in-Depth Impact Review for AA45A			
Method of Providing DID	Required to Support Deterministic Analysis or Fire PRA?	Changes or Improvements Necessary for DID?	Basis/Justification
Echelon 1: Prevent fires from starting			
Combustible Control is implemented in accordance with Procedure PMP-2270-CCM-001, Control of Combustible Materials.	Yes	No	• This element is adequate based on no perceived weakness of, or over-reliance on, another echelon of defense-in-depth.
Hot Work Control is implemented in accordance with Procedure PMP-2270-WBG-001, Welding, Burning and Grinding Activities.	Yes	No	
Echelon 2: Rapidly detect, control and extinguish promptly those fires that do occur thereby limiting fire damage			
Fire Detection System	Yes	No	• Suppression and detection are already required and fire fighting activities are not expected to be challenging; therefore, no changes or improvements to Echelon 2 attributes are necessary to maintain defense-in-depth.
Fixed Fire Suppression	Yes	No	
Portable Fire Extinguishers	Yes	No	
Hose stations and hydrants	Yes	No	
Pre-Fire Plan	Yes	No	
Echelon 3: Provide adequate level of fire protection for systems and structures so that a fire will not prevent essential safety functions from being performed			
Walls, floors ceilings and structural elements are rated or have been evaluated as adequate for the hazard.	Yes	No	• Although VFDR AA45A-001 is affected in a potentially high risk scenario, based on a detailed review, the VFDR is not the cause for the high risk of the scenario, therefore implementing additional DID echelon 3 attributes for this VFDR would provide negligible risk improvement.
Penetrations in the fire area barrier are rated or have been evaluated as adequate for the hazard.	Yes	No	
Supplemental barriers (e.g., ERFBS, cable tray covers, etc.)	Yes	No	
Guidance provided to operations personnel detailing the required success path(s) including recovery actions to achieve nuclear safety performance criteria.	No	No	

## Fire Area AA45A – Attachment 2 - Fire Risk Evaluation Results Summary

### A-2.7 Safety Margin Considerations

In accordance with NEI 04-02, the maintenance of adequate Safety Margin is assessed by the consideration categories of analyses utilized by this Fire Risk Evaluation.

Safety margins are considered to be maintained if:

- Codes and Standards or their alternatives accepted for use by the NRC are met.

AND

- Safety analyses acceptance criteria in the licensing basis (e.g., FSAR, supporting analyses) are met, or provides sufficient margin to account for analysis and data uncertainty.

The following summarizes the bases for ensuring the maintenance of safety margins:

- The risk-informed, performance based processes utilized are based upon NFPA 805, 2001 edition, endorsed by the NRC in 10 CFR 50.48(c).
- The Fire Risk Evaluation process is in accordance with NEI 04-02, Revision 2, which is endorsed by the NRC in Regulatory Guide 1.205, Revision 1.
- The Fire PRA is developed in accordance with NUREG/CR-6850, which was developed jointly between the NRC and EPRI.
- The Fire PRA has undergone an industry peer review, in order to ensure the Fire PRA meets the appropriate quality standards of ASME/ANS RA-Sa-2009, "Standard for Level 1/Large Early Release Frequency Probabilistic Risk Assessment for Nuclear Power Plant Applications," Dated February 2, 2009
- The "combined analysis approach" is used during transition (NEI 04-02, Section 5.3.4.3); therefore, MEFS/LFS is not analyzed separately from the Fire PRA results.
- The CNP internal events PRA model received two formal industry peer reviews conducted in accordance with applicable NEI guidelines. The initial peer review was performed in 2001, while a subsequent focused scope (i.e., limited scope) peer review was conducted in 2009. The initial, full-scope WOG peer review covered all aspects of the CNP PRA model and the administrative processes used to maintain and update the model. The CNP PRA model has been revised to address all significant issues (i.e., Category A and B Facts & Observations) identified during the initial peer review. None of the findings from the focused-scope peer review were judged to reach the significance level of a Category A or B Fact & Observation; as a result, no changes to the PRA model have yet been made to include resolutions for these latter issues.
- Fire protection systems and features determined to be required by NFPA 805 Chapter 4 have been confirmed to meet the requirements of NFPA 805 Chapter 3 and their associated referenced codes and listings, or provided with acceptable alternatives using processes accepted for use by the NRC (i.e., FAQ 06-0008, FAQ 06-0004, 07-0033).
- Fire modeling performed in support of the transition has been performed within the Fire PRA utilizing codes and standards developed by industry and NRC staff which have been verified and validated in authoritative publications, such as NUREG 1824, "Verification and Validation of Selected Fire Models for Nuclear Power Plant Applications". In general, the fire modeling performed in support of the Fire Risk Evaluations has been performed using conservative methods and input parameters that are based upon

## **Fire Area AA45A – Attachment 2 - Fire Risk Evaluation Results Summary**

NUREG/CR-6850 as documented in the AA45A Detailed Fire Modeling Report, section 7.2. While this is generally not ideal in the context of best estimate probabilistic risk analysis, it is a pragmatic approach given the current state of knowledge regarding the uncertainties related to the application of the fire modeling tools and associated input parameters for specific plant configurations.

- In accordance with the requirements of 10 CFR 50.48(c)(2)(iii), the Fire PRA results, including cutsets for the scenarios of concern, have been reviewed and it was verified that the results presented above do not rely solely on feed and bleed as the fire-protected safe shutdown path for maintaining reactor coolant inventory, pressure control, and decay heat removal capability for this fire area.

### **A-2.8 Transition Risk Evaluation Conclusions**

The transition change evaluation determined that these changes:

- Are acceptable based upon the measured change in CDF and LERF
- Maintained adequate defense-in-depth and safety margins

The results of this evaluation meet the requirements of NFPA 805 Risk Evaluation; therefore, the use of the performance based analysis approach is acceptable.



## 1.0 PURPOSE

This report documents the Fire Safety Analysis (FSA) for Cook Nuclear Plant (CNP) Fire Area AA45B, Unit 2 CD Switchgear Room (El. 609 ft. 6 in.) which comprises fire zone(s) 47B. The purpose of this analysis is to demonstrate the achievement of the nuclear safety and radioactive release performance criteria of NFPA 805 as required by 10 CFR 50.48(c). The Fire Safety Analysis is a key part of compliance with Section 2.7.1.2 Fire Protection Program Design Basis Document of NFPA 805.

## 2.0 ANALYSIS METHODOLOGY

The FSA is the design basis document as described in NFPA 805 Section 2.7.1.2. The following steps are performed to develop the FSA on a fire area basis:

- Identify significant fire hazards in the fire area. This is based on NFPA 805 approach to analyze the plant from an ignition source and fuel package perspective.
- Summarize Nuclear Safety Capability Analysis (NSCA) compliance strategies. This is the result of the NEI 04-02 B-3 Table review of the Safe Shutdown Analysis.
- Summarize Non-Power Operations Modes compliance strategies.
- Summarize Radioactive Release compliance strategies. The transition review process required per NEI 04-02 is used to develop these results.
- Provide Fire Probabilistic Risk Assessment summary of results. This is based on the results from the plant Fire PRA.
- Perform risk informed, performance based evaluations if needed for the performance based approach.
- Summarize Defense-in-Depth strategy for each fire area.
- Determine key analysis assumptions which are candidates to be included in the NFPA 805 monitoring program.
- Provide conclusions relative to NFPA 805 compliance.

### **3.0 ANALYSIS**

#### **3.1 Classical Fire Protection**

##### **3.1.1 Construction**

Walls, floors and ceilings to adjacent fire areas and fire zones are reinforced concrete in excess of a 3-hour rating.

A fire area boundary evaluation was performed for the construction features (i.e. fire doors, undampered ventilation duct, and open penetrations) of the switchgear rooms which have a fire resistance rating of less than 3 hours (Engineering Equivalency Evaluation 11-15).

Applicable Engineering Equivalency Evaluations are documented in Attachment 1.

##### **3.1.2 Doors and Access Openings**

Fire doors having a 3-hour rating are provided to adjacent Fire Areas AA43 and AA2 - Fire Zones 45 and 97.

A fire area boundary evaluation was performed for an unrated ceiling hatch to Fire Area AA52 - Fire Zone 60 (Engineering Equivalency Evaluation 9-20).

##### **3.1.3 Penetrations**

Penetrations in fire barriers between this fire zone and adjacent fire areas, fire zones and the yard are provided with fire seals.

A fire area boundary evaluation was performed for the unrated fire barrier penetrations between Fire Area AA43 - Fire Zone 45, Fire Area AA44 - Fire Zones 46A, 46B, 46C, 46D, Fire Areas AA45A and AA45B - Fire Zones 47A, 47B and Fire Area AA52 - Fire Zone 60 (Engineering Equivalency Evaluation 11-6).

A fire area technical evaluation was prepared to evaluate a fire seal design between Fire Zones 47A and 47B. (Engineering Equivalency Evaluation 11-28.)

Seismic expansion gaps are sealed with a glass fiber reinforced silicone sheeting.



### 3.1.4 Detection

The table below outlines the fire detection system(s) provided in the Fire Area:

Table 3-1, Fire Area AA45B Detection Systems								
Fire Zone	Type of System	Local (L) / Remote (R)	Detection Actuates Suppression?	Required System?				
				S	L	E	R	D
47B	Infrared	L/R	Y	N	N	Y	N	N
47B	Ionization	L/R	N	N	N	Y	N	N
Table 3-1 Legend:								
Table Field: "Required System?"								
S	- Required for Chapter 4 Separation Criteria							
L	- Required for NRC Approved Licensing Action							
E	- Required for Engineering Equivalency Evaluation							
R	- Required for Risk Significance							
D	- Required to maintain adequate balance of Defense-in-Depth in a Change Evaluation or Fire Risk Evaluation							

Cross zoned ionization smoke detectors (2) and infra-red detectors (3) are provided which alarm in the Unit 2 Control Room. The ionization detectors are part of a larger detection circuit which includes Fire Zones 47A and 47B.

### 3.1.5 Fixed Suppression

The table below outlines the fixed fire suppression system(s) provided in the Fire Area:

Table 3-2, Fire Area AA45B Suppression Systems							
Fire Zone	Type of System	Full (F) / Partial (P)	Required System?				
			S	L	E	R	D
47B	Automatic CO2	F	N	N	Y	N	N
Table 3-2 Legend:							
Table Field: "Required System?"							
S	- Required for Chapter 4 Separation Criteria						
L	- Required for NRC Approved Licensing Action						
E	- Required for Engineering Equivalency Evaluation						
R	- Required for Risk Significance						
D	- Required to maintain adequate balance of Defense-in-Depth in a Change Evaluation or Fire Risk Evaluation						

A low pressure CO2 total flooding system supplied from the 17 ton tank is provided. This system is automatically actuated. Operation of this system discharges CO2 simultaneously into Fire Zones 47A and 47B.

### 3.1.6 Manual Suppression / Response Strategy

A postulated fire will be identified by early detection using ionization type smoke detection, infra-red detection or by plant personnel using plant communication system to notify the control room.

The automatic detection systems alarm in the control room. The Control Room operator will dispatch the fire brigade for initiation of manual fire fighting. A fire in this fire area will be contained by the construction features discussed in Section 3.1.1. Manual suppression is provided by the CNP Fire Brigade.

There are fire extinguishers located in this fire zone.

Water hose reels are located in the adjacent Turbine Building Fire Zone 97.

Floor drains are available in this fire area.

### 3.1.7 Ventilation

A fire in this area will be contained by the fire barriers. Smoke can be removed by portable fans and flexible ducting to the Turbine Building and outdoors. The normal building ventilating systems in the Auxiliary Building will then exhaust the smoke via filtered monitored pathways. This fire area is listed as a non-controlled area in the Fire Pre Plans and therefore there is reasonable assurance that products of combustion will not be contaminated.

There are 4-hour rated undampered ventilation shafts in the ceiling which pass through Fire Area AA52 - Fire Zone 60 to the Yard.

### 3.1.8 Other Features

Some cable trays within Fire Area A45B are provided with bottom covers and/or are fully enclosed.

## 3.2 Fire Hazards Identification

The fire area contains both ignition sources and combustible fire hazards. The ignition sources consist of 4kV busses, plant heater and transformers for Bus C and D. Combustibles consist primarily of cable insulation, rubber and plastics.

The exterior fire hazards that are adjacent to exterior walls are the Unit 2 Main Transformers approximately 25ft away. Water spray suppression systems are provided for the transformers. In addition, reinforced concrete walls and 3 hour rated fire seals provide separation for the Fire Area. The fixed suppression, spatial separation and rated construction are sufficient to provide protection for credited equipment within the plant.

The current fire loading classification is considered low.

## 3.3 NSCA Compliance Summary

Fire Area AA45B, the Unit 2 Green Train Switchgear Room (EL. 609'-6"), contains the Unit 2 Green Train (CD) 4kV non-safety and safety buses, supporting equipment and Red and Green train cables, conduits and raceways.

Compliance with the nuclear safety performance criteria is achieved using the deterministic approach in accordance with NFPA 805, Section 4.2.3.2.

Safe and stable condition of Unit 2 will be accomplished using Steam Generators 1 and 4 via the Unit 2 West Motor Driven Auxiliary Feedwater Pump, Control Room Process Monitoring, Unit 2

Charging via the West Pump, Unit 2 Component Cooling Water via the West Pump, Unit 2 ESW via the West Pump. Electrical power is supplied to the Red Train via Offsite Power. Additionally, Red Train Emergency Diesel (AB) is also available.

The Nuclear Safety Performance Criteria compliance strategy for AA45B is documented within the NSCA Report.

### **3.3.1 Variances**

There are no variances for this fire area.

### **3.3.2 Recovery Actions Credited**

There are no recovery actions for this fire area.

### **3.4 Non-Power Operational Modes Compliance Summary**

A review of CNP for the potential effects of a fire in this Fire Area while in non-power modes of operation (NPO) was conducted. This review was conducted using the guidance provided in NEI 04-02 and FAQ 07-0040, "Non-Power Operations Clarifications".

The review determined that there are potential failures that affect certain Key Safety Functions (KSF) as a result of the fire in this area, and the fire could result in the loss of one or more KSF paths. Compensatory measures are required during high risk evolution periods to provide reasonable assurance a fire will not adversely affect key safety functions and the NFPA 805 performance goal for NPO is therefore satisfied. The results of the NPO analysis are contained within Technical Evaluation R1900-005-001, Non-Power Operation Modes Transition Review Report.

### **3.5 Radioactive Release Compliance Summary**

The NFPA 805 radiological release goal is to provide reasonable assurance that a fire will not result in a radiological release that adversely affects the public, plant personnel or the environment. The NFPA 805 requirement is to ensure a radiation release to any unrestricted area due to the direct effects of fire suppression activities (but not involving fuel damage) shall be as low as reasonably achievable and shall not exceed applicable plant Technical Specification limits.

AA45B is located outside the Radiological Controlled Area (RCA) and is not a storage location for contaminated materials, therefore there is reasonable assurance a fire in this area will not result in radiation release. The review of this fire area, with respect to radioactive release, is documented in the NFPPM.

### 3.6 Probabilistic Risk Assessment-Summary of Results

A Fire PRA (FPRA) quantification of Fire Area AA45B was performed and is documented in PRA-NB-FIRE-FQ, Fire PRA Model Quantification Notebook. The fire risk quantification for Fire Area AA45B is analyzed using detailed fire modeling to consider risk of fire scenarios of ignition sources. PRA-NB-FIRE-FQ includes a summary of all potentially risk-significant fire scenarios (i.e., CDF > 1.0E-7 or LERF > 1.0E-8). Bounding CDF / LERF per calendar year values are reported that are based on the risk values documented in PRA-NB-FIRE-FSS, Fire PRA Fire Scenario Selection.

Fire Protection features credited in the Fire PRA are documented in R1900-0411-AA45B, Detailed Fire Modeling Report: Fire Compartment: AA45B Unit 2 CD Switchgear Room (EL 609 FT 6 IN). PRA-NB-FIRE-FSS documents the revision level of the fire modeling reports used in the most recent Fire PRA quantification.

### 3.7 Risk-Informed, Performance-Based Evaluations

There are no VFDRs for this fire area, and therefore, no Fire Risk Evaluations have been performed.

#### 3.7.1 Transition Risk-Informed, Performance-Based Evaluations

There are no VFDRs for this fire area, and therefore this section is not applicable to Fire Area AA45B.

### 3.8 Defense-in-Depth

Per NFPA 805, section 2.4.4.2, "Defense-in-Depth": The deterministic approach for meeting the performance criteria shall be deemed to satisfy this defense-in-depth requirement.

### 3.9 Monitoring Program Input

A Monitoring Program will be developed in accordance with FAQ 10-0059, Rev. 1. Methods to monitor availability, reliability, and performance of fire protection program structures, systems, and components (SSCs), as well as programmatic elements will be provided. Additionally, effectiveness measures are established to review program related performance and trends. For AA45B the following systems and features are candidates for inclusion in the CNP Fire Protection Monitoring Program:

- Fire Area boundary barriers discussed in Section 3.1
- Fire Detection System (infrared and ionization)
- CO2 Suppression System

## 4.0 CONCLUSION

The nuclear safety and radioactive release performance criteria of NFPA 805 are met for a fire in Fire Area AA45B. This Fire Safety Analysis has demonstrated that for Fire Area AA45B a success path remains free of fire damage using the deterministic approach per Section 4.2.3 of NFPA 805.

## **5.0 REFERENCES**

- 5.1 CNP Fire Pre-Plans, Volumes I, II, and III, Revisions 17, 14, and 18 respectively
- 5.2 Fire Hazards Analysis
- 5.3 NFPA 805, Performance-Based Standard for Fire Protection for Light Water Reactor Electric Generating Plants
- 5.4 NFPPM, NFPA 805 Fire Protection Program Manual (NFPPM)
- 5.5 Nuclear Energy Institute (NEI) 04-02, Guidance for Implementing a Risk-Informed, Performance-Based Fire Protection Program under 10 CFR 50.48(c), Rev. 2
- 5.6 Nuclear Safety Capability Assessment Report
- 5.7 PRA-NB-FIRE-FQ, Fire PRA Model Quantification Notebook
- 5.8 PRA-NB-FIRE-FSS, Fire PRA Fire Scenario Selection
- 5.9 Regulatory Guide 1.205, Risk-Informed, Performance-Based Fire Protection for Existing Light-Water Nuclear Power Plants, Rev. Revision 1
- 5.10 Technical Evaluation R1900-005-001, Non-Power Operation Modes Transition Review

**Fire Area AA45B – Attachment 1 - Table B-3 - Fire Area Transition**

<u>Unit</u>	<u>Fire Area</u>	<u>Description</u>
2	AA45B	Unit 2 CD Switchgear Room (El. 609 ft. 6 in.)

<u>Fire Zone</u>	<u>Description</u>
47B	4KV CD Switchgear Room - El. 609 ft. 6 in. - Unit 2

**Regulatory Basis**

4.2.3.2 - Deterministic Approach

<b>Performance Goal</b>	<b>Method of Accomplishment</b>	<b>Comments</b>
Reactivity Control	Unit 2 - Trip the reactor from the Control Room. Borate using Unit 2 West Charging Pump supplied from the RWST. Use source range monitoring for indication.	None
Inventory and Pressure Control	Unit 2 - Control inventory using Unit 2 West Charging Pump. Control pressure using Unit 2 Pressurizer Safety Relief Valves.	None
Decay Heat Removal	Unit 2 - Feed SGs 1 & 4 with Unit 2 West MDAFW Pump. The DHR function also requires MS isolation with a steam release path through the Safety Relief Valves.	None
Process Monitoring	Unit 2 Process Monitoring - Use Unit 2 process monitoring in the Control Room for the following: Pressurizer level, RCS pressure and temperature, and S/G level and Pressure. Unit 2 Source Range Monitoring - Use Unit 2 source range monitoring in the Control Room powered from Unit 1.	None
Vital Auxiliaries	Unit 2 Electrical - Control Unit 2 Red (AB) Train Electrical Distribution with Unit 2 Red (AB) Train Offsite Power or Unit 2 Red (AB) DG. Unit 2 ESW - Operate Unit 2 West ESW. Unit 2 CCW - Operate Unit 2 West CCW. Unit 2 HVAC - Operate Unit 2 Control Room HVAC. Operate Unit 2 Auxiliary Building HVAC. Operate Unit 2 Red (AB) DG HVAC. Unit 2 Red (AB) Switchgear HVAC is not available. Operate Unit 2 West MDAFW Room HVAC system. Operate the Unit 2 West ESW Room HVAC system.	None

**Fire Area AA45B – Attachment 1 - Table B-3 - Fire Area Transition**

<u>Unit</u>	<u>Fire Area</u>	<u>Description</u>
2	AA45B	Unit 2 CD Switchgear Room (El. 609 ft. 6 in.)

**Reference Documents**

Genesis Solution Suite, EDISON / SAFE-PB, DC Cook V 3.4.0

Nuclear Safety Capability Assessment Report

**Licensing Actions**

None

**Existing Engineering Equivalency Evaluations (EEEE)****EEEE Title Engineering Equivalency Evaluation 9-20 - Fire Zone 47B (Fire Area AA45B) and Fire Zone 60 (Fire Area AA52) Hatch Evaluation**

**Summary** The purpose of this engineering equivalency evaluation is to document the acceptability of an unrated steel plate hatch located between the Unit 2 4kV Switchgear Room and the Unit 2 Switchgear Room Cable Vault in Fire Zone 47B (Fire Area AA45B) and Fire Zone 60 (Fire Area AA52) respectively. A 3-hr fire-rated hatch assembly is not commercially available for use in this location.

Note: This engineering equivalency evaluation has been reviewed by the NRC. Refer to NRC SER dated June 17, 1988, for acceptance of unrated fire hatches in fire area boundaries. The NRC concluded that the level of fire safety is equivalent to that achieved by conformance with the guidelines of Section D.1.j of Appendix A to BTP APCSB 9.5-1, and, therefore, the deviations for the unrated fire hatches were found acceptable.

Reasonable assurance is provided that a fire in Fire Zone 47B or Fire Zone 60 would not impair safe shutdown capabilities of Unit 2. This engineering equivalency evaluation does not adversely impact on other engineering equivalency evaluations.

The hatch was evaluated and found to be acceptable based on the fire hazards and fire protection systems within the evaluated areas.

**Fire Area AA45B – Attachment 1 - Table B-3 - Fire Area Transition**

<u>Unit</u>	<u>Fire Area</u>	<u>Description</u>
2	AA45B	Unit 2 CD Switchgear Room (El. 609 ft. 6 in.)

<b><u>EEEE Title</u></b>	<b>Engineering Equivalency Evaluation 11-6 - Unit 2 Emergency Power Systems/4 KV Switchgear Complex Ventilation Shaft Boundary Evaluation (Fire Areas AA45A, AA45B, AA43, AA44 and AA52).</b>
<b><u>Summary</u></b>	<p>The purpose of this engineering equivalency evaluation is to document the acceptability of unrated fire barrier penetration seals between the Unit 2 EPS/4KV switchgear complex ventilation shafts in Fire Zones 45 (Fire Area AA43), 46A through 46D (Fire Area AA44), 47A (Fire Area AA45A) and 47B (Fire Area AA45B), and the Unit 2 switchgear cable spreading room in Fire Zone 60 (Fire Area AA52).</p> <p>Reasonable assurance is provided that a fire in Fire Areas AA43, AA44, AA45A, AA45B or AA52 would not impair safe shutdown capabilities of Unit 2. This engineering equivalency evaluation does not impact other engineering equivalency evaluations.</p> <p>The fire barrier penetration seals were evaluated and found to be acceptable based on the fire hazards, fire protection systems and construction features within the evaluated areas.</p>
<b><u>EEEE Title</u></b>	<b>Engineering Equivalency Evaluation 11-9 - Turbine, Auxiliary and Containment Buildings Boundary Evaluation</b>
<b><u>Summary</u></b>	<p>The purpose of this engineering equivalency evaluation is to describe in general, the approach and existence of evaluations performed to determine and reconcile fire area boundaries having components or designs with less than a 3-hr fire rating on preventing the spread of fire. This engineering equivalency evaluation also specifically evaluates the impact of unrated door assemblies on the spread of fire.</p> <p>Reasonable assurance is provided that the fire area boundaries having components or design less than a 3-hr fire rating will not increase the spread of fire or impair the safe shutdown capabilities of Units 1 or 2. In addition, this engineering equivalency evaluation does not adversely impact on other engineering equivalency evaluations or exemption requests.</p> <p>This evaluation supports additional evaluations credited in this fire area.</p>



**Fire Area AA45B – Attachment 1 - Table B-3 - Fire Area Transition**

<u>Unit</u>	<u>Fire Area</u>	<u>Description</u>
2	AA45B	Unit 2 CD Switchgear Room (El. 609 ft. 6 in.)
<b><u>EEEE Title</u></b>	<b>Engineering Equivalency Evaluation 11-15 - Switchgear Room Construction Boundary Room Evaluation Fire Zones 40A, 40B, 41, 42A, 45, 46A, 47A and 47B (Fire Areas AA39A, AA39B, AA40, AA41, AA43, AA44, AA45A and AA45B)</b>	
<b><u>Summary</u></b>	<p>The purpose of this engineering equivalency evaluation is to document the acceptability of the construction features of the switchgear rooms which have a fire resistance rating of less than 3 hours and their impact on the spread of fire. In particular, fire doors having a 1 1/2-hr fire rating and open penetrations are analyzed by this engineering equivalency evaluation, as other unrated construction features have been previously analyzed under separate engineering equivalency evaluations. The applicable Fire Areas in Unit 1 are AA39A, AA39B, AA40 and AA41. The applicable Fire Areas in Unit 2 are AA43, AA45A and AA45B.</p> <p>Reasonable assurance is provided that the construction features of the switchgear rooms which have a fire resistance rating of less than 3 hours will prevent the spread of fire and not impair the safe shutdown capabilities of Unit 1 and Unit 2. This engineering equivalency evaluation does not impact other engineering equivalency evaluations.</p> <p>The switchgear room boundaries were evaluated and found to be acceptable based on the fire hazards and fire protection systems within the areas.</p>	
<b><u>EEEE Title</u></b>	<b>Engineering Equivalency Evaluation 11-24 - Fire Retention Capability of Nonconforming Fire Seals in Fire Zones having a Low Combustible Loading Classification</b>	
<b><u>Summary</u></b>	<p>The purpose of this engineering equivalency evaluation is to document the acceptability of fire seal designs which do not meet the requirements of the installation specification or fire test data in fire zones having a low combustible loading classification would have on preventing the spread of fire.</p> <p>Reasonable assurance is provided that fire seals which do not meet the requirements of the installation specification or fire test data in fire zones having a low combustible loading classification, will provide adequate fire retention capabilities and will not impair the safe shutdown capabilities of CNP or increase the spread of fire between fire zones. In addition, this engineering equivalency evaluation does not adversely impact other engineering equivalency evaluations or exemptions.</p> <p>Refer to Engineering Equivalency Evaluation 11.28.</p>	

**Fire Area AA45B – Attachment 1 - Table B-3 - Fire Area Transition**

<u>Unit</u>	<u>Fire Area</u>	<u>Description</u>
2	AA45B	Unit 2 CD Switchgear Room (El. 609 ft. 6 in.)
<hr/>		
<b><u>EEEE Title</u></b>	<b>Engineering Equivalency Evaluation 11-28 - Generic Fire Seal Design 2 (Fire Areas AA7, AA8, AA39A, AA40, AA43, AA45A, AA45B, AA48 and AA52)</b>	
<b><u>Summary</u></b>	<p>The purpose of this engineering equivalency evaluation is to document the acceptability of deviations to Generic Fire Seal Design 2 on preventing the spread of fire. The applicable Fire Areas include AA7, AA8, AA39A, AA40, AA43, AA54A, AA54B, AA48 and AA52.</p> <p>Reasonable assurance is provided that deviations to Generic Fire Seal Design 2, Fire Seals W7109, W7952, F8150, F8152, F8162, F8184, F8859, F8861, F8863, F8887 and W9058, and the attributes discussed in the engineering equivalency evaluation do not impair the safe shutdown capabilities of CNP or increase the ability of fire to spread between fire zones. This engineering equivalency evaluation does not impact other engineering equivalency evaluations.</p> <p>Attribute Nos. 2, 7, 9 and the 11 fire seals of Generic Fire Seal Design 2 were evaluated and found to be acceptable based on the fire hazards and fire protection systems within the evaluated areas.</p>	
<b><u>EEEE Title</u></b>	<b>Engineering Equivalency Evaluation 12-19 - CO2 Fire Suppression System Concentrations (Fire Areas AA7, AA8, AA9, AA10, AA29, AA30, AA31, AA37, AA38, AA39, AA40, AA41, AA43, AA44, AA45, AA48, AA49, AA50, AA51, AA52 and AA53)</b>	
<b><u>Summary</u></b>	<p>The purpose of this engineering equivalency evaluation is to document the acceptability of the CO2 fire suppression systems in fire zones containing concentrations of cable insulation and the potential for deep-seated fires. This engineering equivalency evaluation determines the CO2 system's impact on the spread of fire and previous engineering equivalency evaluations and exemption requests. Although there are other fire zones that use CO2 for fire suppression such as the DG Rooms, they are installed to suppress surface-type, combustible liquid fires and are not included in this analysis, because they do not contain significant concentrations of cable insulation capable of producing deep-seated fires.</p> <p>All of the CO2 systems included in this engineering equivalency evaluation are capable of performing their intended function, containing the fire until the Fire Brigade arrives, preventing fire spread to adjacent fire zones, and ensuring that safe shutdown of CNP can be achieved and maintained.</p> <p>The existing suppression systems were evaluated and found to be acceptable based on the fire hazards and fire protection systems within the evaluated areas.</p>	

**Fire Area AA45B – Attachment 1 - Table B-3 - Fire Area Transition**

<u>Unit</u>	<u>Fire Area</u>	<u>Description</u>
2	AA45B	Unit 2 CD Switchgear Room (El. 609 ft. 6 in.)

**Fire Suppression Effects on Nuclear Safety Performance Criteria**

The CNP fire brigade is trained to discharge water in a judicious manner and instructed to direct hose streams and portable extinguishers at the base of the fire to limit the amount of overspray beyond the immediate fire zone. For this reason, fire brigade activities are not expected to fail components not already considered damaged by fire. It has been concluded that water impingement on cables is not a concern. Electrical cabinets are provided with a seal at the conduit interface. Per visual inspection any side vents for this equipment are pointed downward to prevent water intrusion. The drainage features of the fire area mitigate the potential for flooding damage due to fire suppression, such that the standing water would not affect credited equipment.

In the event of discharge, the CO2 system will not adversely affect equipment operating within this fire area or in AA45A (which will also discharge). Potential condensation developing on electrical components is a long term issue that would be eliminated by ventilating the fire area after actuation. Per visual inspection, all CO2 nozzles in both fire areas are located greater than 5 ft. away from any credited equipment and therefore, the possibility of thermal shock due to CO2 actuation has been deemed to be a non-issue in this fire area in accordance to EPRI NP-7253 "Effects of Fire Suppressants on Electrical Components in Nuclear Power Plants". Since it is shown that suppression effects will not impact the nuclear safety performance criteria, the fire area configuration is deemed acceptable.

**References:**

Technical Evaluation 12.1, "Fire Suppression Effects Study"

Technical Evaluation 12.1, "Supplemental Information to Fire Suppression Effects Study – Supplement 1"

**Fire Area Comments**

None

D. C. Cook Nuclear Plant  
Fire Safety Analysis

Fire Area: AA46

Unit 1 Control Room (El. 633 ft.)

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Attachments

Fire Area AA46 – Attachment 1 - Table B-3 - Fire Area Transition

Fire Area AA46 – Attachment 2 - Fire Risk Evaluation Results Summary

## 1.0 PURPOSE

This report documents the Fire Safety Analysis (FSA) for Cook Nuclear Plant (CNP) Fire Area AA46, Unit 1 Control Room (El. 633 ft.) which comprises fire zone(s) 53. The purpose of this analysis is to demonstrate the achievement of the nuclear safety and radioactive release performance criteria of NFPA 805 as required by 10 CFR 50.48(c). The Fire Safety Analysis is a key part of compliance with Section 2.7.1.2 Fire Protection Program Design Basis Document of NFPA 805. This analysis also documents results of risk-informed, performance-based Fire Risk Evaluations (FREs). These evaluations are associated with Variances from Deterministic Requirements (VFDRs) of NFPA 805 Chapter 4.

## 2.0 ANALYSIS METHODOLOGY

The FSA is the design basis document as described in NFPA 805 Section 2.7.1.2. The following steps are performed to develop the FSA on a fire area basis:

- Identify significant fire hazards in the fire area. This is based on NFPA 805 approach to analyze the plant from an ignition source and fuel package perspective.
- Summarize Nuclear Safety Capability Analysis (NSCA) compliance strategies. This is the result of the NEI 04-02 B-3 Table review of the Safe Shutdown Analysis.
- Summarize Non-Power Operations Modes compliance strategies.
- Summarize Radioactive Release compliance strategies. The transition review process required per NEI 04-02 is used to develop these results.
- Provide Fire Probabilistic Risk Assessment summary of results. This is based on the results from the plant Fire PRA.
- Perform risk informed, performance based evaluations if needed for the performance based approach.
- Summarize Defense-in-Depth strategy for each fire area.
- Determine key analysis assumptions which are candidates to be included in the NFPA 805 monitoring program.
- Provide conclusions relative to NFPA 805 compliance.

### **3.0 ANALYSIS**

#### **3.1 Classical Fire Protection**

##### **3.1.1 Construction**

Walls, floors and ceilings to adjacent fire areas are reinforced concrete or concrete block in excess of a 3-hour rating.

The Unit 2 Hot Shutdown Panel (HSDP) is separated from the Unit 1 Control Room by concrete block, steel framing and TSI Thermo-Lag subliming panels. A fire area engineering equivalency evaluation was performed for deviations to the 3-hour rating of the HSDP. (Engineering Equivalency Evaluation 11-36).

Applicable Engineering Equivalency Evaluations are documented in Attachment 1.

##### **3.1.2 Doors and Access Openings**

Fire area engineering equivalency evaluations were performed for unrated floor and ceiling hatches to Fire Areas AA50 and AA57A - Fire Zones 57 and 70 (Engineering Equivalency Evaluations 9-13 and 9-5, respectively).

Fire doors having a 3-hour rating are provided to adjacent Fire Areas AA3, AA47, AA2 and AA51 - Fire Zones 52, 54, 129 and 145.

A manual roll-up fire door having a 3-hour rating is provided to adjacent Fire Area AA51 - Fire Zone 145.

A non-UL/FM approved electromagnetic door lock is provided on one Class A door (EEE-11-69).

##### **3.1.3 Penetrations**

Penetrations in fire barriers between this fire zone and adjacent fire areas are provided with fire seals. Refer to Technical Evaluation 11-25 for evaluation of pressure retention capability of Control Room pressure boundary fire seals.

### 3.1.4 Detection

The table below outlines the fire detection system(s) provided in the Fire Area:

Table 3-1, Fire Area AA46 Detection Systems								
Fire Zone	Type of System	Local (L) / Remote (R)	Detection Actuates Suppression?	Required System?				
				S	L	E	R	D
53	Ionization	L/R	No Auto Supp. (N/A)	N	N	Y	Y	N
Table 3-1 Legend:								
Table Field: "Required System?"								
S	- Required for Chapter 4 Separation Criteria							
L	- Required for NRC Approved Licensing Action							
E	- Required for Engineering Equivalency Evaluation							
R	- Required for Risk Significance							
D	- Required to maintain adequate balance of Defense-in-Depth in a Change Evaluation or Fire Risk Evaluation							

Twenty-five ionization detectors are located beneath the suspended ceiling and 20 ionization detectors are located above the suspended ceiling which alarm in the Unit 1 Control Room. These detectors are part of a larger detection circuit which includes the Hot Shutdown Panel, Fire Zone 145.

### 3.1.5 Fixed Suppression

The table below outlines the fixed fire suppression system(s) provided in the Fire Area:

Table 3-2, Fire Area AA46 Suppression Systems							
Fire Zone	Type of System	Full (F) / Partial (P)	Required System?				
			S	L	E	R	D
53	None	N/A	N/A	N/A	N/A	N/A	N/A
Table 3-2 Legend:							
Table Field: "Required System?"							
S	- Required for Chapter 4 Separation Criteria						
L	- Required for NRC Approved Licensing Action						
E	- Required for Engineering Equivalency Evaluation						
R	- Required for Risk Significance						
D	- Required to maintain adequate balance of Defense-in-Depth in a Change Evaluation or Fire Risk Evaluation						

Fire Area AA46 is not provided with automatic fire suppression.

### 3.1.6 Manual Suppression / Response Strategy

A postulated fire will be identified by early detection using ionization type smoke detection or by the Control Room operators within the control room. Although the automatic detection systems alarm in the control room, plant operators will most likely detect the fire prior to activation. The Control Room operator will initiate manual fire fighting activities using a fire extinguisher and

also alert the fire brigade. A fire in this fire area will be contained by the construction features discussed in Section 3.1.1. Manual suppression is provided by the CNP Fire Brigade and the Control Room operators.

There are fire extinguishers located in this fire zone, with additional extinguishers located in adjacent Fire Zone 52, 54 and 129. Water hose reels are located in adjacent Fire Zone 129 and Fire Zone 52.

There is a breathing apparatus in this fire zone. Additional apparatus is located in the Turbine Building Fire Zone 130.

Drainage is not available. Drainage is into Fire Zones 52 or 129 through the doorways and Fire Zone 57 through the floor hatch.

### **3.1.7 Ventilation**

A fire in this area will be contained by the fire barriers. Smoke can be removed by portable fans and flexible ducting to the Turbine Building and outdoors. The normal building ventilating systems in the Auxiliary Building will then exhaust the smoke via filtered monitored pathways. The Control Room HVAC system is not used or credited for smoke removal. This fire area is listed as a non-controlled area in the Fire Pre Plans and therefore there is reasonable assurance that products of combustion will not be contaminated.

Fire dampers having a 3-hour rating are provided to adjacent Fire Area AA57A - Fire Zone 70.

### **3.1.8 Other Features**

The Control Room is constantly manned while tenable conditions exist.

The Unit 2 Hot Shutdown Panel enclosure (Fire Zone 145) is located within the larger Unit 1 Control Room.

A small raised floor space (16' x 13' x 8" H) is provided at the operator's work station (Engineering Equivalency Evaluation 11-41).

Control room carpeting meets the original licensing basis of the CNP Plant Standard Review Plan BTP 9.5.1 Appendix A and additionally meets the requirements of NRC Reg. Guide 1.189 (April 2001). The combustible loading classification of the fire area reflects the carpeting. The combustible loading remains within the analyzed limits for the control room.

(Removed Acoustical Baffles per EC-0000054046, FPPR-2014-0022)

## **3.2 Fire Hazards Identification**

The fire area contains both ignition sources and combustible fire hazards. The ignition sources consist of main control room boards and control room back panels. Combustibles consist primarily of cable insulation, cellulose, rubber, plastics, Thermo-Lag, control room carpet and other small computer equipment. The current fire loading classification is considered moderate (fire load classification change per EC-0000054707, FPCE-2016-0017A).

## **3.3 NSCA Compliance Summary**



Fire Area AA46 is the Unit 1 Control Room and as such contains Unit 1 Red and Green Train safe shutdown cables; controls for valve, pump, electrical Bus/MCC, and instrumentation; as well as 250VDC and 120VAC power supplies.

Compliance with the nuclear safety performance criteria is achieved using the performance-based approach in accordance with NFPA 805, Section 4.2.4.2.

In the case of a Control Room evacuation, Unit 1 safe and stable is accomplished by crediting crosssties to the unaffected Unit 2 via the following: Alternate AFW to Steam Generators 2 and 3 via the Unit 2 West Motor Driven Auxiliary Feedwater Pump, Alternate CVCS via the Unit 2 East or West Pump and ESW crossstie via normally available crossstie lineup. Unit 2 CCW is credited to support the required Unit 2 crossstie systems. Local Shutdown Indicating Panels are credited to provide process and source range monitoring with Unit 2 power crossstie. Control Room evacuation is postulated to determine the compliance strategy of this area.

The Nuclear Safety Performance Criteria compliance strategy for AA46 is documented within the NSCA Report.

### 3.3.1 Variances

The variances identified for evaluation for this fire area are grouped as follows:

#### 3.3.1.1 VFDR No. AA46-001

1-NRV-151, 1-NRV-152 and 1-NRV-153 - Pressurizer PORVs are required to be closed to support RCS integrity. RCS integrity is required to maintain positive control over RCS inventory and pressure. 1-NRV-151 may fail due to fire induced damage of cable 8667R-1 and 9705R-1. 1-NRV-152 may fail due to fire induced damage cables 8675R-1 and 9706R-1. 1-NRV-153 may fail due to fire induced damage of cables 8757G-1 and 8932G-1. Failure of these cables could spuriously open the valves. This condition represents a variance from the deterministic requirements of NFPA 805, Section 4.2.3. This is a separation issue.

This VFDR has been evaluated and it was determined that the risk, safety margin and defense-in-depth meet the acceptance criteria of NFPA 805 Section 4.2.4 with a recovery action credited.

#### 3.3.1.2 VFDR No. AA46-002

1-NSO-021, 1-NSO-022, 1-NSO-023 and 1-NSO-024 – The RX Head Vent Valves are required to be closed to support RCS integrity. RCS integrity is required to maintain positive control over RCS inventory and pressure. 1-NSO-021 or 1-NSO-022 and 1-NSO-023 or 1-NSO-024 are required to remain closed to provide RCS integrity. All of the RX Head Vent Valves may fail due to a full area fire within Fire Area AA46. 1-NSO-021 may fail due to fire induced damage of cable 9914PG-1. 1-NSO-022 may fail due to fire induced damage of cable 9914PG-1. 1-NSO-023 may fail due to fire induced damage of cable 9914PR-1. 1-NSO-024 may fail due to fire induced damage of cable 9920PR-1. These cable failures could spuriously open the valves. This condition represents a variance from the deterministic requirements of NFPA 805, Section 4.2.3. This is a separation issue.

This VFDR has been evaluated and it was determined that the risk, safety margin and defense-in-depth meet the acceptance criteria of NFPA 805 Section 4.2.4 with a recovery action credited.

**3.3.1.3 VFDR No. AA46-003**

1-NSO-061, 1-NSO-062, 1-NSO-063 and 1-NSO-064 – The Post Accident Vent Valves are required to be closed to support RCS integrity. RCS integrity is required to maintain positive control over RCS inventory and pressure. 1-NSO-061 or 1-NSO-062 and 1-NSO-063 or 1-NSO-064 are required to remain closed to provide RCS integrity. All of the Post Accident Vent Valves may fail due to a full area fire within Fire Area AA46. 1-NSO-061 may fail due to fire induced damage of cable 9901PG-1. 1-NSO-062 may fail due to fire induced damage of cable 9907PG-1. 1-NSO-063 may fail due to fire induced damage of cable 9901PR-1. 1-NSO-064 may fail due to fire induced damage of cable 9907PR-1. These cable failures could spuriously open the valves. This condition represents a variance from the deterministic requirements of NFPA 805, Section 4.2.3. This is a separation issue.

This VFDR has been evaluated and it was determined that the risk, safety margin and defense-in-depth meet the acceptance criteria of NFPA 805 Section 4.2.4 with a recovery action credited.

**3.3.1.4 VFDR No. AA46-004**

1-QRV-111, 1-QRV-112, 1-QRV-160, 1-QRV-161 and 1-QRV-162 – Letdown Isolation Valves are required to be closed to support CVCS isolation. CVCS isolation is required to maintain positive control over inventory and pressure. In order to achieve letdown isolation the following valves need to be closed; 1-QRV-111 or 1-QRV-112 or (1-QRV-160 and 1-QRV-161 and 1-QRV-162). All of these valves may fail due to a full area fire within Fire Area AA46. 1-QRV-111 may fail due to fire induced damage of cables 8486PG-1 and 8943G-1. 1-QRV-112 may fail due to fire induced damage of cables 8467PR-1 and 8947R-1. 1-QRV-160 may fail due to fire induced damage of cable 9141G-1. 1-QRV-161 may fail due to fire induced damage of cable 8494G-1. 1-QRV-162 may fail due to fire induced damage of cable 8496G-1. These cable failures could spuriously open the valves. This condition represents a variance from the deterministic requirements of NFPA 805, Section 4.2.3. This is a separation issue.

This VFDR has been evaluated and it was determined that the risk, safety margin and defense-in-depth meet the acceptance criteria of NFPA 805 Section 4.2.4 with a defense-in-depth action credited.

**3.3.1.5 VFDR No. AA46-005**

1-DCR-310 and 1-DCR-340 - SG 1 and 4 Blowdown Isolation Valves are required to be closed to support main steam isolation. Main steam isolation is required to prevent uncontrolled cooldown through over-steaming. SG 1 and 4 Blowdown Isolation Valves may fail due to a full area fire within Fire Area AA46. 1-DCR-310 may fail due to fire induced damage of cable 8682G-1. 1-DCR-340 may fail due to fire induced damage of cable 8686G-1. These cable failures could spuriously open the valves. SGs 1 and 4 are not credited for decay heat removal due to a fire within Fire Area AA46. This condition represents a variance from the deterministic requirements of NFPA 805, Section 4.2.3. This is a separation issue.

This VFDR has been evaluated and it was determined that the risk, safety margin and defense-in-depth meet the acceptance criteria of NFPA 805 Section 4.2.4 with a recovery action credited.

**3.3.1.6 VFDR No. AA46-006**

1-DCR-320 and 1-DCR-330 - SG 2 and 3 Blowdown Isolation Valves are required to be closed to support main steam isolation. Main steam isolation is required to prevent uncontrolled cooldown through over-steaming. SG 2 and 3 Blowdown Isolation Valves may fail due to a full area fire within Fire Area AA46. 1-DCR-320 may fail due to fire induced damage of cable 8682R-1. 1-DCR-330 may fail due to fire induced damage of cable 8686R-1. These cable failures could spuriously open the valves. SGs 2 and 3 are credited for decay heat removal due to a fire within Fire Area AA46. This condition represents a variance from the deterministic requirements of NFPA 805, Section 4.2.3. This is a separation issue.

This VFDR has been evaluated and it was determined that the risk, safety margin and defense-in-depth meet the acceptance criteria of NFPA 805 Section 4.2.4 with a recovery action credited.

**3.3.1.7 VFDR No. AA46-007**

1-MRV-210 and 1-MRV-240 – The SG 1 and 4 Main Steam Stop Valves are required to be closed to support main steam isolation. Main steam isolation is required to prevent the uncontrolled cooldown through over-steaming. SGs 1 and 4 are not credited for decay heat removal due to a fire within Fire Area AA46. 1-MRV-210 may not be available due to the failure of 1-MMO-210, 1-MRV-211 and 1-MRV-212. 1-MMO-210, 3 Way Air Open Valve for SG 1 Stop Valve vents air from the Main Steam Stop Valve to either 1-MRV-211 or 1-MRV-212. 1-MMO-210 may fail due to fire induced damage of cable 5693-1. This cable failure will spuriously operate the valve to either position. Failure of 1-MRV-211 and 1-MRV-212 will require either valve to be manually failed to the open position dependent upon the 3 way valve's position. 1-MRV-240 may not be available due to the failure of 1-MMO-240, 1-MRV-241 and 1-MRV-242. 1-MMO-240, 3 Way Air Open Valve for SG 4 Stop Valve vents air from the Main Steam Stop Valve to either 1-MRV-241 or 1-MRV-242. 1-MMO-240 may fail due to fire induced damage of cable 5699R-1. This cable failure will spuriously operate the valve to either position. Failure of 1-MRV-241 and 1-MRV-242 will require either valve to be manually failed to the open position dependent upon the 3 way valve's position. This condition represents a variance from the deterministic requirements of NFPA 805, Section 4.2.3. This is a separation issue.

This VFDR has been evaluated and it was determined that the risk, safety margin and defense-in-depth meet the acceptance criteria of NFPA 805 Section 4.2.4 with a recovery action credited.

**3.3.1.8 VFDR No. AA46-008**

1-MRV-220 and 1-MRV-230 – Main Steam Stop Valves for SGs 2 and 3 are required to be closed to support main steam isolation. Main steam isolation is required to prevent uncontrolled cooldown through over-steaming. SGs 2 and 3 are credited for decay heat removal due to a fire within Fire Area AA46. 1-MRV-220 may not be available due to the failure of 1-MMO-220, 1-MRV-221 and 1-MRV-222. 1-MMO-220, 3 Way Air Open Valve for SG 2 Stop Valve vents air from the Main Steam Stop Valve to either 1-MRV-221 or 1-MRV-222. 1-MMO-220 may fail due to fire induced damage of cable 5695-1. This cable failure will spuriously operate the valve to either position. Failure of 1-MRV-221 and 1-MRV-222 will require either valve to be manually failed to the open position dependent upon the 3 way valve's position. 1-MRV-230 may not be available due to the failure of 1-MMO-230, 1-MRV-231 and 1-MRV-232. 1-MMO-230, 3 Way Air Open Valve for SG 3 Stop Valve vents air from the Main Steam Stop Valve to either 1-MRV-231 or 1-MRV-232. 1-MMO-230 may fail due to fire induced damage of cable 5697G-1. This cable failure will spuriously operate the valve to either position. Failure of 1-MRV-231 and 1-MRV-232 will require either valve to be manually failed to the open position dependent upon the 3 way valve's position. This condition represents a variance from the deterministic requirements of NFPA 805, Section 4.2.3. This is a separation issue.

This VFDR has been evaluated and it was determined that the risk, safety margin and defense-in-depth meet the acceptance criteria of NFPA 805 Section 4.2.4 with a recovery action credited.

**3.3.1.9 VFDR No. AA46-009**

1-MRV-213-P and 1-MRV-243-P – SG 1 and 4 PORVs are required to be closed to support main steam isolation. Main steam isolation is required to prevent uncontrolled cooldown through over-steaming. SGs 1 and 4 are not credited for decay heat removal due to a fire within Fire Area AA46. 1-MRV-213-P may fail due to fire induced damage of cables 11815-1, 11916-1, 6841-1 and 9050W-1. 1-MRV-243-P may fail due to fire induced damage of cables 11838-1, 11917-1, 6842-1 and 9051W-1. Failure of these cables could spuriously open the valves. This condition represents a variance from the deterministic requirements of NFPA 805, Section 4.2.3. This is a separation issue.

This VFDR has been evaluated and it was determined that the risk, safety margin and defense-in-depth meet the acceptance criteria of NFPA 805 Section 4.2.4 with a recovery action credited.

**3.3.1.10 VFDR No. AA46-010**

1-MRV-223-P and 1-MRV-233-P – SG 2 and 3 PORVs are required to be closed to support main steam isolation. Main steam isolation is required to prevent uncontrolled cooldown through over-steaming. SGs 2 and 3 are credited for decay heat removal due to a fire within Fire Area AA46. 1-MRV-223-P may fail due to fire induced damage of cables 11828-1, 11900-1, 18132-1 and 9050Y-1. 1-MRV-233-P may fail due to fire induced damage of cables 11829-1, 11901-1, 18133-1 and 9051Y-1. Failure of these cables could spuriously open the valves. This condition represents a variance from the deterministic requirements of NFPA 805, Section 4.2.3. This is a separation issue.

This VFDR has been evaluated and it was determined that the risk, safety margin and defense-in-depth meet the acceptance criteria of NFPA 805 Section 4.2.4 with a recovery action credited.

**3.3.1.11 VFDR No. AA46-011**

1-BLI-120-CRI, 1-BLI-130-CRI, 1-MPP-220-CRI, 1-MPP-230-CRI, 1-NLP-151-CRI, 1-NPS-110-CRI, 1-NTR-120, 1-NTR-220 and 1- NRI-1 - Control Room process monitoring and source range monitoring may not be available due to a fire in Fire Area AA46. Process monitoring is required to be available to monitor key primary and secondary parameters. Source Range is required to provide indication of fission activity to ensure sub-criticality. The instrumentation is not available with the Unit 1 Control Room due a fire within the Unit 1 Control Room. Alternate process and source range monitoring powered from Unit 2 is required at the Unit 1 LSI panels. The LSI panels require manual actions to transfer to the Unit 2 power supply. Transfer switch at 1-LSI-6 feeds both 1-LSI-6 and 1-LSI-2. Transfer switch at 1-LSI-5 feeds both 1-LSI-5 and 1-LSI-1. Transfer switch at 1-LSI-4 feeds both 1-LSI-4 and 1-LSI-3. Local monitoring of SG 2 and 3 level indication is required at 1-LSI-2. Local monitoring of SG 2 pressure indication, RCS loop temperature and source range monitoring is required at 1-LSI-4. Local monitoring of SG 3 pressure indication is required at LSI-6. Local monitoring of pressurizer level and pressure indication is required at LSI-3. This set of instruments has been credited due to SGs 2 and 3 being credited for AFW. This condition represents a variance from the deterministic requirements of NFPA 805, Section 4.2.3. This is a separation issue.

This VFDR has been evaluated and it was determined that the risk, safety margin and defense-in-depth meet the acceptance criteria of NFPA 805 Section 4.2.4 with a recovery action credited.

**3.3.1.12 VFDR No. AA46-012**

1-PP-3E, 1-PP-3W and 1-PP-4 - A Unit 1 AFW Pump is required to be operable to support decay heat removal. Decay heat removal is required to be capable of removing sufficient heat from the reactor core such that the fuel is maintained in a safe and stable condition. A full area fire in Fire Area AA46 may cause the loss of the Unit 1 East and West MDAFW Pumps and the Unit 1 TDAFW Pump. The East MDAFW Pump, 1-PP-3E may fail due to fire induced damage of 250VDC Distribution Cabinet 1-MCCD, 4kV Bus 1-T11D and cables. The West MDAFW Pump, 1-PP-3W may fail due to fire induced damage of 250VDC Distribution Cabinet 1-MCAB, 4kV Bus 1-T11A and cables. The TDAFW Pump, 1-PP-4 may fail due to fire induced damage of cables 8004BR-1, 8006BR-1 and 900BR-1. This condition represents a variance from the deterministic requirements of NFPA 805, Section 4.2.3. This is a separation issue.

This VFDR has been evaluated and it was determined that the risk, safety margin and defense-in-depth meet the acceptance criteria of NFPA 805 Section 4.2.4 with a recovery action credited.

**3.3.1.13 VFDR No. AA46-013**

1-FMO-222 and 1-FMO-232- SG 2 and 3 AFW Supply Valves are required to be operable to support decay heat removal for Unit 1. Decay heat removal shall be capable of removing heat from the reactor core such that the fuel is maintained in a safe and stable condition. Decay heat removal requires a set of 2 supply valves be operable with their corresponding AFW pump. The following sets of Unit 1 SG AFW supply valves may fail due to a full area fire within Fire Area; 1-FMO-212 and 1-FMO-242, 1-FMO-222 and 1-FMO-232, 1-FMO-221 and 1-FMO-231. The Unit 2 West AFW Pump is credited to provide decay heat removal through Unit 1 SGs 2 and 3. This requires 1-FMO-222 and 1-FMO-232 be operable. 1-FMO-222 may fail due to fire induced damage of 600V MCC 1-EZC-D and cable 8542G-1. 1-FMO-232 is may fail due to fire induced damage of 600V MCC 1-EZC-D and cable 8539G-1. These cable failures could spuriously close the valves. This condition represents a variance from the deterministic requirements of NFPA 805, Section 4.2.3. This is a separation issue.

This VFDR has been evaluated and it was determined that the risk, safety margin and defense-in-depth meet the acceptance criteria of NFPA 805 Section 4.2.4 with a recovery action credited.



**3.3.1.14 VFDR No. AA46-014**

1-PP-45-1, 1-PP-45-2, 1-PP-45-3 and 1-PP-45-4 – The RCPs are required to be tripped to prevent a loss of coolant accident if seal cooling and thermal barrier cooling is lost. A full area fire within Fire Area AA46 may cause the loss of seal cooling, thermal barrier cooling and Control Room trip capability of the RCPs. 1-PP-45-1 may lose Control Room trip capability due to fire induced damage of cables 10467-1 and 6793-1. 1-PP-45-2 may lose Control Room trip capability due to fire induced damage of cables 10143-1 and 4959-1. 1-PP-45-3 may lose Control Room trip capability due to fire induced damage of cables 10160-1 and 5649-1. 1-PP-45-4 may lose Control Room trip capability due to fire induced damage of cables 10485-1 and 4963R-1. This condition represents a variance from the requirements of NFPA 805, Section 4.2.3. This is a separation issue.

This VFDR has been evaluated and it was determined that the risk, safety margin and defense-in-depth meet the acceptance criteria of NFPA 805 Section 4.2.4 with a recovery action credited.

**3.3.1.15 VFDR No. AA46-015**

1-PP-50E, 1-PP-50W, 1-ICM-250 and 1-IMO-51 - The Unit 1 East or West Charging Pump is required to be operable to support CVCS for inventory control, reactivity control and seal cooling. The Unit 1 Charging Pumps may fail due to a full area fire within Fire Area AA46. 1-PP-50E and 1-PP-50W may fail due to the loss of power, Unit 1 CCW cooling and cable faults. Failure of both Unit 1 charging pumps requires cross-tying to the Unit 2 charging pumps to provide charging. Cross-tying requires the operation of manual valves 1-CS-302, 1-CS-534 and 2-CS-536. Cross-tying the charging system credits injecting through the Unit 1 BIT. Charging injecting through the BIT requires the Boron Injection Tank Outlet Shutoff Valve (1-ICM-250) to be open and 1 out of the 4 Boron Injection Line to Cold Leg Shutoff Valves (1-IMO-51, 1-IMO-52, 1-IMO-53 and 1-IMO-54) to be open. 1-ICM-250 is normally closed and failed closed on the loss of power. 1-ICM-250 may fail due to fire induced damage of 600V MCC 1-AM-D and cables 9090G-1, 9091G-1 and 9548G-1. 1-IMO-51 may fail due to fire induced damage of cable 8370G-1. 1-IMO-52 may fail due to fire induced damage of cable 8372R-1. 1-IMO-53 may fail due to fire induced damage of cable 8384G-1. 1-IMO-54 may fail due to fire induced damage of cable 8314R-1. The cable failures of the Boron Injection Line Valves could spuriously close the valves. This condition represents a variance from the deterministic requirements of NFPA 805, Section 4.2.3. This is a separation issue.

This VFDR has been evaluated and it was determined that the risk, safety margin and defense-in-depth meet the acceptance criteria of NFPA 805 Section 4.2.4 with a recovery action credited.

**3.3.1.16 VFDR No. AA46-016**

1-PZRHTR.AUTO – Pressurizer heater is required not to spuriously operate to ensure pressure control is maintained. Spurious operation of the pressurizer heater could heat up the pressurizer causing an uncontrolled pressure increase in the RCS. 1-PZRHTR.AUTO may fail due to fire induced damage of cables 8733PO-1 and 9600PY-1. Failure of these cables could cause spurious operation of the pressurizer heater. This condition represents a variance from the deterministic requirements of NFPA 805, Section 4.2.3. This is a separation issue.

This VFDR has been evaluated and it was determined that the risk, safety margin and defense-in-depth meet the acceptance criteria of NFPA 805 Section 4.2.4 with a defense-in-depth action credited.

**3.3.1.17 VFDR No. AA46-017**

1-QRV-10, 1-QRV-20, 1-QRV-30 and 1-QRV-40 - RCP Seal Water Return Isolation Valves are required to be open to support CVCS. Seal return lines are required to be open to prevent damage to the RCP seals. Damage to the seals could result in a leak of 180 GPM. These valves are required to be open to maintain inventory and pressure control. 1-QRV-10 may fail due to fire induced damage of cable 4418PR-1. 1-QRV-20 may fail due to fire induced damage of cable 4955PG-1. 1-QRV-30 may fail due to fire induced damage of cable 5654PG-1. 1-QRV-40 may fail due to fire induced damage of cable 5002PR-1. These cable failures could spuriously close the valves. This condition represents a variance from the deterministic requirements of NFPA 805, Section 4.2.3. This is a separation issue.

This VFDR has been evaluated and it was determined that the risk, safety margin and defense-in-depth meet the acceptance criteria of NFPA 805 Section 4.2.4 with a recovery action credited.

**3.3.1.18 VFDR No. AA46-018**

1-NRV-163 and 1-NRV-164 – Pressurizer Spray Valves are required to be closed to support RCS integrity. RCS integrity is required to maintain positive control over RCS inventory and pressure. 1-NRV-163 may fail due to fire induced damage of cables 10182-1, 10183-1, 10751-1, 10773-1, 11266-1, 18895-1, 8733PO-1 and 9600PY-1. 1-NRV-164 may fail due to fire induced damage of cables 10182-1, 10184-1, 10751-1, 10773-1, 11480-1, 18896-1, 8733PO-1 and 9600PY-1. Failure of these cables could spuriously open the valves. Opening of the Pressurizer Spray Valves with RCP # 3 and # 4 running will result in a SI. This condition represents a variance from the deterministic requirements of NFPA 805, Section 4.2.3. This is a separation issue.

This VFDR has been evaluated and it was determined that the risk, safety margin and defense-in-depth meet the acceptance criteria of NFPA 805 Section 4.2.4 with a recovery action credited.



**3.3.1.19 VFDR No. AA46-019**

1-QRV-113, 1-QRV-114 and 1-QRV-170 – Excess Letdown Isolation Valves are required to be closed to support CVCS isolation. CVCS isolation is required to maintain positive control over inventory and pressure. In order to achieve excess letdown isolation the following valves need to be closed; 1-QRV-113 or 1-QRV-114 or 1-QRV-170. All of these valves may fail due to a full area fire within Fire Area AA46. 1-QRV-113 may fail due to fire induced damage of cable 6238PR-1. 1-QRV-114 may fail due to fire induced damage of cable 6239PG-1. 1-QRV-170 may fail due to fire induced damage cable 18872-1. These cable failures could spuriously open the valves. This condition represents a variance from the deterministic requirements of NFPA 805, Section 4.2.3. This is a separation issue.

This VFDR has been evaluated and it was determined that the risk, safety margin and defense-in-depth meet the acceptance criteria of NFPA 805 Section 4.2.4 with a defense-in-depth action credited.

**3.3.2 Recovery Actions Credited**

For each VFDR, a Fire Risk Evaluation has been performed to assess the acceptability of risk, defense-in-depth, and safety margin. This evaluation determined whether or not recovery actions are required to ensure that one success path necessary to achieve and maintain the nuclear safety performance criteria is maintained free of fire damage by a single fire. Table 3-3 identifies the credited recovery actions for this area. Actions retained for DID are identified as “DID Actions” within Table 3-3. Additional information for DID actions is contained within Section 3.8 of this report. Note that, for completeness, all VFDRs are contained within Table 3-3, even if the Fire Risk Evaluation has determined that a recovery action is not required. In those instances where a recovery action has been determined to not be required, the word “None” is provided in the “Action” column in the table.

<b>Table 3-3, Recovery Actions Credited</b>		
<b>VFDR</b>	<b>Component</b>	<b>Action</b>
AA46-001	1-NRV-151	1-NRV-151-CLOSE-ALT (De-energize 1-CCV-AB at 1-MCAB circuit 16 to close 1-NRV-151)
	1-NRV-152	1-NRV-152-CLOSE-ALT (De-energize 1-CCV-AB at 1-MCAB circuit 16 to close 1-NRV-152)
	1-NRV-153	1-NRV-153-CLOSE-ALT (De-energize 1-CCV-CD at 1-MCCD circuit 16 to close 1-NRV-153)

Table 3-3, Recovery Actions Credited		
VFDR	Component	Action
AA46-002	1-NSO-021 1-NSO-022 1-NSO-023 1-NSO-024	1-NSO-021-CLOSE ALT (De-energize 1-CCV-CD at 1-MCCD circuit 16 to close 1-NSO-021)  1-NSO-023-CLOSE ALT (De-energize 1-CCV-AB at 1-MCAB circuit 16 to close 1-NSO-023)
AA46-003	1-NSO-061 1-NSO-062 1-NSO-063 1-NSO-064	1-NSO-061-CLOSE ALT (De-energize 1-CCV-CD at 1-MCCD circuit 16 to close 1-NSO-061)  1-NSO-063-CLOSE ALT (De-energize 1-CCV-AB at 1-MCAB circuit 16 to close 1-NSO-063)
AA46-004	1-QRV-111	DID ACTION 1-QRV-111-CLOSE ALT (De-energize 1-CCV-CD at 1-MCCD circuit 16 to close 1-QRV-111)
AA46-005	1-DCR-310 1-DCR-340	1-DCR-310/340-CLOSE ALT (De-energize 1-CCV-CD at 1-MCCD circuit 16 to fail 1-DC-310 and 1-DCR-340 closed)
AA46-006	1-DCR-320 1-DCR-330	1-DCR-320/330-CLOSE ALT (De-energize 1-CCV-AB at 1-MCAB circuit 16 to fail 1-DCR-320 and 1-DCR-330 closed)

Table 3-3, Recovery Actions Credited		
VFDR	Component	Action
AA46-007	1-MRV-210 1-MRV-240	<p>1-MRV-211-OPEN (Manually open 1-MRV-211 to close valve 1-MRV-210)</p> <p>or</p> <p>1-MRV-212-OPEN (Manually open 1-MRV-212 to close valve 1-MRV-210)</p> <p>and</p> <p>1-MRV-241-OPEN (Manually open 1-MRV-241 to close valve 1-MRV-240)</p> <p>or</p> <p>1-MRV-242-OPEN (Manually open 1-MRV-242 to close valve 1-MRV-240)</p>
AA46-008	1-MRV-220 1-MRV-230	<p>1-MRV-221-OPEN (Manually Open 1-MRV-221 to close 1-MRV-220)</p> <p>or</p> <p>1-MRV-222-OPEN (Manually Open 1-MRV-222 to close 1-MRV-220)</p> <p>and</p> <p>1-MRV-231-OPEN (Manually Open 1-MRV-231 to close 1-MRV-230)</p> <p>or</p> <p>1-MRV-232-OPEN (Manually Open 1-MRV-232 to close 1-MRV-230)</p>
AA46-009	1-MRV-213-P 1-MRV-243-P	<p>1-MRV-213-P-CLOSE (Manually close 1-MRV-213)</p> <p>1-MRV-243-P-CLOSE (Manually close 1-MRV-243)</p>

Table 3-3, Recovery Actions Credited		
VFDR	Component	Action
AA46-010	1-MRV-223-P 1-MRV-233-P	1-MRV-223-P-CLOSE (Manually close 1-MRV-223)  1-MRV-233-P-CLOSE (Manually close 1-MRV-233)
AA46-011	1-BLI-120-CRI 1-BLI-130-CRI 1-MPP-220-CRI 1-MPP-230-CRI 1-NLP-151-CRI 1-NPS-110-CRI 1-NTR-120 1-NTR-220 1- NRI-1	1-LSI-4-ALT-PWR (Align unaffected Unit Power to LSI Panel)  1-LSI-6-ALT-PWR (Align unaffected Unit Power to LSI Panel)  1-LSI-2-LOCAL (Locally monitor 1-LSI-2)  1-LSI-3-LOCAL (Locally monitor 1-LSI-3)  1-LSI-4-LOCAL (Locally monitor 1-LSI-4)  1-LSI-6-LOCAL (Locally monitor 1-LSI-6)
AA46-012	1-PP-3E 1-PP-3W 1-PP-4	1-FW-129-OPEN (Open manual valve 1-FW-129)  2-FW-261-CLOSE (Close manual valve 2-FW-261)
AA46-013	1-FMO-222 1-FMO-232	1-FMO-222-OPERATE (De-energize and manually operate 1-FMO-222)  1-FMO-232-OPERATE (De-energize and manually operate 1-FMO-232)

Table 3-3, Recovery Actions Credited		
VFDR	Component	Action
AA46-014	1-PP-45-1 1-PP-45-2 1-PP-45-3 1-PP-45-4	1-PP-45-1-TRIP (Locally trip RCP 1)  1-PP-45-2-TRIP (Locally trip RCP 2)  1-PP-45-3-TRIP (Locally trip RCP 3)  1-PP-45-4-TRIP (Locally trip RCP 4)
AA46-015	1-PP-50E 1-PP-50W 1-ICM-250	1-CS-302-CLOSE (Close manual valve 1-CS-302)  1-CS-534-OPEN (Open manual valve 1-CS-534)  2-CS-536-OPEN (Open manual valve 2-CS-534)  1-ICM-250-OPEN (De-energize and manually open 1-ICM-250)  1-IMO-51-OPEN (De-energize and manually open 1-IMO-51)
AA46-016	1-PZRHTR.AUTO	DID ACTION 1-PZRHTR.AUTO-OFF (Trip breakers T11A6 and T11D9 prior to control room evacuation and locally trip breakers to eliminate spurious operation of the heater)
AA46-017	1-QRV-10 1-QRV-20 1-QRV-30 1-QRV-40	1-QRV-10/40-OPEN-ALT (De-energize VDAB panel by opening circuit #1 on MDAB to open 1-QRV-10 and 1-QRV-40)  1-QRV-20/30-OPEN-ALT (De-energize VDAB panel by opening circuit #1 on MDAB to open 1-QRV-20 and 1-QRV-30)
AA46-018	1-NRV-163 1-NRV-164	1-RCP-ALL-TRIP (Locally trip Unit 1 RCPs)

Table 3-3, Recovery Actions Credited		
VFDR	Component	Action
AA46-019	1-QRV-113 1-QRV-114 1-QRV-170	DID ACTION 1-QRV-113-CLOSE ALT (De-energize CRAB and VDAB at MDAB circuit 1 to close 1-QRV- 113)

### 3.4 Non-Power Operational Modes Compliance Summary

A review of CNP for the potential effects of a fire in this Fire Area while in non-power modes of operation (NPO) was conducted. This review was conducted using the guidance provided in NEI 04-02 and FAQ 07-0040, "Non-Power Operations Clarifications".

The review determined that there are potential failures that affect certain Key Safety Functions (KSF) as a result of the fire in this area, and the fire could result in the loss of one or more KSF paths. These concerns "i.e. pinch points" have been addressed by the implementation of a continuous fire watch in the fire area during periods defined as "High Risk Evolutions" in the referenced NPO Analysis. The fire area is continuously manned by Operations personnel who will be credited as the continuous fire watch. Continuous fire watches during high risk evolution periods provides reasonable assurance a fire will not adversely affect key safety functions and the NFPA 805 performance goal for NPO is therefore satisfied. The results of the NPO analysis are contained within Technical Evaluation R1900-005-001, Non-Power Operation Modes Transition Review Report.

### 3.5 Radioactive Release Compliance Summary

The NFPA 805 radiological release goal is to provide reasonable assurance that a fire will not result in a radiological release that adversely affects the public, plant personnel or the environment. The NFPA 805 requirement is to ensure a radiation release to any unrestricted area due to the direct effects of fire suppression activities (but not involving fuel damage) shall be as low as reasonably achievable and shall not exceed applicable plant Technical Specification limits.

AA46 is located outside the Radiological Controlled Area (RCA) and is not a storage location for contaminated materials, therefore there is reasonable assurance a fire in this area will not result in radiation release. The review of this fire area, with respect to radioactive release, is documented in the NFPPM.

### 3.6 Probabilistic Risk Assessment-Summary of Results

A Fire PRA (FPRA) quantification of Fire Area AA46 was performed and is documented in PRA-NB-FIRE-FQ, Fire PRA Model Quantification Notebook. The fire risk quantification for Fire Area AA46 is analyzed using the main control room fire modeling methodology. PRA-NB-FIRE-FQ includes a summary of all potentially risk-significant fire scenarios (i.e., CDF > 1.0E-7 or LERF > 1.0E-8). Bounding CDF / LERF per calendar year values are reported that are based on the risk values documented in PRA-NB-FIRE-FSS, Fire PRA Fire Scenario Selection.

Fire Protection features credited in the Fire PRA are documented in R1900-0411-MCR, Detailed Fire Modeling Report: Fire Compartment: AA46 and AA47 Main Control Room Fire Evacuation Study (Unit 1 and Unit 2). PRA-NB-FIRE-FSS documents the revision level of the fire modeling reports used in the most recent Fire PRA quantification.

### 3.7 Risk-Informed, Performance-Based Evaluations

Fire Risk Evaluations (FREs) have been performed to ensure that variances from the NFPA 805 deterministic requirements are acceptable. The evaluation process consists of an integrated assessment of the acceptability of risk, defense-in-depth, and safety margins.

#### 3.7.1 Transition Risk-Informed, Performance-Based Evaluations

The ‘changes’ associated with NFPA 805 transition were those variances from the deterministic requirements of NFPA 805 or with the existing fire protection licensing basis that were brought into compliance with the NFPA 805 performance based approach. The change identified for evaluation for Fire Area AA46 is as follows:

- Separation Issues

The Fire Risk Evaluation has determined that the change is acceptable based upon:

- The measured change in CDF and LERF.
- Adequate defense-in-depth and safety margins being maintained.

Refer to Attachment 2 for a summary of results associated with the Fire Risk Evaluations.

### 3.8 Defense-in-Depth

A comprehensive risk-informed, performance-based analysis includes consideration of defense-in-depth (DID) as part of an integrated evaluation of risk considerations. In general, defense-in-depth involves consideration of the extent to which fire protection systems and features are provided within the three echelons of fire-protection:

- Preventing fires from starting,
- Rapidly detecting fires and controlling and extinguishing promptly those fires that do occur, thereby limiting fire damage,
- Providing an adequate level of fire protection for structures, systems, and components important to safety, so that a fire that is not promptly extinguished will not prevent the nuclear safety performance criteria from being met.

Each VFDR was evaluated for DID. The following recovery actions have been retained for DID.

VFDR No. AA46-004: 1-QRV-111, 1-QRV-112, 1-QRV-160 and 1-QRV-162 - The Letdown Isolation Valves are required to be closed to support CVCS isolation. CVCS isolation is required to maintain positive control over inventory and pressure. These valves may spuriously open due to a fire within AA46. These failures can be mitigated by locally de-energizing valve 1-QRV-111 to fail the valve closed. This recovery action is being retained to ensure CVCS isolation is maintained.

VFDR No. AA46-016: 1-PZRHTR.AUTO - The pressurizer heater is required not to spuriously operate to ensure pressure control is maintained. Spurious operation of the pressurizer heater could heat up the pressurizer causing an uncontrolled pressure increase in the RCS. The pressurizer heater may spuriously operate due to a fire within AA46. This failure can be mitigated by locally de-energizing the heater. This recovery action is being retained to ensure spurious operation of the pressurizer heater does not occur.

VFDR No. AA46-019: 1-QRV-113, 1-QRV-114 and 1-QRV-170 - The Excess Letdown Isolation Valves are required to be closed to support CVCS isolation. CVCS isolation is required to maintain positive control over inventory and pressure. These valves may spuriously open due to a fire within AA46. These failures can be mitigated by locally de-energizing valve 1-QRV-113 to fail the valve closed. This recovery action is being retained to ensure CVCS isolation is maintained.

Based on the assessment in support of the Fire Risk Evaluation, defense-in-depth is maintained for fire area AA46. Refer to Attachment 2 for details associated with the Fire Risk Evaluation.

### 3.9 Monitoring Program Input

A Monitoring Program will be developed in accordance with FAQ 10-0059, Rev. 1. Methods to monitor availability, reliability, and performance of fire protection program structures, systems, and components (SSCs), as well as programmatic elements will be provided. Additionally, effectiveness measures are established to review program related performance and trends. For AA46 the following systems and features are candidates for inclusion in the CNP Fire Protection Monitoring Program:

- Fire Area boundary barriers discussed in Section 3.1
- Fire Detection System (ionization)

### 4.0 CONCLUSION

The nuclear safety and radioactive release performance criteria of NFPA 805 are met for a fire in



Fire Area AA46. This Fire Risk Evaluation for Fire Area AA46 has demonstrated that

- The change in core damage frequency (delta CDF) is acceptable, and
- The change in large early release frequency (delta LERF) is acceptable, and
- Defense-in-depth and safety margins are maintained.

This is confirmation that a success path effectively remains free of fire damage and that the performance-based approach is acceptable per Section 4.2.4.2 of NFPA 805.

## 5.0 REFERENCES

- 5.1 Calculation PRA-FIRE-NB-CRE, Fire PRA Cumulative Risk Evaluations
- 5.2 CNP Fire Pre-Plans, Volumes I, II, and III, Revisions 17, 14, and 18 respectively
- 5.3 Fire Hazards Analysis
- 5.4 NFPA 805, Performance-Based Standard for Fire Protection for Light Water Reactor Electric Generating Plants
- 5.5 NFPPM, NFPA 805 Fire Protection Program Manual (NFPPM)
- 5.6 Nuclear Energy Institute (NEI) 04-02, Guidance for Implementing a Risk-Informed, Performance-Based Fire Protection Program under 10 CFR 50.48(c), Rev. 2
- 5.7 Nuclear Safety Capability Assessment Report
- 5.8 PRA-NB-FIRE-FQ, Fire PRA Model Quantification Notebook
- 5.9 PRA-NB-FIRE-FSS, Fire PRA Fire Scenario Selection
- 5.10 Regulatory Guide 1.205, Risk-Informed, Performance-Based Fire Protection for Existing Light-Water Nuclear Power Plants, Rev. Revision 1
- 5.11 Technical Evaluation R1900-005-001, Non-Power Operation Modes Transition Review

**Fire Area AA46 – Attachment 1 - Table B-3 - Fire Area Transition**

<u>Unit</u>	<u>Fire Area</u>	<u>Description</u>
1	AA46	Unit 1 Control Room (El. 633 ft.)

<u>Fire Zone</u>	<u>Description</u>
53	Unit 1 Control Room - El. 633 ft. 0 in.

**Regulatory Basis**

4.2.4.2 - Performance-Based Approach - Fire Risk Evaluation with simplifying deterministic assumptions

<b>Performance Goal</b>	<b>Method of Accomplishment</b>	<b>Comments</b>
Reactivity Control	Unit 1 - Trip the reactor from the Control Room. Borate using Unit 2 East or West Charging Pumps supplied from the Unit 2 RWST injecting through the Unit 1 BIT. Use source range monitoring for indication.	None
Inventory and Pressure Control	Unit 1 - Control inventory using Unit 2 East and West Charging Pumps injecting through the Unit 1 BIT. Control pressure using Unit 1 Pressurizer Safety Relief Valves.	VFDRs identified for CVCS and RCS integrity.
Decay Heat Removal	Unit 1 - Feed Unit 1 SGs 2 & 3 with Unit 2 West MDAFW Pump. The DHR function also requires MS isolation with a steam release path through the Safety Relief Valves.	VFDRs identified for AFW and MS isolation.
Process Monitoring	Unit 1 Process Monitoring - Use Unit 1 alternate process monitoring powered from Unit 2 at the local shutdown panels for the following: Pressurizer level, RCS pressure and temperature, and S/G level and Pressure. Unit 1 Source Range Monitoring - Use Unit 1 alternate source range monitoring powered from Unit 2 at the local shutdown panels.	VFDRs identified for process and source range monitoring.
Vital Auxiliaries	Unit 1 Electrical - Control Unit 2 Red (AB) Train Electrical Distribution with Unit 2 Red (AB) DG. Control Unit 2 Green (CD) Train Electrical Distribution with Unit 2 Green (CD) DG. Unit 1 ESW - Operate Unit 2 East and West ESW. Unit 1 CCW - Operate Unit 2 East and West CCW. Unit 1 HVAC - Unit 1 Control Room HVAC is not required as alternate shutdown is utilized for this area. Unit 1 Auxiliary Building HVAC is not operational, Unit 2 Auxiliary Building HVAC remains available and provides adequate cooling. Operate Unit 2 Red (AB) and Green (CD) DG HVAC.	Unit 2 vital auxiliaries are credited to support Unit 2 equipment that is crosstied to Unit 1.

**Fire Area AA46 – Attachment 1 - Table B-3 - Fire Area Transition**

<u>Unit</u>	<u>Fire Area</u>	<u>Description</u>
1	AA46	Unit 1 Control Room (El. 633 ft.)
		Operate Unit 2 Red (AB) and Green (CD) Switchgear HVAC. Operate Unit 2 West MDAFW Room HVAC system. Operate the Unit 2 East and West ESW Room HVAC systems.

**Reference Documents**

Genesis Solution Suite, EDISON / SAFE-PB, DC Cook V 3.4.0

Nuclear Safety Capability Assessment Report

**Licensing Actions**

None

**Existing Engineering Equivalency Evaluations (EEEE)****EEEE Title Engineering Equivalency Evaluation 9-5 - Fire Zones 70 (Fire Area AA57A) and 73 (Fire Area AA57B) Hatch Evaluations**

**Summary** The purpose of this engineering equivalency evaluation is to document the acceptability of unrated floor hatches located between the HVAC Equipment Rooms (Fire Zones 70 and 73) and the Unit 1 and Unit 2 Main Control Rooms (Fire Zones 53 and 54), and the fixed suppression exemption requests for the Main Control Rooms or other engineering equivalency evaluations. Fire Zones 70 and 73 are located in Fire Areas AA57A and AA57B, respectively, while Fire Zones 53 and 54 are located in Fire Areas AA46 and AA47, respectively. A 3-hr fire-rated hatch assembly is not commercially available for use in this location.

Note: This engineering equivalency evaluation has been reviewed by the NRC. Refer to NRC SER dated June 17, 1988, for acceptance of unrated fire hatches in fire area boundaries. The NRC concluded that the level of fire safety is equivalent to that achieved by conformance with the guidelines of Section D.1.j of Appendix A to BTP APCSB 9.5-1, and, therefore, the deviations for the unrated fire hatches were found acceptable.

Reasonable assurance is provided that a fire in Fire Zones 70, 71, 72 and 73 would not impair the safe shutdown capabilities in either unit. This engineering equivalency evaluation does not adversely impact other engineering equivalency evaluations.

The hatches were evaluated and found to be acceptable based on the fire hazards, fire protection systems and construction features within the evaluated areas. Also, some areas being evaluated are continuously manned.

**Fire Area AA46 – Attachment 1 - Table B-3 - Fire Area Transition**

<u>Unit</u>	<u>Fire Area</u>	<u>Description</u>
1	AA46	Unit 1 Control Room (El. 633 ft.)

<b><u>EEEE Title</u></b>	<b>Engineering Equivalency Evaluation 9-13 - Fire Zone 53 (Fire Area AA46) and Fire Zone 57 (Fire Area AA50) Hatch Evaluation</b>
<b><u>Summary</u></b>	<p>The purpose of this engineering equivalency evaluation is to document the acceptability of an unrated steel plate hatch located between the Unit 1 Control Room in Fire Zone 53 (Fire Area AA46) and the Unit 1 Control Room Cable Vault in Fire Zone 57 (Fire Area AA50) and the request for a fixed suppression exemption in Fire Zone 53. A 3-hr fire-rated hatch assembly is not commercially available for use in this location.</p> <p>Note: This engineering equivalency evaluation has been reviewed by the NRC. Refer to NRC SER dated June 17, 1988, for acceptance of unrated fire hatches in fire area boundaries. The NRC concluded that the level of fire safety is equivalent to that achieved by conformance with the guidelines of Section D.1.j of Appendix A to BTP APCSB 9.5-1, and, therefore, the deviations for the unrated fire hatches were found acceptable.</p> <p>Reasonable assurance is provided that a fire in Fire Zone 53 or Fire Zone 57 would not impair the safe shutdown capabilities of Unit 1. This engineering equivalency evaluation does not adversely impact other engineering equivalency evaluations.</p> <p>The hatch was evaluated and found to be acceptable based on the fire hazards, fire protection systems and construction features within the evaluated areas.</p>
<b><u>EEEE Title</u></b>	<b>Engineering Equivalency Evaluation 11-9 - Turbine, Auxiliary and Containment Buildings Boundary Evaluation</b>
<b><u>Summary</u></b>	<p>The purpose of this engineering equivalency evaluation is to describe in general, the approach and existence of evaluations performed to determine and reconcile fire area boundaries having components or designs with less than a 3-hr fire rating on preventing the spread of fire. This engineering equivalency evaluation also specifically evaluates the impact of unrated door assemblies on the spread of fire.</p> <p>Reasonable assurance is provided that the fire area boundaries having components or design less than a 3-hr fire rating will not increase the spread of fire or impair the safe shutdown capabilities of Units 1 or 2. In addition, this engineering equivalency evaluation does not adversely impact on other engineering equivalency evaluations or exemption requests.</p> <p>This evaluation supports additional evaluations credited in this fire area.</p>

**Fire Area AA46 – Attachment 1 - Table B-3 - Fire Area Transition**

<u>Unit</u>	<u>Fire Area</u>	<u>Description</u>
1	AA46	Unit 1 Control Room (El. 633 ft.)
<hr/>		
<b><u>EEEE Title</u></b>	<b>Engineering Equivalency Evaluation 11-36 - Unit 1 and Unit 2 Hot Shutdown Panel Enclosure: Unit 1 Fire Zone 144 (Fire Area AA50) and Unit 2 Fire Zone 145 (Fire Area AA51)</b>	
<b><u>Summary</u></b>	<p>The purpose of this engineering equivalency evaluation is to document the acceptability that deviations to the 3-hr fire rating of the Unit 1 and Unit 2 Hot Shutdown Panel (HSDP) enclosures (Fire Zone 144 for Unit 1 and Fire Zone 145 for Unit 2) would have on preventing the spread of fire. This engineering equivalency evaluation evaluates the ability of the existing structure to provide adequate separation of the HSDPs from their opposite unit's control room. In addition to the reduction of the roof/ceiling assembly fire rating from 3 hours to a nominal 2 hours (2 hours and 12 minutes), this engineering equivalency evaluation reviews the roll-up fire door installation and the protective design for the columns.</p> <p>Reasonable assurance is provided that the deviation from providing a 3-hr rated enclosure for each of the HSDPs will not impair the safe shutdown capabilities of CNP or increase the potential for spread of fire between the HSDP enclosures (Fire Zones 144 and 145) and the control rooms (Fire Zones 53 and 54) in which they are located.</p> <p>The HSDPs were evaluated and found to be acceptable based on the fire hazards, fire protection systems and construction features within the evaluated areas. Also, some areas being evaluated are continuously manned.</p>	
<b><u>EEEE Title</u></b>	<b>Engineering Equivalency Evaluation 11-41 - Unit 1 Fire Zone 53 (Fire Area AA46) and Unit 2 Fire Zone 54 (Fire Area AA47) Boundary Evaluation</b>	
<b><u>Summary</u></b>	<p>The purpose of this engineering equivalency evaluation is to document the acceptability of installing a partial raised floor in the Unit 1 and Unit 2 control rooms (Fire Zones 53 and 54) on preventing the spread of fire. The engineering equivalency evaluation demonstrates that the existing fire protection measures for the control room are adequate and will not require the raised floor area to be provided with an automatic detection or suppression system.</p> <p>Reasonable assurance is provided that the installation of a partial raised floor in the Unit 1 and Unit 2 control rooms, Fire Zones 53 and 54 respectively, will not impair the safe shutdown capabilities of CNP or aid in the spread of fire within the zones. This engineering equivalency evaluation does not impact other engineering equivalency evaluations.</p> <p>The partial raised floor was evaluated and found to be acceptable based on the fire hazards, fire protection systems and construction features within the evaluated areas. Also, the areas being evaluated are continuously manned.</p>	

**Fire Area AA46 – Attachment 1 - Table B-3 - Fire Area Transition**

<u>Unit</u>	<u>Fire Area</u>	<u>Description</u>
1	AA46	Unit 1 Control Room (El. 633 ft.)

<b><u>EEEE Title</u></b>	<b>Engineering Equivalency Evaluation 11-69 - Electromagnetic Fire/Security Door Locks</b>
<b><u>Summary</u></b>	<p>The purpose of this evaluation is to document acceptability of non-UL/FM approved DynaLock Model 2280 electromagnetic door locks that were installed under EC-0000050114. NFPA 80 1970 Ed. Section 516 Builders Hardware, sub-section b. Locks and Latches states, in part, "Only labeled fire exit hardware shall be used." The Dynalock Model 2280 magnetic door locks are installed primarily for Security purposes and are not UL/FM approved devices as required by code. Therefore, this evaluation is necessary to provide technical justification supporting acceptability of the Dynalock Model 2280 electromagnetic lock mechanism.</p> <p>This evaluation shows that the use of the DynaLock Model 2280 magnetic lock devices provides, reasonable assurance fire doors will remain closed and retain the required passive fire protection function. The use of the DynaLock Model 2280 magnetic lock devices has no impact on the ability of CNP to achieve and maintain a safe and stable condition, nor does it increase the risk of the spread of fire between plant fire zones.</p> <p>EEE-11-69 evaluated magnetic door latches installed on door 1-DR-AUX412B in this Analysis Area boundary. This evaluation shows that the use of the DynaLock Model 2280 magnetic lock devices provides reasonable assurance fire doors will remain closed and retain the required passive fire protection function.</p>
<b><u>EEEE Title</u></b>	<b>Engineering Equivalency Evaluation 11-79 - Fire Zone 53 (AA46) And Fire Zone 57 (AA50) Fire Barrier Penetration Seals</b>
<b><u>Summary</u></b>	<p>The purpose of this evaluation is to document the acceptability of fire barrier penetration seals in the floor of the Unit 1 Control Room that have been identified with a fire seal depth below the minimum depth required per ES-FIRE-0601-QCF, Engineering Specification for Fire Rated Seals, for a three hour fire seal.</p> <p>Floor fire seals with less than the required fire seal depth are acceptable as is and reasonable assurance is provided that a fire in Fire Zone 53 (AA46) or Fire Zone 57 (AA50) would not impair the ability of CNP to reach and maintain a safe and stable hot standby. In addition, this evaluation does not impact other evaluations, but will encompass the evaluation formally contained in EEE-11-49.</p> <p>The fire rated penetration seals were evaluated and found to be acceptable based on the fire hazards, fire protection systems, and transient combustible and hot work restrictions within the evaluated areas, as well as the identical response for fire safe shutdown required by procedures for the evaluated areas.</p>

**Fire Area AA46 – Attachment 1 - Table B-3 - Fire Area Transition**

<u>Unit</u>	<u>Fire Area</u>	<u>Description</u>
1	AA46	Unit 1 Control Room (El. 633 ft.)

**Fire Suppression Effects on Nuclear Safety Performance Criteria**

The CNP fire brigade is trained to discharge water in a judicious manner and instructed to direct hose streams and portable extinguishers at the base of the fire to limit the amount of overspray beyond the immediate fire zone. For this reason, fire brigade activities are not expected to fail components not already considered damaged. It has been concluded that water impingement on cables is not a concern. Electrical cabinets are provided with a seal at the conduit interface. Per visual inspection any side vents for this equipment are pointed downward to prevent water intrusion. The drainage features of the fire area mitigate the potential for flooding damage due to fire suppression, such that the standing water would not affect credited equipment.

This fire area is not equipped with a fixed fire suppression system. Since it is shown that suppression effects will not impact the nuclear safety performance criteria, the fire area configuration is deemed acceptable.

**References:**

Technical Evaluation 12.1, "Fire Suppression Effects Study"

Technical Evaluation 12.1, "Supplemental Information to Fire Suppression Effects Study – Supplement 1"

**Fire Area Comments**

Revise time requirement \ time basis per AR 2015-14147 for VFDR AA46-014

## Fire Area AA46 – Attachment 2 - Fire Risk Evaluation Results Summary

### A2.1 Introduction

The ‘changes’ associated with NFPA 805 transition were those variances from the deterministic requirements of NFPA 805. The changes identified for evaluation for fire area AA46 are grouped as follows:

- Separation Issues

This attachment is a summary of the Fire Risk Evaluation for the fire area. The complete results and methodology are contained in the Cumulative Fire Risk Evaluation, PRA-FIRE-NB-CRE. (FPCE 2017-0009)

### A2.2 Inputs/Assumptions

1. Assumptions from the Fire PRA apply to this calculation.
2. Detailed fire modeling was not performed for Fire Area AA46. A single whole room burnout scenario was assumed.

### A2.3 Fire Modeling Methodology

Detailed fire modeling was not performed for Fire Area AA46. This area was modeled considering whole room burnout.

### A2.4 Scenario Descriptions and Model Results

A single whole room burnout scenario was modeled for Fire Area AA46. All targets within the fire area were assumed damaged.

#### A2.4.1 Ignition Sources

The fixed ignition sources in Fire Area AA46 consist of the main control room boards and control room back panels. Additional detail regarding the ignition sources in this area is available in the Fire PRA Report. All fire scenarios, whether resulting from fixed or transient ignition sources, are assumed to damage all targets in the fire area.

#### A2.4.2 Scenario Results

A delta risk calculation has been performed to quantify the risk associated with the VFDRs in the fire area.

### A2.5 Fire Risk Evaluation Results

PRA-FIRE-NB-CRE documents scenarios and corresponding impacted VFDRs that were evaluated for delta risk during the transition to NFPA 805 and also all changes to the Fire Protection Program that are currently incorporated into the Fire PRA model. The acceptability of the Cumulative Fire Risk Evaluations was based on calculated delta risk meeting the thresholds of NEI 04-02, RG 1.205 and RG 1.174. (FPCE 2017-0009)



## Fire Area AA46 – Attachment 2 - Fire Risk Evaluation Results Summary

### A-2.6 Impact of VFDR on Defense-in-Depth

Defense-in-Depth has been evaluated for this fire area. The impacts of this evaluation are summarized in the table below:

Defense-in-Depth Impact Review for AA46			
Method of Providing DID	Required to Support Deterministic Analysis or Fire PRA?	Changes or Improvements Necessary for DID?	Basis/Justification
Echelon 1: Prevent fires from starting			
Combustible Control is implemented in accordance with Procedure PMP-2270-CCM-001, Control of Combustible Materials.	Yes	No	• This element is adequate based on no perceived weakness of, or over-reliance on, another echelon of defense-in-depth.
Hot Work Control is implemented in accordance with Procedure PMP-2270-WBG-001, Welding, Burning and Grinding Activities.	Yes	No	
Echelon 2: Rapidly detect, control and extinguish promptly those fires that do occur thereby limiting fire damage			
Fire Detection System	Yes	No	• Detection is already required and fire fighting activities are not expected to be challenging, therefore, no changes or improvements to Echelon 2 attributes are necessary to maintain defense-in-depth.
Fixed Fire Suppression	No	No	
Portable Fire Extinguishers	Yes	No	
Hose stations and hydrants	Yes	No	
Pre-Fire Plan	Yes	No	
Echelon 3: Provide adequate level of fire protection for systems and structures so that a fire will not prevent essential safety functions from being performed			
Walls, floors ceilings and structural elements are rated or have been evaluated as adequate for the hazard.	Yes	No	• There are significant modeling differences between the Fire PRA and nuclear safety capability assessment (i.e., due to different success criteria, end states, etc.) and therefore recovery actions for VFDR AA46-004, AA46-016 and AA46-019 have been credited to ensure that defense-in-depth is maintained.
Penetrations in the fire area barrier are rated or have been evaluated as adequate for the hazard.	Yes	No	
Supplemental barriers (e.g., ERFBS, cable tray covers, etc.)	No	No	• Where a variance can possibly be affected in a potentially high risk scenario, based on a detailed review, the VFDR is either not the cause for the high risk of the scenario or the mitigating recovery action is credited; therefore no changes or improvements to Echelon 3 attributes are necessary to maintain defense-in-depth.
Guidance provided to operations personnel detailing the required success path(s) including recovery actions to achieve nuclear safety performance criteria.	Yes	Yes	

## Fire Area AA46 – Attachment 2 - Fire Risk Evaluation Results Summary

### A-2.7 Safety Margin Considerations

In accordance with NEI 04-02, the maintenance of adequate Safety Margin is assessed by the consideration categories of analyses utilized by this Fire Risk Evaluation.

Safety margins are considered to be maintained if:

- Codes and Standards or their alternatives accepted for use by the NRC are met.

AND

- Safety analyses acceptance criteria in the licensing basis (e.g., FSAR, supporting analyses) are met, or provides sufficient margin to account for analysis and data uncertainty.

The following summarizes the bases for ensuring the maintenance of safety margins:

- The risk-informed, performance based processes utilized are based upon NFPA 805, 2001 edition, endorsed by the NRC in 10 CFR 50.48(c).
- The Fire Risk Evaluation process is in accordance with NEI 04-02, Revision 2, which is endorsed by the NRC in Regulatory Guide 1.205, Revision 1.
- The Fire PRA is developed in accordance with NUREG/CR-6850, which was developed jointly between the NRC and EPRI.
- The Fire PRA has undergone an industry peer review, in order to ensure the Fire PRA meets the appropriate quality standards of ASME/ANS RA-Sa-2009, "Standard for Level 1/Large Early Release Frequency Probabilistic Risk Assessment for Nuclear Power Plant Applications," Dated February 2, 2009
- The "bounding risk assessment" is used during transition (NEI 04-02, Section 5.3.4.2). This approach conservatively assumes that target set damage occurs for postulated fire events which resulted in whole room burn up, and therefore, MEFS/LFS is not analyzed separately from the Fire PRA results.
- The CNP internal events PRA model received two formal industry peer reviews conducted in accordance with applicable NEI guidelines. The initial peer review was performed in 2001, while a subsequent focused scope (i.e., limited scope) peer review was conducted in 2009. The initial, full-scope WOG peer review covered all aspects of the CNP PRA model and the administrative processes used to maintain and update the model. The CNP PRA model has been revised to address all significant issues (i.e., Category A and B Facts & Observations) identified during the initial peer review. None of the findings from the focused-scope peer review were judged to reach the significance level of a Category A or B Fact & Observation; as a result, no changes to the PRA model have yet been made to include resolutions for these latter issues.
- Fire protection systems and features determined to be required by NFPA 805 Chapter 4 have been confirmed to meet the requirements of NFPA 805 Chapter 3 and their associated referenced codes and listings, or provided with acceptable alternatives using processes accepted for use by the NRC (i.e., FAQ 06-0008, FAQ 06-0004, 07-0033).
- Fire modeling has not been performed in support of the change evaluations and results are therefore, based on whole area burn up. As such, the results are considered very conservative.
- In accordance with the requirements of 10 CFR 50.48(c)(2)(iii), the Fire PRA results, including cutsets for

## **Fire Area AA46 – Attachment 2 - Fire Risk Evaluation Results Summary**

the scenarios of concern, have been reviewed and it was verified that the results presented above do not rely solely on feed and bleed as the fire-protected safe shutdown path for maintaining reactor coolant inventory, pressure control, and decay heat removal capability for this fire area.

### **A-2.8 Transition Risk Evaluation Conclusions**

The transition change evaluation determined that these changes:

- Are acceptable based upon the measured change in CDF and LERF
- Maintained adequate defense-in-depth and safety margins

The results of this evaluation meet the requirements of NFPA 805 Risk Evaluation; therefore, the use of the performance based analysis approach is acceptable.

## D. C. Cook Nuclear Plant Fire Safety Analysis

## Fire Area: AA47

Unit 2 Control Room (El. 633 ft.)

## Table of Contents

<b>Purpose</b> .....	Section 1.0
<b>Analysis Methodology</b> .....	Section 2.0
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<b>Conclusion</b> .....	Section 4.0
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## Attachments

Fire Area AA47 – Attachment 1 - Table B-3 - Fire Area Transition

## Fire Area AA47 – Attachment 2 - Fire Risk Evaluation Results Summary

## 1.0 PURPOSE

This report documents the Fire Safety Analysis (FSA) for Cook Nuclear Plant (CNP) Fire Area AA47, Unit 2 Control Room (El. 633 ft.) which comprises fire zone(s) 54. The purpose of this analysis is to demonstrate the achievement of the nuclear safety and radioactive release performance criteria of NFPA 805 as required by 10 CFR 50.48(c). The Fire Safety Analysis is a key part of compliance with Section 2.7.1.2 Fire Protection Program Design Basis Document of NFPA 805. This analysis also documents results of risk-informed, performance-based Fire Risk Evaluations (FREs). These evaluations are associated with Variances from Deterministic Requirements (VFDRs) of NFPA 805 Chapter 4.

## 2.0 ANALYSIS METHODOLOGY

The FSA is the design basis document as described in NFPA 805 Section 2.7.1.2. The following steps are performed to develop the FSA on a fire area basis:

- Identify significant fire hazards in the fire area. This is based on NFPA 805 approach to analyze the plant from an ignition source and fuel package perspective.
- Summarize Nuclear Safety Capability Analysis (NSCA) compliance strategies. This is the result of the NEI 04-02 B-3 Table review of the Safe Shutdown Analysis.
- Summarize Non-Power Operations Modes compliance strategies.
- Summarize Radioactive Release compliance strategies. The transition review process required per NEI 04-02 is used to develop these results.
- Provide Fire Probabilistic Risk Assessment summary of results. This is based on the results from the plant Fire PRA.
- Perform risk informed, performance based evaluations if needed for the performance based approach.
- Summarize Defense-in-Depth strategy for each fire area.
- Determine key analysis assumptions which are candidates to be included in the NFPA 805 monitoring program.
- Provide conclusions relative to NFPA 805 compliance.

### **3.0 ANALYSIS**

#### **3.1 Classical Fire Protection**

##### **3.1.1 Construction**

Walls, floors and ceilings to adjacent fire areas are reinforced concrete in excess of a 3-hour rating.

The Unit 1 Hot Shutdown Panel is separated from the Unit 2 Control Room by concrete block, steel framing and TSI Thermo-Lag subliming panels. A fire area engineering equivalency evaluation was performed for deviations to the 3-hour rating of the HSDP. (Engineering Equivalency Evaluation 11-36).

Applicable Engineering Equivalency Evaluations are documented in Attachment 1.

##### **3.1.2 Doors and Access Openings**

Fire area boundary evaluations were performed for unrated floor and ceiling hatches to Fire Areas AA51 and AA57B - Fire Zones 58 and 73 (Engineering Equivalency Evaluations 9-17 and 9-5, respectively).

A manual roll-up fire door having a 3-hour rating is provided to adjacent Fire Area AA50 - Fire Zone 144.

Fire doors having a 3-hour rating are provided to adjacent Fire Areas AA3, AA46, AA2 and AA50 - Fire Zones 52, 53, 130 and 144.

A non-UL/FM approved electromagnetic door lock is provided on one Class A door (EEE-11-69).

##### **3.1.3 Penetrations**

Note: Statements regarding fire resistance rating of penetration seals are not applicable to seals in barriers to Analysis Area YD.

Penetrations in fire barriers between this fire zone and adjacent fire areas are provided with fire seals. Refer to Technical Evaluation 11-25 for evaluation of pressure retention capability of Control Room pressure boundary fire seals.

### 3.1.4 Detection

The table below outlines the fire detection system(s) provided in the Fire Area:

Table 3-1, Fire Area AA47 Detection Systems								
Fire Zone	Type of System	Local (L) / Remote (R)	Detection Actuates Suppression?	Required System?				
				S	L	E	R	D
54	Ionization	L/R	No Auto Supp. (N/A)	N	N	Y	Y	N
Table 3-1 Legend:								
Table Field: "Required System?"								
S	- Required for Chapter 4 Separation Criteria							
L	- Required for NRC Approved Licensing Action							
E	- Required for Engineering Equivalency Evaluation							
R	- Required for Risk Significance							
D	- Required to maintain adequate balance of Defense-in-Depth in a Change Evaluation or Fire Risk Evaluation							

Twenty-four ionization detectors are located beneath the suspended ceiling and 17 ionization detectors are located above the suspended ceiling which alarm in the Unit 2 Control Room. These detectors are part of a larger detection circuit that includes the Hot Shutdown Panel. Fire Zone 144.

### 3.1.5 Fixed Suppression

The table below outlines the fixed fire suppression system(s) provided in the Fire Area:

Table 3-2, Fire Area AA47 Suppression Systems							
Fire Zone	Type of System	Full (F) / Partial (P)	Required System?				
			S	L	E	R	D
54	None	N/A	N/A	N/A	N/A	N/A	N/A
Table 3-2 Legend:							
Table Field: "Required System?"							
S	- Required for Chapter 4 Separation Criteria						
L	- Required for NRC Approved Licensing Action						
E	- Required for Engineering Equivalency Evaluation						
R	- Required for Risk Significance						
D	- Required to maintain adequate balance of Defense-in-Depth in a Change Evaluation or Fire Risk Evaluation						

Fire Area AA47 is not provided with automatic fire suppression.

### 3.1.6 Manual Suppression / Response Strategy

A postulated fire will be identified by early detection using ionization type smoke detection or by the Control Room operators within the control room. Although the automatic detection systems alarm in the control room, plant operators will most likely detect the fire prior to activation. The Control Room operator will initiate manual fire fighting activities using a fire extinguisher and

also alert the fire brigade. A fire in this fire area will be contained by the construction features discussed in Section 3.1.1. Manual suppression is provided by the CNP Fire Brigade and the Control Room operators.

There are fire extinguishers located in this fire zone, with additional extinguishers located in adjacent Fire Zone 52, 53 and 130. Water hose reels are located in adjacent Fire Zone 130 and in Fire Zone 52. There is a breathing apparatus in this fire zone. Additional apparatus is located in the Turbine Building Fire Zone 130.

Drainage is not Available. Drainage is into Fire Zones 52 or 130 through the doorways and Fire Zone 58 through the floor hatch.

### 3.1.7 Ventilation

A fire in this area will be contained by the fire barriers. Smoke can be removed by portable fans and flexible ducting to the Turbine Building and outdoors. The normal building ventilating systems in the Auxiliary Building will then exhaust the smoke via filtered monitored pathways. The Control Room HVAC system is not used or credited for smoke removal. This fire area is listed as a non-controlled area in the Fire Pre Plans and therefore there is reasonable assurance that products of combustion will not be contaminated.

Fire dampers having a 3-hour rating are provided to adjacent Fire Area AA57B - Fire Zone 73.

A fire area engineering equivalency evaluation was performed for an undampened ventilation duct to Fire Area AA57B - Fire Zone 73 (Engineering Equivalency Evaluation 9-2).

### 3.1.8 Other Features

The Control Room is constantly manned while tenable conditions exist.

The Unit 1 Hot Shutdown Panel enclosure (Fire Zone 144) is located within the larger Unit 2 Control Room.

A small raised floor space (16' x 13' x 8" H) is provided at the operator's work station (Engineering Equivalency Evaluation 11-41).

Control room carpeting meets the original licensing basis of the CNP Plant Standard Review Plan BTP 9.5.1 Appendix A and additionally meets the requirements of NRC Reg. Guide 1.189 (April 2001). The combustible loading classification of the fire area reflects the carpeting. The combustible loading remains within the analyzed limits for the control room.

(Removed Acoustical Baffles per EC-0000054046, FPPR-2014-0022)

## 3.2 Fire Hazards Identification

The fire area contains both ignition sources and combustible fire hazards. The ignition sources consist of main control room boards and control room back panels. Combustibles consist primarily of cable insulation, cellulose, rubber, plastics, Thermo-Lag, control room carpet and other small computer equipment. The current fire loading classification is considered low.

## 3.3 NSCA Compliance Summary



Fire Area AA47 is the Unit 2 Control Room and as such contains Unit 2 Red and Green Train safe shutdown cables; controls for valve, pump, electrical Bus/MCC, and instrumentation; as well as 250VDC and 120VAC power supplies.

Compliance with the nuclear safety performance criteria is achieved using the performance-based approach in accordance with NFPA 805, Section 4.2.4.2.

In the case of a Control Room evacuation, Unit 2 safe and stable is accomplished by crediting crossties to the unaffected Unit 2 via the following: Alternate AFW to Steam Generators 2 and 3 via the Unit 1 West Motor Driven Auxiliary Feedwater Pump, Alternate CVCS via the Unit 1 East or West Pump and ESW crosstie via normally available crosstie lineup. Unit 2 CCW is credited to support the required Unit 2 crosstie systems. Local Shutdown Indicating Panels are credited to provide process and source range monitoring with Unit 2 power crosstie. Control Room evacuation is postulated to determine the compliance strategy of this area.

The Nuclear Safety Performance Criteria compliance strategy for AA47 is documented within the NSCA Report.

### 3.3.1 Variances

The variances identified for evaluation for this fire area are grouped as follows:

#### 3.3.1.1 VFDR No. AA47-001

2-NRV-151, 2-NRV-152 and 2-NRV-153 - Pressurizer PORVs are required to be closed to support RCS integrity. RCS integrity is required to maintain positive control over RCS inventory and pressure. 2-NRV-151 may fail due to fire induced damage of cable 8667R-2 and 9705PR-2. 2-NRV-152 may fail due to fire induced damage of cables 8675R-2 and 9706PR-2. 2-NRV-153 may fail due to fire induced damage of cables 8757PG-2 and 8932G-2. Failure of these cables could spuriously open the valves. This condition represents a variance from the deterministic requirements of NFPA 805, Section 4.2.3. This is a separation issue.

This VFDR has been evaluated and it was determined that the risk, safety margin and defense-in-depth meet the acceptance criteria of NFPA 805 Section 4.2.4 with a recovery action credited.

### 3.3.1.2 VFDR No. AA47-002

2-NSO-021, 2-NSO-022, 2-NSO-023 and 2-NSO-024 – The RX Head Vent Valves are required to be closed to support RCS integrity. RCS integrity is required to maintain positive control over RCS inventory and pressure. 2-NSO-021 or 2-NSO-022 and 2-NSO-023 or 2-NSO-024 are required to remain closed to provide RCS integrity. All of the RX Head Vent Valves may fail due to a full area fire within Fire Area AA47. 2-NSO-021 may fail due to fire induced damage of cable 9801PG-2. 2-NSO-022 may fail due to fire induced damage of cable 9807PG-2. 2-NSO-023 may fail due to fire induced damage of cable 9801PR-2. 2-NSO-024 may fail due to fire induced damage of cable 9807PR-2. These cable failures could spuriously open the valves. This condition represents a variance from the deterministic requirements of NFPA 805, Section 4.2.3. This is a separation issue.

This VFDR has been evaluated and it was determined that the risk, safety margin and defense-in-depth meet the acceptance criteria of NFPA 805 Section 4.2.4 with a recovery action credited.

### 3.3.1.3 VFDR No. AA47-003

2-NSO-061, 2-NSO-062, 2-NSO-063 and 2-NSO-064 – The Post Accident Vent Valves are required to be closed to support RCS integrity. RCS integrity is required to maintain positive control over RCS inventory and pressure. 2-NSO-061 or 2-NSO-062 and 2-NSO-063 or 2-NSO-064 are required to remain closed to provide RCS integrity. All of the Post Accident Vent Valves may fail due to a full area fire within Fire Area AA47. 2-NSO-061 may fail due to fire induced damage of cable 9814PG-2. 2-NSO-062 may fail due to fire induced damage of cable 9820PG-2. 2-NSO-063 may fail due to fire induced damage of cable 9814PR-2. 2-NSO-064 may fail due to fire induced damage of cable 9820PR-2. These cable failures could spuriously open the valves. This condition represents a variance from the deterministic requirements of NFPA 805, Section 4.2.3. This is a separation issue.

This VFDR has been evaluated and it was determined that the risk, safety margin and defense-in-depth meet the acceptance criteria of NFPA 805 Section 4.2.4 with a recovery action credited.

### 3.3.1.4 VFDR No. AA47-004

2-QRV-111, 2-QRV-112, 2-QRV-160, 2-QRV-161 and 2-QRV-162 – Letdown Isolation Valves are required to be closed to support CVCS isolation. CVCS isolation is required to maintain positive control over inventory and pressure. In order to achieve letdown isolation the following valves need to be closed; 2-QRV-111 or 2-QRV-112 or (2-QRV-160 and 2-QRV-161 and 2-QRV-162). All of these valves may fail due to a full area fire within Fire Area AA46. 2-QRV-111 may fail due to fire induced damage of cables 8486G-2 and 8943G-2. 2-QRV-112 may fail due to fire induced damage of cables 8467R-2 and 8947R-2. 2-QRV-160 may fail due to fire induced damage of cable 9141G-2. 2-QRV-161 may fail due to fire induced damage of cable 8494G-2. 2-QRV-162 may fail due to fire induced damage of cable 8496G-2. These cable failures could spuriously open the valves. This condition represents a variance from the deterministic requirements of NFPA 805, Section 4.2.3. This is a separation issue.

This VFDR has been evaluated and it was determined that the risk, safety margin and defense-in-depth meet the acceptance criteria of NFPA 805 Section 4.2.4 with a defense-in-depth action credited.

**3.3.1.5 VFDR No. AA47-005**

2-DCR-310 and 2-DCR-340 - SG 1 and 4 Blowdown Isolation Valves are required to be closed to support main steam isolation. Main steam isolation is required to prevent uncontrolled cooldown through over-steaming. SG 1 and 4 Blowdown Isolation Valves may fail due to a full area fire within Fire Area AA47. 2-DCR-310 may fail due to fire induced damage of cable 8682G-2. 2-DCR-340 may fail due to fire induced damage of cable 8686G-2. These cable failures could spuriously open the valves. SGs 1 and 4 are not credited for decay heat removal due to a fire within Fire Area AA47. This condition represents a variance from the deterministic requirements of NFPA 805, Section 4.2.3. This is a separation issue.

This VFDR has been evaluated and it was determined that the risk, safety margin and defense-in-depth meet the acceptance criteria of NFPA 805 Section 4.2.4 with a recovery action credited.

**3.3.1.6 VFDR No. AA47-006**

2-DCR-320 and 2-DCR-330 - SG 2 and 3 Blowdown Isolation Valves are required to be closed to support main steam isolation. Main steam isolation is required to prevent uncontrolled cooldown through over-steaming. SG 2 and 3 Blowdown Isolation Valves may fail due to a full area fire within Fire Area AA47. 2-DCR-320 may fail due to fire induced damage of cable 8682R-2. 2-DCR-330 may fail due to fire induced damage of cable 8686R-2. These cable failures could spuriously open the valves. SGs 2 and 3 are credited for decay heat removal due to a fire within Fire Area AA47. This condition represents a variance from the deterministic requirements of NFPA 805, Section 4.2.3. This is a separation issue.

This VFDR has been evaluated and it was determined that the risk, safety margin and defense-in-depth meet the acceptance criteria of NFPA 805 Section 4.2.4 with a recovery action credited.

**3.3.1.7 VFDR No. AA47-007**

2-MRV-210 and 2-MRV-240 – The SG 1 and 4 Main Steam Stop Valves are required to be closed to support main steam isolation. Main steam isolation is required to prevent the uncontrolled cooldown through over-steaming. SGs 1 and 4 are not credited for decay heat removal due to a fire within Fire Area AA47. 2-MRV-210 may not be available due to the failure of 2-MMO-210, 2-MRV-211 and 2-MRV-212. 2-MMO-210, 3 Way Air Open Valve for SG 1 Stop Valve vents air from the Main Steam Stop Valve to either 2-MRV-211 or 2-MRV-212. 2-MMO-210 may fail due to fire induced damage of cable 5693-2. This cable failure will spuriously operate the valve to either position. Failure of 2-MRV-211 and 2-MRV-212 will require either valve to be manually failed to the open position dependent upon the 3 way valve's position. 2-MRV-240 may not be available due to the failure of 2-MMO-240, 2-MRV-241 and 2-MRV-242. 2-MMO-240, 3 Way Air Open Valve for SG 4 Stop Valve vents air from the Main Steam Stop Valve to either 2-MRV-241 or 2-MRV-242. 2-MMO-240 may fail due to fire induced damage of cable 5699-2. This cable failure will spuriously operate the valve to either position. Failure of 2-MRV-241 and 2-MRV-242 will require either valve to be manually failed to the open position dependent upon the 3 way valve's position. This condition represents a variance from the deterministic requirements of NFPA 805, Section 4.2.3. This is a separation issue.

This VFDR has been evaluated and it was determined that the risk, safety margin and defense-in-depth meet the acceptance criteria of NFPA 805 Section 4.2.4 with a recovery action credited.

**3.3.1.8 VFDR No. AA47-008**

2-MRV-220 and 2-MRV-230 – Main Steam Stop Valves for SGs 2 and 3 are required to be closed to support main steam isolation. Main steam isolation is required to prevent uncontrolled cooldown through over-steaming. SGs 2 and 3 are credited for decay heat removal due to a fire within Fire Area AA47. 2-MRV-220 is not available due to the failure of 2-MMO-220, 2-MRV-221 and 2-MRV-222. 2-MMO-220, 3 Way Air Open Valve for SG 2 Stop Valve vents air from the Main Steam Stop Valve to either 2-MRV-221 or 2-MRV-222. 2-MMO-220 may fail due to fire induced damage of cable 5695R-2. This cable failure will spuriously operate the valve to either position. Failure of 2-MRV-221 and 2-MRV-222 will require either valve to be manually failed to the open position dependent upon the 3 way valve's position. 2-MRV-230 is not available due to the failure of 2-MMO-230, 2-MRV-231 and 2-MRV-232. 2-MMO-230, 3 Way Air Open Valve for SG 3 Stop Valve vents air from the Main Steam Stop Valve to either 2-MRV-231 or 2-MRV-232. 2-MMO-230 may fail due to fire induced damage of cable 5697-2. This cable failure will spuriously operate the valve to either position. Failure of 2-MRV-231 and 2-MRV-232 will require either valve to be manually failed to the open position dependent upon the 3 way valve's position. This condition represents a variance from the deterministic requirements of NFPA 805, Section 4.2.3. This is a separation issue.

This VFDR has been evaluated and it was determined that the risk, safety margin and defense-in-depth meet the acceptance criteria of NFPA 805 Section 4.2.4 with a recovery action credited.

**3.3.1.9 VFDR No. AA47-009**

2-MRV-213-P and 2-MRV-243-P – SG 1 and 4 PORVs are required to be closed to support main steam isolation. Main steam isolation is required to prevent uncontrolled cooldown through over-steaming. SGs 1 and 4 are not credited for decay heat removal due to a fire within Fire Area AA47. 2-MRV-213-P may fail due to fire induced damage of cables 11815-2, 11916-2, 6841-2 and 9050W-2. 2-MRV-243-P may fail due to fire induced damage of cables 11838-2, 11917-2, 6842-2 and 9051W-2. Failure of these cables could spuriously open the valves. This condition represents a variance from the deterministic requirements of NFPA 805, Section 4.2.3. This is a separation issue.

This VFDR has been evaluated and it was determined that the risk, safety margin and defense-in-depth meet the acceptance criteria of NFPA 805 Section 4.2.4 with a recovery action credited.

**3.3.1.10 VFDR No. AA47-010**

2-MRV-223-P and 2-MRV-233-P – SG 2 and 3 PORVs are required to be closed to support main steam isolation. Main steam isolation is required to prevent uncontrolled cooldown through over-steaming. SGs 2 and 3 are credited for decay heat removal due to a fire within Fire Area AA47. 7-MRV-223-P may fail due to fire induced damage of cables 11828-2, 11900-2, 18132-2 and 9050Y-2. 2-MRV-233-P may fail due to fire induced damage of cables 11829-2, 11901-2, 18133-2 and 9051Y-2. Failure of these cables could spuriously open the valves. This condition represents a variance from the deterministic requirements of NFPA 805, Section 4.2.3. This is a separation issue.

This VFDR has been evaluated and it was determined that the risk, safety margin and defense-in-depth meet the acceptance criteria of NFPA 805 Section 4.2.4 with a recovery action credited.

**3.3.1.11 VFDR No. AA47-011**

2-BLI-120-CRI, 2-BLI-130-CRI, 2-MPP-220-CRI, 2-MPP-230-CRI, 2-NTR-120, 2-NTR-220, 2-NLP-151-CRI, 2-NPS-110-CRI and 2- NRI-1 - Control Room process monitoring and source range monitoring may not be available due to a fire in Fire Area AA47. Process monitoring is required to be available to monitor key primary and secondary parameters. Source Range is required to provide indication of fission activity to ensure sub-criticality. The Control Room instrumentation is not available due to a fire within the Unit 2 Control Room. Alternate process and source range monitoring powered from Unit 1 is required at the Unit 2 LSI panels. The LSI panels require manual actions to transfer to the Unit 1 power supply. Transfer switch at 2-LSI-6XX feeds both 2-LSI-6XX and 2-LSI-2. Transfer switch at 2-LSI-5XX feeds both 2-LSI-5XX and 2-LSI-1. Transfer switch at 2-LSI-4 feeds both 2-LSI-4 and 2-LSI-3. Local monitoring of SG 2 and 3 level indication is required at 2-LSI-2. Local monitoring of pressurizer level and pressure indication is required at 2-LSI-3. Local monitoring of SG 2 pressure, RCS loop 2 temperature and source range monitoring is required at 2-LSI-4. Local monitoring of SG 3 pressure is required at LSI-6XX. This set of instruments has been credited due to SGs 2 and 3 being credited for AFW. This condition represents a variance from the deterministic requirements of NFPA 805, Section 4.2.3. This is a separation issue.

This VFDR has been evaluated and it was determined that the risk, safety margin and defense-in-depth meet the acceptance criteria of NFPA 805 Section 4.2.4 with a recovery action credited.

**3.3.1.12 VFDR No. AA47-012**

2-PP-3E, 2-PP-3W and 2-PP-4 - A Unit 2 AFW Pump is required to be operable to support decay heat removal. Decay heat removal is required to be capable of removing sufficient heat from the reactor core such that the fuel is maintained in a safe and stable condition. A full area fire in Fire Area AA47 may cause the loss of the Unit 2 East and West MDAFW Pumps and the Unit 2 TDAFW Pump. The East MDAFW Pump, 1-PP-3E may fail due to fire induced damage of 250VDC Distribution Cabinet 2-MCCD, 4kV Bus 2-T21D and cables. The West MDAFW Pump, 2-PP-3W may fail due to fire induced damage of 250VDC Distribution Cabinet 2-MCAB, 4kV Bus 2-T21A and cables. The TDAFW Pump, 1-PP-4 may fail due to fire induced damage of cables 9956BR-2 and 9957BR-2. These failures require the use of alternate feedwater cross-tied from Unit 1 to Unit 2. This condition represents a variance from the deterministic requirements of NFPA 805, Section 4.2.3. This is a separation issue.

This VFDR has been evaluated and it was determined that the risk, safety margin and defense-in-depth meet the acceptance criteria of NFPA 805 Section 4.2.4 with a recovery action credited.

**3.3.1.13 VFDR No. AA47-013**

2-PP-45-1, 2-PP-45-2, 2-PP-45-3 and 2-PP-45-4 – The RCPs are required to be tripped to prevent a loss of coolant accident if seal cooling and thermal barrier cooling is lost. A full area fire within Fire Area AA47 may cause the loss of seal cooling, thermal barrier cooling and Control Room trip capability of the RCPs. 2-PP-45-1 may lose Control Room trip capability due to fire induced damage of cables 10467-2 and 6783-2. 2-PP-45-2 may lose Control Room trip capability due to fire induced damage of cables 10143-2 and 4959-2. 2-PP-45-3 may lose Control Room trip capability due to fire induced damage of cables 10160-2 and 5649-2. 2-PP-45-4 may lose Control Room trip capability due to fire induced damage of cables 10485-2 and 4963-2. This condition represents a variance from the deterministic requirements of NFPA 805, Section 4.2.3. This is a separation issue.

This VFDR has been evaluated and it was determined that the risk, safety margin and defense-in-depth meet the acceptance criteria of NFPA 805 Section 4.2.4 with a recovery action credited.

**3.3.1.14 VFDR No. AA47-014**

2-FMO-222 and 2-FMO-232- SG 2 and 3 AFW Supply Valves are required to be operable to support decay heat removal for Unit 2. Decay heat removal shall be capable of removing heat from the reactor core such that the fuel is maintained in a safe and stable condition. Decay heat removal requires a set of 2 supply valves be operable with their corresponding AFW pump. The following sets of Unit 2 SG AFW supply valves may fail due to a full area fire within Fire Area AA47; 2-FMO-212 and 2-FMO-242, 2-FMO-222 and 2-FMO-232, 2-FMO-221 and 2-FMO-231. The Unit 1 West MDAFW Pump is credited to provide decay heat removal through Unit 2 SGs 2 and 3. This requires 2-FMO-222 and 2-FMO-232 be operable. 2-FMO-222 may fail due to fire induced damage of 600V VCC 2-EZC-D and cable 8542G-2. 2-FMO-232 may fail due to fire induced damage of 600V VCC 1-EZC-D and cable 8539G-2. This condition represents a variance from the deterministic requirements of NFPA 805, Section 4.2.3. This is a separation issue.

This VFDR has been evaluated and it was determined that the risk, safety margin and defense-in-depth meet the acceptance criteria of NFPA 805 Section 4.2.4 with a recovery action credited.

**3.3.1.15 VFDR No. AA47-015**

2-PZRHTR.AUTO – Pressurizer heater is required not to spuriously operate to ensure pressure control is maintained. Spurious operation of the pressurizer heater could heat up the pressurizer causing an uncontrolled pressure increase in the RCS. 2-PZRHTR.AUTO may fail due to fire induced damage of cables 8733PO-2 and 9600PY-2. Failure of these cables could cause spurious operation of the pressurizer heater. This condition represents a variance from the deterministic requirements of NFPA 805, Section 4.2.3. This is a separation issue.

This VFDR has been evaluated and it was determined that the risk, safety margin and defense-in-depth meet the acceptance criteria of NFPA 805 Section 4.2.4 with a defense-in-depth action credited.



**3.3.1.16 VFDR No. AA47-016**

2-PP-50E, 2-PP-50W, 2-ICM-250 and 2-IMO-51 - The Unit 2 East or West Charging Pump is required to be operable to support CVCS for inventory control, reactivity control and seal cooling. The Unit 2 Charging Pumps may fail due to a full area fire within Fire Area AA47. 2-PP-50E and 2-PP-50W may fail due to the loss of power, unit 2 CCW cooling and cable faults. Failure of both Unit 2 charging pumps requires cross-tying to the Unit 1 charging pumps to provide charging. Cross-tying requires the operation of manual valves 2-CS-302, 2-CS-534 and 1-CS-536. Cross-tying the charging system credits injecting through the Unit 2 BIT. Charging injecting through the BIT requires the Boron Injection Tank Outlet Shutoff Valve (2-ICM-250) to be open and 1 out of the 4 Boron Injection Line to Cold Leg Shutoff Valves (2-IMO-51, 2-IMO-52, 2-IMO-53 and 2-IMO-54) to be open. 2-ICM-250 is normally closed and failed closed on the loss of power. 2-ICM-250 may fail due to fire induced damage of 600V MCC 2-AM-D and cables 9090G-2, 9091G-2 and 9548G-2. 2-IMO-51 may fail due to fire induced damage of cable 8370G-2. 2-IMO-52 may fail due to fire induced damage of cable 8372R-2. 2-IMO-53 may fail due to fire induced damage of cable 8396G-2. 2-IMO-54 may fail due to fire induced damage of cable 8314R-2. The cable failures of the Boron Injection Line Valves could spuriously close the valve. This condition represents a variance from the deterministic requirements of NFPA 805, Section 4.2.3. This is a separation issue.

This VFDR has been evaluated and it was determined that the risk, safety margin and defense-in-depth meet the acceptance criteria of NFPA 805 Section 4.2.4 with a recovery action credited.

**3.3.1.17 VFDR No. AA47-017**

2-QRV-10, 2-QRV-20, 2-QRV-30 and 2-QRV-40 - RCP Seal Water Return Isolation Valves are required to be open to support CVCS. Seal return lines are required to be open to prevent damage to the RCP seals. Damage to the seals could result in a leak of 180 GPM. These valves are required to be open to maintain inventory and pressure control. 2-QRV-10 may fail due to fire induced damage of cable 4418-2. 2-QRV-20 may fail due to fire induced damage of cable 4955-2. 2-QRV-30 may fail due to fire induced damage of cable 5654-2. 2-QRV-40 may fail due to fire induced damage of cable 5002-2. These cable failures could spuriously close the valves. This condition represents a variance from the deterministic requirements of NFPA 805, Section 4.2.3. This is a separation issue.

This VFDR has been evaluated and it was determined that the risk, safety margin and defense-in-depth meet the acceptance criteria of NFPA 805 Section 4.2.4 with a recovery action credited.



**3.3.1.18 VFDR No. AA47-018**

2-NRV-163 and 2-NRV-164 – Pressurizer Spray Valves are required to be closed to support RCS integrity. RCS integrity is required to maintain positive control over RCS inventory and pressure. 2-NRV-163 may fail due to fire induced damage of cables 10182-2, 10183-2, 10751-2, 10773-2, 11266-2, 6662PO-2, 8733PO-2 and 9600PY-2. 2-NRV-164 may fail due to fire induced damage of cables 10182-2, 10184-2, 10751-2, 10773-2, 11480-2, 6663PO-2, 8733PO-2 and 9600PY-2. Failure of these cable failures could spuriously open the valves. Opening of the Pressurizer Spray Valves with RCP # 3 and # 4 running will result in a SI. This condition represents a variance from the deterministic requirements of NFPA 805, Section 4.2.3. This is a separation issue.

This VFDR has been evaluated and it was determined that the risk, safety margin and defense-in-depth meet the acceptance criteria of NFPA 805 Section 4.2.4 with a recovery action credited.

**3.3.1.19 VFDR No. AA47-019**

2-QRV-113, 2-QRV-114 and 2-QRV-170 – Excess Letdown Isolation Valves are required to be closed to support CVCS isolation. CVCS isolation is required to maintain positive control over inventory and pressure. In order to achieve excess letdown isolation the following valves need to be closed; 2-QRV-113 or 2-QRV-114 or 2-QRV-170. All of these valves may fail due to a full area fire within Fire Area AA47. 2-QRV-113 may fail due to fire induced damage of cable 6238-2. 2-QRV-114 may fail due to fire induced damage of cable 6239-1. 2-QRV-170 may fail due to fire induced damage of cable 5779P-2. These cable failures could spuriously open the valves. This condition represents a variance from the deterministic requirements of NFPA 805, Section 4.2.3. This is a separation issue.

This VFDR has been evaluated and it was determined that the risk, safety margin and defense-in-depth meet the acceptance criteria of NFPA 805 Section 4.2.4 with a defense-in-depth action credited.

**3.3.2 Recovery Actions Credited**

For each VFDR, a Fire Risk Evaluation has been performed to assess the acceptability of risk, defense-in-depth, and safety margin. This evaluation determined whether or not recovery actions are required to ensure that one success path necessary to achieve and maintain the nuclear safety performance criteria is maintained free of fire damage by a single fire. Table 3-3 identifies the credited recovery actions for this area. Actions retained for DID are identified as “DID Actions” within Table 3-3. Additional information for DID actions is contained within Section 3.8 of this report. Note that, for completeness, all VFDRs are contained within Table 3-3, even if the Fire Risk Evaluation has determined that a recovery action is not required. In those instances where a recovery action has been determined to not be required, the word “None” is provided in the “Action” column in the table.

<b>Table 3-3, Recovery Actions Credited</b>		
<b>VFDR</b>	<b>Component</b>	<b>Action</b>
AA47-001	2-NRV-151	2-NRV-151-CLOSE-ALT (De-energize 2-CCV-AB at 2-MCAB circuit 16 to close 2-NRV-151)
	2-NRV-152	
	2-NRV-153	

Table 3-3, Recovery Actions Credited		
VFDR	Component	Action
		<p>2-NRV-152-CLOSE-ALT (De-energize 2-CCV-AB at 2-MCAB circuit 16 to close 2-NRV-152)</p> <p>2-NRV-153-CLOSE-ALT (De-energize 2-CCV-CD at 2-MCCD circuit 16 to close 2-NRV-153)</p>
AA47-002	<p>2-NSO-021 2-NSO-022 2-NSO-023 2-NSO-024</p>	<p>2-NSO-021-CLOSE ALT (De-energize 2-CCV-CD at 2-MCCD circuit 16 to close 2-NSO-021)</p> <p>2-NSO-023-CLOSE ALT (De-energize 2-CCV-AB at 2-MCAB circuit 16 to close 2-NSO-023)</p>
AA47-003	<p>2-NSO-061 2-NSO-062 2-NSO-063 2-NSO-064</p>	<p>2-NSO-061-CLOSE ALT (De-energize 2-CCV-CD at 2-MCCD circuit 16 to close 2-NSO-061)</p> <p>2-NSO-063-CLOSE ALT (De-energize 2-CCV-AB at 2-MCAB circuit 16 to close 2-NSO-063)</p>
AA47-004	<p>2-QRV-111 2-QRV-112 2-QRV-160 2-QRV-161 2-QRV-162</p>	<p>DID ACTION 2-QRV-111-CLOSE ALT (De-energize 2-CCV-CD at 2-MCCD circuit 16 to close 2-QRV-111)</p>
AA47-005	<p>2-DCR-310 2-DCR-340</p>	<p>2-DCR-310/340-CLOSE ALT (De-energize 2-CCV-CD at 2-MCCD circuit 16 to fail 2-DC-310 and 2-DCR-340 closed)</p>
AA47-006	<p>2-DCR-320 2-DCR-330</p>	<p>2-DCR-320/330-CLOSE ALT (De-energize 2-CCV-AB at 2-MCAB circuit 16 to fail 2-DCR-320 and 2-DCR-330 closed)</p>

Table 3-3, Recovery Actions Credited		
VFDR	Component	Action
AA47-007	2-MRV-210 2-MRV-240	2-MRV-211-OPEN (Manually open 2-MRV-211 to close valve 2-MRV-210)  or  2-MRV-212-OPEN (Manually open 2-MRV-212 to close valve 2-MRV-210)  and  2-MRV-241-OPEN (Manually open 2-MRV-241 to close valve 2-MRV-240)  or  2-MRV-222-OPEN (Manually open 2-MRV-242 to close valve 2-MRV-240)
AA47-008	2-MRV-220 2-MRV-230	2-MRV-221-OPEN (Manually Open 2-MRV-221 to close 2-MRV-220)  or  2-MRV-222-OPEN (Manually Open 2-MRV-222 to close 2-MRV-220)  and  2-MRV-231-OPEN (Manually Open 2-MRV-231 to close 2-MRV-230)  or  2-MRV-232-OPEN (Manually Open 2-MRV-232 to close 2-MRV-230)
AA47-009	2-MRV-213-P 2-MRV-243-P	2-MRV-213-P-CLOSE (Manually close 1-MRV-213)  2-MRV-243-P-CLOSE (Manually close 1-MRV-243)

Table 3-3, Recovery Actions Credited		
VFDR	Component	Action
AA47-010	2-MRV-223-P 2-MRV-233-P	2-MRV-223-P-CLOSE (Manually close 2-MRV-223)  2-MRV-233-P-CLOSE (Manually close 2-MRV-233)
AA47-011	2-BLI-120-CRI 2-BLI-130-CRI 2-MPP-220-CRI 2-MPP-230-CRI 2-NTR-120 2-NTR-220 2-NLP-151-CRI 2-NPS-110-CRI 2-NRI-1	2-LSI-4-ALT-PWR (Align unaffected Unit Power to LSI Panel)  2-LSI-6XX-ALT-PWR (Align unaffected Unit Power to LSI Panel)  2-LSI-2-LOCAL (Locally monitor 2-LSI-2)  2-LSI-3-LOCAL (Locally monitor 2-LSI-3)  2-LSI-4-LOCAL (Locally monitor 2-LSI-4)  2-LSI-6XX-LOCAL (Locally monitor 2-LSI-6XX)
AA47-012	2-PP-3E 2-PP-3W 2-PP-4	1-FW-261-CLOSE (Close manual valve 1-FW-261)  2-FW-129-OPEN (Open manual valve 2-FW-129)
AA47-013	2-PP-45-1 2-PP-45-2 2-PP-45-3 2-PP-45-4	2-PP-45-1-TRIP (Locally trip RCP 1)  2-PP-45-2-TRIP (Locally trip RCP 2)  2-PP-45-3-TRIP (Locally trip RCP 3)  2-PP-45-4-TRIP (Locally trip RCP 4)

Table 3-3, Recovery Actions Credited		
VFDR	Component	Action
AA47-014	2-FMO-222 2-FMO-232	2-FMO-222-OPERATE (De-energize and manually operate 2-FMO-222)  2-FMO-232-OPERATE (De-energize and manually operate 2-FMO-232)
AA47-015	2-PZRHTR.AUTO	DID ACTION 2-PZRHTR.AUTO-OFF (Trip breakers T21A6 AND T21D9 prior to control room evacuation and locally trip breakers to eliminate spurious operation of the heater)
AA47-016	2-PP-50E 2-PP-50W 2-ICM-250	1-CS-536-OPEN (Open manual valve 1-CS-536)  2-CS-302-CLOSE (Close manual valve 2-CS-302)  2-CS-534-OPEN (Open manual valve 2-CS-534)  2-ICM-250-OPEN (De-energize and manually open 2-ICM-250)  2-IMO-51-OPEN (De-energize and manually open 2-IMO-51)
AA47-017	2-QRV-10 2-QRV-20 2-QRV-30 2-QRV-40	2-QRV-10/40-OPEN-ALT (De-energize VDAB panel by opening circuit #1 on MDAB to open 2-QRV-10 and 2-QRV-40)  2-QRV-20/30-OPEN-ALT (De-energize VDAB panel by opening circuit #1 on MDAB to open 2-QRV-20 and 2-QRV-30)
AA47-018	2-NRV-163 2-NRV-164	2-RCP-ALL-TRIP (Locally trip Unit 2 RCPs)
AA47-019	2-QRV-113 2-QRV-114 2-QRV-170	DID ACTION 2-QRV-113-CLOSE ALT (De-energize CRAB and VDAB at MDAB circuit 1 to close 2-QRV-113)

### 3.4 Non-Power Operational Modes Compliance Summary

A review of CNP for the potential effects of a fire in this Fire Area while in non-power modes of operation (NPO) was conducted. This review was conducted using the guidance provided in NEI 04-02 and FAQ 07-0040, "Non-Power Operations Clarifications".

The review determined that there are potential failures that affect certain Key Safety Functions (KSF) as a result of the fire in this area, and the fire could result in the loss of one or more KSF paths. These concerns "i.e. pinch points" have been addressed by the implementation of a continuous fire watch in the fire area during periods defined as "High Risk Evolutions" in the referenced NPO Analysis. The fire area is continuously manned by Operations personnel who will be credited as the continuous fire watch. Continuous fire watches during high risk evolution periods provides reasonable assurance a fire will not adversely affect key safety functions and the NFPA 805 performance goal for NPO is therefore satisfied. The results of the NPO analysis are contained within Technical Evaluation R1900-005-001, Non-Power Operation Modes Transition Review Report.

### 3.5 Radioactive Release Compliance Summary

The NFPA 805 radiological release goal is to provide reasonable assurance that a fire will not result in a radiological release that adversely affects the public, plant personnel or the environment. The NFPA 805 requirement is to ensure a radiation release to any unrestricted area due to the direct effects of fire suppression activities (but not involving fuel damage) shall be as low as reasonably achievable and shall not exceed applicable plant Technical Specification limits.

AA47 is located outside the Radiological Controlled Area (RCA) and is not a storage location for contaminated materials, therefore there is reasonable assurance a fire in this area will not result in radiation release. The review of this fire area, with respect to radioactive release, is documented in the NFPPM.

### 3.6 Probabilistic Risk Assessment-Summary of Results

A Fire PRA (FPRA) quantification of Fire Area AA47 was performed and is documented in PRA-NB-FIRE-FQ, Fire PRA Model Quantification Notebook. The fire risk quantification for Fire Area AA47 is analyzed using the main control room fire modeling methodology. PRA-NB-FIRE-FQ includes a summary of all potentially risk-significant fire scenarios (i.e., CDF > 1.0E-7 or LERF > 1.0E-8). Bounding CDF / LERF per calendar year values are reported that are based on the risk values documented in PRA-NB-FIRE-FSS, Fire PRA Fire Scenario Selection.

Fire Protection features credited in the Fire PRA are documented in R1900-0411-MCR, Detailed Fire Modeling Report: Fire Compartment: AA46 and AA47 Main Control Room Fire Evacuation Study (Unit 1 and Unit 2). PRA-NB-FIRE-FSS documents the revision level of the fire modeling reports used in the most recent Fire PRA quantification.

### 3.7 Risk-Informed, Performance-Based Evaluations

Fire Risk Evaluations (FREs) have been performed to ensure that variances from the NFPA 805 deterministic requirements are acceptable. The evaluation process consists of an integrated assessment of the acceptability of risk, defense-in-depth, and safety margins.

#### 3.7.1 Transition Risk-Informed, Performance-Based Evaluations

The ‘changes’ associated with NFPA 805 transition were those variances from the deterministic requirements of NFPA 805 or with the existing fire protection licensing basis that were brought into compliance with the NFPA 805 performance based approach. The change identified for evaluation for Fire Area AA47 is as follows:

- Separation Issues

The Fire Risk Evaluation has determined that the change is acceptable based upon:

- The measured change in CDF and LERF.
- Adequate defense-in-depth and safety margins being maintained.

Refer to Attachment 2 for a summary of results associated with the Fire Risk Evaluations.

### 3.8 Defense-in-Depth

A comprehensive risk-informed, performance-based analysis includes consideration of defense-in-depth (DID) as part of an integrated evaluation of risk considerations. In general, defense-in-depth involves consideration of the extent to which fire protection systems and features are provided within the three echelons of fire-protection:

- Preventing fires from starting,
- Rapidly detecting fires and controlling and extinguishing promptly those fires that do occur, thereby limiting fire damage,
- Providing an adequate level of fire protection for structures, systems, and components important to safety, so that a fire that is not promptly extinguished will not prevent the nuclear safety performance criteria from being met.

Each VFDR was evaluated for DID. The following recovery actions have been retained for DID.

VFDR No. AA47-004: 2-QRV-111, 2-QRV-112, 2-QRV-160, 2-QRV-161 and 2-QRV-162 - The Letdown Isolation Valves are required to be closed to support CVCS isolation. CVCS isolation is required to maintain positive control over inventory and pressure. These valves may spuriously open due to a fire within AA47. These failures can be mitigated by locally de-energizing valve 2-QRV-111 to fail the valve closed. This recovery action is being retained to ensure CVCS isolation is maintained.

VFDR No. AA46-015: 2-PZRHTR.AUTO - The pressurizer heater is required not to spuriously operate to ensure pressure control is maintained. Spurious operation of the pressurizer heater could heat up the pressurizer causing an uncontrolled pressure increase in the RCS. The pressurizer heater may spuriously operate due to a fire within AA47. This failure can be mitigated by locally de-energizing the heater. This recovery action is being retained to ensure spurious operation of the pressurizer heater does not occur.

VFDR No. AA47-019: 2-QRV-113, 2-QRV-114 and 2-QRV-170 - The Excess Letdown Isolation Valves are required to be closed to support CVCS isolation. CVCS isolation is required to maintain positive control over inventory and pressure. These valves may spuriously open due to a fire within AA47. These failures can be mitigated by locally de-energizing valve 2-QRV-113 to fail the valve closed. This recovery action is being retained to ensure CVCS isolation is maintained.

Based on the assessment in support of the Fire Risk Evaluation, defense-in-depth is maintained for fire area AA47. Refer to Attachment 2 for details associated with the Fire Risk Evaluation.

### 3.9 Monitoring Program Input

A Monitoring Program will be developed in accordance with FAQ 10-0059, Rev. 1. Methods to monitor availability, reliability, and performance of fire protection program structures, systems, and components (SSCs), as well as programmatic elements will be provided. Additionally, effectiveness measures are established to review program related performance and trends. For AA47 the following systems and features are candidates for inclusion in the CNP Fire Protection Monitoring Program:

- Fire Area boundary barriers discussed in Section 3.1
- Fire Detection System (ionization)

### 4.0 CONCLUSION



The nuclear safety and radioactive release performance criteria of NFPA 805 are met for a fire in Fire Area AA47. This Fire Risk Evaluation for Fire Area AA47 has demonstrated that

- The change in core damage frequency (delta CDF) is acceptable, and
- The change in large early release frequency (delta LERF) is acceptable, and
- Defense-in-depth and safety margins are maintained.

This is confirmation that a success path effectively remains free of fire damage and that the performance-based approach is acceptable per Section 4.2.4.2 of NFPA 805.

## 5.0 REFERENCES

- 5.1 Calculation PRA-FIRE-NB-CRE, Fire PRA Cumulative Risk Evaluations
- 5.2 CNP Fire Pre-Plans, Volumes I, II, and III, Revisions 17, 14, and 18 respectively
- 5.3 Fire Hazards Analysis
- 5.4 NFPA 805, Performance-Based Standard for Fire Protection for Light Water Reactor Electric Generating Plants
- 5.5 NFPPM, NFPA 805 Fire Protection Program Manual (NFPPM)
- 5.6 Nuclear Energy Institute (NEI) 04-02, Guidance for Implementing a Risk-Informed, Performance-Based Fire Protection Program under 10 CFR 50.48(c), Rev. 2
- 5.7 Nuclear Safety Capability Assessment Report
- 5.8 PRA-NB-FIRE-FQ, Fire PRA Model Quantification Notebook
- 5.9 PRA-NB-FIRE-FSS, Fire PRA Fire Scenario Selection
- 5.10 Regulatory Guide 1.205, Risk-Informed, Performance-Based Fire Protection for Existing Light-Water Nuclear Power Plants, Rev. Revision 1
- 5.11 Technical Evaluation R1900-005-001, Non-Power Operation Modes Transition Review

**Fire Area AA47 – Attachment 1 - Table B-3 - Fire Area Transition**

<u>Unit</u>	<u>Fire Area</u>	<u>Description</u>
2	AA47	Unit 2 Control Room (El. 633 ft.)

<u>Fire Zone</u>	<u>Description</u>
54	Unit 2 Control Room - El. 633 ft. 0 in.

**Regulatory Basis**

4.2.4.2 - Performance-Based Approach - Fire Risk Evaluation with simplifying deterministic assumptions

<b>Performance Goal</b>	<b>Method of Accomplishment</b>	<b>Comments</b>
Reactivity Control	Unit 2 - Trip the reactor from the Control Room. Borate using Unit 1 East or West Charging Pumps supplied from the Unit 1 RWST injecting through the Unit 2 BIT. Use source range monitoring for indication.	None
Inventory and Pressure Control	Unit 2 - Control inventory using Unit 1 East or West Charging Pumps through the Unit 2 BIT. Control pressure using Unit 2 Pressurizer Safety Relief Valves with allowable manual actions.	VFDRs identified for CVCS and RCS integrity.
Decay Heat Removal	Unit 2 - Feed SGs 2 & 3 with Unit 1 West MDAFW Pump. The DHR function also requires MS isolation with a steam release path through the Safety Relief Valves.	VFDRs identified for AFW and MS isolation.
Process Monitoring	Unit 2 Process Monitoring - Use Unit 2 alternate process monitoring powered from Unit 1 at the local shutdown panels for the following: Pressurizer level, RCS pressure and temperature, and S/G level and Pressure. Unit 2 Source Range Monitoring - Use Unit 2 alternate source range monitoring powered from Unit 1 at the local shutdown panels.	VFDRs identified for process and source range monitoring.
Vital Auxiliaries	Unit 2 Electrical - Control Unit 1 Red (AB) Train Electrical Distribution with Unit 1 Red (AB) DG. Control Unit 1 Green (CD) Train Electrical Distribution with Unit 1 Green (CD) DG. Unit 2 ESW - Operate Unit 1 East and West ESW. Unit 2 CCW - Operate Unit 1 East and West CCW. Unit 2 HVAC - Unit 2 Control Room HVAC is not required as alternate shutdown is utilized for this area. Unit 2 Auxiliary Building HVAC is not operational, Unit 1 Auxiliary Building HVAC remains available and provides adequate cooling. Operate Unit 1 Red (AB) and Green (CD) DG HVAC.	Unit 1 vital auxiliaries are credited to support Unit 1 equipment that is crosstied to Unit 2.

**Fire Area AA47 – Attachment 1 - Table B-3 - Fire Area Transition**

<u>Unit</u>	<u>Fire Area</u>	<u>Description</u>
2	AA47	Unit 2 Control Room (El. 633 ft.)
Operate Unit 1 Red (AB) and Green (CD) Switchgear HVAC. Operate Unit 1 West MDAFW Room HVAC system. Operate the Unit 1 East and West ESW Room HVAC systems.		

**Reference Documents**

Genesis Solution Suite, EDISON / SAFE-PB, DC Cook V 3.4.0

Nuclear Safety Capability Assessment Report

**Licensing Actions**

None

**Existing Engineering Equivalency Evaluations (EEEE)****EEEE Title Engineering Equivalency Evaluation 9-2 - Fire Zone 54 (Fire Area AA47) and Fire Zone 73 (Fire Area AA57B) Duct Evaluation**

**Summary** The purpose of this engineering equivalency evaluation is to document the acceptability of an undampened HVAC steel duct that penetrates the ceiling/floor assembly between the Unit 2 Control Room and Unit 2 HVAC Equipment Room, Fire Zone 54 (Fire Area AA47) and Fire Zone 73 (Fire Area AA57B), respectively.

Reasonable assurance is provided that a fire in Fire Zone 54 or Fire Zones 72 and 73 would not impair the safe shutdown capabilities of CNP Unit 2. This engineering equivalency evaluation does not adversely impact other engineering equivalency evaluations.

The duct was evaluated and found to be acceptable based on the fire protection systems and construction features within the evaluated areas.

**Fire Area AA47 – Attachment 1 - Table B-3 - Fire Area Transition**

<u>Unit</u>	<u>Fire Area</u>	<u>Description</u>
2	AA47	Unit 2 Control Room (El. 633 ft.)

**EEEE Title Engineering Equivalency Evaluation 9-5 - Fire Zones 70 (Fire Area AA57A) and 73 (Fire Area AA57B) Hatch Evaluations**

**Summary** The purpose of this engineering equivalency evaluation is to document the acceptability of unrated floor hatches located between the HVAC Equipment Rooms (Fire Zones 70 and 73) and the Unit 1 and Unit 2 Main Control Rooms (Fire Zones 53 and 54), and the fixed suppression exemption requests for the Main Control Rooms or other engineering equivalency evaluations. Fire Zones 70 and 73 are located in Fire Areas AA57A and AA57B, respectively, while Fire Zones 53 and 54 are located in Fire Areas AA46 and AA47, respectively. A 3-hr fire-rated hatch assembly is not commercially available for use in this location.

Note: This engineering equivalency evaluation has been reviewed by the NRC. Refer to NRC SER dated June 17, 1988, for acceptance of unrated fire hatches in fire area boundaries. The NRC concluded that the level of fire safety is equivalent to that achieved by conformance with the guidelines of Section D.1.j of Appendix A to BTP APCSB 9.5-1, and, therefore, the deviations for the unrated fire hatches were found acceptable.

Reasonable assurance is provided that a fire in Fire Zones 70, 71, 72 and 73 would not impair the safe shutdown capabilities in either unit. This engineering equivalency evaluation does not adversely impact other engineering equivalency evaluations.

The hatches were evaluated and found to be acceptable based on the fire hazards, fire protection systems and construction features within the evaluated areas. Also, some areas being evaluated are continuously manned.

**EEEE Title Engineering Equivalency Evaluation 9-17 - Fire Zone 54 (Fire Area AA47) and Fire Zone 58 (Fire Area AA51) Hatch Evaluation**

**Summary** The purpose of this engineering equivalency evaluation is to document the acceptability of an unrated steel plate hatch located between the Unit 2 Control Room and the Unit 2 Control Room Cable Vault in Fire Zones 54 (Fire Area AA47) and Fire Zone 58 (Fire Area AA51) respectively. A 3-hr fire-rated hatch assembly is not commercially available for use in this location.

Note: This engineering equivalency evaluation has been reviewed by the NRC. Refer to NRC SER dated June 17, 1988, for acceptance of unrated fire hatches in fire area boundaries. The NRC concluded that the level of fire safety is equivalent to that achieved by conformance with the guidelines of Section D.1.j of Appendix A to BTP APCSB 9.5-1, and, therefore, the deviations for the unrated fire hatches were found acceptable.

Reasonable assurance is provided that a fire in Fire Zone 54 or Fire Zone 58 would not impair the safe shutdown capabilities of Unit 2 or impact on the fixed suppression exemption request for Fire Zone 54. This engineering equivalency evaluation does not adversely impact other engineering equivalency evaluations.

The hatch was evaluated and found to be acceptable based on the fire hazards, fire protection systems and construction features within the evaluated areas.

**Fire Area AA47 – Attachment 1 - Table B-3 - Fire Area Transition**

<u>Unit</u>	<u>Fire Area</u>	<u>Description</u>
2	AA47	Unit 2 Control Room (El. 633 ft.)

<b><u>EEEE Title</u></b>	<b>Engineering Equivalency Evaluation 11-9 - Turbine, Auxiliary and Containment Buildings Boundary Evaluation</b>
<b><u>Summary</u></b>	<p>The purpose of this engineering equivalency evaluation is to describe in general, the approach and existence of evaluations performed to determine and reconcile fire area boundaries having components or designs with less than a 3-hr fire rating on preventing the spread of fire. This engineering equivalency evaluation also specifically evaluates the impact of unrated door assemblies on the spread of fire.</p> <p>Reasonable assurance is provided that the fire area boundaries having components or design less than a 3-hr fire rating will not increase the spread of fire or impair the safe shutdown capabilities of Units 1 or 2. In addition, this engineering equivalency evaluation does not adversely impact on other engineering equivalency evaluations or exemption requests.</p> <p>This evaluation supports additional evaluations credited in this fire area.</p>
<b><u>EEEE Title</u></b>	<b>Engineering Equivalency Evaluation 11-36 - Unit 1 and Unit 2 Hot Shutdown Panel Enclosure: Unit 1 Fire Zone 144 (Fire Area AA50) and Unit 2 Fire Zone 145 (Fire Area AA51)</b>
<b><u>Summary</u></b>	<p>The purpose of this engineering equivalency evaluation is to document the acceptability that deviations to the 3-hr fire rating of the Unit 1 and Unit 2 Hot Shutdown Panel (HSDP) enclosures (Fire Zone 144 for Unit 1 and Fire Zone 145 for Unit 2) would have on preventing the spread of fire. This engineering equivalency evaluation evaluates the ability of the existing structure to provide adequate separation of the HSDPs from their opposite unit's control room. In addition to the reduction of the roof/ceiling assembly fire rating from 3 hours to a nominal 2 hours (2 hours and 12 minutes), this engineering equivalency evaluation reviews the roll-up fire door installation and the protective design for the columns.</p> <p>Reasonable assurance is provided that the deviation from providing a 3-hr rated enclosure for each of the HSDPs will not impair the safe shutdown capabilities of CNP or increase the potential for spread of fire between the HSDP enclosures (Fire Zones 144 and 145) and the control rooms (Fire Zones 53 and 54) in which they are located.</p> <p>The HSDPs were evaluated and found to be acceptable based on the fire hazards, fire protection systems and construction features within the evaluated areas. Also, some areas being evaluated are continuously manned.</p>

**Fire Area AA47 – Attachment 1 - Table B-3 - Fire Area Transition**

<u>Unit</u>	<u>Fire Area</u>	<u>Description</u>
2	AA47	Unit 2 Control Room (El. 633 ft.)
<hr/>		
<b><u>EEEE Title</u></b>	<b>Engineering Equivalency Evaluation 11-41 - Unit 1 Fire Zone 53 (Fire Area AA46) and Unit 2 Fire Zone 54 (Fire Area AA47) Boundary Evaluation</b>	
<b><u>Summary</u></b>	<p>The purpose of this engineering equivalency evaluation is to document the acceptability of installing a partial raised floor in the Unit 1 and Unit 2 control rooms (Fire Zones 53 and 54) on preventing the spread of fire. The engineering equivalency evaluation demonstrates that the existing fire protection measures for the control room are adequate and will not require the raised floor area to be provided with an automatic detection or suppression system.</p> <p>Reasonable assurance is provided that the installation of a partial raised floor in the Unit 1 and Unit 2 control rooms, Fire Zones 53 and 54 respectively, will not impair the safe shutdown capabilities of CNP or aid in the spread of fire within the zones. This engineering equivalency evaluation does not impact other engineering equivalency evaluations.</p> <p>The partial raised floor was evaluated and found to be acceptable based on the fire hazards, fire protection systems and construction features within the evaluated areas. Also, the areas being evaluated are continuously manned.</p>	
<b><u>EEEE Title</u></b>	<b>Engineering Equivalency Evaluation 11-58 - Unit 2 Control Room Fire Rated Floor Penetration Seals Fire Zones 54 (Fire Area AA47) and 58 (Fire Area AA51)</b>	
<b><u>Summary</u></b>	<p>The purpose of this engineering equivalency evaluation is to document the acceptability of the installation of plastic sleeves in the Unit 2 Control Room fire-rated floor penetration seals F-6894, F-6895, F-6896, F-6897, F-6898, F-6899, F-6900, F-6901, F-6902, F-6903, F-6904, F-6906, F-6907, F-6909, and F-6010.</p> <p>Consistent with the defense-in-depth philosophy and fire protection features described in the FSA, expansion characteristics of silicone foam and requirement of Main Control Room evacuation in a fire event the discrepancy noted in this evaluation for the subject seals will have no impact on the ability to safely shutdown CNP in a fire event.</p> <p>The plastic sleeves were evaluated and found to be acceptable based on the fire hazards, fire protection systems and construction features within the evaluated areas. Also, one of the areas being evaluated is continuously manned.</p>	

**Fire Area AA47 – Attachment 1 - Table B-3 - Fire Area Transition**

<u>Unit</u>	<u>Fire Area</u>	<u>Description</u>
2	AA47	Unit 2 Control Room (El. 633 ft.)

**EEEE Title Engineering Equivalency Evaluation 11-69 - Electromagnetic Fire/Security Door Locks**

**Summary** The purpose of this evaluation is to document acceptability of non-UL/FM approved DynaLock Model 2280 electromagnetic door locks that were installed under EC-0000050114. NFPA 80 1970 Ed. Section 516 Builders Hardware, sub-section b. Locks and Latches states, in part, "Only labeled fire exit hardware shall be used." The Dynalock Model 2280 magnetic door locks are installed primarily for Security purposes and are not UL/FM approved devices as required by code. Therefore, this evaluation is necessary to provide technical justification supporting acceptability of the Dynalock Model 2280 electromagnetic lock mechanism.

This evaluation shows that the use of the DynaLock Model 2280 magnetic lock devices provides, reasonable assurance fire doors will remain closed and retain the required passive fire protection function. The use of the DynaLock Model 2280 magnetic lock devices has no impact on the ability of CNP to achieve and maintain a safe and stable condition, nor does it increase the risk of the spread of fire between plant fire zones.

EEE-11-69 evaluated magnetic door latches installed on door 2-DR-AUX411B in this Analysis Area boundary. This evaluation shows that the use of the DynaLock Model 2280 magnetic lock devices provides reasonable assurance fire doors will remain closed and retain the required passive fire protection function.

**EEEE Title Engineering Equivalency Evaluation 11-80 - Fire Zone 54 (AA47) And Fire Zone 58 (AA51) Fire Barrier Penetration Seals**

**Summary** The purpose of this evaluation is to document the acceptability of fire barrier penetration seals in the floor of the Unit 1 Control Room that have been identified with a fire seal depth below the minimum depth required per ES-FIRE-0601-QCF, Engineering Specification for Fire Rated Seals, for a three hour fire seal.

Floor fire seals with less than the required fire seal depth are acceptable as is and reasonable assurance is provided that a fire in Fire Zone 54 (AA47) or Fire Zone 58 (AA51) would not impair the ability of CNP to reach and maintain a safe and stable hot standby. In addition, this evaluation does not impact other evaluations.

The fire rated penetration seals were evaluated and found to be acceptable based on the fire hazards, fire protection systems, and transient combustible and hot work restrictions within the evaluated areas, as well as the identical response for fire safe shutdown required by procedures for the evaluated areas.

**Fire Area AA47 – Attachment 1 - Table B-3 - Fire Area Transition**

<u>Unit</u>	<u>Fire Area</u>	<u>Description</u>
2	AA47	Unit 2 Control Room (El. 633 ft.)

**Fire Suppression Effects on Nuclear Safety Performance Criteria**

The CNP fire brigade is trained to discharge water in a judicious manner and instructed to direct hose streams and portable extinguishers at the base of the fire to limit the amount of overspray beyond the immediate fire zone. For this reason, fire brigade activities are not expected to fail components not already considered damaged. It has been concluded that water impingement on cables is not a concern. Electrical cabinets are provided with a seal at the conduit interface. Per visual inspection any side vents for this equipment are pointed downward to prevent water intrusion. The drainage features of the fire area mitigate the potential for flooding damage due to fire suppression, such that the standing water would not affect credited equipment.

This fire area is not equipped with a fixed fire suppression system. Since it is shown that suppression effects will not impact the nuclear safety performance criteria, the fire area configuration is deemed acceptable.

**References:**

Technical Evaluation 12.1, "Fire Suppression Effects Study"

Technical Evaluation 12.1, "Supplemental Information to Fire Suppression Effects Study – Supplement 1"

**Fire Area Comments**

Revise time requirement \ time basis per AR 2015-14147 for VFDR AA47-013 and AA47-018



## Fire Area AA47 – Attachment 2 - Fire Risk Evaluation Results Summary

### A2.1 Introduction

The ‘changes’ associated with NFPA 805 transition were those variances from the deterministic requirements of NFPA 805. The changes identified for evaluation for fire area AA47 are grouped as follows:

- Separation Issues

This attachment is a summary of the Fire Risk Evaluation for the fire area. The complete results and methodology are contained in the Cumulative Fire Risk Evaluation, PRA-FIRE-NB-CRE. (FPCE 2017-0009)

### A2.2 Inputs/Assumptions

1. Assumptions from the Fire PRA apply to this calculation.
2. Detailed fire modeling was not performed for Fire Area AA47. A single whole room burnout scenario was assumed.

### A2.3 Fire Modeling Methodology

Detailed fire modeling was not performed for Fire Area AA47. This area was modeled considering whole room burnout.

### A2.4 Scenario Descriptions and Model Results

A single whole room burnout scenario was modeled for Fire Area AA47. All targets within the fire area were assumed damaged.

#### A2.4.1 Ignition Sources

The fixed ignition sources in Fire Area AA47 consist of the main control room boards and control room back panels. Additional detail regarding the ignition sources in this area is available in the Fire PRA Report. All fire scenarios, whether resulting from fixed or transient ignition sources, are assumed to damage all targets in the fire area.

#### A2.4.2 Scenario Results

A delta risk calculation has been performed to quantify the risk associated with the VFDRs in the fire area.

### A2.5 Fire Risk Evaluation Results

PRA-FIRE-NB-CRE documents scenarios and corresponding impacted VFDRs that were evaluated for delta risk during the transition to NFPA 805 and also all changes to the Fire Protection Program that are currently incorporated into the Fire PRA model. The acceptability of the Cumulative Fire Risk Evaluations was based on calculated delta risk meeting the thresholds of NEI 04-02, RG 1.205 and RG 1.174. (FPCE 2017-0009)

## Fire Area AA47 – Attachment 2 - Fire Risk Evaluation Results Summary

### A-2.6 Impact of VFDR on Defense-in-Depth

Defense-in-Depth has been evaluated for this fire area. The impacts of this evaluation are summarized in the table below:

Defense-in-Depth Impact Review for AA47			
Method of Providing DID	Required to Support Deterministic Analysis or Fire PRA?	Changes or Improvements Necessary for DID?	Basis/Justification
Echelon 1: Prevent fires from starting			
Combustible Control is implemented in accordance with Procedure PMP-2270-CCM-001, Control of Combustible Materials.	Yes	No	• This element is adequate based on no perceived weakness of, or over-reliance on, another echelon of defense-in-depth.
Hot Work Control is implemented in accordance with Procedure PMP-2270-WBG-001, Welding, Burning and Grinding Activities.	Yes	No	
Echelon 2: Rapidly detect, control and extinguish promptly those fires that do occur thereby limiting fire damage			
Fire Detection System	Yes	No	• Detection is already required and fire fighting activities are not expected to be challenging, therefore, no changes or improvements to Echelon 2 attributes are necessary to maintain defense-in-depth.
Fixed Fire Suppression	No	No	
Portable Fire Extinguishers	Yes	No	
Hose stations and hydrants	Yes	No	
Pre-Fire Plan	Yes	No	
Echelon 3: Provide adequate level of fire protection for systems and structures so that a fire will not prevent essential safety functions from being performed			
Walls, floors ceilings and structural elements are rated or have been evaluated as adequate for the hazard.	Yes	No	• There are significant modeling differences between the Fire PRA and nuclear safety capability assessment (i.e., due to different success criteria, end states, etc.) and therefore recovery actions for VFDR AA47-004, AA47-015 and AA47-019 have been credited to ensure that defense-in-depth is maintained.
Penetrations in the fire area barrier are rated or have been evaluated as adequate for the hazard.	Yes	No	
Supplemental barriers (e.g., ERFBS, cable tray covers, etc.)	No	No	• Where a variance can possibly be affected in a potentially high risk scenario, based on a detailed review, the VFDR is either not the cause for the high risk of the scenario or the mitigating recovery action is credited; therefore no changes or improvements to Echelon 3 attributes are necessary to maintain defense-in-depth.
Guidance provided to operations personnel detailing the required success path(s) including recovery actions to achieve nuclear safety performance criteria.	Yes	Yes	

## Fire Area AA47 – Attachment 2 - Fire Risk Evaluation Results Summary

### A-2.7 Safety Margin Considerations

In accordance with NEI 04-02, the maintenance of adequate Safety Margin is assessed by the consideration categories of analyses utilized by this Fire Risk Evaluation.

Safety margins are considered to be maintained if:

- Codes and Standards or their alternatives accepted for use by the NRC are met.

AND

- Safety analyses acceptance criteria in the licensing basis (e.g., FSAR, supporting analyses) are met, or provides sufficient margin to account for analysis and data uncertainty.

The following summarizes the bases for ensuring the maintenance of safety margins:

- The risk-informed, performance based processes utilized are based upon NFPA 805, 2001 edition, endorsed by the NRC in 10 CFR 50.48(c).
- The Fire Risk Evaluation process is in accordance with NEI 04-02, Revision 2, which is endorsed by the NRC in Regulatory Guide 1.205, Revision 1.
- The Fire PRA is developed in accordance with NUREG/CR-6850, which was developed jointly between the NRC and EPRI.
- The Fire PRA has undergone an industry peer review, in order to ensure the Fire PRA meets the appropriate quality standards of ASME/ANS RA-Sa-2009, "Standard for Level 1/Large Early Release Frequency Probabilistic Risk Assessment for Nuclear Power Plant Applications," Dated February 2, 2009
- The "bounding risk assessment" is used during transition (NEI 04-02, Section 5.3.4.2). This approach conservatively assumes that target set damage occurs for postulated fire events which resulted in whole room burn up, and therefore, MEFS/LFS is not analyzed separately from the Fire PRA results.
- The CNP internal events PRA model received two formal industry peer reviews conducted in accordance with applicable NEI guidelines. The initial peer review was performed in 2001, while a subsequent focused scope (i.e., limited scope) peer review was conducted in 2009. The initial, full-scope WOG peer review covered all aspects of the CNP PRA model and the administrative processes used to maintain and update the model. The CNP PRA model has been revised to address all significant issues (i.e., Category A and B Facts & Observations) identified during the initial peer review. None of the findings from the focused-scope peer review were judged to reach the significance level of a Category A or B Fact & Observation; as a result, no changes to the PRA model have yet been made to include resolutions for these latter issues.
- Fire protection systems and features determined to be required by NFPA 805 Chapter 4 have been confirmed to meet the requirements of NFPA 805 Chapter 3 and their associated referenced codes and listings, or provided with acceptable alternatives using processes accepted for use by the NRC (i.e., FAQ 06-0008, FAQ 06-0004, 07-0033).
- Fire modeling has not been performed in support of the change evaluations and results are therefore, based on whole area burn up. As such, the results are considered very conservative.
- In accordance with the requirements of 10 CFR 50.48(c)(2)(iii), the Fire PRA results, including cutsets for

## **Fire Area AA47 – Attachment 2 - Fire Risk Evaluation Results Summary**

the scenarios of concern, have been reviewed and it was verified that the results presented above do not rely solely on feed and bleed as the fire-protected safe shutdown path for maintaining reactor coolant inventory, pressure control, and decay heat removal capability for this fire area.

### **A-2.8 Transition Risk Evaluation Conclusions**

The transition change evaluation determined that these changes:

- Are acceptable based upon the measured change in CDF and LERF
- Maintained adequate defense-in-depth and safety margins

The results of this evaluation meet the requirements of NFPA 805 Risk Evaluation; therefore, the use of the performance based analysis approach is acceptable.

## D. C. Cook Nuclear Plant Fire Safety Analysis

## Fire Area: AA48

Unit 1 Switchgear Rooms Cable Vault and Auxiliary Cable Vault (El. 625 ft. 10 in. and 620 ft. 6 in.)

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## Attachments

Fire Area AA48 – Attachment 1 - Table B-3 - Fire Area Transition

## Fire Area AA48 – Attachment 2 - Fire Risk Evaluation Results Summary

## 1.0 PURPOSE

This report documents the Fire Safety Analysis (FSA) for Cook Nuclear Plant (CNP) Fire Area AA48, Unit 1 Switchgear Rooms Cable Vault and Auxiliary Cable Vault (El. 625 ft. 10 in. and 620 ft. 6 in.) which comprises fire zone(s) 55, 56. The purpose of this analysis is to demonstrate the achievement of the nuclear safety and radioactive release performance criteria of NFPA 805 as required by 10 CFR 50.48(c). The Fire Safety Analysis is a key part of compliance with Section 2.7.1.2 Fire Protection Program Design Basis Document of NFPA 805. This analysis also documents results of risk-informed, performance-based Fire Risk Evaluations (FREs). These evaluations are associated with Variances from Deterministic Requirements (VFDRs) of NFPA 805 Chapter 4.

## 2.0 ANALYSIS METHODOLOGY

The FSA is the design basis document as described in NFPA 805 Section 2.7.1.2. The following steps are performed to develop the FSA on a fire area basis:

- Identify significant fire hazards in the fire area. This is based on NFPA 805 approach to analyze the plant from an ignition source and fuel package perspective.
- Summarize Nuclear Safety Capability Analysis (NSCA) compliance strategies. This is the result of the NEI 04-02 B-3 Table review of the Safe Shutdown Analysis.
- Summarize Non-Power Operations Modes compliance strategies.
- Summarize Radioactive Release compliance strategies. The transition review process required per NEI 04-02 is used to develop these results.
- Provide Fire Probabilistic Risk Assessment summary of results. This is based on the results from the plant Fire PRA.
- Perform risk informed, performance based evaluations if needed for the performance based approach.
- Summarize Defense-in-Depth strategy for each fire area.
- Determine key analysis assumptions which are candidates to be included in the NFPA 805 monitoring program.
- Provide conclusions relative to NFPA 805 compliance.

### 3.0 ANALYSIS

#### 3.1 Classical Fire Protection

##### 3.1.1 Construction

Walls, floors and ceilings to adjacent fire areas are reinforced concrete in excess of a 3-hour rating.

In Fire Zone 55, walls to the CD Battery Room, Panel Area and Charger Room are reinforced concrete in excess of a 3-hour rating. Air handling ducts passing through this fire zone to the roof are enclosed in 4-hour rated concrete block. An unrated wall constructed of 1-inch marine board and steel framing provides a corridor to the Battery and Charger Rooms and provides separation from the rest of the cable spreading area.

In Fire Zone 56, a fire area boundary evaluation was performed for the construction features (i.e. an unrated steel plate floor hatch, fire dampers having a 1 1/2-hour fire rating, and silicone foam fire seals) of the cable spreading rooms that have a fire resistance rating of less than 3 hours (Engineering Equivalency Evaluations 9-14, 11-4, and 11-14).

Applicable Engineering Equivalency Evaluations are documented in Attachment 1.

##### 3.1.2 Doors and Access Openings

Three-hour doors are provided in all boundary walls.

In Fire Zone 55, a fire area boundary evaluation was performed for unrated floor hatches to Fire Zones 40B and 41, respectively. A fire door having a 3-hour rating is provided at the stairway to adjacent Fire Area AA40 - Fire Zone 41. Fire doors having a 3-hour rating are provided to the CD Battery Room and between the panel area and cable spreading area.

In Fire Zone 56, a fire area boundary evaluation was performed for an unrated floor hatch to Fire Zone 43. A fire door having a 3-hour rating are provided to adjacent Fire Area 36/42 - Fire Zone 44N.

##### 3.1.3 Penetrations

In Fire Zone 55, penetrations in fire barriers between this fire zone and adjacent fire areas are provided with fire seals. Additionally, fire seals are provided for penetrations in the interior walls of the Charger Room, CD Battery Room, Panel Room and Stairway. Also fire seals are provided in the north and east exterior walls.

A fire area boundary evaluation was performed for the unrated fire barrier penetration seals installed between Fire Areas AA39A and AA39B - Fire Zones 40A and 40B, Fire Area AA40 - Fire Zone 41, Fire Area AA41 - Fire Zones 42A, 42B, 42C, 42D and Fire Area AA48 - Fire Zone 55 (Engineering Equivalency Evaluation 11-5).

A fire area engineering equivalency evaluation was prepared to evaluate a fire seal design between Fire Zones 41 and 55 (Engineering Equivalency Evaluation 11-28).

Seismic gaps are sealed with a glass fiber reinforced silicone sheeting.

In Fire Zone 56, penetrations in fire barriers between this fire zone and adjacent fire areas are provided with fire seals.

A fire area boundary evaluation was performed for the 8-inch thick silicone foam fire seals installed between this fire zone and Fire Area AA36/42 - Fire Zone 44N (Engineering Equivalency Evaluation 11-4).

To prevent CO2 leakage through the floor hatch, a gasket is bolted to the top of the plate cover.

### 3.1.4 Detection

The table below outlines the fire detection system(s) provided in the Fire Area:

<b>Table 3-1, Fire Area AA48 Detection Systems</b>									
<b>Fire Zone</b>	<b>Type of System</b>	<b>Local (L) / Remote (R)</b>	<b>Detection Actuates Suppression?</b>	<b>Required System?</b>					
				<b>S</b>	<b>L</b>	<b>E</b>	<b>R</b>	<b>D</b>	
55	Infrared	L/R	Y	N	N	Y	Y	N	
55	Ionization	L/R	Y	N	N	Y	Y	N	
56	Ionization	L/R	Y	N	N	Y	Y	N	
<b>Table 3-1 Legend:</b>									
Table Field: "Required System?"									
S	- Required for Chapter 4 Separation Criteria								
L	- Required for NRC Approved Licensing Action								
E	- Required for Engineering Equivalency Evaluation								
R	- Required for Risk Significance								
D	- Required to maintain adequate balance of Defense-in-Depth in a Change Evaluation or Fire Risk Evaluation								

For Fire Zone 55, cross zoned ionization smoke detectors (22) and infra-red detectors (10) are provided which alarm in the Unit 1 Control Room. The infra-red detectors annunciate in the Control Room on 2 separate circuits. No infra-red detectors are located in the CD Battery Room.

For Fire Zone 56, six ionization detectors are provided which alarm in the Unit 1 Control Room.



### 3.1.5 Fixed Suppression

The table below outlines the fixed fire suppression system(s) provided in the Fire Area:

Table 3-2, Fire Area AA48 Suppression Systems								
Fire Zone	Type of System	Full (F) / Partial (P)	Required System?					
			S	L	E	R	D	
55	Automatic CO2	P	N	N	Y	Y	N	
56	Automatic CO2	F	N	N	Y	Y	N	
Table 3-2 Legend:								
Table Field: "Required System?"								
S	- Required for Chapter 4 Separation Criteria							
L	- Required for NRC Approved Licensing Action							
E	- Required for Engineering Equivalency Evaluation							
R	- Required for Risk Significance							
D	- Required to maintain adequate balance of Defense-in-Depth in a Change Evaluation or Fire Risk Evaluation							

A low pressure CO2 total flooding system supplied from the 17 ton tank is provided which is actuated by the listed detection systems. No CO2 protection is provided in the CD Battery Room (Fire Zone 55).

### 3.1.6 Manual Suppression / Response Strategy

A postulated fire will be identified by early detection using ionization type smoke detection, infra-red detection or by plant personnel using plant communication system to notify the control room. The automatic detection systems alarm in the control room. The Control Room operator will dispatch the fire brigade for initiation of manual fire fighting. A fire in this fire area will be contained by the construction features discussed in Section 3.1.1. Manual suppression is provided by the CNP Fire Brigade.

Fire extinguishers are located in Fire Zone 55 and 56, one of which is located in the panel area of Fire Zone 55.

Water hose reels are located in Fire Zone 55. For Fire Zone 56, a continuous water hose reel is located in adjacent Fire Zone 44N.

Floor drains are not available in this fire area. The Fire Brigade is equipped with a sump pump that may be used to remove an accumulation of water.

### 3.1.7 Ventilation

A fire in this area will be contained by the fire barriers. Smoke can be removed by portable fans and flexible ducting to other areas of the Auxiliary Building and outdoors if not contaminated. Contaminated smoke can be removed by portable fans and flexible ducting to other areas of the Auxiliary Building per the Fire Pre-Plans. The normal building ventilating systems in the Auxiliary Building will then exhaust the smoke via filtered monitored pathways.

In Fire Zone 55, a fire damper having a 3-hour rating is provided to adjacent Fire Zone 41. Fire

dampers having a 3-hour rating are provided in interior boundaries: 1) between the cable spreading area and the panel area, 2) between the cable spreading area and the CD Battery Room and 3) between the Charging Room and the CD Battery Room.

In Fire Zone 56, a 3-hour fire damper assembly is provided to meet the requirements of NFPA 90A. Fire dampers having a 3-hour rating are provided to adjacent Fire Zone 44N.

### 3.1.8 Other Features

Some cable trays within Fire Area AA48 are provided with bottom covers and/or are fully enclosed.

This fire area is procedurally controlled as a transient combustible and hot work free zone.

## 3.2 Fire Hazards Identification

The fire area contains both ignition sources and combustible fire hazards. The ignition sources consist of battery chargers, battery control panels and distribution panels. Combustibles consist primarily of exposed electrical cables in trays, rubber, battery cells and plastics.

The exterior fire hazards that are adjacent to exterior walls are the Unit 1 Main, Auxiliary and Start-up Transformers. Water spray suppression systems are provided for the transformers. In addition, this Fire Area is constructed of reinforced concrete with no penetrations in the north or east walls adjacent to the transformers. The missile barriers around each transformer also provide a measure of fire barrier protection, limiting radiant heat in the direction of the Fire Area. The fixed suppression and rated construction are sufficient to provide protection for credited equipment within the plant.

The roof of this Fire Area does not require a rating for protection. The orientation of the Fire Area prevents direct impact from radiant heat. The orientation of the Fire Area as well as the reinforced concrete construction is sufficient to prevent an exposure to credited equipment inside the plant through the roof of this Fire Area.

The current fire loading classification is low.

## 3.3 NSCA Compliance Summary

Fire Area AA48 is the Unit 1 Switchgear Rooms Cable Vault and as such contains Unit 1 Red (AB) and Green (CD) Train safe shutdown cables; controls for valves, pumps, electrical Bus/MCCs, diesel generators and instrumentation; as well as 250VDC power supplies.

Compliance with the nuclear safety performance criteria is achieved using the performance based approach in accordance with NFPA 805, Section 4.2.4.2.

Unit 1 safe and stable for Unit 1 is accomplished by crediting crossties to the unaffected Unit 2 via the following: Alternate AFW to Steam Generators 1 and 4 via the Unit 2 East Motor Driven Auxiliary Feedwater Pump, Alternate CVCS via the Unit 2 East or West Pump and ESW crosstie via normally available crosstie lineup. Unit 2 CCW is credited to support the required Unit 2 crosstie systems. Local Shutdown Indicating Panels are credited to provide process and source range monitoring with Unit 2 power crosstie.

The Nuclear Safety Performance Criteria compliance strategy for AA48 is documented within the NSCA Report.

### 3.3.1 Variances

The variances identified for evaluation for this fire area are grouped as follows:

#### 3.3.1.1 VFDR No. AA48-001

1-PP-3E, 1-PP-3W and 1-PP-4 - A Unit 1 AFW Pump is required to be operable to support decay heat removal. Decay heat removal is required to be capable of removing sufficient heat from the reactor core such that the fuel is maintained in a safe and stable condition. A full area fire in Fire Area AA48 may cause the loss of the Unit 1 East and West MDAFW Pumps and the Unit 1 TDAFW Pump. The East MDAFW Pump, 1-PP-3E may fail due to fire induced damage of 250VDC Cabinet 1-MCCD, 4kV Bus 1-T11D and cables. The West MDAFW Pump, 1-PP-3W may fail due to fire induced damage of 250VDC Cabinet 1-MCAB, 4kV Bus 1-T11A and cables. The TDAFW Pump, 1-PP-4 may fail due to fire induced damage of the TDAFW Pump Trip and Throttle Valve 1-QT-506. This condition represents a variance from the deterministic requirements of NFPA 805, Section 4.2.3. This is a separation issue.

This VFDR has been evaluated and it was determined that the risk, safety margin and defense-in-depth meet the acceptance criteria of NFPA 805 Section 4.2.4 with a recovery action credited and plant modifications to implement transient free areas.

#### 3.3.1.2 VFDR No. AA48-002

1-FMO-212 and 1-FMO-242- SG 1 and 4 AFW Supply Valves are required to be operable to support decay heat removal for Unit 1. Decay heat removal shall be capable of removing heat from the reactor core such that the fuel is maintained in a safe and stable condition. Decay heat removal requires a set of 2 supply valves be operable with their corresponding AFW pump. The following sets of Unit 1 SG AFW Supply Valves may fail due to a full area fire within Fire Area AA48; 1-FMO-212 and 1-FMO-242, 1-FMO-222 and 1-FMO-232, 1-FMO-221 and 1-FMO-231. The Unit 2 East AFW Pump is credited to provide decay heat removal through Unit 1 SGs 1 and 4 for a fire within AA48. This requires 1-FMO-212 and 1-FMO-242 be operable. 1-FMO-212 may fail due to fire induced damage of 600V VCC 1-AZV-A. 1-FMO-242 may fail due to fire induced damage of 600V VCC 1-EZV-A. This condition represents a variance from the deterministic requirements of NFPA 805, Section 4.2.3. This is a separation issue.

This VFDR has been evaluated and it was determined that the risk, safety margin and defense-in-depth meet the acceptance criteria of NFPA 805 Section 4.2.4 with a recovery action credited and plant modifications to implement transient free areas.

**3.3.1.3 VFDR No. AA48-003**

1-DCR-310 and 1-DCR-340 - SG 1 and 4 Blowdown Isolation Valves are required to be closed to support main steam isolation. Main steam isolation is required to prevent uncontrolled cooldown through over-steaming. SG 1 and 4 Blowdown Isolation Valves may fail due to a full area fire within Fire Area AA48. 1-DCR-310 may fail due to fire induced damage of cable 8682G-1. 1-DCR-340 may fail due to fire induced damage of cable 8686G-1. These cable failures could spuriously open the valves. SGs 1 and 4 are credited for decay heat removal for a fire within Fire Area AA48. This condition represents a variance from the deterministic requirements of NFPA 805, Section 4.2.3. This is a separation issue.

This VFDR has been evaluated and it was determined that the risk, safety margin and defense-in-depth meet the acceptance criteria of NFPA 805 Section 4.2.4 with a defense-in-depth action credited.

**3.3.1.4 VFDR No. AA48-004**

1-MRV-210 and 1-MRV-240 – The SG 1 and 4 Main Steam Stop Valves are required to be closed to support main steam isolation. Main steam isolation is required to prevent the uncontrolled cooldown through over-steaming. SGs 1 and 4 are credited for decay heat removal due to a fire within Fire Area AA48. 1-MRV-210 may fail due to fire induced damage of 1-MMO-210, 1-MRV-211 and 1-MRV-212. 1-MMO-210, 3 Way Air Open Valve for SG 1 Stop Valve vents air from the Main Steam Stop Valve to either 1-MRV-211 or 1-MRV-212. Cable failures to the 3 way stop valve will spuriously operate it to either position. Failure of 1-MRV-211 and 1-MRV-212 will require either valve to be manually failed to the open position dependent upon the 3 way valve's position. 1-MRV-240 may fail due to fire induced damage of 1-MMO-240, 1-MRV-241 and 1-MRV-242. 1-MMO-240, 3 Way Air Open Valve for SG 4 Stop Valve vents air from the Main Steam Stop Valve to either 1-MRV-241 or 1-MRV-242. Cable failures to the 3 way stop valve will spuriously operate it to either position. Failure of 1-MRV-241 and 1-MRV-242 will require either valve to be manually failed to the open position dependent upon the 3 way valve's position. This condition represents a variance from the deterministic requirements of NFPA 805, Section 4.2.3. This is a separation issue.

This VFDR has been evaluated and it was determined that the risk, safety margin and defense-in-depth meet the acceptance criteria of NFPA 805 Section 4.2.4 with a recovery action credited and plant modifications to implement transient free areas.

**3.3.1.5 VFDR No. AA48-005**

1-MRV-220 and 1-MRV-230 – Main Steam Stop Valves for SGs 2 and 3 are required to be closed to support main steam isolation. Main steam isolation is required to prevent uncontrolled cooldown through over-steaming. SGs 2 and 3 are not credited for decay heat removal due to a fire within Fire Area AA48. 1-MRV-220 may not be available due to the failure of 1-MRV-221. 1-MRV-230 may not be available due to the failure of 1-MMO-230, 1-MRV-231 and 1-MRV-232. 1-MMO-230, 3 Way Air Open Valve for SG 3 Stop Valve vents air from the Main Steam Stop Valve to either 1-MRV-231 or 1-MRV-232. Cable failures to the 3 way stop valve will spuriously operate it to either position. Failure of 1-MRV-231 and 1-MRV-232 will require either valve to be manually failed to the open position dependent upon the 3 way valve's position. This condition represents a variance from the deterministic requirements of NFPA 805, Section 4.2.3. This is a separation issue.

This VFDR has been evaluated and it was determined that the risk, safety margin and defense-in-depth meet the acceptance criteria of NFPA 805 Section 4.2.4 with a defense-in-depth action credited and plant modifications to implement transient free areas.

**3.3.1.6 VFDR No. AA48-006**

1-MRV-213-P and 1-MRV-243-P – SG 1 and 4 PORVs are required to be closed to support main steam isolation. Main steam isolation is required to prevent uncontrolled cooldown through over-steaming. SGs 1 and 4 are credited for decay heat removal for a fire within Fire Area AA48. 1-MRV-213-P may fail due to fire induced damage of cables 6841-1 and 9050W-1. 1-MRV-243-P may fail due to fire induced damage of cables 6842-1 and 9051W-1. Failure of these cables could spuriously open the valves. This condition represents a variance from the deterministic requirements of NFPA 805, Section 4.2.3. This is a separation issue.

This VFDR has been evaluated and it was determined that the risk, safety margin and defense-in-depth meet the acceptance criteria of NFPA 805 Section 4.2.4 with a recovery action credited and plant modifications to implement transient free areas.

**3.3.1.7 VFDR No. AA48-007**

1-PP-50E and 1-PP-50W - The Unit 1 East or West Charging Pump is required to be operable to support CVCS for inventory control, reactivity control and seal cooling. The Unit 1 Charging Pumps may fail due to a full area fire within Fire Area AA48. 1-PP-50E may fail due to fire induced damage of its power supply, cooling and cables. 1-PP-50W may fail due to fire induced damage of its power supply, cooling and cables. Failure of both Unit 1 charging pumps requires cross-tying to the Unit 2 charging pumps to provide CVCS. Cross-tying requires the operation of manual valves 1-CS-302, 1-CS-534 and 2-CS-536. This condition represents a variance from the deterministic requirements of NFPA 805, Section 4.2.3. This is a separation issue.

This VFDR has been evaluated and it was determined that the risk, safety margin and defense-in-depth meet the acceptance criteria of NFPA 805 Section 4.2.4 with a recovery action credited and plant modifications to implement transient free areas.

**3.3.1.8 VFDR No. AA48-008**

1-ICM-250 and 1-ICM-251- Boron Injection Tank Outlet Shutoff Valves are required to be open to support Unit 1 alternate CVCS. These valves are required to be open to support inventory and reactivity control. The Unit 1 alternate charging flow path injects borated water from the Unit 2 RWST with the Unit 2 pumps through the Unit 1 BIT into the cold leg loops. These valves are normally closed and fails as-is on the loss of power. 1-ICM-250 may fail due to fire induced damage of 600V MCC 1-AM-D. 1-ICM-251 may fail due to fire induced damage of 600V VCC 1-AZV-A. These failures could prevent the valves from opening. This condition represents a variance from the deterministic requirements of NFPA 805, Section 4.2.3. This is a separation issue.

This VFDR has been evaluated and it was determined that the risk, safety margin and defense-in-depth meet the acceptance criteria of NFPA 805 Section 4.2.4 with a recovery action credited and plant modifications to implement transient free areas.

**3.3.1.9 VFDR No. AA48-009**

1-IMO-51, 1-IMO-52, 1-IMO-53 and 1-IMO-54 - Boron Injection Line to Cold Leg Shutoff Valves are required to be open to support Unit 1 alternate CVCS. CVCS is required to support inventory, reactivity and pressure control. 1 of the 4 boron injection line valves is required to be open to support Unit 1 alternate CVCS. All 4 of the valves may fail due to a full area fire within Fire Area AA48. The Unit 1 alternate charging flow path injects borated water from the Unit 2 RWST with the Unit 2 pumps through the Unit 1 BIT into the cold leg loops. These valves are normally open and fails as-is on the loss of power. 1-IMO-51 may fail due to fire induced damage of cable 8370G-1. 1-IMO-52 may fail due to fire induced damage of cable 8372R-1. 1-IMO-53 may fail due to fire induced damage of cable 8384G-1. 1-IMO-54 may fail due to fire induced damage of cable 8314R-1. These cable failures could spuriously close the valves. This condition represents a variance from the deterministic requirements of NFPA 805, Section 4.2.3. This is a separation issue.

This VFDR has been evaluated and it was determined that the risk, safety margin and defense-in-depth meet the acceptance criteria of NFPA 805 Section 4.2.4 with plant modifications to implement transient free areas.

**3.3.1.10 VFDR No. AA48-010**

1-PP-45-1, 1-PP-45-2, 1-PP-45-3 and 1-PP-45-4 – The RCPs are required to be tripped to prevent a loss of coolant accident if seal cooling and thermal barrier cooling are lost. A full area fire within Fire Area AA48 may cause the loss of seal cooling, thermal barrier cooling and Control Room trip capability of the RCPs. 1-PP-45-1 may lose Control Room trip capability due to fire induced damage of cables 3422R-1, 4448PR-1 and 6783-1. 1-PP-45-2 may lose Control Room trip capability due to fire induced damage of cables 12364G-1, 3496G-1, 4959-1 and 7960PG-1. 1-PP-45-3 may lose Control Room trip capability due to fire induced damage of cables 14621G-1, 3497G-1, 5649-1 and 7957PG-1. 1-PP-45-4 may lose Control Room trip capability due to fire induced damage of cables 12884R-1, 3421R-1, 4963R-1 and 7992PR-1. This condition represents a variance from the deterministic requirements of NFPA 805, Section 4.2.3. This is a separation issue.

This VFDR has been evaluated and it was determined that the risk, safety margin and defense-in-depth meet the acceptance criteria of NFPA 805 Section 4.2.4 with a recovery action credited and plant modifications to implement transient free areas.



**3.3.1.11 VFDR No. AA48-011**

1-BLI-110-CRI, 1-BLI-140-CRI, 1-MPP-210-CRI, 1-MPP-240-CRI, 1-NTR-140, 1-NTR-240, 1-NLP-151-CRI, 1-NPS-110-CRI and 1-NRI-1 – Control Room process monitoring and source range monitoring may not be available due to a fire in Fire Area AA48. Process monitoring is required to be available to monitor key primary and secondary parameters. Source Range is required to provide indication of fission activity to ensure sub-criticality. The instrumentation is not available within the Unit 1 Control Room due a fire within Fire Area AA48. Alternate process and source range monitoring powered from Unit 2 is required at the Unit 1 LSI panels. The LSI panels require manual actions to transfer to the Unit 2 power supply. A transfer switch at 1-LSI-6 feeds both 1-LSI-6 and 1-LSI-2. A transfer switch at 1-LSI-5 feeds both 1-LSI-5 and 1-LSI-1. A transfer switch at 1-LSI-4 feeds both 1-LSI-4 and 1-LSI-3. Local monitoring of SG 1 and 4 level indication is required at 1-LSI-1 and 1-LSI-4. Local monitoring of SG 1 and 4 pressure indication is required at 1-LSI-4 and 1-LSI-5. Local monitoring of RCS loop temperature is required at 1-LSI-4. Local monitoring of pressurizer level and pressure indication is required at 1-LSI-3. This set of instruments has been credited due to SGs 1 and 4 being credited for AFW. It is to be noted that source range monitoring at the LSI panel is credited, despite the availability of the Control Room Indicator, since all other LSI indication is required. This condition represents a variance from the deterministic requirements of NFPA 805, Section 4.2.3. This is a separation issue.

This VFDR has been evaluated and it was determined that the risk, safety margin and defense-in-depth meet the acceptance criteria of NFPA 805 Section 4.2.4 with a recovery action credited and plant modifications to implement transient free areas.

**3.3.1.12 VFDR No. AA48-012**

1-NRV-153 - Pressurizer PORVs are required to be closed to support RCS integrity. RCS integrity is required to maintain positive control over RCS inventory and pressure. 1-NRV-153 may fail due to fire induced damage of cable 8757G-1. Failure of this cable could spuriously open the valve. This condition represents a variance from the deterministic requirements of NFPA 805, Section 4.2.3. This is a separation issue.

This VFDR has been evaluated and it was determined that the risk, safety margin and defense-in-depth meet the acceptance criteria of NFPA 805 Section 4.2.4 with a defense-in-depth action credited.

**3.3.1.13 VFDR No. AA48-013**

1-NSO-021 and 1-NSO-022 - RX Head Vent Valves are required to be closed to support RCS Integrity. RCS integrity is required to maintain positive control over RCS inventory and pressure. 1-NSO-021 and 1-NSO-022 are in series requiring one of the valves to remain closed to provide RCS integrity. 1-NSO-021 may fail due to cable 9914PG-1. 1-NSO-022 may fail due to fire induce damage of cable 9914PG-1. Failure of these cables could spuriously open the valves. This condition represents a variance from the deterministic requirements of NFPA 805, Section 4.2.3. This is a separation issue.

This VFDR has been evaluated and it was determined that the risk, safety margin and defense-in-depth meet the acceptance criteria of NFPA 805 Section 4.2.4 with a defense-in-depth action credited.

**3.3.1.14 VFDR No. AA48-014**

1-NSO-061 and 1-NSO-062 - Post Accident Vent Valves are required to be closed to support RCS integrity. RCS integrity is required to maintain positive control over RCS inventory and pressure. 1-NSO-061 and 1-NSO-062 are in series requiring one of the valves to remain closed to provide RCS integrity. 1-NSO-061 may fail due to fire induced damage of cable 9901PG-1. 1-NSO-062 may fail due to fire induced damage of cable 9907PG-1. Failure of these cables could spuriously open the valves. This condition represents a variance from the deterministic requirements of NFPA 805, Section 4.2.3. This is a separation issue.

This VFDR has been evaluated and it was determined that the risk, safety margin and defense-in-depth meet the acceptance criteria of NFPA 805 Section 4.2.4 with a defense-in-depth action credited.

**3.3.1.15 VFDR No. AA48-015**

1-QRV-20 and 1-QRV-30 - RCP Seal Water Return Isolation Valves are required to be open to support RCS integrity by maintaining the RCP seal. RCS integrity is required to maintain positive control over RCS inventory and pressure. 1-QRV-20 may fail due to fire induced damage of cable 4955PG-1. 1-QRV-30 may fail due to fire induced damage of cable 5654PG-1. These cables could cause spurious closure of these valves. This condition represents a variance from the deterministic requirements of NFPA 805, Section 4.2.3. This is a separation issue.

This VFDR has been evaluated and it was determined that the risk, safety margin and defense-in-depth meet the acceptance criteria of NFPA 805 Section 4.2.4 with a defense-in-depth action credited.

**3.3.2 Recovery Actions Credited**

For each VFDR, a Fire Risk Evaluation has been performed to assess the acceptability of risk, defense-in-depth, and safety margin. This evaluation determined whether or not recovery actions are required to ensure that one success path necessary to achieve and maintain the nuclear safety performance criteria is maintained free of fire damage by a single fire. Table 3-3 identifies the credited recovery actions for this area. Actions retained for DID are identified as “DID Actions” within Table 3-3. Additional information for DID actions is contained within Section 3.8 of this report. Note that, for completeness, all VFDRs are contained within Table 3-3, even if the Fire Risk Evaluation has determined that a recovery action is not required. In those instances where a recovery action has been determined to not be required, the word “None” is provided in the “Action” column in the table.

<b>Table 3-3, Recovery Actions Credited</b>		
<b>VFDR</b>	<b>Component</b>	<b>Action</b>
AA48-001	1-PP-3E 1-PP-3W 1-PP-4	2-FW-129-OPEN (Open manual valve 1-FW-129)
		2-FW-262-CLOSE (Close manual valve 2-FW-261)



Table 3-3, Recovery Actions Credited		
VFDR	Component	Action
AA48-002	1-FMO-212 1-FMO-242	1-FMO-212-OPERATE (De-energize and manually operate 1-FMO-222)  1-FMO-242-OPERATE (De-energize and manually operate 1-FMO-232)
AA48-003	1-DCR-310 1-DCR-340	DID ACTION(S) 1-DCR-310-CLOSE1-DCR-340- CLOSE (Remove fuses in MCR to fail closed AOVs 1-DCR-310 and 1- DCR-340)
AA48-004	1-MRV-210 1-MRV-240	1-MRV-211-OPEN (Manually open 1-MRV-211 to close valve 1-MRV-210)  or  1-MRV-212-OPEN (Manually open 1-MRV-212 to close valve 1-MRV-210)  and  1-MRV-241-OPEN (Manually open 1-MRV-241 to close valve 1-MRV-240)  or  1-MRV-242-OPEN (Manually open 1-MRV-242 to close valve 1-MRV-240)

Table 3-3, Recovery Actions Credited		
VFDR	Component	Action
AA48-005	1-MRV-220 1-MRV-230	DID ACTION 1-MRV-221-OPEN (Manually Open 1-MRV-221 to close 1-MRV-220)  and  1-MRV-231-OPEN (Manually Open 1-MRV-231 to close 1-MRV-230)  or  1-MRV-232-OPEN (Manually Open 1-MRV-232 to close 1-MRV-230)
AA48-006	1-MRV-213-P 1-MRV-243-P	1-MRV-213-P-CLOSE (Manually close 1-MRV-213)  1-MRV-243-P-CLOSE (Manually close 1-MRV-243)
AA48-007	1-PP-50E 1-PP-50W	1-CS-302-CLOSE (Close manual valve 1-CS-302)  1-CS-534-OPEN (Open manual valve 1-CS-534)  2-CS-536-OPEN (Open manual valve 2-CS-536)
AA48-008	1-ICM-250 1-ICM-251	1-ICM-250-OPEN (De-energize and manually open 1- ICM-250)
AA48-009	1-IMO-51 1-IMO-52 1-IMO-53 1-IMO-54	None

Table 3-3, Recovery Actions Credited		
VFDR	Component	Action
AA48-010	1-PP-45-1 1-PP-45-2 1-PP-45-3 1-PP-45-4	1-PP-45-1-TRIP (Locally trip RCP 1)  1-PP-45-2-TRIP (Locally trip RCP 2)  1-PP-45-3-TRIP (Locally trip RCP 3)  1-PP-45-4-TRIP (Locally trip RCP 4)
AA48-011	1-BLI-110-CRI 1-BLI-140-CRI 1-MPP-210-CRI 1-MPP-240-CRI 1-NTR-140 1-NTR-240 1-NLP-151-CRI 1-NPS-110-CRI 1-NRI-1	1-LSI-4-ALT-PWR (Align unaffected Unit Power to LSI Panel)  1-LSI-5-ALT-PWR (Align unaffected Unit Power to LSI Panel)  1-LSI-1-LOCAL (Locally monitor 1-LSI-1)  1-LSI-3-LOCAL (Locally monitor 1-LSI-3)  1-LSI-4-LOCAL (Locally monitor 1-LSI-4)  1-LSI-5-LOCAL (Locally monitor 1-LSI-5)
AA48-012	1-NRV-153	DID ACTION(S) 1-NRV-153-CLOSE (Remove fuses in MCR to fail closed PORV 1-NRV-153)
AA48-013	1-NSO-021	DID ACTION(S) 1-NSO-021-CLOSE (Remove fuses in MCR to fail closed AOV 1-NSO-021)
AA48-014	1-NSO-061	DID ACTION(S) 1-NSO-061-CLOSE (Remove fuses in MCR to fail closed AOV 1-NSO-061)

Table 3-3, Recovery Actions Credited		
VFDR	Component	Action
AA48-015	1-QRV-20 1-QRV-30	DID ACTION(S) 1-QRV-20-OPEN 1-QRV-30-OPEN (Remove fuses in MCR to fail closed AOVs 1-QRV-20 and 1-QRV-30)

### 3.4 Non-Power Operational Modes Compliance Summary

A review of CNP for the potential effects of a fire in this Fire Area while in non-power modes of operation (NPO) was conducted. This review was conducted using the guidance provided in NEI 04-02 and FAQ 07-0040, "Non-Power Operations Clarifications".

The review determined that there are potential failures that affect certain Key Safety Functions (KSF) as a result of the fire in this area, and the fire could result in the loss of one or more KSF paths. Compensatory measures are required during high risk evolution periods to provide reasonable assurance a fire will not adversely affect key safety functions and the NFPA 805 performance goal for NPO is therefore satisfied. The results of the NPO analysis are contained within Technical Evaluation R1900-005-001, Non-Power Operation Modes Transition Review Report.

### 3.5 Radioactive Release Compliance Summary

The NFPA 805 radiological release goal is to provide reasonable assurance that a fire will not result in a radiological release that adversely affects the public, plant personnel or the environment. The NFPA 805 requirement is to ensure a radiation release to any unrestricted area due to the direct effects of fire suppression activities (but not involving fuel damage) shall be as low as reasonably achievable and shall not exceed applicable plant Technical Specification limits.

Fire Zone 55 of Fire Area AA48 is located outside the Radiological Controlled Area (RCA) and is not a storage location for contaminated materials, therefore there is reasonable assurance a fire in this area will not result in any radiation release.

Fire Zone 56 of Fire Area AA48 is within the Radiological Controlled Area (RCA) and has been identified as a potential fire area for radioactive release due to fire fighting activities. In accordance with NFPA 805 FAQ 09-0056, this potential has been reviewed to ensure that engineering controls, fire pre-plans, and fire brigade training materials are provided for containment and monitoring of gaseous and liquid effluents associated with fire suppression agents and products of combustion.

The review concludes that the steps to limit radiation release to other areas due to the direct effects of fire suppression activities, in addition to compliance with NFPA 805, Chapter 4, ensure that any radioactive release will be as low as reasonably achievable and will not exceed limits designated in the CNP Technical Specifications.

The review of this fire area, with respect to radioactive release, is documented in the NFPPM.

### 3.6 Probabilistic Risk Assessment-Summary of Results

A Fire PRA (FPRA) quantification of Fire Area AA48 was performed and is documented in PRA-NB-FIRE-FQ, Fire PRA Model Quantification Notebook. The fire risk quantification for Fire Area AA48 is analyzed using detailed fire modeling to consider risk of fire scenarios of ignition sources. PRA-NB-FIRE-FQ includes a summary of all potentially risk-significant fire scenarios (i.e., CDF > 1.0E-7 or LERF > 1.0E-8). Bounding CDF / LERF per calendar year values are reported that are based on the risk values documented in PRA-NB-FIRE-FSS, Fire PRA Fire Scenario Selection.

Transient combustible and hot work free zones were credited in the FPRA for this fire area.

Fire Protection features credited in the Fire PRA are documented in R1900-0411-AA48, Detailed Fire Modeling Report: Fire Compartment: AA48 Unit 1 Switchgear Rooms Cable Vault and Auxiliary Cable Vault (EL. 625 FT 10 IN and 620 FT 6 IN). PRA-NB-FIRE-FSS documents the revision level of the fire modeling reports used in the most recent Fire PRA quantification.

### 3.7 Risk-Informed, Performance-Based Evaluations

Fire Risk Evaluations (FREs) have been performed to ensure that variances from the NFPA 805 deterministic requirements are acceptable. The evaluation process consists of an integrated assessment of the acceptability of risk, defense-in-depth, and safety margins.

#### 3.7.1 Transition Risk-Informed, Performance-Based Evaluations

The ‘changes’ associated with NFPA 805 transition were those variances from the deterministic requirements of NFPA 805 or with the existing fire protection licensing basis that were brought into compliance with the NFPA 805 performance based approach. The change identified for evaluation for Fire Area AA48 is as follows:

- Separation Issues

The Fire Risk Evaluation has determined that the change is acceptable based upon:

- The measured change in CDF and LERF.
- Adequate defense-in-depth and safety margins being maintained.

Refer to Attachment 2 for a summary of results associated with the Fire Risk Evaluations.

### 3.8 Defense-in-Depth

A comprehensive risk-informed, performance-based analysis includes consideration of defense-in-depth (DID) as part of an integrated evaluation of risk considerations. In general, defense-in-depth involves consideration of the extent to which fire protection systems and features are provided within the three echelons of fire-protection:

- Preventing fires from starting,
- Rapidly detecting fires and controlling and extinguishing promptly those fires that do occur, thereby limiting fire damage,
- Providing an adequate level of fire protection for structures, systems, and components important to safety, so that a fire that is not promptly extinguished will not prevent the nuclear safety performance criteria from being met.

Each VFDR was evaluated for DID. The following recovery actions have been retained for DID.

VFDR No. AA48-003: 1-DCR-310 and 1-DCR-340 - SG 1 and 4 Blowdown Isolation Valves are required to be closed to support main steam isolation. Main steam isolation is required to prevent uncontrolled cooldown through over-steaming. SG 1 and 4 Blowdown Isolation Valves may fail due to a full area fire within Fire Area AA48. Loss of Main Steam isolation can be mitigated by removing fuses to ensure valves fail shut. This recovery action is being retained for DID to ensure Main Steam isolation is maintained.

VFDR No. AA48-005: 1-MRV-220 and 1-MRV-230 – The SG 2 and 3 Main Steam Stop Valves are required to be closed to support main steam isolation. Main steam isolation is required to prevent the uncontrolled cooldown through over-steaming. Failure of the MSSV dump valves for both 1-MRV-220 and 1-MRV-230 may cause the inability to close the valves. These failures can be mitigated by manually opening the MSSV dump valves. These recovery actions are being retained for DID to ensure main steam isolation is maintained.

VFDR No. AA48-012: 1-NRV-153 - Pressurizer PORVs are required to be closed to support RCS integrity. RCS integrity is required to maintain positive control over RCS inventory and pressure. The spurious opening can be mitigated by de-energizing the valve to fail it closed. This recovery action is being retained for DID to ensure RCS pressure and inventory control is maintained.

VFDR No. AA48-013: 1-NSO-021 and 1-NSO-022 - RX Head Vent Valves are required to be closed to support

RCS Integrity. RCS integrity is required to maintain positive control over RCS inventory and pressure. 1-NSO-021 and 1-NSO-022 are in series requiring one of the valves to remain closed to provide RCS integrity. The spurious opening can be mitigated by de-energizing the valve to fail it closed. This recovery action is being retained for DID to ensure RCS pressure and inventory control is maintained.

VFDR No. AA48-014: 1-NSO-061 and 1-NSO-062 - Post Accident Vent Valves are required to be closed to support

RCS integrity. RCS integrity is required to maintain positive control over RCS inventory and pressure. 1-NSO-061 and 1-NSO-062 are in series requiring one of the valves to remain closed to provide RCS integrity. The spurious opening can be mitigated by de-energizing the valve to fail it closed. This recovery action is being retained for DID to ensure RCS pressure and inventory control is maintained.

VFDR No. AA48-015: 1-QVR-20 and 1-QVR-30 - RCP Seal Water Return Isolation Valves are required to be open to support RCS integrity by maintaining the RCP seal. RCS integrity is required to maintain positive control over RCS inventory and pressure. The spurious closing can be mitigated by de-energizing the valve to fail it open. This recovery action is being retained for DID to ensure RCS integrity is maintained.

Based on the assessment in support of the Fire Risk Evaluation, defense-in-depth is maintained for fire area AA48. Refer to Attachment 2 for details associated with the Fire Risk Evaluation.

### 3.9 Monitoring Program Input

A Monitoring Program will be developed in accordance with FAQ 10-0059, Rev. 1. Methods to monitor availability, reliability, and performance of fire protection program structures, systems, and components (SSCs), as well as programmatic elements will be provided. Additionally, effectiveness measures are established to review program related performance and trends. For AA48 the following systems and features are candidates for inclusion in the CNP Fire Protection Monitoring Program:

- Fire Area boundary barriers discussed in Section 3.1
- Fire Detection System
- Fire Suppression System (CO<sub>2</sub>)
- Transient Combustible and Hot Work Free Zone
- Cable tray covers

### 4.0 CONCLUSION

The nuclear safety and radioactive release performance criteria of NFPA 805 are met for a fire in Fire Area AA48. This Fire Risk Evaluation for Fire Area AA48 has demonstrated that

- The change in core damage frequency (delta CDF) is acceptable, and
- The change in large early release frequency (delta LERF) is acceptable, and
- Defense-in-depth and safety margins are maintained.

This is confirmation that a success path effectively remains free of fire damage and that the performance-based approach is acceptable per Section 4.2.4.2 of NFPA 805.

## **5.0 REFERENCES**

- 5.1 Calculation PRA-FIRE-NB-CRE, Fire PRA Cumulative Risk Evaluations
- 5.2 CNP Fire Pre-Plans, Volumes I, II, and III, Revisions 17, 14, and 18 respectively
- 5.3 Fire Hazards Analysis
- 5.4 NFPA 805, Performance-Based Standard for Fire Protection for Light Water Reactor Electric Generating Plants
- 5.5 NFPPM, NFPA 805 Fire Protection Program Manual (NFPPM)
- 5.6 Nuclear Energy Institute (NEI) 04-02, Guidance for Implementing a Risk-Informed, Performance-Based Fire Protection Program under 10 CFR 50.48(c), Rev. 2
- 5.7 Nuclear Safety Capability Assessment Report
- 5.8 PRA-NB-FIRE-FQ, Fire PRA Model Quantification Notebook
- 5.9 PRA-NB-FIRE-FSS, Fire PRA Fire Scenario Selection
- 5.10 R1900-0411-AA48, AA48 - Detailed Fire Modeling Report
- 5.11 Regulatory Guide 1.205, Risk-Informed, Performance-Based Fire Protection for Existing Light-Water Nuclear Power Plants, Rev. Revision 1
- 5.12 Technical Evaluation R1900-005-001, Non-Power Operation Modes Transition Review



**Fire Area AA48 – Attachment 1 - Table B-3 - Fire Area Transition**

<u>Unit</u>	<u>Fire Area</u>	<u>Description</u>
1	AA48	Unit 1 Switchgear Rooms Cable Vault and Auxiliary Cable Vault (El. 625 ft. 10 in. and 620 ft. 6 in.)

**Fire Zone Description**

55	Switchgear Room Cable Vault - El. 625 ft. 10 in. - Unit 1
56	Auxiliary Cable Vault - El. 620 ft. 6 in. - Unit 1

**Regulatory Basis**

4.2.4.2 - Performance-Based Approach - Fire Risk Evaluation with simplifying deterministic assumptions

<b>Performance Goal</b>	<b>Method of Accomplishment</b>	<b>Comments</b>
Reactivity Control	Unit 1 - Trip the reactor from the Control Room. Borate using Unit 2 East or West Charging Pump supplied from the Unit 2 RWST injecting through the Unit 1 BIT. Use Unit 1 source range monitoring at the LSI panel.	None
Inventory and Pressure Control	Unit 1 - Control inventory using Unit 2 East or West Charging Pump through the Unit 1 BIT. Control pressure using Unit 1 Pressurizer Safety Relief Valves.	VFDRs identified for CVCS and RCS integrity.
Decay Heat Removal	Unit 1 - Feed Unit 1 SGs 1 & 4 with Unit 2 East MDAFW Pump. The DHR function also requires MS isolation with a steam release path through the Safety Relief Valves.	VFDRs identified for AFW and MS isolation.
Process Monitoring	Unit 1 Process Monitoring - Use Unit 1 alternate process monitoring powered from Unit 2 at the local shutdown panels for the following: Pressurizer level, RCS pressure and temperature, and S/G level and Pressure. Unit 1 Source Range Monitoring - Use Unit 1 alternate source range monitoring powered from Unit 2 at the local shutdown panels.	VFDRs identified for process and source range monitoring.
Vital Auxiliaries	Unit 1 Electrical - Control Unit 2 Red (AB) Train Electrical Distribution with Unit 2 Red (AB) DG. Control Unit 2 Green (CD) Train Electrical Distribution with Unit 2 Green (CD) DG. Unit 1 ESW - Operate Unit 2 East or West ESW to provide cooling to the Unit 2 CCW Heat Exchangers and the Unit 2 Red (AB) and Green (CD) DGs for alternate shutdown for Unit 1. Unit 1 CCW - Operate Unit 2 East or West CCW to provide cooling to the Unit 2 Charging Pumps for alternate shutdown for Unit 1.	None

**Fire Area AA48 – Attachment 1 - Table B-3 - Fire Area Transition**

<u>Unit</u>	<u>Fire Area</u>	<u>Description</u>
1	AA48	Unit 1 Switchgear Rooms Cable Vault and Auxiliary Cable Vault (El. 625 ft. 10 in. and 620 ft. 6 in.)
<p>Unit 1 HVAC - Unit 1 Control Room HVAC is not required as alternate shutdown is utilized for this area. Unit 1 Auxiliary Building HVAC is not operational, Unit 2 Auxiliary Building HVAC remains available and provides adequate cooling. Operate Unit 2 Red (AB) and Green (CD) DG HVAC. Operate Unit 2 Red (AB) and Green (CD) Switchgear HVAC. Operate Unit 2 East MDAFW Room HVAC system. Operate the Unit 2 East and West ESW Room HVAC systems.</p>		

**Reference Documents**

Genesis Solution Suite, EDISON / SAFE-PB, DC Cook V 3.4.0

Nuclear Safety Capability Assessment Report

**Licensing Actions**

None

**Existing Engineering Equivalency Evaluations (EEEE)****EEEE Title Engineering Equivalency Evaluation 9-14 - Fire Zone 43 (Fire Area AA36/42) and Fire Zone 56 (Fire Area AA48) Hatch Evaluation**

**Summary** The purpose of this engineering equivalency evaluation is to document the acceptability of an unrated steel plate floor hatch located between the Access Control Area and the Unit 1 Auxiliary Cable Vault in Fire Zones 43 (Fire Area AA36/42) and 56 (Fire Area AA48) respectively. A 3-hr fire-rated hatch assembly is not commercially available for use in this location.

Note: This engineering equivalency evaluation has been reviewed by the NRC. Refer to NRC SER dated June 17, 1988, for acceptance of unrated fire hatches in fire area boundaries. The NRC concluded that the level of fire safety is equivalent to that achieved by conformance with the guidelines of Section D.1.j of Appendix A to BTP APCSB 9.5-1, and, therefore, the deviations for the unrated fire hatches were found acceptable.

Reasonable assurance is provided that a fire in Fire Zone 43 or Fire Zone 56 would not impair the safe shutdown capabilities of Unit 1 and the current configuration of the hatch is acceptable as-is. This engineering equivalency evaluation does not adversely impact other engineering equivalency evaluations.

The hatch was evaluated and found to be acceptable based on the fire hazards and fire protection systems within the evaluated areas. Also,

**Fire Area AA48 – Attachment 1 - Table B-3 - Fire Area Transition**

<u>Unit</u>	<u>Fire Area</u>	<u>Description</u>
1	AA48	Unit 1 Switchgear Rooms Cable Vault and Auxiliary Cable Vault (El. 625 ft. 10 in. and 620 ft. 6 in.)

one of the areas being evaluated is normally manned.

**EEEE Title Engineering Equivalency Evaluation 9-15 - Fire Zone 40B (Fire Area AA39B) and Fire Zone 55 (Fire Area AA48) Hatch Evaluation**

**Summary** The purpose of this engineering equivalency evaluation is to document the acceptability of an unrated steel plate floor hatch located between the Unit 1 4kV Switchgear Room and the Unit 1 Switchgear Room Cable Vault in Fire Zones 40B (Fire Area AA39B) and 55 (Fire Area AA48) respectively. A 3-hr fire-rated hatch assembly is not commercially available for use in this location.

Note: This engineering equivalency evaluation has been reviewed by the NRC. Refer to NRC SER dated June 17, 1988, for acceptance of unrated fire hatches in fire area boundaries. The NRC concluded that the level of fire safety is equivalent to that achieved by conformance with the guidelines of Section D.1.j of Appendix A to BTP APCSB 9.5-1, and, therefore, the deviations for the unrated fire hatches were found acceptable.

Reasonable assurance is provided that a fire in Fire Zone 40B or Fire Zone 55 would not impair safe shutdown capabilities of Unit 1. This engineering equivalency evaluation does not adversely impact other engineering equivalency evaluations.

The hatch was evaluated and found to be acceptable based on the fire hazards and fire protection systems within the evaluated areas.

**EEEE Title Engineering Equivalency Evaluation 9-16 - Fire Zone 41 (Fire Area AA40) and Fire Zone 55 (Fire Area AA48) Hatch Evaluation**

**Summary** The purpose of this engineering equivalency evaluation is to document the acceptability of an unrated steel plate hatch located between the Unit 1 ESS and MCC Room and the Unit 1 Switchgear Room Cable Vault in Fire Zones 41 (Fire Area AA40) and 55 (Fire Area AA48). A 3-hr fire-rated hatch assembly is not commercially available for use in this location.

Reasonable assurance is provided that a fire in Fire Zone 41 or Fire Zone 55 would not impair safe shutdown capabilities of Unit 1. This engineering equivalency evaluation does not adversely impact other engineering equivalency evaluations.

The hatch was evaluated and found to be acceptable based on the fire hazards and fire protection systems within the evaluated areas.

**Fire Area AA48 – Attachment 1 - Table B-3 - Fire Area Transition**

<u>Unit</u>	<u>Fire Area</u>	<u>Description</u>
1	AA48	Unit 1 Switchgear Rooms Cable Vault and Auxiliary Cable Vault (El. 625 ft. 10 in. and 620 ft. 6 in.)
<b><u>EEEE Title</u></b>	<b>Engineering Equivalency Evaluation 11-4 - Unit 1 Auxiliary Building Elevation 620 ft. 6 in. to Auxiliary Cable Vault Fire Zone 44N (Fire Area AA36/42) to Fire Zone 56 (Fire Area AA48)</b>	
<b><u>Summary</u></b>	<p>The purpose of this engineering equivalency evaluation is to document the acceptability of the 8 in. thick silicone foam fire seals protecting the penetrations between Fire Zone 56 (Fire Area AA48, auxiliary cable vault at elevation 620 ft.) and Fire Zone 44N (Fire Area AA36/42, Auxiliary Building - north end at elevation 609 ft.).</p> <p>The existing 8 in. silicone foam fire seals located within the penetrations between Fire Zone 56 and Fire Zone 44N are acceptable for maintaining the rating of the fire area boundary. In addition, this engineering equivalency evaluation does not adversely impact other engineering equivalency evaluations.</p> <p>The fire seals were evaluated and found to be acceptable based on the fire hazards, fire protection systems and construction features within the evaluated areas.</p>	
<b><u>EEEE Title</u></b>	<b>Engineering Equivalency Evaluation 11-5 - Unit 1 Emergency Power Systems/4 KV Switchgear Complex Ventilation Shaft Boundary Evaluation (Fire Areas AA39A, AA39B, AA40, AA41 and AA48).</b>	
<b><u>Summary</u></b>	<p>The purpose of this engineering equivalency evaluation is to document the acceptability of unrated fire barrier penetration seals between the Unit 1 EPS/4KV switchgear complex ventilation shafts in Fire Zones 40A (Fire Area AA39A), 40B (Fire Area AA39B), 41 (Fire Area AA40) and 42A to 42D (Fire Area AA41) and the Unit 1 switchgear cable spreading room in Fire Zone 55 (Fire Area AA48).</p> <p>Reasonable assurance is provided that a fire in Fire Areas AA39A, AA39B, AA40, AA41 or AA48 would not impair safe shutdown capabilities of Unit 1. This engineering equivalency evaluation does not impact other engineering equivalency evaluations.</p> <p>The construction features were evaluated and found to be acceptable based on the fire hazards and fire protection systems within the evaluated areas.</p>	

**Fire Area AA48 – Attachment 1 - Table B-3 - Fire Area Transition**

<b><u>Unit</u></b>	<b><u>Fire Area</u></b>	<b><u>Description</u></b>
1	AA48	Unit 1 Switchgear Rooms Cable Vault and Auxiliary Cable Vault (El. 625 ft. 10 in. and 620 ft. 6 in.)

<b><u>EEEE Title</u></b>	<b>Engineering Equivalency Evaluation 11-9 - Turbine, Auxiliary and Containment Buildings Boundary Evaluation</b>
<b><u>Summary</u></b>	<p>The purpose of this engineering equivalency evaluation is to describe in general, the approach and existence of evaluations performed to determine and reconcile fire area boundaries having components or designs with less than a 3-hr fire rating on preventing the spread of fire. This engineering equivalency evaluation also specifically evaluates the impact of unrated door assemblies on the spread of fire.</p> <p>Reasonable assurance is provided that the fire area boundaries having components or design less than a 3-hr fire rating will not increase the spread of fire or impair the safe shutdown capabilities of Units 1 or 2. In addition, this engineering equivalency evaluation does not adversely impact on other engineering equivalency evaluations or exemption requests.</p> <p>This evaluation supports additional evaluations credited in this fire area.</p>
<b><u>EEEE Title</u></b>	<b>Engineering Equivalency Evaluation 11-14 - Cable Spreading Room Construction Boundary Evaluation (Fire Areas AA3, AA7, AA8, AA9, AA10, AA29, AA30, AA31, AA34, AA35, AA36/42, AA37, AA38, AA48, AA50, AA51 and AA52)</b>
<b><u>Summary</u></b>	<p>The purpose of this engineering equivalency evaluation is to document the acceptability of the construction features of the cable spreading rooms which have a fire resistance rating of less than 3 hours for their impact on the spread. In particular, fire dampers having a 1 1/2-hr fire rating were analyzed by this evaluation. Other unrated construction features have been previously analyzed under separate engineering equivalency evaluations. The applicable fire areas include: AA3, AA7, AA8, AA9, AA10, AA29, AA30, AA31, AA34, AA35, AA36/42, AA37, AA38, AA48, AA50, AA51 and AA52.</p> <p>Reasonable assurance is provided that the construction features of the cable spreading rooms which have a fire resistance rating of less than 3 hours will prevent the spread of fire and not impair the safe shutdown capabilities of Unit 1 and Unit 2. In addition, this engineering equivalency evaluation does not adversely impact other engineering equivalency evaluations.</p> <p>The construction features of the cable spreading room were evaluated and found to be acceptable based on the fire hazards, fire protection systems and construction features within the areas.</p>

**Fire Area AA48 – Attachment 1 - Table B-3 - Fire Area Transition**

<u>Unit</u>	<u>Fire Area</u>	<u>Description</u>
1	AA48	Unit 1 Switchgear Rooms Cable Vault and Auxiliary Cable Vault (El. 625 ft. 10 in. and 620 ft. 6 in.)
<hr/>		
<b><u>EEEE Title</u></b>	<b>Engineering Equivalency Evaluation 11-24 - Fire Retention Capability of Nonconforming Fire Seals in Fire Zones having a Low Combustible Loading Classification</b>	
<b><u>Summary</u></b>	<p>The purpose of this engineering equivalency evaluation is to document the acceptability of fire seal designs which do not meet the requirements of the installation specification or fire test data in fire zones having a low combustible loading classification would have on preventing the spread of fire.</p> <p>Reasonable assurance is provided that fire seals which do not meet the requirements of the installation specification or fire test data in fire zones having a low combustible loading classification, will provide adequate fire retention capabilities and will not impair the safe shutdown capabilities of CNP or increase the spread of fire between fire zones. In addition, this engineering equivalency evaluation does not adversely impact other engineering equivalency evaluations or exemptions.</p> <p>Refer to Engineering Equivalency Evaluation 11.28.</p>	
<b><u>EEEE Title</u></b>	<b>Engineering Equivalency Evaluation 11-28 - Generic Fire Seal Design 2 (Fire Areas AA7, AA8, AA39A, AA40, AA43, AA45A, AA45B, AA48 and AA52)</b>	
<b><u>Summary</u></b>	<p>The purpose of this engineering equivalency evaluation is to document the acceptability of deviations to Generic Fire Seal Design 2 on preventing the spread of fire. The applicable Fire Areas include AA7, AA8, AA39A, AA40, AA43, AA54A, AA54B, AA48 and AA52.</p> <p>Reasonable assurance is provided that deviations to Generic Fire Seal Design 2, Fire Seals W7109, W7952, F8150, F8152, F8162, F8184, F8859, F8861, F8863, F8887 and W9058, and the attributes discussed in the engineering equivalency evaluation do not impair the safe shutdown capabilities of CNP or increase the ability of fire to spread between fire zones. This engineering equivalency evaluation does not impact other engineering equivalency evaluations.</p> <p>Attribute Nos. 2, 7, 9 and the 11 fire seals of Generic Fire Seal Design 2 were evaluated and found to be acceptable based on the fire hazards and fire protection systems within the evaluated areas.</p>	

**Fire Area AA48 – Attachment 1 - Table B-3 - Fire Area Transition**

<u>Unit</u>	<u>Fire Area</u>	<u>Description</u>
1	AA48	Unit 1 Switchgear Rooms Cable Vault and Auxiliary Cable Vault (El. 625 ft. 10 in. and 620 ft. 6 in.)
<b><u>EEEE Title</u></b>	<b>Engineering Equivalency Evaluation 12-19 - CO2 Fire Suppression System Concentrations (Fire Areas AA7, AA8, AA9, AA10, AA29, AA30, AA31, AA37, AA38, AA39, AA40, AA41, AA43, AA44, AA45, AA48, AA49, AA50, AA51, AA52 and AA53)</b>	
<b><u>Summary</u></b>	<p>The purpose of this engineering equivalency evaluation is to document the acceptability of the CO2 fire suppression systems in fire zones containing concentrations of cable insulation and the potential for deep-seated fires. This engineering equivalency evaluation determines the CO2 system's impact on the spread of fire and previous engineering equivalency evaluations and exemption requests. Although there are other fire zones that use CO2 for fire suppression such as the DG Rooms, they are installed to suppress surface-type, combustible liquid fires and are not included in this analysis, because they do not contain significant concentrations of cable insulation capable of producing deep-seated fires.</p> <p>All of the CO2 systems included in this engineering equivalency evaluation are capable of performing their intended function, containing the fire until the Fire Brigade arrives, preventing fire spread to adjacent fire zones, and ensuring that safe shutdown of CNP can be achieved and maintained.</p> <p>The existing suppression systems were evaluated and found to be acceptable based on the fire hazards and fire protection systems within the evaluated areas.</p>	

**Fire Suppression Effects on Nuclear Safety Performance Criteria**

The CNP fire brigade is trained to discharge water in a judicious manner and instructed to direct hose streams and portable extinguishers at the base of the fire to limit the amount of overspray beyond the immediate fire zone. For this reason, fire brigade activities are not expected to fail components not already considered damaged by fire. It has been concluded that water impingement on cables is not a concern. Electrical cabinets are provided with a seal at the conduit interface. Per visual inspection any side vents for this equipment are pointed downward to prevent water intrusion. The drainage features of the fire area mitigate the potential for flooding damage due to fire suppression, such that the standing water would not affect credited equipment.

In the event of discharge, the CO2 system will not adversely affect the equipment operating within the fire area. Potential condensation developing on electrical components is a long term issue that would be eliminated by ventilating the fire area after actuation. Per visual inspection, a CO2 nozzle is located within 2 ft. of 1-BC-CD2. The nozzle is directed at the cabinet and the cabinet has a vented top. As such, this component is considered failed in the performance-based analysis for all scenarios. All other CO2 nozzles are located greater than 5 ft. away from any credited equipment and therefore, the possibility of thermal shock due to CO2 actuation has been deemed to be a non-issue in this fire area in accordance to EPRI NP-7253 "Effects of Fire Suppressants on Electrical Components in Nuclear Power Plants". Since it is shown that suppression effects will not impact the nuclear safety performance criteria, the fire area configuration is deemed acceptable.

**References:**

Technical Evaluation 12.1, "Fire Suppression Effects Study"

Technical Evaluation 12.1, "Supplemental Information to Fire Suppression Effects Study – Supplement 1"

**Fire Area AA48 – Attachment 1 - Table B-3 - Fire Area Transition**

<u>Unit</u>	<u>Fire Area</u>	<u>Description</u>
1	AA48	Unit 1 Switchgear Rooms Cable Vault and Auxiliary Cable Vault (El. 625 ft. 10 in. and 620 ft. 6 in.)

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**Fire Area Comments**

Revise time requirement \ time basis per AR 2015-14147 for VFDR AA49-010



## Fire Area AA48 – Attachment 2 - Fire Risk Evaluation Results Summary

### A2.1 Introduction

The ‘changes’ associated with NFPA 805 transition were those variances from the deterministic requirements of NFPA 805. The changes identified for evaluation for fire area AA48 are grouped as follows:

- Separation Issues

This attachment is a summary of the Fire Risk Evaluation for the fire area. The complete results and methodology are contained in the Cumulative Fire Risk Evaluation, PRA-FIRE-NB-CRE. (FPCE 2017-0009)

### A2.2 Inputs/Assumptions

Fire modeling processes and inputs provided in NUREG/CR-6850 are appropriate for use in a risk-informed, performance-based evaluation. The complete list of assumptions used in the fire modeling methodology for this fire area is contained in Detailed Fire Modeling Technical Evaluation R1900-0411-AA48 [Ref 5.13].

### A2.3 Fire Modeling Methodology

Fire PRA fire modeling results are used as the initial input into this Fire Risk Evaluation. The process consists of conservative bounding analyses using NUREG/CR-6850 methods. As needed, refinements are made to utilize more realistic parameters. The complete fire modeling methodology for this fire area is contained in Detailed Fire Modeling Technical Evaluation R1900-0411-AA48.

### A2.4 Scenario Descriptions and Model Results

Fire Area AA48 was evaluated for the impact of fires originating from both fixed and transient ignition sources. Complete descriptions of each fire scenario is contained within the Detailed Fire Modeling Technical Evaluation R1900-0411-AA48.

#### A2.4.1 Ignition Sources

Fire Area AA48 contains 250VDC distribution panels MDCD and MCCD, ammeter shunt cabinet BC-CD-SH, battery chargers CD1 and CD2 and various other battery related equipment. Per discussion with plant personnel, the heat release rates for all switchgear, load centers, and MCC electrical cabinets have been characterized as qualified cable because items of this nature are generally constructed on-site. For other electrical cabinet types, where the internal cable qualification was unknown, the heat release rates have been assumed as non-qualified. Ignition sources in Fire Area AA48 were modeled using the 98th percentile fire as a screening approach and later refined based on the risk significance of the scenario. 75th percentile fires were also postulated for 1-BC-CD1 and 1-BC-CD2.

In Fire Area AA48, the 98th percentile HRR was used for all transient fires. The 98th percentile HRR bounds the possible transient ignition sources expected for this fire area, which were fire tested and identified in NUREG/CR-6850, Appendix G, Table G-7. For transient scenarios, the cable spreading room portion of Fire Zone 55 and all of Fire Zone 56 was analyzed as a combustibile and hot work free zone.

#### A2.4.2 Scenario Results

A delta risk calculation has been performed to quantify the risk associated with the VFDRs in the fire area.

### A2.5 Fire Risk Evaluation Results

### **Fire Area AA48 – Attachment 2 - Fire Risk Evaluation Results Summary**

PRA-FIRE-NB-CRE documents scenarios and corresponding impacted VFDRs that were evaluated for delta risk during the transition to NFPA 805 and also all changes to the Fire Protection Program that are currently incorporated into the Fire PRA model. The acceptability of the Cumulative Fire Risk Evaluations was based on calculated delta risk meeting the thresholds of NEI 04-02, RG 1.205 and RG 1.174. (FPCE 2017-0009)

**Fire Area AA48 – Attachment 2 - Fire Risk Evaluation Results Summary****A-2.6 Impact of VFDR on Defense-in-Depth**

Defense-in-Depth has been evaluated for this fire area. The impacts of this evaluation are summarized in the table below:

Defense-in-Depth Impact Review for AA48			
Method of Providing DID	Required to Support Deterministic Analysis or Fire PRA?	Changes or Improvements Necessary for DID?	Basis/Justification
Echelon 1: Prevent fires from starting			
Combustible Control is implemented in accordance with Procedure PMP-2270-CCM-001, Control of Combustible Materials.	Yes	No	• Combustible free zones have been implemented for the cable spreading portions of the Fire Area for the purposes of calculating risk. This element is adequate based on no perceived weakness of, or over-reliance on, another echelon of defense-in-depth.
Hot Work Control is implemented in accordance with Procedure PMP-2270-WBG-001, Welding, Burning and Grinding Activities.	Yes	No	
Echelon 2: Rapidly detect, control and extinguish promptly those fires that do occur thereby limiting fire damage			
Fire Detection System	Yes	No	• Suppression and detection are already required and fire fighting activities are not expected to be challenging; therefore, no changes or improvements to Echelon 2 attributes are necessary to maintain defense-in-depth.
Fixed Fire Suppression	Yes	No	
Portable Fire Extinguishers	Yes	No	
Hose stations and hydrants	Yes	No	
Pre-Fire Plan	Yes	No	
Echelon 3: Provide adequate level of fire protection for systems and structures so that a fire will not prevent essential safety functions from being performed			
Walls, floors ceilings and structural elements are rated or have been evaluated as adequate for the hazard.	Yes	No	• There are significant modeling differences between the Fire PRA and nuclear safety capability assessment (i.e., due to different success criteria, end states, etc.) and therefore a recovery action for VFDR AA48-005 has been credited to ensure that defense-in-depth is maintained.  • Where a variance can possibly be affected in a potentially high risk scenario, based on a detailed review, the VFDR is either not the cause for the high risk of the scenario or the mitigating recovery action is credited; therefore no changes or improvements to Echelon 3 attributes are necessary to maintain defense-in-depth.
Penetrations in the fire area barrier are rated or have been evaluated as adequate for the hazard.	Yes	No	
Supplemental barriers (e.g., ERFBS, cable tray covers, etc.)	Yes	No	
Guidance provided to operations personnel detailing the required success path(s) including recovery actions to achieve nuclear safety performance criteria.	Yes	Yes	
			• Defense in Depth actions were credited to remove fuses or open breakers in the Control Room to prevent spurious equipment operation due to internal shorts.

## Fire Area AA48 – Attachment 2 - Fire Risk Evaluation Results Summary

### A-2.7 Safety Margin Considerations

In accordance with NEI 04-02, the maintenance of adequate Safety Margin is assessed by the consideration categories of analyses utilized by this Fire Risk Evaluation.

Safety margins are considered to be maintained if:

- Codes and Standards or their alternatives accepted for use by the NRC are met.

AND

- Safety analyses acceptance criteria in the licensing basis (e.g., FSAR, supporting analyses) are met, or provides sufficient margin to account for analysis and data uncertainty.

The following summarizes the bases for ensuring the maintenance of safety margins:

- The risk-informed, performance based processes utilized are based upon NFPA 805, 2001 edition, endorsed by the NRC in 10 CFR 50.48(c).
- The Fire Risk Evaluation process is in accordance with NEI 04-02, Revision 2, which is endorsed by the NRC in Regulatory Guide 1.205, Revision 1.
- The Fire PRA is developed in accordance with NUREG/CR-6850, which was developed jointly between the NRC and EPRI.
- The Fire PRA has undergone an industry peer review, in order to ensure the Fire PRA meets the appropriate quality standards of ASME/ANS RA-Sa-2009, "Standard for Level 1/Large Early Release Frequency Probabilistic Risk Assessment for Nuclear Power Plant Applications," Dated February 2, 2009
- The "combined analysis approach" is used during transition (NEI 04-02, Section 5.3.4.3); therefore, MEFS/LFS is not analyzed separately from the Fire PRA results.
- The CNP internal events PRA model received two formal industry peer reviews conducted in accordance with applicable NEI guidelines. The initial peer review was performed in 2001, while a subsequent focused scope (i.e., limited scope) peer review was conducted in 2009. The initial, full-scope WOG peer review covered all aspects of the CNP PRA model and the administrative processes used to maintain and update the model. The CNP PRA model has been revised to address all significant issues (i.e., Category A and B Facts & Observations) identified during the initial peer review. None of the findings from the focused-scope peer review were judged to reach the significance level of a Category A or B Fact & Observation; as a result, no changes to the PRA model have yet been made to include resolutions for these latter issues.
- Fire protection systems and features determined to be required by NFPA 805 Chapter 4 have been confirmed to meet the requirements of NFPA 805 Chapter 3 and their associated referenced codes and listings, or provided with acceptable alternatives using processes accepted for use by the NRC (i.e., FAQ 06-0008, FAQ 06-0004, 07-0033).
- Fire modeling performed in support of the transition has been performed within the Fire PRA utilizing codes and standards developed by industry and NRC staff which have been verified and validated in authoritative publications, such as NUREG 1824, "Verification and Validation of Selected Fire Models for Nuclear Power Plant Applications". In general, the fire modeling performed in support of the Fire Risk Evaluations has been performed using conservative methods and input parameters that are based upon

## Fire Area AA48 – Attachment 2 - Fire Risk Evaluation Results Summary

NUREG/CR-6850 as documented in the AA48 Detailed Fire Modeling Report, section 7.2. While this is generally not ideal in the context of best estimate probabilistic risk analysis, it is a pragmatic approach given the current state of knowledge regarding the uncertainties related to the application of the fire modeling tools and associated input parameters for specific plant configurations.

- In accordance with the requirements of 10 CFR 50.48(c)(2)(iii), the Fire PRA results, including cutsets for the scenarios of concern, have been reviewed and it was verified that the results presented above do not rely solely on feed and bleed as the fire-protected safe shutdown path for maintaining reactor coolant inventory, pressure control, and decay heat removal capability for this fire area.

### A-2.8 Transition Risk Evaluation Conclusions

The transition change evaluation determined that these changes:

- Are acceptable based upon the measured change in CDF and LERF
- Maintained adequate defense-in-depth and safety margins

The results of this evaluation meet the requirements of NFPA 805 Risk Evaluation; therefore, the use of the performance based analysis approach is acceptable.

## D. C. Cook Nuclear Plant Fire Safety Analysis

## Fire Area: AA50

Unit 1 Control Room Cable Vault and Hot Shutdown Panel Area (El. 624 ft. and 633 ft.)

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<b>Purpose</b> .....	Section 1.0
<b>Analysis Methodology</b> .....	Section 2.0
<b>Analysis</b> .....	Section 3.0
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## Attachments

Fire Area AA50 – Attachment 1 - Table B-3 - Fire Area Transition

## Fire Area AA50 – Attachment 2 - Fire Risk Evaluation Results Summary

## 1.0 PURPOSE

This report documents the Fire Safety Analysis (FSA) for Cook Nuclear Plant (CNP) Fire Area AA50, Unit 1 Control Room Cable Vault and Hot Shutdown Panel Area (El. 624 ft. and 633 ft.) which comprises fire zone(s) 57, 144. The purpose of this analysis is to demonstrate the achievement of the nuclear safety and radioactive release performance criteria of NFPA 805 as required by 10 CFR 50.48(c). The Fire Safety Analysis is a key part of compliance with Section 2.7.1.2 Fire Protection Program Design Basis Document of NFPA 805. This analysis also documents results of risk-informed, performance-based Fire Risk Evaluations (FREs). These evaluations are associated with Variances from Deterministic Requirements (VFDRs) of NFPA 805 Chapter 4.

## 2.0 ANALYSIS METHODOLOGY

The FSA is the design basis document as described in NFPA 805 Section 2.7.1.2. The following steps are performed to develop the FSA on a fire area basis:

- Identify significant fire hazards in the fire area. This is based on NFPA 805 approach to analyze the plant from an ignition source and fuel package perspective.
- Summarize Nuclear Safety Capability Analysis (NSCA) compliance strategies. This is the result of the NEI 04-02 B-3 Table review of the Safe Shutdown Analysis.
- Summarize Non-Power Operations Modes compliance strategies.
- Summarize Radioactive Release compliance strategies. The transition review process required per NEI 04-02 is used to develop these results.
- Provide Fire Probabilistic Risk Assessment summary of results. This is based on the results from the plant Fire PRA.
- Perform risk informed, performance based evaluations if needed for the performance based approach.
- Summarize Defense-in-Depth strategy for each fire area.
- Determine key analysis assumptions which are candidates to be included in the NFPA 805 monitoring program.
- Provide conclusions relative to NFPA 805 compliance.

## 3.0 ANALYSIS

### 3.1 Classical Fire Protection

#### 3.1.1 Construction

In Fire Zone 57, walls, floors and ceilings to adjacent fire areas are reinforced concrete in excess of a 3-hour rating. A fire area boundary evaluation was performed for the construction features of the cable spreading rooms that have a fire resistance rating of less than 3 hours.

In Fire Zone 144, walls to the adjacent fire areas are either of reinforced concrete (to Fire Zone 53) or concrete block with at least a 3-hour rating. The roof is constructed from panels of the subliming material that forms a protective skin equivalent to a 2-hour and 12-minute rating. The floor is part of the Control Room floor/ceiling assembly that has a 3-hour rating.

A fire door (man door) having a 3-hour rating is provided to the adjacent Unit 2 Control Room Fire Area AA47 - Fire Zone 54. A manual rolling fire door having a 3-hour rating is also provided across the front of the hot shutdown panel to provide the necessary separation with the Unit 2 Control Room. The rolling fire door is manually operated for purposes of raising and lowering during normal plant activities.

Applicable Engineering Equivalency Evaluations are documented in Attachment 1.

#### 3.1.2 Doors and Access Openings

In Fire Zone 57, a fire area boundary evaluation was performed for an unrated ceiling hatch to Fire Area AA46 - Fire Zone 53. Fire doors having a 3-hour rating are provided to adjacent Fire Areas AA36/42 and AA51 - Fire Zones 44N and 58, respectively.

In Fire Zone 144, a fire door (man door) having a 3-hour rating is provided to the adjacent Unit 2 Control Room Fire Area AA47 - Fire Zone 54. A manual rolling fire door having a 3-hour rating is also provided across the front of the hot shutdown panel to provide the necessary separation with the Unit 2 Control Room. The rolling fire door is manually operated for purposes of raising and lowering during normal plant activities.

#### 3.1.3 Penetrations

In Fire Zone 57, penetrations in fire barriers between this fire zone and adjacent fire areas are provided with fire seals. Additionally, all penetrations in walls and ceiling of the Hot Shutdown Panel Cable Vaults are provided with fire seals.

In Fire Zone 144, penetrations in fire barriers between this fire zone and adjacent fire areas and adjacent Fire Zone 57 are provided with fire seals (Technical Evaluation 11-25).



### 3.1.4 Detection

The table below outlines the fire detection system(s) provided in the Fire Area:

Table 3-1, Fire Area AA50 Detection Systems								
Fire Zone	Type of System	Local (L) / Remote (R)	Detection Actuates Suppression?	Required System?				
				S	L	E	R	D
57	Ionization	L/R	Y	N	N	Y	Y	N
144	Ionization	L/R	No Auto Supp. (N/A)	N	N	Y	Y	N
Table 3-1 Legend:								
Table Field: "Required System?"								
S	- Required for Chapter 4 Separation Criteria							
L	- Required for NRC Approved Licensing Action							
E	- Required for Engineering Equivalency Evaluation							
R	- Required for Risk Significance							
D	- Required to maintain adequate balance of Defense-in-Depth in a Change Evaluation or Fire Risk Evaluation							

For Fire Zone 57, cross zoned ionization detectors (65 detectors total) are provided which alarm in the Unit 1 Control Room. Each of these detection circuits provides complete coverage for the Control Room cable vault area including the Unit 2 Hot Shutdown Panel Cable Vault, Fire Zone 58.

For Fire Zone 144, one ionization detector inside the hot shutdown panel with remote indicating light located on the outside of the enclosure. This detector is part of the Unit 2 Control Room (Fire Zone 54) detection circuit that alarms in the Unit 2 Control Room.

### 3.1.5 Fixed Suppression

The table below outlines the fixed fire suppression system(s) provided in the Fire Area:

Table 3-2, Fire Area AA50 Suppression Systems								
Fire Zone	Type of System	Full (F) / Partial (P)	Required System?					
			S	L	E	R	D	
57	Halon	F	N	N	Y	Y	N	
57	Manual CO2	F	N	N	Y	N	N	
144	None	N/A	N/A	N/A	N/A	N/A	N/A	
Table 3-2 Legend:								
Table Field: "Required System?"								
S	- Required for Chapter 4 Separation Criteria							
L	- Required for NRC Approved Licensing Action							
E	- Required for Engineering Equivalency Evaluation							
R	- Required for Risk Significance							
D	- Required to maintain adequate balance of Defense-in-Depth in a Change Evaluation or Fire Risk Evaluation							

For Fire Zone 57, an automatic total flooding Halon system provides the primary suppression

coverage and is actuated by the listed detection system. Fixed suppression is not provided in Fire Zone 144.

### 3.1.6 Manual Suppression / Response Strategy

A postulated fire will be identified by early detection using ionization type smoke detection or by plant personnel using plant communication system to notify the control room. The automatic detection system alarms in the control room. The Control Room operator will dispatch the fire brigade for initiation of manual fire fighting. A fire in this fire area will be contained by the construction features discussed in Section 3.1.1. Manual suppression is provided by the CNP Fire Brigade. A low pressure CO2 total flooding system is provided as the backup suppression system. This system is manually actuated. Operation of this system discharges CO2 into Fire Zone 57. This suppression system provides protection for the Control Room cable vault area as well as the Unit 1 Hot Shutdown Panel Cable Vault as a back up to the Halon system mentioned above.

Fire extinguishers are located in Fire Zone 57. Fire extinguishers are located adjacent to Fire Zone 144 in Fire Area AA47 - Fire Zone 54.

Water hose reels are located at the back door of the Control Room in Fire Zone 52 and in the Turbine Building, Fire Zone 130. A hose reel is located at the rear door in adjacent Fire Zone 44N.

Floor drains are not available in Fire Zone 57 or 144. The Fire Brigade is equipped with a sump pump that may be used to remove an accumulation of water in the fire zone.

Breathing apparatus located in adjacent Fire Zones 53, 54 and in AA36/42 – Fire Zone 44N.

### 3.1.7 Ventilation

A fire in this area will be contained by the fire barriers. Smoke can be removed by portable fans and flexible ducting to other areas of the Auxiliary Building and outdoors. The normal building ventilating systems in the Auxiliary Building will then exhaust the smoke via filtered monitored pathways. This fire area is listed as a non-controlled area in the Fire Pre Plans and therefore there is reasonable assurance that products of combustion will not be contaminated.

In Fire Zone 57, fire dampers having a 3-hour rating are provided to adjacent Fire Zone 44N.

There are no ventilation penetrations into Fire Zone 144.

### 3.1.8 Other Features

Some cable trays within Fire Area AA50 are provided with bottom covers and/or are fully enclosed.

This fire area is procedurally controlled as a transient combustible and hot work free zone.

## 3.2 Fire Hazards Identification

The fire area does not contain fixed ignition sources, however it does contain combustible fire hazards. Combustibles consist primarily of exposed electrical cables in trays. The current combustible loading classification is considered moderate for Fire Zone 57 and high for Fire Zone 144.

### 3.3 NSCA Compliance Summary

Fire Area AA50 contains Unit 1 Red and Green train raceways and cables as well as the Unit 2 HSD panel. This panel contains some Unit 1 instrument loop support components and/or cables.

Compliance with the nuclear safety performance criteria is achieved using the performance-based approach in accordance with NFPA 805, Section 4.2.4.2.

Safe and stable condition of Unit 1 will be accomplished using Alternate AFW to Steam Generators 2 and 3 via Unit 2 West Motor Driven Auxiliary Feedwater Pump, Alternate Charging via Unit 2 East or West Pump, LSI panel control and power via Unit 2, Unit 2 ESW and CCW support systems for the Unit 2 crosstie systems supporting Unit 1.

The Nuclear Safety Performance Criteria compliance strategy for AA50 is documented within the NSCA Report.

#### 3.3.1 Variances

The variances identified for evaluation for this fire area are grouped as follows:

##### 3.3.1.1 VFDR No. AA50-001

1-PP-3E, 1-PP-3W and 1-PP-4 - A Unit 1 AFW Pump is required to be operable to support decay heat removal. Decay heat removal is required to be capable of removing sufficient heat from the reactor core such that the fuel is maintained in a safe and stable condition. A full area fire in Fire Area AA50 may cause the loss of the Unit 1 East and West MDAFW Pumps and the Unit 1 TDAFW Pump. The East MDAFW Pump, 1-PP-3E may fail due to fire induced damage of 250VDC Cabinet 1-MCCD, 4kV Bus 1-T11D and cables. The West MDAFW Pump, 1-PP-3W may fail due to fire induced damage of 250VDC Cabinet 1-MCAB, 4kV Bus 1-T11A and cables. The TDAFW Pump, 1-PP-4 may fail due to fire induced damage of cables 8004BR-1 and 8006BR-1. This condition represents a variance from the deterministic requirements of NFPA 805, Section 4.2.3. This is a separation issue.

This VFDR has been evaluated and it was determined that the risk, safety margin and defense-in-depth meet the acceptance criteria of NFPA 805 Section 4.2.4 with a recovery action credited and plant modifications to implement transient free areas.

**3.3.1.2 VFDR No. AA50-002**

1-FMO-222 and 1-FMO-232- SG 2 and 3 AFW Supply Valves are required to be operable to support decay heat removal for Unit 1. Decay heat removal shall be capable of removing heat from the reactor core such that the fuel is maintained in a safe and stable condition. Decay heat removal requires a set of 2 supply valves be operable with their corresponding AFW pump. The following sets of Unit 1 SG AFW Supply Valves may fail due to a full area fire within Fire Area AA50; 1-FMO-212 and 1-FMO-242, 1-FMO-222 and 1-FMO-232, 1-FMO-221 and 1-FMO-231. The Unit 2 West AFW Pump is credited to provide decay heat removal through Unit 1 SGs 2 and 3 for a fire within Fire Area AA50. This requires 1-FMO-222 and 1-FMO-232 be operable. 1-FMO-222 may fail due to fire induced damage of 600V MCC 1-EZC-D and cables 8541G-1, 8542G-1, 8543G-1, 9573G-1, 9574G-1, 9742G-1 and 9747G-1. 1-FMO-232 may fail due to fire induced damage of 600V MCC 1-EZC-D and cables 8538G-1, 8539G-1, 8540G-1, 9568G-1, 9579G-1, 9745G-1 and 9748G-1. This condition represents a variance from the deterministic requirements of NFPA 805, Section 4.2.3. This is a separation issue.

This VFDR has been evaluated and it was determined that the risk, safety margin and defense-in-depth meet the acceptance criteria of NFPA 805 Section 4.2.4 with a recovery action credited and plant modifications to implement transient free areas.

**3.3.1.3 VFDR No. AA50-003**

1-DCR-310 and 1-DCR-340 - The SG Blowdown Isolation Valves are required to be closed to support main steam isolation. Main steam isolation is required to prevent uncontrolled cooldown through over steaming. SG 1 and 4 Blowdown Isolation Valves may fail due to a full area fire within Fire Area AA50. 1-DCR-310 may fail due to fire induced damage of cable 8682G-1. 1-DCR-340 may fail due to fire induced damage of cable 8686G-1. These cable failures could spuriously open the valves. SGs 1 and 4 are not credited for decay heat removal due to a fire within Fire Area AA50. This condition represents a variance from the deterministic requirements of NFPA 805, Section 4.2.3. This is a separation issue.

This VFDR has been evaluated and it was determined that the risk, safety margin and defense-in-depth meet the acceptance criteria of NFPA 805 Section 4.2.4 with plant modifications to implement transient free areas.

**3.3.1.4 VFDR No. AA50-004**

1-DCR-320 and 1-DCR-330 - SG 2 & 3 Blowdown Isolation Valves are required to be closed to support main steam isolation. Main steam isolation is required to prevent uncontrolled cooldown through over-steaming. SG 2 & 3 Blowdown Isolation Valves may fail due to a full area fire within Fire Area AA50. 1-DCR-320 may fail due to fire induced damage of cable 8682R-1. 1-DCR-330 may fail due to fire induced damage of cable 8686R-1. These cable failures could spuriously open the valves. SGs 2 and 3 are credited for decay heat removal for a fire within Fire Area AA50. This condition represents a variance from the deterministic requirements of NFPA 805, Section 4.2.3. This is a separation issue.

This VFDR has been evaluated and it was determined that the risk, safety margin and defense-in-depth meet the acceptance criteria of NFPA 805 Section 4.2.4 with a defense-in-depth action credited.

### 3.3.1.5 VFDR No. AA50-005

1-MRV-210 and 1-MRV-240 – The SG 1 and 4 Main Steam Stop Valves are required to be closed to support main steam isolation. Main steam isolation is required to prevent the uncontrolled cooldown through over-steaming. SGs 1 and 4 are not credited for decay heat removal due to a fire within Fire Area AA50. 1-MRV-210 may fail due to fire induced damage of 1-MMO-210, 1-MRV-211 and 1-MRV-212. 1-MMO-210, 3 Way Air Open Valve for SG 1 Stop Valve vents air from the Main Steam Stop Valve to either 1-MRV-211 or 1-MRV-212. Cable failures to the 3 way stop valve will spuriously operate it to either position. Failure of 1-MRV-211 and 1-MRV-212 will require either valve to be manually failed to the open position dependent upon the 3 way valve's position. 1-MRV-240 may fail due to fire induced damage of 1-MMO-240, 1-MRV-241 and 1-MRV-242. 1-MMO-240, 3 Way Air Open Valve for SG 4 Stop Valve vents air from the Main Steam stop Valve to either 1-MRV-241 or 1-MRV-242. Cable failures to the 3 way stop valve will spuriously operate it to either position. Failure of 1-MRV-241 and 1-MRV-242 will require either valve to be manually failed to the open position dependent upon the 3 way valve's position. This condition represents a variance from the deterministic requirements of NFPA 805, Section 4.2.3. This is a separation issue.

This VFDR has been evaluated and it was determined that the risk, safety margin and defense-in-depth meet the acceptance criteria of NFPA 805 Section 4.2.4 with a defense-in-depth action credited and plant modifications to implement transient free areas.

### 3.3.1.6 VFDR No. AA50-006

1-MRV-220 and 1-MRV-230 – Main Steam Stop Valves for SGs 2 and 3 are required to be closed to support main steam isolation. Main steam isolation is required to prevent uncontrolled cooldown through over-steaming. SGs 2 and 3 are credited for decay heat removal due to a fire within Fire Area AA50. 1-MRV-220 may not be available due to the failure of 1-MMO-220, 1-MRV-221 and 1-MRV-222. 1-MMO-220, 3 Way Air Open Valve for SG 2 Stop Valve vents air from the main steam stop valve to either 1-MRV-221 or 1-MRV-222. Cable failures to the 3 way stop valve will spuriously operate it to either position. Failure of 1-MRV-221 and 1-MRV-222 will require either valve to be manually failed to the open position dependent upon the 3 way valve's position. 1-MRV-230 may not be available due to the failure of 1-MMO-230, 1-MRV-231 and 1-MRV-232. 1-MMO-230, 3 Way Air Open Valve for SG 3 Stop Valve vents air from the Main Steam Stop Valve to either 1-MRV-231 or 1-MRV-232. Cable failures to the 3 way stop valve will spuriously operate it to either position. Failure of 1-MRV-231 and 1-MRV-232 will require either valve to be manually failed to the open position dependent upon the 3 way valve's position. This condition represents a variance from the deterministic requirements of NFPA 805, Section 4.2.3. This is a separation issue.

This VFDR has been evaluated and it was determined that the risk, safety margin and defense-in-depth meet the acceptance criteria of NFPA 805 Section 4.2.4 with a recovery action credited and plant modifications to implement transient free areas

**3.3.1.7 VFDR No. AA50-007**

1-MRV-213-P and 1-MRV-243-P – SG 1 and 4 PORVs are required to be closed to support main steam isolation. Main steam isolation is required to prevent uncontrolled cooldown through over-steaming. SGs 1 and 4 are not credited for decay heat removal for a fire within Fire Area AA50. 1-MRV-213-P may fail due to fire induced damage of cables 11815-1, 11916-1, 6841-1 and 9050W-1. 1-MRV-243-P may fail due to fire induced damage of cables 11838-1, 11917-1, 6842-1 and 9051W-1. Failure of these cables could spuriously open the valves. This condition represents a variance from the deterministic requirements of NFPA 805, Section 4.2.3. This is a separation issue.

This VFDR has been evaluated and it was determined that the risk, safety margin and defense-in-depth meet the acceptance criteria of NFPA 805 Section 4.2.4 with a defense-in-depth action credited and plant modifications to implement transient free areas.

**3.3.1.8 VFDR No. AA50-008**

1-MRV-223-P and 1-MRV-233-P - SG 2 and 3 PORVs are required to be closed to support main steam isolation. Main Steam Isolation provides integrity of the secondary side of the steam generators to prevent uncontrolled cooldown through over-steaming. 1-MRV-223-P may fail due to fire induced damage of cables 11828-1, 11900-1, 18132-1 and 9050Y-1. 1-MRV-233-P may fail due to fire induced damage of cables 11829-1, 11901-1, 18133-1 and 9051Y-1. These cable failures could spuriously open the valves. SGs 2 and 3 are credited for decay heat removal due to fire within Fire Area AA50. This condition represents a variance from the deterministic requirements of NFPA 805, Section 4.2.3. This is a separation issue.

This VFDR has been evaluated and it was determined that the risk, safety margin and defense-in-depth meet the acceptance criteria of NFPA 805 Section 4.2.4 with a recovery action credited and plant modifications to implement transient free areas.

**3.3.1.9 VFDR No. AA50-009**

1-PP-50E and 1-PP-50W - The Unit 1 East or West Charging Pump is required to be operable to support CVCS for inventory, reactivity and pressure control and seal cooling. The Unit 1 charging pumps may fail due to a full area fire within Fire Area AA50. 1-PP-50E may fail due to fire induced damage of its power supply, cooling and cables. 1-PP-50W may fail due to fire induced damage of its power supply, cooling and cables. Failure of both Unit 1 charging pumps requires cross-tying to the Unit 2 charging pumps to provide charging. Cross-tying requires the operation of manual valves 1-CS-302, 1-CS-534 and 2-CS-536. This condition represents a variance from the deterministic requirements of NFPA 805, Section 4.2.3. This is a separation issue.

This VFDR has been evaluated and it was determined that the risk, safety margin and defense-in-depth meet the acceptance criteria of NFPA 805 Section 4.2.4 with a recovery action credited and plant modifications to implement transient free areas.



### 3.3.1.10 VFDR No. AA50-010

1-QRV-10, 1-QRV-20, 1-QRV-30 and 1-QRV-40 - RCP Seal Water Return Isolation Valves are required to be open to support CVCS. Seal return lines are required to be open to prevent damage to the RCP seals. Damage to the seals could result in a leak of 180 GPM. These valves are required to be open to maintain inventory and pressure control. 1-QRV-10 may fail due to fire induced damage of cable 4418PR-1. 1-QRV-20 may fail due to fire induced damage of cable 4955PG-1. 1-QRV-30 may fail due to fire induced damage of cable 5654PG-1. 1-QRV-40 may fail due to fire induced damage of cable 5002PR-1. These cable failures could spuriously close the valves. This condition represents a variance from the deterministic requirements of NFPA 805, Section 4.2.3. This is a separation issue.

This VFDR has been evaluated and it was determined that the risk, safety margin and defense-in-depth meet the acceptance criteria of NFPA 805 Section 4.2.4 with a recovery action credited and plant modifications to implement transient free areas.

### 3.3.1.11 VFDR No. AA50-011

1-ICM-250 and 1-ICM-251 - BIT Outlet Shutoff Valves are required to be open to support Unit 1 alternate CVCS. CVCS is required to be operable to support inventory, reactivity and pressure control. The Unit 1 alternate charging flow path injects borated water from the Unit 2 RWST with the Unit 2 pumps through the Unit 1 BIT into the cold leg loops. These valves are normally closed and fails as-is on the loss of power. 1-ICM-250 may fail due to fire induced damage of 600V MCC 1-AM-D and cables 9090G-1, 9091G-1 and 9548G-1. 1-ICM-251 may fail due to fire induced damage of 600V VCC and cables 9063R-1, 9064R-1 and 9065R-1. These failures could prevent the valve from opening. This condition represents a variance from the deterministic requirements of NFPA 805, Section 4.2.3. This is a separation issue.

This VFDR has been evaluated and it was determined that the risk, safety margin and defense-in-depth meet the acceptance criteria of NFPA 805 Section 4.2.4 with a recovery action credited and plant modifications to implement transient free areas.

### 3.3.1.12 VFDR No. AA50-012

1-IMO-51, 1-IMO-52, 1-IMO-53 and 1-IMO-54 - Boron Injection Line to Cold Leg 1 Shutoff Valves are required to be open to support Unit 1 alternate CVCS. The valves are required to be open to support inventory and reactivity control. 1 of the 4 boron injection line valves is required to be open to support unit 1 alternate CVCS. All 4 of the valves may fail due to a full area fire within Fire Area AA50. The Unit 1 alternate charging flow path injects borated water from the Unit 2 RWST with the Unit 2 pumps through the Unit 1 BIT into the cold leg loops. These valves are normally open and fails as-is on the loss of power. 1-IMO-51 may fail due to fire induced damage of cable 8370G-1. 1-IMO-52 may fail due to fire induced damage of cable 8372R-1. 1-IMO-53 may fail due to fire induced damage of cable 8384G-1. 1-IMO-54 may fail due to fire induced damage of cable 8314R-1. These cable failures could spuriously close the valves. This condition represents a variance from the deterministic requirements of NFPA 805, Section 4.2.3. This is a separation issue.

This VFDR has been evaluated and it was determined that the risk, safety margin and defense-in-depth meet the acceptance criteria of NFPA 805 Section 4.2.4 with plant modifications to implement transient free areas.

**3.3.1.13 VFDR No. AA50-013**

1-NRV-163 and 1-NRV-164 – Pressurizer Spray Valves are required to be closed to support RCS integrity. RCS integrity is required to maintain positive control over RCS inventory and pressure. Spurious opening of the Pressurizer Spray Valves with the RCPs running will cause a drop in RCS pressure resulting in a SI. Control Room trip of RCPs 3 and 4 may not be available due to fire induced damage of the RCP circuits with Fire Area AA50. 1-NRV-163 may fail due to fire induced damage of cables 10751-1, 10773-1, 11266-1, 8733PO-1 and 9600PY-1. 1-NRV-164 may fail due to fire induced damage of cables 10751-1, 10773-1, 11480-1, 8733PO-1 and 9600PY-1. Failure of these cables could spuriously open the valves. This condition represents a variance from the deterministic requirements of NFPA 805, Section 4.2.3. This is a separation issue.

This VFDR has been evaluated and it was determined that the risk, safety margin and defense-in-depth meet the acceptance criteria of NFPA 805 Section 4.2.4 with a recovery action credited and plant modifications to implement transient free areas.

**3.3.1.14 VFDR No. AA50-014**

1-PP-45-1, 1-PP-45-2, 1-PP-45-3 and 1-PP-45-4 – The RCPs are required to be tripped to prevent a loss of coolant accident if seal cooling and thermal barrier cooling are lost. A full area fire within Fire Area AA50 may cause the loss of seal cooling, thermal barrier and Control Room trip capability of the RCPs. 1-PP-45-1 may lose Control Room trip capability due to fire induced damage of cables 10467-1 and 6783-1. 1-PP-45-2 may lose Control Room trip capability due to fire induced damage of cables 10143-1 and 4959-1. 1-PP-45-3 may lose Control Room trip capability due to fire induced damage of cables 10160-1 and 5649-1. 1-PP-45-4 may lose Control Room trip capability due to fire induced damage of cables 10485-1 and 4963R-1. This condition represents a variance from the deterministic requirements of NFPA 805, Section 4.2.3. This is a separation issue.

This VFDR has been evaluated and it was determined that the risk, safety margin and defense-in-depth meet the acceptance criteria of NFPA 805 Section 4.2.4 with a recovery action credited and plant modifications to implement transient free areas.

**3.3.1.15 VFDR No. AA50-015**

1-NSO-021 and 1-NSO-022 – The RX Head Vent Valves are required to be closed to support RCS integrity. RCS integrity is required to maintain positive control over RCS inventory and pressure. 1-NSO-021 and 1-NSO-022 are in series, requiring 1 of the valves to remain closed to provide RCS integrity. 1-NSO-021 may fail due to fire induced damage of cable 9914PG-1. 1-NSO-022 may fail due to fire induced damage of cable 9914PG-1. These cable failures could spuriously open the valves. This condition represents a variance from the deterministic requirements of NFPA 805, Section 4.2.3. This is a separation issue.

This VFDR has been evaluated and it was determined that the risk, safety margin and defense-in-depth meet the acceptance criteria of NFPA 805 Section 4.2.4 with a recovery action credited and plant modifications to implement transient free areas.



**3.3.1.16 VFDR No. AA50-016**

1-NSO-023 and 1-NSO-024 – The RX Head Vent Valves are required to be closed to support RCS integrity. RCS integrity is required to maintain positive control over RCS inventory and pressure. 1-NSO-023 and 1-NSO-024 are in series, requiring 1 of the valves to remain closed to provide RCS integrity. 1-NSO-023 may fail due to fire induced damage of cable 9914PR-1. 1-NSO-024 may fail due to fire induced damage of cable 9920PR-1. These cable failures could spuriously open the valves. This condition represents a variance from the deterministic requirements of NFPA 805, Section 4.2.3. This is a separation issue.

This VFDR has been evaluated and it was determined that the risk, safety margin and defense-in-depth meet the acceptance criteria of NFPA 805 Section 4.2.4 with a recovery action credited and plant modifications to implement transient free areas.

**3.3.1.17 VFDR No. AA50-017**

1-NSO-061 and 1-NSO-062 – The Post Accident Valves are required to be closed to support RCS integrity. RCS integrity is required to maintain positive control over RCS inventory and pressure. 1-NSO-061 and 1-NSO-062 are in series, requiring 1 of the valves to remain closed to provide RCS integrity. 1-NSO-061 may fail due to fire induced damage of cable 9901PG-1. 1-NSO-062 may fail due to fire induced damage of cable 9907PG-1. These cable failures could spuriously open the valves. This condition represents a variance from the deterministic requirements of NFPA 805, Section 4.2.3. This is a separation issue.

This VFDR has been evaluated and it was determined that the risk, safety margin and defense-in-depth meet the acceptance criteria of NFPA 805 Section 4.2.4 with a recovery action credited and plant modifications to implement transient free areas.

**3.3.1.18 VFDR No. AA50-018**

1-NSO-063 and 1-NSO-064 – The Post Accident Valves are required to be closed to support RCS integrity. RCS integrity is required to maintain positive control over RCS inventory and pressure. 1-NSO-063 and 1-NSO-064 are in series, requiring 1 of the valves to remain closed to provide RCS integrity. 1-NSO-063 may fail due to fire induced damage of cable 9901PR-1. 1-NSO-064 may fail due to fire induced damage of cable 9907PR-1. These cable failures could spuriously open the valves. This condition represents a variance from the deterministic requirements of NFPA 805, Section 4.2.3. This is a separation issue.

This VFDR has been evaluated and it was determined that the risk, safety margin and defense-in-depth meet the acceptance criteria of NFPA 805 Section 4.2.4 with a recovery action credited and plant modifications to implement transient free areas.

**3.3.1.19 VFDR No. AA50-019**

1-QRV-111, 1-QRV-112, 1-QRV-160, 1-QRV-161 and 1-QRV-162– Letdown Isolation Valves are required to be closed to support CVCS isolation. CVCS isolation is required to maintain positive control over inventory and pressure. In order to achieve letdown isolation the following valves need to be closed; 1-QRV-111 or 1-QRV-112 or (1-QRV-160 and 1-QRV-161 and 1-QRV-162). All of these valves may fail due to a full area fire within Fire Area AA50. 1-QRV-111 may fail due to fire induced damage of cables 8486PG-1 and 8943G-1. 1-QRV-112 may fail due to fire induced damage of cables 8467PR-1 and 8947R-1. 1-QRV-160 may fail due to fire induced damage of cables 9106PG-1 and 9141G-1. 1-QRV-161 may fail due to fire induced damage of cables 8470PG-1 and 8494G-1. 1-QRV-162 may fail due to fire induced damage of cables 8473PG-1 and 8496G-1. These cable failures could spuriously open the valves. This condition represents a variance from the deterministic requirements of NFPA 805, Section 4.2.3. This is a separation issue.

This VFDR has been evaluated and it was determined that the risk, safety margin and defense-in-depth meet the acceptance criteria of NFPA 805 Section 4.2.4 with a recovery action credited and plant modifications to implement transient free areas.

**3.3.1.20 VFDR No. AA50-020**

1-BLI-120-CRI, 1-BLI-130-CRI, 1-MPP-220-CRI, 1-MPP-230-CRI, 1-NLP-151-CRI, 1-NPS-110-CRI, 1-NTR-120, 1-NTR-220 and 1- NRI-1 - Control Room process monitoring and source range monitoring may not be available due to a fire in Fire Area AA50. Process monitoring is required to be available to monitor key primary and secondary parameters. Source Range is required to provide indication of fission activity to ensure sub-criticality. The instrumentation is not available within the Unit 1 Control Room due a fire within Fire Area AA50. Alternate process and source range monitoring powered from Unit 2 is required at the Unit 1 LSI panels. The LSI panels require manual actions to transfer to the Unit 2 power supply. A transfer switch at 1-LSI-6 feeds both 1-LSI-6 and 1-LSI-2. A transfer switch at 1-LSI-5 feeds both 1-LSI-5 and 1-LSI-1. A transfer switch at 1-LSI-4 feeds both 1-LSI-4 and 1-LSI-3. Local monitoring of SG 2 and 3 level indication is required at 1-LSI-2. Local monitoring of SG 2 pressure indication, RCS loop temperature and source range monitoring is required at 1-LSI-4. Local monitoring of SG 3 pressure indication is required at LSI-6. Local monitoring of pressurizer level and pressure indication is required at LSI-3. This set of instruments has been credited due to SG 2 and 3 being credited for AFW. This condition represents a variance from the deterministic requirements of NFPA 805, Section 4.2.3. This is a separation issue.

This VFDR has been evaluated and it was determined that the risk, safety margin and defense-in-depth meet the acceptance criteria of NFPA 805 Section 4.2.4 with a recovery action credited and plant modifications to implement transient free areas.

**3.3.1.21 VFDR No. AA50-021**

1-NRV-151, 1-NRV-152 and 1-NRV-153 - Pressurizer PORVs are required to be closed to support RCS integrity. RCS integrity is required to maintain positive control over RCS inventory and pressure. 1-NRV-151 may fail due to fire induced damage of cables 9705R-1 and 8667R-1. 1-NRV-152 may fail due to fire induced damage cables 9706R-1 and 8675R-1. 1-NRV-153 may fail due to fire induced damage of cables 8757G-1 and 8932G-1. Failure of these cables could spuriously open the valves. This condition represents a variance from the deterministic requirements of NFPA 805, Section 4.2.3. This is a separation issue.

This VFDR has been evaluated and it was determined that the risk, safety margin and defense-in-depth meet the acceptance criteria of NFPA 805 Section 4.2.4 with a defense-in-depth action credited.

**3.3.2 Recovery Actions Credited**

For each VFDR, a Fire Risk Evaluation has been performed to assess the acceptability of risk, defense-in-depth, and safety margin. This evaluation determined whether or not recovery actions are required to ensure that one success path necessary to achieve and maintain the nuclear safety performance criteria is maintained free of fire damage by a single fire. Table 3-3 identifies the credited recovery actions for this area. Actions retained for DID are identified as “DID Actions” within Table 3-3. Additional information for DID actions is contained within Section 3.8 of this report. Note that, for completeness, all VFDRs are contained within Table 3-3, even if the Fire Risk Evaluation has determined that a recovery action is not required. In those instances where a recovery action has been determined to not be required, the word “None” is provided in the “Action” column in the table.

<b>Table 3-3, Recovery Actions Credited</b>		
<b>VFDR</b>	<b>Component</b>	<b>Action</b>
AA50-001	1-PP-3W 1-PP-3E 1-PP-4	1-FW-129-OPEN (Open manual valve 1-FW-129)  2-FW-261-CLOSE (Close manual valve 2-FW-261)
AA50-002	1-FMO-222 1-FMO-232	1-FMO-222-OPERATE (De-energize and manually operate 1-FMO-222)  1-FMO-232-OPERATE (De-energize and manually operate 1-FMO-232)
AA50-003	1-DCR-310 1-DCR-340	None
AA50-004	1-DCR-320 1-DCR-330	DID ACTION(S) 1-DCR-320-CLOSE 1-DCR-330-CLOSE (Remove fuses in MCR to fail closed AOVs 2-DCR-320 and 2-DCR-330)

Table 3-3, Recovery Actions Credited		
VFDR	Component	Action
AA50-005	1-MRV-210	DID ACTION
	1-MRV-240	1-MRV-211-OPEN (Manually open 1-MRV-211 to close valve 1-MRV-210)  or  1-MRV-212-OPEN (Manually open 1-MRV-212 to close valve 1-MRV-210)  and  1-MRV-241-OPEN (Manually open 1-MRV-241 to close valve 1-MRV-240)  or  1-MRV-242-OPEN (Manually open 1-MRV-242 to close valve 1-MRV-240)
AA50-006	1-MRV-220	1-MRV-221-OPEN (Manually open 1-MRV-221 to close valve 1-MRV-220)  or  1-MRV-222-OPEN (Manually open 1-MRV-222 to close valve 1-MRV-220)  and  1-MRV-231-OPEN (Manually open 1-MRV-231 to close valve 1-MRV-230)  or  1-MRV-232-OPEN (Manually open 1-MRV-232 to close valve 1-MRV-230)
	1-MRV-230	

Table 3-3, Recovery Actions Credited		
VFDR	Component	Action
AA50-007	1-MRV-213-P 1-MRV-243-P	DID ACTION 1-MRV-213-P-CLOSE (Manually vent air to close 1-MRV-213)  1-MRV-243-P-CLOSE (Manually vent air to close 1-MRV-243)
AA50-008	1-MRV-223-P 1-MRV-233-P	1-MRV-223-P-CLOSE (Manually close 1-MRV-223)  1-MRV-233-P-CLOSE (Manually close 1-MRV-233)
AA50-009	1-PP-50E 1-PP-50W	1-CS-302-CLOSE (Close manual valve 1-CS-302)  1-CS-534-OPEN (Open manual valve 1-CS-534)  2-CS-536-OPEN (Open manual valve 2-CS-536)
AA50-010	1-QRV-10 1-QRV-20 1-QRV-30 1-QRV-40	1-QRV-10/40-OPEN-ALT (De-energize 1-VDAB at 1-MDAB to fail 1-QRV-10 and 1-QRV-40 open)  1-QRV-20/30-OPEN-ALT (De-energize 1-VDCD at 1-MDCD to fail 1-QRV-20 and 1-QRV-30 open)
AA50-011	1-ICM-250 1-ICM-251	1-ICM-250-OPEN (De-energize and manually open 1-ICM-250)
AA50-012	1-IMO-51 1-IMO-52 1-IMO-53 1-IMO-54	None
AA50-013	1-NRV-163 1-NRV-164	1-PP-45-3-TRIP (Locally trip RCP # 3)  1-PP-45-4-TRIP (Locally trip RCP # 4)

Table 3-3, Recovery Actions Credited		
VFDR	Component	Action
AA50-014	1-PP-45-1 1-PP-45-2 1-PP-45-3 1-PP-45-4	1-PP-45-1-TRIP (Locally trip RCP 1)  1-PP-45-2-TRIP (Locally trip RCP 2)  1-PP-45-3-TRIP (Locally trip RCP 3)  1-PP-45-4-TRIP (Locally trip RCP 4)
AA50-015	1-NSO-021 1-NSO-022	1-NSO-021-CLOSE ALT (De-energize 1-CCV-CD at 1-MCCD to fail 1-NSO-021 closed)
AA50-016	1-NSO-023 1-NSO-024	1-NSO-023-CLOSE ALT (De-energize 1-CCV-AB at 1-MCAB to fail 1-NSO-023 closed)
AA50-017	1-NSO-061 1-NSO-062	1-NSO-061-CLOSE ALT (De-energize 1-CCV-CD at 1-MCCD to fail 1-NSO-061 closed)
AA50-018	1-NSO-063 1-NSO-064	1-NSO-063-CLOSE ALT (De-energize 1-CCV-AB at 1-MCAB to fail 1-NSO-063 closed)
AA50-019	1-QRV-111 1-QRV-112 1-QRV-160 1-QRV-161 1-QRV-162	1-QRV-111-CLOSE ALT (De-energize 1-CCV-CD at 1-MCCD to fail 1-QRV-111 closed)

Table 3-3, Recovery Actions Credited		
VFDR	Component	Action
AA50-020	1-BLI-120-CRI 1-BLI-130-CRI 1-MPP-220-CRI 1-MPP-230-CRI 1-NLP-151-CRI 1-NPS-110-CRI 1-NTR-120 1-NTR-220 1- NRI-1	1-LSI-4-ALT-PWR (Align unaffected Unit Power to LSI Panel)  1-LSI-6-ALT-PWR (Align unaffected Unit Power to LSI Panel)  1-LSI-2-LOCAL (Locally monitor 1-LSI-2)  1-LSI-3-LOCAL (Locally monitor 1-LSI-3)  1-LSI-4-LOCAL (Locally monitor 1-LSI-4)  1-LSI-6-LOCAL (Locally monitor 1-LSI-6)
AA50-021	1-NRV-151 1-NRV-152 1-NRV-153	DID ACTION(S) 1-NRV-151-CLOSE 1-NRV-152-CLOSE 1-NRV-153-CLOSE (Remove fuses in MCR to fail closed PORVs 1-NRV-151, 1-NRV-152, and 1-NRV-153)

### 3.4 Non-Power Operational Modes Compliance Summary

A review of CNP for the potential effects of a fire in this Fire Area while in non-power modes of operation (NPO) was conducted. This review was conducted using the guidance provided in NEI 04-02 and FAQ 07-0040, "Non-Power Operations Clarifications".

The review determined that there are potential failures that affect certain Key Safety Functions (KSF) as a result of the fire in this area, and the fire could result in the loss of one or more KSF paths. Compensatory measures are required during high risk evolution periods to provide reasonable assurance a fire will not adversely affect key safety functions and the NFPA 805 performance goal for NPO is therefore satisfied. The results of the NPO analysis are contained within Technical Evaluation R1900-005-001, Non-Power Operation Modes Transition Review Report.

### 3.5 Radioactive Release Compliance Summary

The NFPA 805 radiological release goal is to provide reasonable assurance that a fire will not result in a radiological release that adversely affects the public, plant personnel or the environment. The NFPA 805 requirement is to ensure a radiation release to any unrestricted area due to the direct effects of fire suppression activities (but not involving fuel damage) shall be as low as reasonably achievable and shall not exceed applicable plant Technical Specification limits.

AA50 is located outside the Radiological Controlled Area (RCA) and is not a storage location for contaminated materials, therefore there is reasonable assurance a fire in this area will not result in radiation release. The review of this fire area, with respect to radioactive release, is documented in the NFPPM.

### 3.6 Probabilistic Risk Assessment-Summary of Results

A Fire PRA (FPRA) quantification of Fire Area AA50 was performed and is documented in PRA-NB-FIRE-FQ, Fire PRA Model Quantification Notebook. The fire risk quantification for Fire Area AA50 is analyzed using detailed fire modeling to consider risk of fire scenarios of ignition sources. PRA-NB-FIRE-FQ includes a summary of all potentially risk-significant fire scenarios (i.e., CDF > 1.0E-7 or LERF > 1.0E-8). Bounding CDF / LERF per calendar year values are reported that are based on the risk values documented in PRA-NB-FIRE-FSS, Fire PRA Fire Scenario Selection.

Transient combustible and hot work free zones were credited in the FPRA for this fire area.

Fire Protection features credited in the Fire PRA are documented in R1900-0411-AA50, Detailed Fire Modeling Report: Fire Compartment: AA50 Unit 1 Control Room Cable Vault and Hot Shutdown Panel Area (EL. 624 FT and 633 FT). PRA-NB-FIRE-FSS documents the revision level of the fire modeling reports used in the most recent Fire PRA quantification.

### 3.7 Risk-Informed, Performance-Based Evaluations

Fire Risk Evaluations (FREs) have been performed to ensure that variances from the NFPA 805 deterministic requirements are acceptable. The evaluation process consists of an integrated assessment of the acceptability of risk, defense-in-depth, and safety margins.

#### 3.7.1 Transition Risk-Informed, Performance-Based Evaluations

The 'changes' associated with NFPA 805 transition were those variances from the deterministic requirements of NFPA 805 or with the existing fire protection licensing basis that were brought into compliance with the NFPA 805 performance based approach. The change identified for evaluation for Fire Area AA50 is as follows:

- Separation Issues

The Fire Risk Evaluation has determined that the change is acceptable based upon:

- The measured change in CDF and LERF.
- Adequate defense-in-depth and safety margins being maintained.

Refer to Attachment 2 for a summary of results associated with the Fire Risk Evaluations.



### 3.8 Defense-in-Depth

A comprehensive risk-informed, performance-based analysis includes consideration of defense-in-depth (DID) as part of an integrated evaluation of risk considerations. In general, defense-in-depth involves consideration of the extent to which fire protection systems and features are provided within the three echelons of fire-protection:

- Preventing fires from starting,
- Rapidly detecting fires and controlling and extinguishing promptly those fires that do occur, thereby limiting fire damage,
- Providing an adequate level of fire protection for structures, systems, and components important to safety, so that a fire that is not promptly extinguished will not prevent the nuclear safety performance criteria from being met.

Each VFDR was evaluated for DID. The following recovery actions have been retained for DID.

VFDR No. AA50-004: 1-DCR-320 and 1-DCR-330 - SG 2 & 3 Blowdown Isolation Valves are required to be closed to support main steam isolation. Main steam isolation is required to prevent uncontrolled cooldown through over-steaming. SG 2 & 3 Blowdown Isolation Valves may fail due to a full area fire within Fire Area AA50. Loss of Main Steam isolation can be mitigated by removing fuses to ensure valves fail shut. This recovery action is being retained for DID to ensure Main Steam isolation is maintained.

VFDR No. AA50-005: 1-MRV-210 and 1-MRV-240 – The SG 1 and 4 Main Steam Stop Valves are required to be closed to support main steam isolation. Main steam isolation is required to prevent the uncontrolled cooldown through over-steaming. Failure of the MSSV dump valves for both 1-MRV-210 and 1-MRV-240 may cause the inability to close the valves. These failures can be mitigated by manually opening the MSSV dump valves. These recovery actions are being retained for DID to ensure main steam isolation is maintained.

VFDR No. AA50-007: 1-MRV-213-P and 1-MRV-243-P - SG 1 and 4 PORVs are required to be closed to support main steam isolation. Main steam isolation provides integrity of the secondary side of the SGs to prevent uncontrolled cooldown through over-steaming. SG 1 and 4 PORVs could spuriously open due cable failures cause by a full area fire within Fire Area AA50. These failures can be mitigated by locally venting air to close to the SG 1 and 4 PORVs. This manual action is being retained for DID to ensure main steam isolation is maintained.

VFDR No. AA50-021: 1-NRV-151, 1-NRV-152 and 1-NRV-153 - Pressurizer PORVs are required to be closed to support RCS integrity. RCS integrity is required to maintain positive control over RCS inventory and pressure. The spurious opening can be mitigated by de-energizing the valve to fail it closed. This recovery action is being retained for DID to ensure RCS pressure and inventory control is maintained.

Based on the assessment in support of the Fire Risk Evaluation, defense-in-depth is maintained for fire area AA50. Refer to Attachment 2 for details associated with the Fire Risk Evaluation.

### 3.9 Monitoring Program Input

A Monitoring Program will be developed in accordance with FAQ 10-0059, Rev. 1. Methods to monitor availability, reliability, and performance of fire protection program structures, systems, and components (SSCs), as well as programmatic elements will be provided. Additionally, effectiveness measures are established to review program related performance and trends. For AA50 the following

systems and features are candidates for inclusion in the CNP Fire Protection Monitoring Program:

- Fire Area boundary barriers discussed in Section 3.1
- Fire Detection System
- Fire Suppression System (Halon)
- Transient Combustible and Hot Work Free Zone
- Cable tray covers

#### 4.0 CONCLUSION

The nuclear safety and radioactive release performance criteria of NFPA 805 are met for a fire in Fire Area AA50. This Fire Risk Evaluation for Fire Area AA50 has demonstrated that

- The change in core damage frequency (delta CDF) is acceptable, and
- The change in large early release frequency (delta LERF) is acceptable, and
- Defense-in-depth and safety margins are maintained.

This is confirmation that a success path effectively remains free of fire damage and that the performance-based approach is acceptable per Section 4.2.4.2 of NFPA 805.

#### 5.0 REFERENCES

- 5.1 Calculation PRA-FIRE-NB-CRE, Fire PRA Cumulative Risk Evaluations
- 5.2 CNP Fire Pre-Plans, Volumes I, II, and III, Revisions 17, 14, and 18 respectively
- 5.3 Fire Hazards Analysis
- 5.4 NFPA 805, Performance-Based Standard for Fire Protection for Light Water Reactor Electric Generating Plants
- 5.5 NFPPM, NFPA 805 Fire Protection Program Manual (NFPPM)
- 5.6 Nuclear Energy Institute (NEI) 04-02, Guidance for Implementing a Risk-Informed, Performance-Based Fire Protection Program under 10 CFR 50.48(c), Rev. 2
- 5.7 Nuclear Safety Capability Assessment Report
- 5.8 PRA-NB-FIRE-FQ, Fire PRA Model Quantification Notebook
- 5.9 PRA-NB-FIRE-FSS, Fire PRA Fire Scenario Selection
- 5.10 R1900-0411-AA51, AA51 - Detailed Fire Modeling Report
- 5.11 Regulatory Guide 1.205, Risk-Informed, Performance-Based Fire Protection for Existing Light-Water Nuclear Power Plants, Rev. Revision 1
- 5.12 Technical Evaluation R1900-005-001, Non-Power Operation Modes Transition Review

**Fire Area AA50 – Attachment 1 - Table B-3 - Fire Area Transition**

<u>Unit</u>	<u>Fire Area</u>	<u>Description</u>
1	AA50	Unit 1 Control Room Cable Vault and Hot Shutdown Panel Area (El. 624 ft. and 633 ft.)

**Fire Zone Description**

57	Control Room Cable Vault - El. 624 ft. 0 in. - Unit 1
144	Unit 1 Hot Shutdown Panel Enclosure - El. 633 ft. 0 in.

**Regulatory Basis**

4.2.4.2 - Performance-Based Approach - Fire Risk Evaluation with simplifying deterministic assumptions

<b>Performance Goal</b>	<b>Method of Accomplishment</b>	<b>Comments</b>
Reactivity Control	Unit 1 - Trip the reactor from the Control Room. Borate using Unit 2 East or West Charging Pump supplied from the Unit 2 RWST. Use Unit 1 source range monitoring for indication at the LSI panel.	None
Inventory and Pressure Control	Unit 1 - Control inventory using Unit 2 East or West Charging Pump through the Unit 1 BIT. Control pressure using Unit 1 Pressurizer Safety Relief Valves.	VFDRs identified for CVCS and RCS integrity.
Decay Heat Removal	Unit 1 - Feed Unit 1 SGs 2 & 3 with Unit 2 West MDAFW Pump. The DHR function also requires MS isolation with a steam release path through the Safety Relief Valves.	VFRDs identified for AFW and MS isolation.
Process Monitoring	Unit 1 Process Monitoring - Use Unit 1 alternate process monitoring powered from Unit 2 at the local shutdown panels for the following: Pressurizer level, RCS pressure and temperature, and S/G level and Pressure. Unit 1 Source Range Monitoring - Use Unit 1 alternate source range monitoring powered from Unit 2 at the local shutdown panels.	VFDRs identified for process and source range monitoring and Main Steam Isolation.
Vital Auxiliaries	Unit 1 Electrical - Control Unit 2 Red (AB) Train Electrical Distribution with Unit 2 Red (AB) DG. Control Unit 2 Green (CD) Train Electrical Distribution with Unit 2 Green (CD) DG. Unit 1 ESW - Operate Unit 2 East or West ESW to provide cooling to the Unit 2 CCW Heat Exchangers and the Unit 2 Red (AB) and Green (CD) DGs for alternate shutdown for Unit 1. Unit 1 CCW - Operate Unit 2 East or West CCW to provide cooling to the Unit 2 Charging Pumps for alternate shutdown for Unit 1.	Unit 2 vital auxiliaries are credited to support Unit 2 equipment that is crosstied to Unit 1.

**Fire Area AA50 – Attachment 1 - Table B-3 - Fire Area Transition**

<u>Unit</u>	<u>Fire Area</u>	<u>Description</u>
1	AA50	Unit 1 Control Room Cable Vault and Hot Shutdown Panel Area (El. 624 ft. and 633 ft.)
		Unit 1 HVAC - Unit 1 Control Room HVAC is not required as alternate shutdown is utilized for this area. Unit 1 Auxiliary Building HVAC is not operational, Unit 2 Auxiliary Building HVAC remains available and provides adequate cooling. Operate Unit 2 Red (AB) and Green (CD) DG HVAC. Operate Unit 2 Red (AB) and Green (CD) Switchgear HVAC. Operate Unit 2 West MDAFW Room HVAC system. Operate the Unit 2 East and West ESW Room HVAC systems.

**Reference Documents**

Genesis Solution Suite, EDISON / SAFE-PB, DC Cook V 3.4.0

Nuclear Safety Capability Assessment Report

**Licensing Actions**

None

**Existing Engineering Equivalency Evaluations (EEEE)****EEEE Title Engineering Equivalency Evaluation 9-13 - Fire Zone 53 (Fire Area AA46) and Fire Zone 57 (Fire Area AA50) Hatch Evaluation**

**Summary** The purpose of this engineering equivalency evaluation is to document the acceptability of an unrated steel plate hatch located between the Unit 1 Control Room in Fire Zone 53 (Fire Area AA46) and the Unit 1 Control Room Cable Vault in Fire Zone 57 (Fire Area AA50) and the request for a fixed suppression exemption in Fire Zone 53. A 3-hr fire-rated hatch assembly is not commercially available for use in this location.

Note: This engineering equivalency evaluation has been reviewed by the NRC. Refer to NRC SER dated June 17, 1988, for acceptance of unrated fire hatches in fire area boundaries. The NRC concluded that the level of fire safety is equivalent to that achieved by conformance with the guidelines of Section D.1.j of Appendix A to BTP APCSB 9.5-1, and, therefore, the deviations for the unrated fire hatches were found acceptable.

Reasonable assurance is provided that a fire in Fire Zone 53 or Fire Zone 57 would not impair the safe shutdown capabilities of Unit 1. This engineering equivalency evaluation does not adversely impact other engineering equivalency evaluations.

The hatch was evaluated and found to be acceptable based on the fire hazards, fire protection systems and construction features within the

**Fire Area AA50 – Attachment 1 - Table B-3 - Fire Area Transition**

<u>Unit</u>	<u>Fire Area</u>	<u>Description</u>
1	AA50	Unit 1 Control Room Cable Vault and Hot Shutdown Panel Area (El. 624 ft. and 633 ft.)

evaluated areas.

**EEEE Title Engineering Equivalency Evaluation 11-9 - Turbine, Auxiliary and Containment Buildings Boundary Evaluation**

**Summary** The purpose of this engineering equivalency evaluation is to describe in general, the approach and existence of evaluations performed to determine and reconcile fire area boundaries having components or designs with less than a 3-hr fire rating on preventing the spread of fire. This engineering equivalency evaluation also specifically evaluates the impact of unrated door assemblies on the spread of fire.

Reasonable assurance is provided that the fire area boundaries having components or design less than a 3-hr fire rating will not increase the spread of fire or impair the safe shutdown capabilities of Units 1 or 2. In addition, this engineering equivalency evaluation does not adversely impact on other engineering equivalency evaluations or exemption requests.

This evaluation supports additional evaluations credited in this fire area.

**EEEE Title Engineering Equivalency Evaluation 11-14 - Cable Spreading Room Construction Boundary Evaluation (Fire Areas AA3, AA7, AA8, AA9, AA10, AA29, AA30, AA31, AA34, AA35, AA36/42, AA37, AA38, AA48, AA50, AA51 and AA52)**

**Summary** The purpose of this engineering equivalency evaluation is to document the acceptability of the construction features of the cable spreading rooms which have a fire resistance rating of less than 3 hours for their impact on the spread. In particular, fire dampers having a 1 1/2-hr fire rating were analyzed by this evaluation. Other unrated construction features have been previously analyzed under separate engineering equivalency evaluations. The applicable fire areas include: AA3, AA7, AA8, AA9, AA10, AA29, AA30, AA31, AA34, AA35, AA36/42, AA37, AA38, AA48, AA50, AA51 and AA52.

Reasonable assurance is provided that the construction features of the cable spreading rooms which have a fire resistance rating of less than 3 hours will prevent the spread of fire and not impair the safe shutdown capabilities of Unit 1 and Unit 2. In addition, this engineering equivalency evaluation does not adversely impact other engineering equivalency evaluations.

The construction features of the cable spreading room were evaluated and found to be acceptable based on the fire hazards, fire protection systems and construction features within the areas.

**Fire Area AA50 – Attachment 1 - Table B-3 - Fire Area Transition**

<u>Unit</u>	<u>Fire Area</u>	<u>Description</u>
1	AA50	Unit 1 Control Room Cable Vault and Hot Shutdown Panel Area (El. 624 ft. and 633 ft.)

<b><u>EEEE Title</u></b>	<b>Engineering Equivalency Evaluation 11-36 - Unit 1 and Unit 2 Hot Shutdown Panel Enclosure: Unit 1 Fire Zone 144 (Fire Area AA50) and Unit 2 Fire Zone 145 (Fire Area AA51)</b>
<b><u>Summary</u></b>	<p>The purpose of this engineering equivalency evaluation is to document the acceptability that deviations to the 3-hr fire rating of the Unit 1 and Unit 2 Hot Shutdown Panel (HSDP) enclosures (Fire Zone 144 for Unit 1 and Fire Zone 145 for Unit 2) would have on preventing the spread of fire. This engineering equivalency evaluation evaluates the ability of the existing structure to provide adequate separation of the HSDPs from their opposite unit's control room. In addition to the reduction of the roof/ceiling assembly fire rating from 3 hours to a nominal 2 hours (2 hours and 12 minutes), this engineering equivalency evaluation reviews the roll-up fire door installation and the protective design for the columns.</p> <p>Reasonable assurance is provided that the deviation from providing a 3-hr rated enclosure for each of the HSDPs will not impair the safe shutdown capabilities of CNP or increase the potential for spread of fire between the HSDP enclosures (Fire Zones 144 and 145) and the control rooms (Fire Zones 53 and 54) in which they are located.</p> <p>The HSDPs were evaluated and found to be acceptable based on the fire hazards, fire protection systems and construction features within the evaluated areas. Also, some areas being evaluated are continuously manned.</p>
<b><u>EEEE Title</u></b>	<b>Engineering Equivalency Evaluation 11-54 - Unit 1 Main Control Room Cable Vault Penetration Seal W5111 Fire Zone 57 and 91 (Fire Areas AA50 and AA2)</b>
<b><u>Summary</u></b>	<p>The purpose of this Engineering Equivalency Evaluation 11-54 is to document the acceptability of the installed configuration of wall penetration seal W5111. The seal is located at elevation 624 ft. west wall of the Unit One Main Control Room Cable Vault (MCRCV) (Fire Area AA50), is a 3-hr fire-rated and provides pressure retention capability for the MCRCV automatic Halon and manual CO2 fire suppression systems. The seal is not in strict compliance with design details and test reports described in Design Specification ES-FIRE-0601-QCF, "Fire Rated Seals" and Engineering Desk-Top-Guide (DTG) 2270-066-001, "Fire Rated Barrier Penetration Seal Qualification Manual." Therefore, consistent with guidance provide in Generic Letter 86-10, this engineering equivalency evaluation documents the technical attributes required to conclude the installed configuration provides an equivalent fire and pressure rating in a fire event impacting Fire Zone 57 and 91.</p> <p>Reasonable assurance is provided repaired penetration seal W5111 will provide adequate fire resistance and pressure retention to support safe shutdown in a fire event.</p> <p>The penetration seal was evaluated and found to be acceptable based on the fire hazards, fire protection systems and construction features within the evaluated areas.</p>

**Fire Area AA50 – Attachment 1 - Table B-3 - Fire Area Transition**

<b><u>Unit</u></b>	<b><u>Fire Area</u></b>	<b><u>Description</u></b>
1	AA50	Unit 1 Control Room Cable Vault and Hot Shutdown Panel Area (El. 624 ft. and 633 ft.)

<b><u>EEEE Title</u></b>	<b>Engineering Equivalency Evaluation 11-79 - Fire Zone 53 (AA46) And Fire Zone 57 (AA50) Fire Barrier Penetration Seals</b>
<b><u>Summary</u></b>	<p>The purpose of this evaluation is to document the acceptability of fire barrier penetration seals in the floor of the Unit 1 Control Room that have been identified with a fire seal depth below the minimum depth required per ES-FIRE-0601-QCF, Engineering Specification for Fire Rated Seals, for a three hour fire seal.</p> <p>Floor fire seals with less than the required fire seal depth are acceptable as is and reasonable assurance is provided that a fire in Fire Zone 53 (AA46) or Fire Zone 57 (AA50) would not impair the ability of CNP to reach and maintain a safe and stable hot standby. In addition, this evaluation does not impact other evaluations, but will encompass the evaluation formally contained in EEE-11-49.</p> <p>The fire rated penetration seals were evaluated and found to be acceptable based on the fire hazards, fire protection systems, and transient combustible and hot work restrictions within the evaluated areas, as well as the identical response for fire safe shutdown required by procedures for the evaluated areas.</p>
<b><u>EEEE Title</u></b>	<b>Engineering Equivalency Evaluation 12-19 - CO2 Fire Suppression System Concentrations (Fire Areas AA7, AA8, AA9, AA10, AA29, AA30, AA31, AA37, AA38, AA39, AA40, AA41, AA43, AA44, AA45, AA48, AA49, AA50, AA51, AA52 and AA53)</b>
<b><u>Summary</u></b>	<p>The purpose of this engineering equivalency evaluation is to document the acceptability of the CO2 fire suppression systems in fire zones containing concentrations of cable insulation and the potential for deep-seated fires. This engineering equivalency evaluation determines the CO2 system's impact on the spread of fire and previous engineering equivalency evaluations and exemption requests. Although there are other fire zones that use CO2 for fire suppression such as the DG Rooms, they are installed to suppress surface-type, combustible liquid fires and are not included in this analysis, because they do not contain significant concentrations of cable insulation capable of producing deep-seated fires.</p> <p>All of the CO2 systems included in this engineering equivalency evaluation are capable of performing their intended function, containing the fire until the Fire Brigade arrives, preventing fire spread to adjacent fire zones, and ensuring that safe shutdown of CNP can be achieved and maintained.</p> <p>The existing suppression systems were evaluated and found to be acceptable based on the fire hazards and fire protection systems within the evaluated areas.</p>

**Fire Area AA50 – Attachment 1 - Table B-3 - Fire Area Transition**

<u>Unit</u>	<u>Fire Area</u>	<u>Description</u>
1	AA50	Unit 1 Control Room Cable Vault and Hot Shutdown Panel Area (El. 624 ft. and 633 ft.)

**Fire Suppression Effects on Nuclear Safety Performance Criteria**

The CNP fire brigade is trained to discharge water in a judicious manner and instructed to direct hose streams and portable extinguishers at the base of the fire to limit the amount of overspray beyond the immediate fire zone. For this reason, fire brigade activities are not expected to fail components not already considered damaged by fire. It has been concluded that water impingement on cables is not a concern. Since this fire area has no equipment targets, in the event of discharge, the automatic suppression system will not create additional failures to cables and conduit. The drainage features of the fire area mitigate the potential for flooding damage due to fire suppression, such that the standing water would not affect credited equipment.

Since it is shown that suppression effects will not impact the nuclear safety performance criteria, the fire area configuration is deemed acceptable.

**References:**

Technical Evaluation 12.1, "Fire Suppression Effects Study"

Technical Evaluation 12.1, "Supplemental Information to Fire Suppression Effects Study – Supplement 1"

**Fire Area Comments**

Revise time requirement \ time basis per AR 2015-14147 for VFDR AA50-013 and AA50-014.



## Fire Area AA50 – Attachment 2 - Fire Risk Evaluation Results Summary

### A2.1 Introduction

The ‘changes’ associated with NFPA 805 transition were those variances from the deterministic requirements of NFPA 805. The changes identified for evaluation for fire area AA50 are grouped as follows:

- Separation Issues

This attachment is a summary of the Fire Risk Evaluation for the fire area. The complete results and methodology are contained in the Cumulative Fire Risk Evaluation, PRA-FIRE-NB-CRE. (FPCE 2017-0009)

### A2.2 Inputs/Assumptions

Fire modeling processes and inputs provided in NUREG/CR-6850 are appropriate for use in a risk-informed, performance-based evaluation. The complete list of assumptions used in the fire modeling methodology for this fire area is contained in Detailed Fire Modeling Technical Evaluation R1900-0411-AA50.

### A2.3 Fire Modeling Methodology

Fire PRA fire modeling results are used as the initial input into this Fire Risk Evaluation. The process consists of conservative bounding analyses using NUREG/CR-6850 methods. As needed, refinements are made to utilize more realistic parameters. The complete fire modeling methodology for this fire area is contained in Detailed Fire Modeling Technical Evaluation R1900-0411-AA50.

### A2.4 Scenario Descriptions and Model Results

Fire Area AA50 was evaluated for the impact of fires originating from transient ignition sources only. Complete descriptions of each fire scenario is contained within the Detailed Fire Modeling Technical Evaluation R1900-0411-AA50.

#### A2.4.1 Ignition Sources

Fire Area AA50 does not contain any fixed ignition sources. The 98th percentile HRR was used for all transient fires. The 98th percentile HRR bounds the possible transient ignition sources expected for this fire area, which were fire tested and identified in NUREG/CR-6850, Appendix G, Table G-7. For transient scenarios, this fire area was analyzed as a combustible and hot work free zone.

#### A2.4.2 Scenario Results

A delta risk calculation has been performed to quantify the risk associated with the VFDRs in the fire area.

### A2.5 Fire Risk Evaluation Results

PRA-FIRE-NB-CRE documents scenarios and corresponding impacted VFDRs that were evaluated for delta risk during the transition to NFPA 805 and also all changes to the Fire Protection Program that are currently incorporated into the Fire PRA model. The acceptability of the Cumulative Fire Risk Evaluations was based on calculated delta risk meeting the thresholds of NEI 04-02, RG 1.205 and RG 1.174. (FPCE 2017-0009)

**Fire Area AA50 – Attachment 2 - Fire Risk Evaluation Results Summary****A-2.6 Impact of VFDR on Defense-in-Depth**

Defense-in-Depth has been evaluated for this fire area. The impacts of this evaluation are summarized in the table below:

Defense-in-Depth Impact Review for AA50			
Method of Providing DID	Required to Support Deterministic Analysis or Fire PRA?	Changes or Improvements Necessary for DID?	Basis/Justification
Echelon 1: Prevent fires from starting			
Combustible Control is implemented in accordance with Procedure PMP-2270-CCM-001, Control of Combustible Materials.	Yes	No	• This element is adequate based on no perceived weakness of, or over-reliance on, another echelon of defense-in-depth.  • Hot work is prohibited in this area during plant operation.
Hot Work Control is implemented in accordance with Procedure PMP-2270-WBG-001, Welding, Burning and Grinding Activities.	Yes	No	
Echelon 2: Rapidly detect, control and extinguish promptly those fires that do occur thereby limiting fire damage			
Fire Detection System	Yes	No	• Although fire fighting activities may be challenging, suppression and detection are provided throughout the fire area and therefore no changes or improvements to Echelon 2 attributes are necessary to maintain defense-in-depth.
Fixed Fire Suppression	Yes	No	
Portable Fire Extinguishers	Yes	No	
Hose stations and hydrants	Yes	No	
Pre-Fire Plan	Yes	No	

**Fire Area AA50 – Attachment 2 - Fire Risk Evaluation Results Summary**

<b>Defense-in-Depth Impact Review for AA50</b>			
<b>Method of Providing DID</b>	<b>Required to Support Deterministic Analysis or Fire PRA?</b>	<b>Changes or Improvements Necessary for DID?</b>	<b>Basis/Justification</b>
<b>Echelon 3: Provide adequate level of fire protection for systems and structures so that a fire will not prevent essential safety functions from being performed</b>			
Walls, floors ceilings and structural elements are rated or have been evaluated as adequate for the hazard.	Yes	No	<ul style="list-style-type: none"> <li>Although VFDR AA50-004 is not considered a significant contribution to core damage frequency, the variance is considered important enough to the NSCA to retain as a recovery action to ensure that defense-in-depth is maintained.</li> <li>There are significant modeling differences between the Fire PRA and nuclear safety capability assessment (i.e., due to different success criteria, end states, etc.) and therefore recovery actions for VFDR AA50-005 and AA50-007 have been credited to ensure that defense-in-depth is maintained.</li> <li>Where a variance can possibly be affected in a potentially high risk scenario, based on a detailed review, the VFDR is either not the cause for the high risk of the scenario or the mitigating recovery action is credited; therefore no changes or improvements to Echelon 3 attributes are necessary to maintain defense-in-depth.</li> </ul>
Penetrations in the fire area barrier are rated or have been evaluated as adequate for the hazard.	Yes	No	<ul style="list-style-type: none"> <li>Defense in Depth actions were credited to remove fuses in the Control Room to prevent spurious equipment operation due to internal shorts.</li> </ul>
Supplemental barriers (e.g., ERFBS, cable tray covers, etc.)	Yes	No	
Guidance provided to operations personnel detailing the required success path(s) including recovery actions to achieve nuclear safety performance criteria.	Yes	Yes	<ul style="list-style-type: none"> <li>Cable tray covers are credited in the detailed fire modeling to reduce fire spread and target damage, and, are therefore, credited for defense-in-depth.</li> </ul>

## Fire Area AA50 – Attachment 2 - Fire Risk Evaluation Results Summary

### A-2.7 Safety Margin Considerations

In accordance with NEI 04-02, the maintenance of adequate Safety Margin is assessed by the consideration categories of analyses utilized by this Fire Risk Evaluation.

Safety margins are considered to be maintained if:

- Codes and Standards or their alternatives accepted for use by the NRC are met.

AND

- Safety analyses acceptance criteria in the licensing basis (e.g., FSAR, supporting analyses) are met, or provides sufficient margin to account for analysis and data uncertainty.

The following summarizes the bases for ensuring the maintenance of safety margins:

- The risk-informed, performance based processes utilized are based upon NFPA 805, 2001 edition, endorsed by the NRC in 10 CFR 50.48(c).
- The Fire Risk Evaluation process is in accordance with NEI 04-02, Revision 2, which is endorsed by the NRC in Regulatory Guide 1.205, Revision 1.
- The Fire PRA is developed in accordance with NUREG/CR-6850, which was developed jointly between the NRC and EPRI.
- The Fire PRA has undergone an industry peer review, in order to ensure the Fire PRA meets the appropriate quality standards of ASME/ANS RA-Sa-2009, "Standard for Level 1/Large Early Release Frequency Probabilistic Risk Assessment for Nuclear Power Plant Applications," Dated February 2, 2009
- The "combined analysis approach" is used during transition (NEI 04-02, Section 5.3.4.3); therefore, MEFS/LFS is not analyzed separately from the Fire PRA results.
- The CNP internal events PRA model received two formal industry peer reviews conducted in accordance with applicable NEI guidelines. The initial peer review was performed in 2001, while a subsequent focused scope (i.e., limited scope) peer review was conducted in 2009. The initial, full-scope WOG peer review covered all aspects of the CNP PRA model and the administrative processes used to maintain and update the model. The CNP PRA model has been revised to address all significant issues (i.e., Category A and B Facts & Observations) identified during the initial peer review. None of the findings from the focused-scope peer review were judged to reach the significance level of a Category A or B Fact & Observation; as a result, no changes to the PRA model have yet been made to include resolutions for these latter issues.
- Fire protection systems and features determined to be required by NFPA 805 Chapter 4 have been confirmed to meet the requirements of NFPA 805 Chapter 3 and their associated referenced codes and listings, or provided with acceptable alternatives using processes accepted for use by the NRC (i.e., FAQ 06-0008, FAQ 06-0004, 07-0033).
- Fire modeling performed in support of the transition has been performed within the Fire PRA utilizing codes and standards developed by industry and NRC staff which have been verified and validated in authoritative publications, such as NUREG 1824, "Verification and Validation of Selected Fire Models for Nuclear Power Plant Applications". In general, the fire modeling performed in support of the Fire Risk Evaluations has been performed using conservative methods and input parameters that are based upon

## Fire Area AA50 – Attachment 2 - Fire Risk Evaluation Results Summary

NUREG/CR-6850 as documented in the AA50 Detailed Fire Modeling Report, section 7.2. While this is generally not ideal in the context of best estimate probabilistic risk analysis, it is a pragmatic approach given the current state of knowledge regarding the uncertainties related to the application of the fire modeling tools and associated input parameters for specific plant configurations.

- In accordance with the requirements of 10 CFR 50.48(c)(2)(iii), the Fire PRA results, including cutsets for the scenarios of concern, have been reviewed and it was verified that the results presented above do not rely solely on feed and bleed as the fire-protected safe shutdown path for maintaining reactor coolant inventory, pressure control, and decay heat removal capability for this fire area.

### A-2.8 Transition Risk Evaluation Conclusions

The transition change evaluation determined that these changes:

- Are acceptable based upon the measured change in CDF and LERF
- Maintained adequate defense-in-depth and safety margins

The results of this evaluation meet the requirements of NFPA 805 Risk Evaluation; therefore, the use of the performance based analysis approach is acceptable.

## D. C. Cook Nuclear Plant Fire Safety Analysis

## Fire Area: AA51

Unit 2 Control Room Cable Vault and Hot Shutdown Panel Area (EI 624 ft. and 633 ft.)

## Table of Contents

<b>Purpose</b> .....	Section 1.0
<b>Analysis Methodology</b> .....	Section 2.0
<b>Analysis</b> .....	Section 3.0
<b>Conclusion</b> .....	Section 4.0
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## Attachments

Fire Area AA51 – Attachment 1 - Table B-3 - Fire Area Transition

## Fire Area AA51 – Attachment 2 - Fire Risk Evaluation Results Summary

## 1.0 PURPOSE

This report documents the Fire Safety Analysis (FSA) for Cook Nuclear Plant (CNP) Fire Area AA51, Unit 2 Control Room Cable Vault and Hot Shutdown Panel Area (EI 624 ft. and 633 ft.) which comprises fire zone(s) 58, 145. The purpose of this analysis is to demonstrate the achievement of the nuclear safety and radioactive release performance criteria of NFPA 805 as required by 10 CFR 50.48(c). The Fire Safety Analysis is a key part of compliance with Section 2.7.1.2 Fire Protection Program Design Basis Document of NFPA 805. This analysis also documents results of risk-informed, performance-based Fire Risk Evaluations (FREs). These evaluations are associated with Variances from Deterministic Requirements (VFDRs) of NFPA 805 Chapter 4.

## 2.0 ANALYSIS METHODOLOGY

The FSA is the design basis document as described in NFPA 805 Section 2.7.1.2. The following steps are performed to develop the FSA on a fire area basis:

- Identify significant fire hazards in the fire area. This is based on NFPA 805 approach to analyze the plant from an ignition source and fuel package perspective.
- Summarize Nuclear Safety Capability Analysis (NSCA) compliance strategies. This is the result of the NEI 04-02 B-3 Table review of the Safe Shutdown Analysis.
- Summarize Non-Power Operations Modes compliance strategies.
- Summarize Radioactive Release compliance strategies. The transition review process required per NEI 04-02 is used to develop these results.
- Provide Fire Probabilistic Risk Assessment summary of results. This is based on the results from the plant Fire PRA.
- Perform risk informed, performance based evaluations if needed for the performance based approach.
- Summarize Defense-in-Depth strategy for each fire area.
- Determine key analysis assumptions which are candidates to be included in the NFPA 805 monitoring program.
- Provide conclusions relative to NFPA 805 compliance.

### 3.0 ANALYSIS

#### 3.1 Classical Fire Protection

##### 3.1.1 Construction

In Fire Zone 58, walls, floors and ceilings to adjacent fire areas are reinforced concrete in excess of a 3-hour rating. A fire area boundary evaluation was performed for the construction features (i.e. an unrated steel plate hatch, fire dampers having a 1 1/2-hour fire rating, and fire seals) of the cable spreading rooms that have a fire resistance rating of less than 3 hours.

A fire area boundary evaluation was performed for an unrated ceiling hatch to Fire Area AA47 - Fire Zone 54. Fire doors having a 3-hour rating are provided to adjacent Fire Areas AA36/42 and AA50 - Fire Zones 44S and 57, respectively.

In Fire Zone 145, walls to the adjacent fire areas are either of reinforced concrete (to Fire Zone 54) or concrete block (to Fire Zone 53) with at least a 3-hour rating. The roof is constructed from panels of the subliming material that forms a protective skin equivalent to a 2-hour and 12.4-minute rating. The floor is part of the Control Room floor/ceiling assembly that has a 3-hour rating.

A fire door (man door) having a 3-hour rating is provided to the adjacent Unit 1 Control Room Fire Area AA46 - Fire Zone 53. A manual rolling fire door having a 3-hour rating is also provided across the front of the hot shutdown panel to provide the necessary separation with the Unit 1 Control Room. The rolling fire door is manually operated for purposes of raising and lowering during normal plant activities.

Applicable Engineering Equivalency Evaluations are documented in Attachment 1.

##### 3.1.2 Doors and Access Openings

In Fire Zone 58, a fire area boundary evaluation was performed for an unrated ceiling hatch to Fire Area AA47 - Fire Zone 54. Fire doors having a 3-hour rating are provided to adjacent Fire Areas AA36/42 and AA50 - Fire Zones 44S and 57, respectively.

In Fire Zone 145, a fire door (man door) having a 3-hour rating is provided to the adjacent Unit 1 Control Room Fire Area AA46 - Fire Zone 53. A manual rolling fire door having a 3-hour rating is also provided across the front of the hot shutdown panel to provide the necessary separation with the Unit 1 Control Room. The rolling fire door is manually operated for purposes of raising and lowering during normal plant activities.

##### 3.1.3 Penetrations

In Fire Zone 58, penetrations in fire barriers between this fire zone and adjacent fire areas are provided with fire seals. Additionally, all penetrations in walls and ceiling of the Hot Shutdown Panel Cable Vaults are provided with fire seals.

In Fire Zone 145, penetrations in fire barriers between this fire zone and adjacent fire areas and adjacent Fire Zone 58 are provided with fire seals (Technical Evaluation 11-25).



### 3.1.4 Detection

The table below outlines the fire detection system(s) provided in the Fire Area:

Table 3-1, Fire Area AA51 Detection Systems								
Fire Zone	Type of System	Local (L) / Remote (R)	Detection Actuates Suppression?	Required System?				
				S	L	E	R	D
58	Ionization	L/R	Y	N	N	Y	Y	N
145	Ionization	L/R	No Auto Supp. (N/A)	N	N	Y	Y	N

**Table 3-1 Legend:**

Table Field: "Required System?"	
S	- Required for Chapter 4 Separation Criteria
L	- Required for NRC Approved Licensing Action
E	- Required for Engineering Equivalency Evaluation
R	- Required for Risk Significance
D	- Required to maintain adequate balance of Defense-in-Depth in a Change Evaluation or Fire Risk Evaluation

For Fire Zone 58, cross zoned ionization detectors (76 detectors total) are provided which alarm in the Unit 2 Control Room. Each of these detection circuits provides complete coverage for the Control Room Cable Vault Area including the Unit 1 Hot Shutdown Panel Cable Vault, Fire Zone 57.

For Fire Zone 145, one ionization detector inside the hot shutdown panel with remote indicating light located on the outside of the enclosure. This detector is part of the Unit 1 Control Room (Fire Zone 53) detection circuit which alarms in the Unit 1 Control Room.

### 3.1.5 Fixed Suppression

The table below outlines the fixed fire suppression system(s) provided in the Fire Area:

Table 3-2, Fire Area AA51 Suppression Systems								
Fire Zone	Type of System	Full (F) / Partial (P)	Required System?					
			S	L	E	R	D	
58	Halon	F	N	N	Y	Y	N	
58	Manual CO2	F	N	N	Y	N	N	
58	Wet Pipe	F	N	N	N	N	N	
145	None	N/A	N/A	N/A	N/A	N/A	N/A	
Table 3-2 Legend:								
Table Field: "Required System?"								
S	- Required for Chapter 4 Separation Criteria							
L	- Required for NRC Approved Licensing Action							
E	- Required for Engineering Equivalency Evaluation							
R	- Required for Risk Significance							
D	- Required to maintain adequate balance of Defense-in-Depth in a Change Evaluation or Fire Risk Evaluation							

For Fire Zone 58, an automatic total flooding Halon system provides the primary suppression coverage and is actuated by the listed detection system. The suppression system provides protection for the Control Room cable vault area as well as the Unit 1 Hot Shutdown Panel Cable Vault.

Also installed in this area is an automatic wet pipe sprinkler system. This sprinkler system is functional, but is not relied upon for controlling fires in the Control Room cable vault by this document.

Fixed fire suppression is not provided in Fire Zone 145.

### **3.1.6 Manual Suppression / Response Strategy**

A postulated fire will be identified by early detection using ionization type smoke detection or by plant personnel using plant communication system to notify the control room. The automatic detection system alarms in the control room. The Control Room operator will dispatch the fire brigade for initiation of manual fire fighting. A fire in this fire area will be contained by the construction features discussed in Section 3.1.1. Manual suppression is provided by the CNP Fire Brigade. A low pressure CO<sub>2</sub> total flooding system is provided as the backup suppression system. This system is manually actuated. Operation of this system discharges CO<sub>2</sub> into Fire Zone 58. This suppression system provides protection for the Control Room cable vault area as well as the Unit 1 Hot Shutdown Panel Cable Vault as a back up to the Halon system mentioned above.

Fire extinguishers are located in Fire Zone 58. Fire extinguishers are located adjacent to Fire Zone 145 in Fire Area AA46 - Fire Zone 53.

Water hose reels are located at the back door of the Control Room in Fire Area AA3 - Fire Zone 52, and in the Turbine Building, Fire Zone 130. A water hose reel located at the base of the ladder leading to the back door in adjacent Fire Area AA36/42 - Fire Zone 44S. Water hose reel with a second hose reel located in adjacent Auxiliary Building Fire Area AA3 - Fire Zone 52.

Floor drains are not available in Fire Zone 58 or 145. The Fire Brigade is equipped with a sump pump that may be used to remove an accumulation of water in the fire zone.

Breathing apparatus located in adjacent Fire Zones 53, 54 and in AA36/42 – Fire Zone 44N.

### **3.1.7 Ventilation**

A fire in this area will be contained by the fire barriers. Smoke can be removed by portable fans and flexible ducting to other areas of the Auxiliary Building and outdoors. The normal building ventilating systems in the Auxiliary Building will then exhaust the smoke via filtered monitored pathways. This fire area is listed as a non-controlled area in the Fire Pre Plans and therefore there is reasonable assurance that products of combustion will not be contaminated.

In Fire Zone 58, fire dampers having a 3-hour rating are provided to adjacent Fire Area AA36/42 - Fire Zones 44N and 44S.

There are no ventilation penetrations into Fire Zone 145.

### **3.1.8 Other Features**

Some cable trays within Fire Area AA51 are provided with bottom covers and/or are fully enclosed.

This fire area is procedurally controlled as a transient combustible and hot work free zone.

### 3.2 Fire Hazards Identification

The fire area does not contain fixed ignition sources, however it does contain combustible fire hazards. Combustibles consist primarily of exposed electrical cables in trays. The current combustible loading classification is considered moderate for Fire Zone 58 and high for Fire Zone 145.

### 3.3 NSCA Compliance Summary

Fire Area AA51 contains Unit 2 Red and Green train raceways and cables as well as the Unit 1 HSD panel. This panel contains some Unit 2 instrument loop support components and/or cables.

Compliance with the nuclear safety performance criteria is achieved using the performance-based approach in accordance with NFPA 805, Section 4.2.4.2.

Safe and stable condition of Unit 2 will be accomplished using Alternate AFW to Steam Generators 2 and 3 via the Unit 1 West Motor Driven Auxiliary Feedwater Pump, Alternate Charging via the Unit 1 East or West Pump, LSI panel control and power via Unit 1, Unit 1 ESW and CCW support systems for the Unit 1 crosstie systems supporting Unit 2.

The Nuclear Safety Performance Criteria compliance strategy for AA51 is documented within the NSCA Report.

#### 3.3.1 Variances

The variances identified for evaluation for this fire area are grouped as follows:

##### 3.3.1.1 VFDR No. AA51-001

2-PP-3E, 2-PP-3W and 2-PP-4 - A Unit 2 AFW Pump is required to be operable to support decay heat removal. Decay heat removal is required to be capable of removing sufficient heat from the reactor core such that the fuel is maintained in a safe and stable condition. A full area fire in Fire Area AA51 may cause the loss of the Unit 2 East and West MDAFW Pumps and the Unit 2 TDAFW Pump. The East MDAFW Pump, 2-PP-3E may fail due to fire induced damage of 250VDC Cabinet 2-MCCD, 4kV Bus 2-T21D and cables. The West MDAFW Pump, 2-PP-3W may fail due to fire induced damage of 250VDC Cabinet 2-MCAB, 4kV Bus 2-T21A and cables. The TDAFW Pump, 2-PP-4 may fail due to fire induced damage of cables 9956BR-2, 9957BR-2 and 9958BR-2. This condition represents a variance from the deterministic requirements of NFPA 805, Section 4.2.3. This is a separation issue.

This VFDR has been evaluated and it was determined that the risk, safety margin and defense-in-depth meet the acceptance criteria of NFPA 805 Section 4.2.4 with a recovery action credited and plant modifications to implement transient free areas.

**3.3.1.2 VFDR No. AA51-002**

2-FMO-222 and 2-FMO-232 - SG 2 and 3 AFW Supply Valves are required to be operable to support decay heat removal for Unit 2. Decay heat removal shall be capable of removing heat from the reactor core such that the fuel is maintained in a safe and stable condition. Decay heat removal requires a set of 2 supply valves be operable with their corresponding AFW pump. The following sets of Unit 1 SG AFW Supply Valves may fail due to a full area fire within Fire Area AA51; 2-FMO-212 and 2-FMO-242, 2-FMO-222 and 2-FMO-232, 2-FMO-221 and 2-FMO-231. The Unit 1 West AFW Pump is credited to provide decay heat removal through Unit 2 SGs 2 and 3 for a fire within Fire Area AA51. This requires 2-FMO-222 and 2-FMO-232 be operable. 2-FMO-222 may fail due to fire induced damage of 600V MCC 2-EZC-D and cables 8542G-2, 8543G-2, 8625G-2, 8635G-2 and 9984G-2. 2-FMO-232 may fail due to fire induced damage of 600V MCC 2-EZC-D and cables 8539G-2, 8543G-2, 8625G-2, 8635G-2 and 9984G-2. This condition represents a variance from the deterministic requirements of NFPA 805, Section 4.2.3. This is a separation issue.

This VFDR has been evaluated and it was determined that the risk, safety margin and defense-in-depth meet the acceptance criteria of NFPA 805 Section 4.2.4 with a recovery action credited and plant modifications to implement transient free areas.

**3.3.1.3 VFDR No. AA51-003**

2-DCR-310 and 2-DCR-340 - The SG Blowdown Isolation Valves are required to be closed to support main steam isolation. Main steam isolation is required to prevent uncontrolled cooldown through over steaming. SG 1 and 4 Blowdown Isolation Valves may fail due to a full area fire within Fire Area AA51. 2-DCR-310 may fail due to fire induced damage of cable 8682G-2. 2-DCR-340 may fail due to fire induced damage of cable 8686G-2. These cable failures could spuriously open the valves. SGs 1 and 4 are not credited for decay heat removal due to a fire within Fire Area AA51. This condition represents a variance from the deterministic requirements of NFPA 805, Section 4.2.3. This is a separation issue.

This VFDR has been evaluated and it was determined that the risk, safety margin and defense-in-depth meet the acceptance criteria of NFPA 805 Section 4.2.4 with plant modifications to implement transient free areas.

**3.3.1.4 VFDR No. AA51-004**

2-DCR-320 and 2-DCR-330 - The SG Blowdown Isolation Valves are required to be closed to support main steam isolation. Main steam isolation is required to prevent uncontrolled cooldown through over steaming. SG 2 and 3 Blowdown Isolation Valves may fail due to a full area fire within Fire Area AA51. 2-DCR-320 may fail due to fire induced damage of cable 8682R-2. 2-DCR-330 may fail due to fire induced damage of cable 8686R-2. These cable failures could spuriously open the valves. SGs 2 and 3 are credited for decay heat removal due to a fire within Fire Area AA51. This condition represents a variance from the deterministic requirements of NFPA 805, Section 4.2.3. This is a separation issue.

This VFDR has been evaluated and it was determined that the risk, safety margin and defense-in-depth meet the acceptance criteria of NFPA 805 Section 4.2.4 with a recovery action credited and plant modifications to implement transient free areas.

**3.3.1.5 VFDR No. AA51-005**

2-MRV-210 and 2-MRV-240 – The SG 1 and 4 Main Steam Stop Valves are required to be closed to support main steam isolation. Main steam isolation is required to prevent the uncontrolled cooldown through over-steaming. SGs 1 and 4 are not credited for decay heat removal due to a fire within Fire Area AA51. 2-MRV-210 may fail due to fire induced damage of 2-MMO-210, 2-MRV-211 and 2-MRV-212. 2-MMO-210, 3 Way Air Open Valve for SG 1 Stop Valve vents air from the Main Steam stop Valve to either 2-MRV-211 or 2-MRV-212. Cable failures to the 3 way stop valve will spuriously operate it to either position. Failure of 2-MRV-211 and 2-MRV-212 will require either valve to be manually failed to the open position dependent upon the 3 way valve's position. 2-MRV-240 may fail due to fire induced damage of 2-MMO-240, 2-MRV-241 and 2-MRV-242. 2-MMO-240, 3 Way Air Open Valve for SG 4 Stop Valve vents air from the Main Steam Stop Valve to either 2-MRV-241 or 2-MRV-242. Cable failures to the 3 way stop valve will spuriously operate it to either position. Failure of 2-MRV-241 and 2-MRV-242 will require either valve to be manually failed to the open position dependent upon the 3 way valve's position. This condition represents a variance from the deterministic requirements of NFPA 805, Section 4.2.3. This is a separation issue.

This VFDR has been evaluated and it was determined that the risk, safety margin and defense-in-depth meet the acceptance criteria of NFPA 805 Section 4.2.4 with a defense-in-depth action credited and plant modifications to implement transient free areas.

**3.3.1.6 VFDR No. AA51-006**

2-MRV-220 and 2-MRV-230 – Main Steam Stop Valves for SGs 2 and 3 are required to be closed to support main steam isolation. Main steam isolation is required to prevent uncontrolled cooldown through over-steaming. SGs 2 and 3 are credited for decay heat removal due to a fire within Fire Area AA51. 2-MRV-220 may fail due to fire induced damage of 2-MMO-220, 2-MRV-221 and 2-MRV-222. 2-MMO-220, 3 Way Air Open Valve for SG 2 Stop Valve vents air from the Main Steam Stop Valve to either 2-MRV-221 or 2-MRV-222. Cable failures to the 3 way stop valve will spuriously operate it to either position. Failure of 2-MRV-221 and 2-MRV-222 will require either valve to be manually failed to the open position dependent upon the 3 way valve's position. 2-MRV-230 may fail due to fire induced damage of 2-MMO-230, 2-MRV-231 and 2-MRV-232. 2-MMO-230, 3 Way Air Open Valve for SG 3 Stop Valve vents air from the Main Steam Stop Valve to either 2-MRV-231 or 2-MRV-232. Cable failures to the 3 way stop valve will spuriously operate it to either position. Failure of 2-MRV-231 and 2-MRV-232 will require either valve to be manually failed to the open position dependent upon the 3 way valve's position. This condition represents a variance from the deterministic requirements of NFPA 805, Section 4.2.3. This is a separation issue.

This VFDR has been evaluated and it was determined that the risk, safety margin and defense-in-depth meet the acceptance criteria of NFPA 805 Section 4.2.4 with a recovery action credited and plant modifications to implement transient free areas.

**3.3.1.7 VFDR No. AA51-007**

2-MRV-213-P and 2-MRV-243-P – SG 1 and 4 PORVs are required to be closed to support main steam isolation. Main steam isolation is required to prevent uncontrolled cooldown through over-steaming. SGs 1 and 4 are not credited for decay heat removal for a fire within Fire Area AA51. 2-MRV-213-P may fail due to fire induced damage of cables 11815-2, 11916-2, 6841-2 and 9050W-2. 2-MRV-243-P may fail due to fire induced damage of cables 11838-2, 11917-2, 6842-2 and 9051W-2. Failure of these cables could spuriously open the valves. This condition represents a variance from the deterministic requirements of NFPA 805, Section 4.2.3. This is a separation issue.

This VFDR has been evaluated and it was determined that the risk, safety margin and defense-in-depth meet the acceptance criteria of NFPA 805 Section 4.2.4 with a defense-in-depth action credited and plant modifications to implement transient free areas.

**3.3.1.8 VFDR No. AA51-008**

2-MRV-223-P and 2-MRV-233-P - SG 2 and 3 PORVs are required to be closed to support main steam isolation. Main steam isolation is required to prevent uncontrolled cooldown through over-steaming. SGs 2 and 3 are credited for decay heat removal due to fire within Fire Area AA51. 2-MRV-223-P may fail due to fire induced damage of cables 11828-2, 11900-2, 18132-2 and 9050Y-2. 2-MRV-233-P may fail due to fire induced damage of cables 11829-2, 11901-2, 18133-2 and 9051Y-2. These cable failures could spuriously open the valves. This condition represents a variance from the deterministic requirements of NFPA 805, Section 4.2.3. This is a separation issue.

This VFDR has been evaluated and it was determined that the risk, safety margin and defense-in-depth meet the acceptance criteria of NFPA 805 Section 4.2.4 with a recovery action credited and plant modifications to implement transient free areas.

**3.3.1.9 VFDR No. AA51-009**

2-PP-50E and 2-PP-50W - The Unit 2 East or West Charging Pump is required to be operable to support CVCS for inventory, reactivity and pressure control and seal cooling. The Unit 2 charging pumps may fail due to a full area fire within Fire Area AA51. 2-PP-50E may fail due to fire induced damage of its power supply, cooling and cables. 2-PP-50W may fail due to fire induced damage of its power supply, cooling and cables. Failure of both Unit 2 Charging Pumps requires cross-tying to the Unit 1 Charging Pumps to provide CVCS. Cross-tying requires the operation of manual valves 2-CS-302, 2-CS-534 and 1-CS-536. This condition represents a variance from the deterministic requirements of NFPA 805, Section 4.2.3. This is a separation issue.

This VFDR has been evaluated and it was determined that the risk, safety margin and defense-in-depth meet the acceptance criteria of NFPA 805 Section 4.2.4 with a recovery action credited and plant modifications to implement transient free areas.



**3.3.1.10 VFDR No. AA51-010**

2-QRV-10, 2-QRV-20, 2-QRV-30 and 2-QRV-40 - RCP Seal Water Return Isolation Valves are required to be open to support CVCS. Seal return lines are required to be open to prevent damage to the RCP seals. Damage to the seals could result in a leak of 180 GPM. These valves are required to be open to maintain inventory and pressure control. 2-QRV-10 may fail due to fire induced damage of cable 4418-2. 2-QRV-20 may fail due to fire induced damage of cable 4955-2. 2-QRV-30 may fail due to fire induced damage of cable 5654-2. 2-QRV-40 may fail due to fire induced damage of cable 5002-2. These cable failures could spuriously close the valves. This condition represents a variance from the deterministic requirements of NFPA 805, Section 4.2.3. This is a separation issue.

This VFDR has been evaluated and it was determined that the risk, safety margin and defense-in-depth meet the acceptance criteria of NFPA 805 Section 4.2.4 with plant modifications to implement transient free areas.

**3.3.1.11 VFDR No. AA51-011**

2-ICM-250 and 2-ICM-251 – The BIT Outlet Shutoff Valves are required to be open to support Unit 2 alternate CVCS. CVCS is required to be operable to support inventory, reactivity and pressure control. The Unit 2 alternate charging flow path injects borated water from the Unit 1 RWST with the Unit 1 pumps through the Unit 2 BIT into the cold leg loops. These valves are normally closed and fail as-is on the loss of power. 2-ICM-250 may fail due to fire induced damage of 600V MCC 2-AM-D and cables 9090G-2, 9091G-2 and 9548G-2. 2-ICM-251 may fail due to fire induced damage of 600V VCC 2-AZV-A and cables 9063R-2, 9064R-2 and 9065R2. These failures could prevent the valves from opening. This condition represents a variance from the deterministic requirements of NFPA 805, Section 4.2.3. This is a separation issue.

This VFDR has been evaluated and it was determined that the risk, safety margin and defense-in-depth meet the acceptance criteria of NFPA 805 Section 4.2.4 with a recovery action credited and plant modifications to implement transient free areas.

**3.3.1.12 VFDR No. AA51-012**

2-IMO-51, 2-IMO-52, 2-IMO-53 and 2-IMO-54 - Boron Injection Line to Cold Leg Shutoff Valves are required to be open to support Unit 2 alternate CVCS. CVCS is required to support inventory, reactivity and pressure control. 1 of the 4 boron injection line valves is required to be open to support Unit 2 alternate CVCS. All 4 of the valves may fail due to a full area fire within Fire Area AA51. The Unit 2 alternate charging flow path injects borated water from the Unit 1 RWST with the Unit 1 pumps through the Unit 2 BIT into the cold leg loops. These valves are normally open and fail as-is on the loss of power. 2-IMO-51 may fail due to fire induced damage of cable 8370G-2. 2-IMO-52 may fail due to fire induced damage of cable 8372R-2. 2-IMO-53 may fail due to fire induced damage of cable 8396G-2. 2-IMO-54 may fail due to fire induced damage of cable 8314R-2. These cable failures could spuriously close the valves. This condition represents a variance from the deterministic requirements of NFPA 805, Section 4.2.3. This is a separation issue.

This VFDR has been evaluated and it was determined that the risk, safety margin and defense-in-depth meet the acceptance criteria of NFPA 805 Section 4.2.4 with plant modifications to implement transient free areas.

**3.3.1.13 VFDR No. AA51-013**

2-NRV-163 and 2-NRV-164 – Pressurizer Spray Valves are required to be closed to support RCS integrity. RCS integrity is required to maintain positive control over RCS inventory and pressure. Spurious opening of the Pressurizer Spray Valves with the RCPs running will cause a drop in RCS pressure resulting in a SI. Control Room trip of RCPs 3 and 4 may not be available due to fire induced damage of the RCP circuits within Fire Area AA51. 2-NRV-163 may fail due to fire induced damage of cables 10751-2, 10773-2, 11266-2, 8733PO-2 and 9600PY-2. 2-NRV-164 may fail due to fire induced damage of cables 10751-2, 10773-2, 11480-2, 8733PO-2 and 9600PY-2. Failure of these cables could spuriously open the valves. This condition represents a variance from the deterministic requirements of NFPA 805, Section 4.2.3. This is a separation issue.

This VFDR has been evaluated and it was determined that the risk, safety margin and defense-in-depth meet the acceptance criteria of NFPA 805 Section 4.2.4 with a recovery action credited and plant modifications to implement transient free areas.

**3.3.1.14 VFDR No. AA51-014**

2-PP-45-1, 2-PP-45-2, 2-PP-45-3 and 2-PP-45-4 – The RCPs are required to be tripped to prevent a loss of coolant accident if seal cooling and thermal barrier cooling are lost. A full area fire within Fire Area AA51 may cause the loss of seal cooling, thermal barrier cooling and Control Room trip capability of the RCPs. 2-PP-45-1 may lose Control Room trip capability due to fire induced damage of cables 10467-2 and 6783-2. 2-PP-45-2 may lose Control Room trip capability due to fire induced damage of cables 10143-2 and 4959-2. 2-PP-45-3 may lose Control Room trip capability due to fire induced damage of cables 10160-2 and 5649-2. 2-PP-45-4 may lose Control Room trip capability due to fire induced damage of cables 10485-2 and 4963-2. This condition represents a variance from the deterministic requirements of NFPA 805, Section 4.2.3. This is a separation issue.

This VFDR has been evaluated and it was determined that the risk, safety margin and defense-in-depth meet the acceptance criteria of NFPA 805 Section 4.2.4 with a recovery action credited and plant modifications to implement transient free areas.

**3.3.1.15 VFDR No. AA51-015**

2-NSO-021 and 2-NSO-022 – The RX Head Vent Valves are required to be closed to support RCS integrity. RCS integrity is required to maintain positive control over RCS inventory and pressure. 2-NSO-021 and 2-NSO-022 are in series, requiring 1 of the valves to remain closed to provide RCS integrity. 2-NSO-021 may fail due to fire induced damage of cable 9801PG-2. 2-NSO-022 may fail due to fire induced damage of cable 9807PG-2. These cable failures could spuriously open the valves. This condition represents a variance from the deterministic requirements of NFPA 805, Section 4.2.3. This is a separation issue.

This VFDR has been evaluated and it was determined that the risk, safety margin and defense-in-depth meet the acceptance criteria of NFPA 805 Section 4.2.4 with a recovery action credited and plant modifications to implement transient free areas.



**3.3.1.16 VFDR No. AA51-016**

2-NSO-023 and 2-NSO-024 – The RX Head Vent Valves are required to be closed to support RCS integrity. RCS integrity is required to maintain positive control over RCS inventory and pressure. 2-NSO-023 and 2-NSO-024 are in series, requiring 1 of the valves to remain closed to provide RCS integrity. 2-NSO-023 may fail due to fire induced damage of cable 9801PR-2. 2-NSO-024 may fail due to fire induced damage of cable 9807PR-2. These cable failures could spuriously open the valves. This condition represents a variance from the deterministic requirements of NFPA 805, Section 4.2.3. This is a separation issue.

This VFDR has been evaluated and it was determined that the risk, safety margin and defense-in-depth meet the acceptance criteria of NFPA 805 Section 4.2.4 with a recovery action credited and plant modifications to implement transient free areas.

**3.3.1.17 VFDR No. AA51-017**

2-NSO-061 and 2-NSO-062 – The Post Accident Valves are required to be closed to support RCS integrity. RCS integrity is required to maintain positive control over RCS inventory and pressure. 2-NSO-061 and 2-NSO-062 are in series, requiring 1 of the valves to remain closed to provide RCS integrity. 2-NSO-061 may fail due to fire induced damage of cable 9814PG-2. 2-NSO-062 may fail due to fire induced damage of cable 9820PG-2. These cable failures could spuriously open the valves. This condition represents a variance from the deterministic requirements of NFPA 805, Section 4.2.3. This is a separation issue.

This VFDR has been evaluated and it was determined that the risk, safety margin and defense-in-depth meet the acceptance criteria of NFPA 805 Section 4.2.4 with a recovery action credited and plant modifications to implement transient free areas.

**3.3.1.18 VFDR No. AA51-018**

2-NSO-063 and 2-NSO-064 – The Post Accident Valves are required to be closed to support RCS integrity. RCS integrity is required to maintain positive control over RCS inventory and pressure. 2-NSO-063 and 2-NSO-064 are in series, requiring 1 of the valves to remain closed to provide RCS integrity. 2-NSO-063 may fail due to fire induced damage of cable 9814PR-2. 2-NSO-064 may fail due to fire induced damage of cable 9820PR-2. These cable failures could spuriously open the valves. This condition represents a variance from the deterministic requirements of NFPA 805, Section 4.2.3. This is a separation issue.

This VFDR has been evaluated and it was determined that the risk, safety margin and defense-in-depth meet the acceptance criteria of NFPA 805 Section 4.2.4 with a recovery action credited and plant modifications to implement transient free areas.

**3.3.1.19 VFDR No. AA51-019**

2-QRV-111, 2-QRV-112, 2-QRV-160, 2-QRV-161 and 2-QRV-162– Letdown Isolation Valves are required to be closed to support CVCS isolation. CVCS isolation is required to maintain positive control over inventory and pressure. In order to achieve letdown isolation the following valves need to be closed; 2-QRV-111 or 2-QRV-112 or (2-QRV-160 and 2-QRV-161 and 2-QRV-162). All of these valves may fail due to a full area fire within Fire Area AA51. 2-QRV-111 may fail due to fire induced damage of cables 8486G-2 and 8943G-2. 2-QRV-112 may fail due to fire induced damage of cables 8467R-2 and 8947R-2. 2-QRV-160 may fail due to fire induced damage of cables 9106PG-2 and 9141G-2. 2-QRV-161 may fail due to fire induced damage of cables 8470PG-2 and 8494G-2. 2-QRV-162 may fail due to fire induced damage of cables 8473PG-2 and 8496G-2. These cable failures could spuriously open the valves. This condition represents a variance from the deterministic requirements of NFPA 805, Section 4.2.3. This is a separation issue.

This VFDR has been evaluated and it was determined that the risk, safety margin and defense-in-depth meet the acceptance criteria of NFPA 805 Section 4.2.4 with a recovery action credited and plant modifications to implement transient free areas.

**3.3.1.20 VFDR No. AA51-020**

2-BLI-120-CRI, 2-BLI-130-CRI, 2-MPP-220-CRI, 2-MPP-230-CRI, 2-NLP-151-CRI, 2-NPS-110-CRI, 2-NTR-120, 2-NTR-220 and 2- NRI-1 - Control Room process monitoring and source range monitoring may not be available due to a fire in fire Area AA51. Process monitoring is required to be available to monitor key primary and secondary parameters. Source Range is required to provide indication of fission activity to ensure sub-criticality. The instrumentation is not available within the Unit 2 Control Room due a fire within Fire Area AA51. Alternate process and source range monitoring powered from Unit 1 is required at the Unit 2 LSI panels. The LSI panels require manual actions to transfer to the Unit 1 power supply. A transfer switch at 2-LSI-6XX feeds both 1-LSI-6XX and 2-LSI-2. A transfer switch at 2-LSI-5XX feeds both 2-LSI-5XX and 2-LSI-1. A transfer switch at 2-LSI-4 feeds both 2-LSI-4 and 2-LSI-3. Local monitoring of SG 2 and 3 level indication is required at 2-LSI-2. Local monitoring of SG 2 pressure indication, RCS loop temperature and source range monitoring is required at 2-LSI-4. Local monitoring of SG 3 pressure indication is required at 2-LSI-6. Local monitoring of pressurizer level and pressure indication is required at 2-LSI-3. This set of instruments has been credited due to SGs 2 and 3 being credited for AFW. This condition represents a variance from the deterministic requirements of NFPA 805, Section 4.2.3. This is a separation issue.

This VFDR has been evaluated and it was determined that the risk, safety margin and defense-in-depth meet the acceptance criteria of NFPA 805 Section 4.2.4 with a recovery action credited and plant modifications to implement transient free areas.

**3.3.1.21 VFDR No. AA51-021**

2-NRV-151, 2-NRV-152 and 2-NRV-153 - Pressurizer PORVs are required to be closed to support RCS integrity. RCS integrity is required to maintain positive control over RCS inventory and pressure. 2-NRV-151 may fail due to fire induced damage of cables 8667R-2 and 9705PR-2. 2-NRV-152 may fail due to fire induced damage of cables 8675R-2 and 9706PR-2. 2-NRV-153 may fail due to fire induced damage of cable 8932PG-2. Failure of these cables could spuriously open the valves. This condition represents a variance from the deterministic requirements of NFPA 805, Section 4.2.3. This is a separation issue.

This VFDR has been evaluated and it was determined that the risk, safety margin and defense-in-depth meet the acceptance criteria of NFPA 805 Section 4.2.4 with a defense-in-depth action credited.

**3.3.2 Recovery Actions Credited**

For each VFDR, a Fire Risk Evaluation has been performed to assess the acceptability of risk, defense-in-depth, and safety margin. This evaluation determined whether or not recovery actions are required to ensure that one success path necessary to achieve and maintain the nuclear safety performance criteria is maintained free of fire damage by a single fire. Table 3-3 identifies the credited recovery actions for this area. Actions retained for DID are identified as “DID Actions” within Table 3-3. Additional information for DID actions is contained within Section 3.8 of this report. Note that, for completeness, all VFDRs are contained within Table 3-3, even if the Fire Risk Evaluation has determined that a recovery action is not required. In those instances where a recovery action has been determined to not be required, the word “None” is provided in the “Action” column in the table.

<b>Table 3-3, Recovery Actions Credited</b>		
<b>VFDR</b>	<b>Component</b>	<b>Action</b>
AA51-001	2-PP-3E 2-PP-3W 2-PP-4	1-FW-261-CLOSE (Close manual valve 1-FW-261)  2-FW-129-OPEN (Open manual valve 2-FW-129)
AA51-002	2-FMO-222 2-FMO-232	2-FMO-222-OPERATE (De-energize and manually operate 2-FMO-222)  2-FMO-232-OPERATE (De-energize and manually operate 2-FMO-232)
AA51-003	2-DCR-310 2-DCR-340	None

Table 3-3, Recovery Actions Credited		
VFDR	Component	Action
AA51-004	2-DCR-320 2-DCR-330	2-DCR-320-CLOSE ALT (De-energize Control Room Panel 2-CCV-AB at 2-MCAB to fail 2- DCR-320 closed)  2-DCR-330-CLOSE ALT (De-energize Control Room Panel 2-CCV-AB at 2-MCAB to fail 2- DCR-320 closed)
AA51-005	2-MRV-210 2-MRV-240	DID ACTION 2-MRV-211-OPEN (Manually open 2-MRV-211 to close valve 2-MRV-210)  or  2-MRV-212-OPEN (Manually open 2-MRV-212 to close valve 2-MRV-210)  and  2-MRV-241-OPEN (Manually open 2-MRV-241 to close valve 2-MRV-240)  or  2-MRV-242-OPEN (Manually open 2-MRV-242 to close valve 2-MRV-240)

Table 3-3, Recovery Actions Credited		
VFDR	Component	Action
AA51-006	2-MRV-220 2-MRV-230	2-MRV-221-OPEN (Manually open 2-MRV-221 to close valve 2-MRV-220)  or  2-MRV-222-OPEN (Manually open 2-MRV-222 to close valve 2-MRV-220)  and  2-MRV-231-OPEN (Manually open 2-MRV-231 to close valve 2-MRV-230)  or  2-MRV-232-OPEN (Manually open 2-MRV-232 to close valve 2-MRV-230)
AA51-007	2-MRV-213-P 2-MRV-243-P	DID ACTION 2-MRV-213-P-CLOSE (Vent air to manually close 2- MRV-213)  2-MRV-243-P-CLOSE (Vent air to manually close 2- MRV-243)
AA51-008	2-MRV-223-P 2-MRV-233-P	2-MRV-223-P-CLOSE (Manually close 2-MRV-223)  2-MRV-233-P-CLOSE (Manually close 2-MRV-233)
AA51-009	2-PP-50E 2-PP-50W	2-CS-302-CLOSE (Close manual valve 2-CS-302)  2-CS-534-OPEN (Open manual valve 2-CS-534)  1-CS-536-OPEN (Open manual valve 1-CS-536)
AA51-010	2-QRV-10 2-QRV-20 2-QRV-30 2-QRV-40	None

Table 3-3, Recovery Actions Credited		
VFDR	Component	Action
AA51-011	2-ICM-250 2-ICM-251	2-ICM-250-OPEN (De-energize and manually open 2-ICM-250)
AA51-012	2-IMO-51 2-IMO-52 2-IMO-53 2-IMO-54	None
AA51-013	2-NRV-163 2-NRV-164	2-PP-45-3-TRIP (Locally trip RCP # 3)  2-PP-45-4-TRIP (Locally trip RCP # 4)
AA51-014	2-PP-45-1 2-PP-45-2 2-PP-45-3 2-PP-45-4	2-PP-45-1-TRIP (Locally trip RCP 1)  2-PP-45-2-TRIP (Locally trip RCP 2)  2-PP-45-3-TRIP (Locally trip RCP 3)  2-PP-45-4-TRIP (Locally trip RCP 4)
AA51-015	2-NSO-021 2-NSO-022	2-NSO-021-CLOSE ALT (De-energize 2-CCV-CD at 2-MCCD to fail 2-NSO-021 closed)
AA51-016	2-NSO-023 2-NSO-024	2-NSO-023-CLOSE ALT (De-energize 2-CCV-AB at 2-MCAB to fail 2-NSO-023 closed)
AA51-017	2-NSO-061 2-NSO-062	2-NSO-061-CLOSE ALT (De-energize 2-CCV-CD at 2-MCCD to fail 2-NSO-061 closed)
AA51-018	2-NSO-063 2-NSO-064	2-NSO-063-CLOSE ALT (De-energize 2-CCV-AB at 2-MCAB to fail 2-NSO-063 closed)
AA51-019	2-QRV-111 2-QRV-112 2-QRV-160 2-QRV-161 2-QRV-162	2-QRV-111-CLOSE ALT (De-energize 2-CCV-CD at 2-MCCD to fail 2-QRV-111 closed)

Table 3-3, Recovery Actions Credited		
VFDR	Component	Action
AA51-020	2-BLI-120-CRI 2-BLI-130-CRI 2-MPP-220-CRI 2-MPP-230-CRI 2-NLP-151-CRI 2-NPS-110-CRI 2-NTR-120 2-NTR-220 2- NRI-1	2-LSI-4-ALT-PWR (Align unaffected Unit Power to LSI Panel)  2-LSI-6XX-ALT-PWR (Align unaffected Unit Power to LSI Panel)  2-LSI-2-LOCAL (Locally monitor 2-LSI-2)  2-LSI-3-LOCAL (Locally monitor 2-LSI-3)  2-LSI-4-LOCAL (Locally monitor 2-LSI-4)  2-LSI-6XX-LOCAL (Locally monitor 2-LSI-6)
AA51-021	2-NRV-151 2-NRV-152 2-NRV-153	DID ACTION(S) 2-NRV-151-CLOSE 2-NRV-152-CLOSE 2-NRV-153-CLOSE (Remove fuses in MCR to fail closed PORVs 2-NRV-151, 2-NRV-152, and 2-NRV-153)

### 3.4 Non-Power Operational Modes Compliance Summary

A review of CNP for the potential effects of a fire in this Fire Area while in non-power modes of operation (NPO) was conducted. This review was conducted using the guidance provided in NEI 04-02 and FAQ 07-0040, "Non-Power Operations Clarifications".

The review determined that there are potential failures that affect certain Key Safety Functions (KSF) as a result of the fire in this area, and the fire could result in the loss of one or more KSF paths. Compensatory measures are required during high risk evolution periods to provide reasonable assurance a fire will not adversely affect key safety functions and the NFPA 805 performance goal for NPO is therefore satisfied. The results of the NPO analysis are contained within Technical Evaluation R1900-005-001, Non-Power Operation Modes Transition Review Report.

### 3.5 Radioactive Release Compliance Summary

The NFPA 805 radiological release goal is to provide reasonable assurance that a fire will not result in a radiological release that adversely affects the public, plant personnel or the environment. The NFPA 805 requirement is to ensure a radiation release to any unrestricted area due to the direct effects of fire suppression activities (but not involving fuel damage) shall be as low as reasonably achievable and shall not exceed applicable plant Technical Specification limits.

AA51 is located outside the Radiological Controlled Area (RCA) and is not a storage location for contaminated materials, therefore there is reasonable assurance a fire in this area will not result in radiation release. The review of this fire area, with respect to radioactive release, is documented in the NFPPM.

### 3.6 Probabilistic Risk Assessment-Summary of Results

A Fire PRA (FPRA) quantification of Fire Area AA51 was performed and is documented in PRA-NB-FIRE-FQ, Fire PRA Model Quantification Notebook. The fire risk quantification for Fire Area AA51 is analyzed using detailed fire modeling to consider risk of fire scenarios of ignition sources. PRA-NB-FIRE-FQ includes a summary of all potentially risk-significant fire scenarios (i.e., CDF > 1.0E-7 or LERF > 1.0E-8). Bounding CDF / LERF per calendar year values are reported that are based on the risk values documented in PRA-NB-FIRE-FSS, Fire PRA Fire Scenario Selection.

Transient combustible and hot work free zones were credited in the FPRA for this fire area.

Fire Protection features credited in the Fire PRA are documented in R1900-0411-AA51, Detailed Fire Modeling Report: Fire Compartment: AA51 Unit 2 Control Room Cable Vault and Hot Shutdown Panel Area (EL. 624 FT and 633 FT). PRA-NB-FIRE-FSS documents the revision level of the fire modeling reports used in the most recent Fire PRA quantification.

### 3.7 Risk-Informed, Performance-Based Evaluations

Fire Risk Evaluations (FREs) have been performed to ensure that variances from the NFPA 805 deterministic requirements are acceptable. The evaluation process consists of an integrated assessment of the acceptability of risk, defense-in-depth, and safety margins.

#### 3.7.1 Transition Risk-Informed, Performance-Based Evaluations

The 'changes' associated with NFPA 805 transition were those variances from the deterministic requirements of NFPA 805 or with the existing fire protection licensing basis that were brought into compliance with the NFPA 805 performance based approach. The change identified for evaluation for Fire Area AA51 is as follows:

- Separation Issues

The Fire Risk Evaluation has determined that the change is acceptable based upon:

- The measured change in CDF and LERF.
- Adequate defense-in-depth and safety margins being maintained.

Refer to Attachment 2 for a summary of results associated with the Fire Risk Evaluations.



### 3.8 Defense-in-Depth

A comprehensive risk-informed, performance-based analysis includes consideration of defense-in-depth (DID) as part of an integrated evaluation of risk considerations. In general, defense-in-depth involves consideration of the extent to which fire protection systems and features are provided within the three echelons of fire-protection:

- Preventing fires from starting,
- Rapidly detecting fires and controlling and extinguishing promptly those fires that do occur, thereby limiting fire damage,
- Providing an adequate level of fire protection for structures, systems, and components important to safety, so that a fire that is not promptly extinguished will not prevent the nuclear safety performance criteria from being met.

Each VFDR was evaluated for DID. The following recovery actions have been retained for DID.

VFDR No. AA51-005: 2-MRV-210 and 2-MRV-240 – The SG 1 and 4 Main Steam Stop Valves are required to be closed to support main steam isolation. Main steam isolation is required to prevent the uncontrolled cooldown through over-steaming. Failure of the MSSV dump valves for both 2-MRV-210 and 2-MRV-240 may cause the inability to close the valves. These failures can be mitigated by manually opening the MSSV dump valves. These recovery actions are being retained for DID to ensure main steam isolation is maintained.

VFDR No. AA51-007: 2-MRV-213-P and 2-MRV-243-P - SG 1 and 4 PORVs are required to be closed to support main steam isolation. Main steam isolation provides integrity of the secondary side of the SGs to prevent uncontrolled cooldown through over-steaming. SG 1 and 4 PORVs could spuriously open due cable failures cause by a full area fire within Fire Area AA51. These failures can be mitigated by locally venting air to close to the SG 1 and 4 PORVs. This recovery action is being retained for DID to ensure main steam isolation is maintained.

VFDR No. AA51-021: 2-NRV-151, 2-NRV-152 and 2-NRV-153 - Pressurizer PORVs are required to be closed to support RCS integrity. RCS integrity is required to maintain positive control over RCS inventory and pressure. The spurious opening can be mitigated by de-energizing the valve to fail it closed. This recovery action is being retained for DID to ensure RCS pressure and inventory control is maintained.

Based on the assessment in support of the Fire Risk Evaluation, defense-in-depth is maintained for fire area AA51. Refer to Attachment 2 for details associated with the Fire Risk Evaluation.

### 3.9 Monitoring Program Input

A Monitoring Program will be developed in accordance with FAQ 10-0059, Rev. 1. Methods to monitor availability, reliability, and performance of fire protection program structures, systems, and components (SSCs), as well as programmatic elements will be provided. Additionally, effectiveness measures are established to review program related performance and trends. For AA51 the following systems and features are candidates for inclusion in the CNP Fire Protection Monitoring Program:

- Fire Area boundary barriers discussed in Section 3.1
- Fire Detection System
- Fire Suppression System (Halon)
- Transient Combustible and Hot Work Free Zone

- Cable tray covers

#### 4.0 CONCLUSION

The nuclear safety and radioactive release performance criteria of NFPA 805 are met for a fire in Fire Area AA51. This Fire Risk Evaluation for Fire Area AA51 has demonstrated that

- The change in core damage frequency (delta CDF) is acceptable, and
- The change in large early release frequency (delta LERF) is acceptable, and
- Defense-in-depth and safety margins are maintained.

This is confirmation that a success path effectively remains free of fire damage and that the performance-based approach is acceptable per Section 4.2.4.2 of NFPA 805.

#### 5.0 REFERENCES

- 5.1 Calculation PRA-FIRE-NB-CRE, Fire PRA Cumulative Risk Evaluations
- 5.2 CNP Fire Pre-Plans, Volumes I, II, and III, Revisions 17, 14, and 18 respectively
- 5.3 Fire Hazards Analysis
- 5.4 NFPA 805, Performance-Based Standard for Fire Protection for Light Water Reactor Electric Generating Plants
- 5.5 NFPPM, NFPA 805 Fire Protection Program Manual (NFPPM)
- 5.6 Nuclear Energy Institute (NEI) 04-02, Guidance for Implementing a Risk-Informed, Performance-Based Fire Protection Program under 10 CFR 50.48(c), Rev. 2
- 5.7 Nuclear Safety Capability Assessment Report
- 5.8 PRA-NB-FIRE-FQ, Fire PRA Model Quantification Notebook
- 5.9 PRA-NB-FIRE-FSS, Fire PRA Fire Scenario Selection
- 5.10 R1900-0411-AA52, AA52 - Detailed Fire Modeling Report
- 5.11 Regulatory Guide 1.205, Risk-Informed, Performance-Based Fire Protection for Existing Light-Water Nuclear Power Plants, Rev. Revision 1
- 5.12 Technical Evaluation R1900-005-001, Non-Power Operation Modes Transition Review

**Fire Area AA51 – Attachment 1 - Table B-3 - Fire Area Transition**

<u>Unit</u>	<u>Fire Area</u>	<u>Description</u>
2	AA51	Unit 2 Control Room Cable Vault and Hot Shutdown Panel Area (El 624 ft. and 633 ft.)

**Fire Zone   Description**

58	Control Room Cable Vault - El. 624 ft. 0 in. - Unit 2
145	Unit 2 Hot Shutdown Panel Enclosure - El. 633 ft. 0 in.

**Regulatory Basis**

4.2.4.2 - Performance-Based Approach - Fire Risk Evaluation with simplifying deterministic assumptions

<b>Performance Goal</b>	<b>Method of Accomplishment</b>	<b>Comments</b>
Reactivity Control	Unit 2 - Trip the reactor from the Control Room. Borate using Unit 1 East or West Charging Pump supplied from the Unit 1 RWST. Use source range monitoring for indication at the LSI panel.	None
Inventory and Pressure Control	Unit 2 - Control inventory using Unit 1 East or West Charging Pump. Control pressure using Unit 2 Pressurizer Safety Relief Valves.	VFDRs identified for CVCS and RCS integrity.
Decay Heat Removal	Unit 2 - Feed SGs 2 & 3 with Unit 1 West MDAFW Pump. The DHR function also requires MS isolation with a steam release path through the Safety Relief Valves.	VFDRs identified for AFW and MS isolation.
Process Monitoring	Unit 2 Process Monitoring - Use Unit 2 alternate process monitoring powered from Unit 1 at the local shutdown panels for the following: Pressurizer level, RCS pressure and temperature, and S/G level and Pressure. Unit 2 Source Range Monitoring - Use Unit 2 alternate source range monitoring powered from Unit 1 at the local shutdown panels.	VFDRs identified for process and source range monitoring.
Vital Auxiliaries	Unit 2 Electrical - Control Unit 1 Red (AB) Train Electrical Distribution with Unit 1 Red (AB) DG. Control Unit 1 Green (CD) Train Electrical Distribution with Unit 1 Green (CD) DG. Unit 2 ESW - Operate Unit 1 East or West ESW to provide cooling to the Unit 1 CCW Heat Exchangers and the Unit 1 Red (AB) and Green (CD) DGs for alternate shutdown for Unit 2. Unit 2 CCW - Operate Unit 1 East or West CCW to provide cooling to the Unit 1 Charging Pumps for alternate shutdown for Unit 2. Unit 2 HVAC - Unit 2 Control Room HVAC is not required as alternate	Unit 1 vital auxiliaries are credited to support Unit 1 equipment that is crosstied to Unit 2.

**Fire Area AA51 – Attachment 1 - Table B-3 - Fire Area Transition**

<u>Unit</u>	<u>Fire Area</u>	<u>Description</u>
2	AA51	Unit 2 Control Room Cable Vault and Hot Shutdown Panel Area (EI 624 ft. and 633 ft.)

shutdown is utilized for this area. Unit 2 Auxiliary Building HVAC is not operational, Unit 1 Auxiliary Building HVAC remains available and provides adequate cooling. Operate Unit 1 Red (AB) and Green (CD) DG HVAC. Operate Unit 1 Red (AB) and Green (CD) Switchgear HVAC. Operate Unit 1 West MDAFW Room HVAC system. Operate the Unit 1 East and West ESW Room HVAC system.

**Reference Documents**

Genesis Solution Suite, EDISON / SAFE-PB, DC Cook V 3.4.0

Nuclear Safety Capability Assessment Report

**Licensing Actions**

None

**Existing Engineering Equivalency Evaluations (EEEE)****EEEE Title Engineering Equivalency Evaluation 9-17 - Fire Zone 54 (Fire Area AA47) and Fire Zone 58 (Fire Area AA51) Hatch Evaluation**

**Summary** The purpose of this engineering equivalency evaluation is to document the acceptability of an unrated steel plate hatch located between the Unit 2 Control Room and the Unit 2 Control Room Cable Vault in Fire Zones 54 (Fire Area AA47) and Fire Zone 58 (Fire Area AA51) respectively. A 3-hr fire-rated hatch assembly is not commercially available for use in this location.

Note: This engineering equivalency evaluation has been reviewed by the NRC. Refer to NRC SER dated June 17, 1988, for acceptance of unrated fire hatches in fire area boundaries. The NRC concluded that the level of fire safety is equivalent to that achieved by conformance with the guidelines of Section D.1.j of Appendix A to BTP APCSB 9.5-1, and, therefore, the deviations for the unrated fire hatches were found acceptable.

Reasonable assurance is provided that a fire in Fire Zone 54 or Fire Zone 58 would not impair the safe shutdown capabilities of Unit 2 or impact on the fixed suppression exemption request for Fire Zone 54. This engineering equivalency evaluation does not adversely impact other engineering equivalency evaluations.

The hatch was evaluated and found to be acceptable based on the fire hazards, fire protection systems and construction features within the evaluated areas.

**Fire Area AA51 – Attachment 1 - Table B-3 - Fire Area Transition**

<u>Unit</u>	<u>Fire Area</u>	<u>Description</u>
2	AA51	Unit 2 Control Room Cable Vault and Hot Shutdown Panel Area (EI 624 ft. and 633 ft.)

**EEEE Title Engineering Equivalency Evaluation 11-9 - Turbine, Auxiliary and Containment Buildings Boundary Evaluation**

**Summary** The purpose of this engineering equivalency evaluation is to describe in general, the approach and existence of evaluations performed to determine and reconcile fire area boundaries having components or designs with less than a 3-hr fire rating on preventing the spread of fire. This engineering equivalency evaluation also specifically evaluates the impact of unrated door assemblies on the spread of fire.

Reasonable assurance is provided that the fire area boundaries having components or design less than a 3-hr fire rating will not increase the spread of fire or impair the safe shutdown capabilities of Units 1 or 2. In addition, this engineering equivalency evaluation does not adversely impact on other engineering equivalency evaluations or exemption requests.

This evaluation supports additional evaluations credited in this fire area.

**EEEE Title Engineering Equivalency Evaluation 11-14 - Cable Spreading Room Construction Boundary Evaluation (Fire Areas AA3, AA7, AA8, AA9, AA10, AA29, AA30, AA31, AA34, AA35, AA36/42, AA37, AA38, AA48, AA50, AA51 and AA52)**

**Summary** The purpose of this engineering equivalency evaluation is to document the acceptability of the construction features of the cable spreading rooms which have a fire resistance rating of less than 3 hours for their impact on the spread. In particular, fire dampers having a 1 1/2-hr fire rating were analyzed by this evaluation. Other unrated construction features have been previously analyzed under separate engineering equivalency evaluations. The applicable fire areas include: AA3, AA7, AA8, AA9, AA10, AA29, AA30, AA31, AA34, AA35, AA36/42, AA37, AA38, AA48, AA50, AA51 and AA52.

Reasonable assurance is provided that the construction features of the cable spreading rooms which have a fire resistance rating of less than 3 hours will prevent the spread of fire and not impair the safe shutdown capabilities of Unit 1 and Unit 2. In addition, this engineering equivalency evaluation does not adversely impact other engineering equivalency evaluations.

The construction features of the cable spreading room were evaluated and found to be acceptable based on the fire hazards, fire protection systems and construction features within the areas.

**Fire Area AA51 – Attachment 1 - Table B-3 - Fire Area Transition**

<u>Unit</u>	<u>Fire Area</u>	<u>Description</u>
2	AA51	Unit 2 Control Room Cable Vault and Hot Shutdown Panel Area (EI 624 ft. and 633 ft.)

<b><u>EEEE Title</u></b>	<b>Engineering Equivalency Evaluation 11-36 - Unit 1 and Unit 2 Hot Shutdown Panel Enclosure: Unit 1 Fire Zone 144 (Fire Area AA50) and Unit 2 Fire Zone 145 (Fire Area AA51)</b>
<b><u>Summary</u></b>	<p>The purpose of this engineering equivalency evaluation is to document the acceptability that deviations to the 3-hr fire rating of the Unit 1 and Unit 2 Hot Shutdown Panel (HSDP) enclosures (Fire Zone 144 for Unit 1 and Fire Zone 145 for Unit 2) would have on preventing the spread of fire. This engineering equivalency evaluation evaluates the ability of the existing structure to provide adequate separation of the HSDPs from their opposite unit's control room. In addition to the reduction of the roof/ceiling assembly fire rating from 3 hours to a nominal 2 hours (2 hours and 12 minutes), this engineering equivalency evaluation reviews the roll-up fire door installation and the protective design for the columns.</p> <p>Reasonable assurance is provided that the deviation from providing a 3-hr rated enclosure for each of the HSDPs will not impair the safe shutdown capabilities of CNP or increase the potential for spread of fire between the HSDP enclosures (Fire Zones 144 and 145) and the control rooms (Fire Zones 53 and 54) in which they are located.</p> <p>The HSDPs were evaluated and found to be acceptable based on the fire hazards, fire protection systems and construction features within the evaluated areas. Also, some areas being evaluated are continuously manned.</p>
<b><u>EEEE Title</u></b>	<b>Engineering Equivalency Evaluation 11-58 - Unit 2 Control Room Fire Rated Floor Penetration Seals Fire Zones 54 (Fire Area AA47) and 58 (Fire Area AA51)</b>
<b><u>Summary</u></b>	<p>The purpose of this engineering equivalency evaluation is to document the acceptability of the installation of plastic sleeves in the Unit 2 Control Room fire-rated floor penetration seals F-6894, F-6895, F-6896, F-6897, F-6898, F-6899, F-6900, F-6901, F-6902, F-6903, F-6904, F-6906, F-6907, F-6909, and F-6010.</p> <p>Consistent with the defense-in-depth philosophy and fire protection features described in the FSA, expansion characteristics of silicone foam and requirement of Main Control Room evacuation in a fire event the discrepancy noted in this evaluation for the subject seals will have no impact on the ability to safely shutdown CNP in a fire event.</p> <p>The plastic sleeves were evaluated and found to be acceptable based on the fire hazards, fire protection systems and construction features within the evaluated areas. Also, one of the areas being evaluated is continuously manned.</p>

**Fire Area AA51 – Attachment 1 - Table B-3 - Fire Area Transition**

<b><u>Unit</u></b>	<b><u>Fire Area</u></b>	<b><u>Description</u></b>
2	AA51	Unit 2 Control Room Cable Vault and Hot Shutdown Panel Area (EI 624 ft. and 633 ft.)

<b><u>EEEE Title</u></b>	<b>Engineering Equivalency Evaluation 11-80 - Fire Zone 54 (AA47) And Fire Zone 58 (AA51) Fire Barrier Penetration Seals</b>
<b><u>Summary</u></b>	<p>The purpose of this evaluation is to document the acceptability of fire barrier penetration seals in the floor of the Unit 1 Control Room that have been identified with a fire seal depth below the minimum depth required per ES-FIRE-0601-QCF, Engineering Specification for Fire Rated Seals, for a three hour fire seal.</p> <p>Floor fire seals with less than the required fire seal depth are acceptable as is and reasonable assurance is provided that a fire in Fire Zone 54 (AA47) or Fire Zone 58 (AA51) would not impair the ability of CNP to reach and maintain a safe and stable hot standby. In addition, this evaluation does not impact other evaluations.</p> <p>The fire rated penetration seals were evaluated and found to be acceptable based on the fire hazards, fire protection systems, and transient combustible and hot work restrictions within the evaluated areas, as well as the identical response for fire safe shutdown required by procedures for the evaluated areas.</p>
<b><u>EEEE Title</u></b>	<b>Engineering Equivalency Evaluation 12-19 - CO2 Fire Suppression System Concentrations (Fire Areas AA7, AA8, AA9, AA10, AA29, AA30, AA31, AA37, AA38, AA39, AA40, AA41, AA43, AA44, AA45, AA48, AA49, AA50, AA51, AA52 and AA53)</b>
<b><u>Summary</u></b>	<p>The purpose of this engineering equivalency evaluation is to document the acceptability of the CO2 fire suppression systems in fire zones containing concentrations of cable insulation and the potential for deep-seated fires. This engineering equivalency evaluation determines the CO2 system's impact on the spread of fire and previous engineering equivalency evaluations and exemption requests. Although there are other fire zones that use CO2 for fire suppression such as the DG Rooms, they are installed to suppress surface-type, combustible liquid fires and are not included in this analysis, because they do not contain significant concentrations of cable insulation capable of producing deep-seated fires.</p> <p>All of the CO2 systems included in this engineering equivalency evaluation are capable of performing their intended function, containing the fire until the Fire Brigade arrives, preventing fire spread to adjacent fire zones, and ensuring that safe shutdown of CNP can be achieved and maintained.</p> <p>The existing suppression systems were evaluated and found to be acceptable based on the fire hazards and fire protection systems within the evaluated areas.</p>

**Fire Area AA51 – Attachment 1 - Table B-3 - Fire Area Transition**

<u>Unit</u>	<u>Fire Area</u>	<u>Description</u>
2	AA51	Unit 2 Control Room Cable Vault and Hot Shutdown Panel Area (EI 624 ft. and 633 ft.)

**Fire Suppression Effects on Nuclear Safety Performance Criteria**

The CNP fire brigade is trained to discharge water in a judicious manner and instructed to direct hose streams and portable extinguishers at the base of the fire to limit the amount of overspray beyond the immediate fire zone. For this reason, fire brigade activities are not expected to fail components not already considered damaged by fire. It has been concluded that water impingement on cables is not a concern. Since this fire area has no equipment targets, in the event of discharge, the automatic suppression system will not create additional failures to cables and conduit. The drainage features of the fire area mitigate the potential for flooding damage due to fire suppression, such that the standing water would not affect credited equipment.

Since it is shown that suppression effects will not impact the nuclear safety performance criteria, the fire area configuration is deemed acceptable.

References:

Technical Evaluation 12.1, "Fire Suppression Effects Study"

Technical Evaluation 12.1, "Supplemental Information to Fire Suppression Effects Study – Supplement 1"

**Fire Area Comments**

Revise time requirement \ time basis per AR 2015-14147 for VFDR AA51-013 and AA51-014.



## Fire Area AA51 – Attachment 2 - Fire Risk Evaluation Results Summary

### A2.1 Introduction

The ‘changes’ associated with NFPA 805 transition were those variances from the deterministic requirements of NFPA 805. The changes identified for evaluation for fire area AA51 are grouped as follows:

- Separation Issues

This attachment is a summary of the Fire Risk Evaluation for the fire area. The complete results and methodology are contained in the Cumulative Fire Risk Evaluation, PRA-FIRE-NB-CRE. (FPCE 2017-0009)

### A2.2 Inputs/Assumptions

Fire modeling processes and inputs provided in NUREG/CR-6850 are appropriate for use in a risk-informed, performance-based evaluation. The complete list of assumptions used in the fire modeling methodology for this fire area is contained in Detailed Fire Modeling Technical Evaluation R1900-0411-AA51.

### A2.3 Fire Modeling Methodology

Fire PRA fire modeling results are used as the initial input into this Fire Risk Evaluation. The process consists of conservative bounding analyses using NUREG/CR-6850 methods. As needed, refinements are made to utilize more realistic parameters. The complete fire modeling methodology for this fire area is contained in Detailed Fire Modeling Technical Evaluation R1900-0411-AA51.

### A2.4 Scenario Descriptions and Model Results

Fire Area AA51 was evaluated for the impact of fires originating from transient ignition sources only. Complete descriptions of each fire scenario is contained within the Detailed Fire Modeling Technical Evaluation R1900-0411-AA51.

#### A2.4.1 Ignition Sources

Fire Area AA51 does not contain any fixed ignition sources. The 98th percentile HRR was used for all transient fires. The 98th percentile HRR bounds the possible transient ignition sources expected for this fire area, which were fire tested and identified in NUREG/CR-6850, Appendix G, Table G-7. For transient scenarios, this fire area was analyzed as a combustible and hot work free zone.

#### A2.4.2 Scenario Results

A delta risk calculation has been performed to quantify the risk associated with the VFDRs in the fire area.

### A2.5 Fire Risk Evaluation Results

PRA-FIRE-NB-CRE documents scenarios and corresponding impacted VFDRs that were evaluated for delta risk during the transition to NFPA 805 and also all changes to the Fire Protection Program that are currently incorporated into the Fire PRA model. The acceptability of the Cumulative Fire Risk Evaluations was based on calculated delta risk meeting the thresholds of NEI 04-02, RG 1.205 and RG 1.174. (FPCE 2017-0009)

## Fire Area AA51 – Attachment 2 - Fire Risk Evaluation Results Summary

### A-2.6 Impact of VFDR on Defense-in-Depth

Defense-in-Depth has been evaluated for this fire area. The impacts of this evaluation are summarized in the table below:

Defense-in-Depth Impact Review for AA51			
Method of Providing DID	Required to Support Deterministic Analysis or Fire PRA?	Changes or Improvements Necessary for DID?	Basis/Justification
<b>Echelon 1: Prevent fires from starting</b>			
Combustible Control is implemented in accordance with Procedure PMP-2270-CCM-001, Control of Combustible Materials.	Yes	No	• This element is adequate based on no perceived weakness of, or over-reliance on, another echelon of defense-in-depth.
Hot Work Control is implemented in accordance with Procedure PMP-2270-WBG-001, Welding, Burning and Grinding Activities.	Yes	No	• Hot work is prohibited in this area during plant operation.
<b>Echelon 2: Rapidly detect, control and extinguish promptly those fires that do occur thereby limiting fire damage</b>			
Fire Detection System	Yes	No	• Although fire fighting activities may be challenging, suppression and detection are provided throughout the fire area and therefore no changes or improvements to Echelon 2 attributes are necessary to maintain defense-in-depth.
Fixed Fire Suppression	Yes	No	
Portable Fire Extinguishers	Yes	No	
Hose stations and hydrants	Yes	No	
Pre-Fire Plan	Yes	No	

**Fire Area AA51 – Attachment 2 - Fire Risk Evaluation Results Summary**

<b>Defense-in-Depth Impact Review for AA51</b>			
<b>Method of Providing DID</b>	<b>Required to Support Deterministic Analysis or Fire PRA?</b>	<b>Changes or Improvements Necessary for DID?</b>	<b>Basis/Justification</b>
<b>Echelon 3: Provide adequate level of fire protection for systems and structures so that a fire will not prevent essential safety functions from being performed</b>			
Walls, floors ceilings and structural elements are rated or have been evaluated as adequate for the hazard.	Yes	No	<ul style="list-style-type: none"> <li>• There are significant modeling differences between the Fire PRA and nuclear safety capability assessment (i.e., due to different success criteria, end states, etc.) and therefore recovery actions for VFDR AA51-005 and AA51-007 have been credited to ensure that defense-in-depth is maintained.</li> <li>• Where a variance can possibly be affected in a potentially high risk scenario, based on a detailed review, the VFDR is either not the cause for the high risk of the scenario or the mitigating recovery action is credited; therefore no changes or improvements to Echelon 3 attributes are necessary to maintain defense-in-depth.</li> </ul>
Penetrations in the fire area barrier are rated or have been evaluated as adequate for the hazard.	Yes	No	<ul style="list-style-type: none"> <li>• Defense in Depth actions were credited to remove fuses in the Control Room to prevent spurious equipment operation due to internal shorts.</li> </ul>
Supplemental barriers (e.g., ERFBS, cable tray covers, etc.)	Yes	No	
Guidance provided to operations personnel detailing the required success path(s) including recovery actions to achieve nuclear safety performance criteria.	Yes	Yes	<ul style="list-style-type: none"> <li>• Cable tray covers are credited in the detailed fire modeling to reduce fire spread and target damage, and, are therefore, credited for defense-in-depth.</li> </ul>

## Fire Area AA51 – Attachment 2 - Fire Risk Evaluation Results Summary

### A-2.7 Safety Margin Considerations

In accordance with NEI 04-02, the maintenance of adequate Safety Margin is assessed by the consideration categories of analyses utilized by this Fire Risk Evaluation.

Safety margins are considered to be maintained if:

- Codes and Standards or their alternatives accepted for use by the NRC are met.

AND

- Safety analyses acceptance criteria in the licensing basis (e.g., FSAR, supporting analyses) are met, or provides sufficient margin to account for analysis and data uncertainty.

The following summarizes the bases for ensuring the maintenance of safety margins:

- The risk-informed, performance based processes utilized are based upon NFPA 805, 2001 edition, endorsed by the NRC in 10 CFR 50.48(c).
- The Fire Risk Evaluation process is in accordance with NEI 04-02, Revision 2, which is endorsed by the NRC in Regulatory Guide 1.205, Revision 1.
- The Fire PRA is developed in accordance with NUREG/CR-6850, which was developed jointly between the NRC and EPRI.
- The Fire PRA has undergone an industry peer review, in order to ensure the Fire PRA meets the appropriate quality standards of ASME/ANS RA-Sa-2009, "Standard for Level 1/Large Early Release Frequency Probabilistic Risk Assessment for Nuclear Power Plant Applications," Dated February 2, 2009
- The "combined analysis approach" is used during transition (NEI 04-02, Section 5.3.4.3); therefore, MEFS/LFS is not analyzed separately from the Fire PRA results.
- The CNP internal events PRA model received two formal industry peer reviews conducted in accordance with applicable NEI guidelines. The initial peer review was performed in 2001, while a subsequent focused scope (i.e., limited scope) peer review was conducted in 2009. The initial, full-scope WOG peer review covered all aspects of the CNP PRA model and the administrative processes used to maintain and update the model. The CNP PRA model has been revised to address all significant issues (i.e., Category A and B Facts & Observations) identified during the initial peer review. None of the findings from the focused-scope peer review were judged to reach the significance level of a Category A or B Fact & Observation; as a result, no changes to the PRA model have yet been made to include resolutions for these latter issues.
- Fire protection systems and features determined to be required by NFPA 805 Chapter 4 have been confirmed to meet the requirements of NFPA 805 Chapter 3 and their associated referenced codes and listings, or provided with acceptable alternatives using processes accepted for use by the NRC (i.e., FAQ 06-0008, FAQ 06-0004, 07-0033).
- Fire modeling performed in support of the transition has been performed within the Fire PRA utilizing codes and standards developed by industry and NRC staff which have been verified and validated in authoritative publications, such as NUREG 1824, "Verification and Validation of Selected Fire Models for Nuclear Power Plant Applications". In general, the fire modeling performed in support of the Fire Risk Evaluations has been performed using conservative methods and input parameters that are based upon

### Fire Area AA51 – Attachment 2 - Fire Risk Evaluation Results Summary

NUREG/CR-6850 as documented in the AA51 Detailed Fire Modeling Report, section 7.2. While this is generally not ideal in the context of best estimate probabilistic risk analysis, it is a pragmatic approach given the current state of knowledge regarding the uncertainties related to the application of the fire modeling tools and associated input parameters for specific plant configurations.

- In accordance with the requirements of 10 CFR 50.48(c)(2)(iii), the Fire PRA results, including cutsets for the scenarios of concern, have been reviewed and it was verified that the results presented above do not rely solely on feed and bleed as the fire-protected safe shutdown path for maintaining reactor coolant inventory, pressure control, and decay heat removal capability for this fire area.

#### A-2.8 Transition Risk Evaluation Conclusions

The transition change evaluation determined that these changes:

- Are acceptable based upon the measured change in CDF and LERF
- Maintained adequate defense-in-depth and safety margins

The results of this evaluation meet the requirements of NFPA 805 Risk Evaluation; therefore, the use of the performance based analysis approach is acceptable.

## D. C. Cook Nuclear Plant Fire Safety Analysis

## Fire Area: AA52

Unit 2 Switchgear Room Cable Vault and Auxiliary Cable Vault (El. 625 ft. 10 in. and 620 ft. 6 in.)

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## Attachments

Fire Area AA52 – Attachment 1 - Table B-3 - Fire Area Transition

## Fire Area AA52 – Attachment 2 - Fire Risk Evaluation Results Summary

## 1.0 PURPOSE

This report documents the Fire Safety Analysis (FSA) for Cook Nuclear Plant (CNP) Fire Area AA52, Unit 2 Switchgear Room Cable Vault and Auxiliary Cable Vault (El. 625 ft. 10 in. and 620 ft. 6 in.) which comprises fire zone(s) 59, 60. The purpose of this analysis is to demonstrate the achievement of the nuclear safety and radioactive release performance criteria of NFPA 805 as required by 10 CFR 50.48(c). The Fire Safety Analysis is a key part of compliance with Section 2.7.1.2 Fire Protection Program Design Basis Document of NFPA 805. This analysis also documents results of risk-informed, performance-based Fire Risk Evaluations (FREs). These evaluations are associated with Variances from Deterministic Requirements (VFDRs) of NFPA 805 Chapter 4.

## 2.0 ANALYSIS METHODOLOGY

The FSA is the design basis document as described in NFPA 805 Section 2.7.1.2. The following steps are performed to develop the FSA on a fire area basis:

- Identify significant fire hazards in the fire area. This is based on NFPA 805 approach to analyze the plant from an ignition source and fuel package perspective.
- Summarize Nuclear Safety Capability Analysis (NSCA) compliance strategies. This is the result of the NEI 04-02 B-3 Table review of the Safe Shutdown Analysis.
- Summarize Non-Power Operations Modes compliance strategies.
- Summarize Radioactive Release compliance strategies. The transition review process required per NEI 04-02 is used to develop these results.
- Provide Fire Probabilistic Risk Assessment summary of results. This is based on the results from the plant Fire PRA.
- Perform risk informed, performance based evaluations if needed for the performance based approach.
- Summarize Defense-in-Depth strategy for each fire area.
- Determine key analysis assumptions which are candidates to be included in the NFPA 805 monitoring program.
- Provide conclusions relative to NFPA 805 compliance.

## 3.0 ANALYSIS

### 3.1 Classical Fire Protection

#### 3.1.1 Construction

Walls, floors and ceilings to adjacent fire areas are reinforced concrete in excess of a 3-hour rating.

In Fire Zone 59, a fire area boundary evaluation was performed for the construction features (i.e. an unrated steel plate floor hatch, fire dampers having a 1 1/2-hour fire rating, and silicone foam fire seals) of the cable spreading rooms that have a fire resistance rating of less than 3 hours (Engineering Equivalency Evaluations 9-14, 11-4, and 11-14).

In Fire Zone 60, walls to the CD Battery Room, Panel Area and Charger Room are reinforced concrete in excess of a 3-hour rating. Air handling ducts passing through this fire zone to the roof are enclosed in 4-hour rated concrete block. An unrated wall constructed of 1-inch marine board and steel framing provides a corridor to the Battery and Charger Rooms and provides separation from the rest of the cable spreading area.

Applicable Engineering Equivalency Evaluations are documented in Attachment 1.

#### 3.1.2 Doors and Access Openings

Three-hour doors are provided in all boundary walls.

In Fire Zone 59, a fire area boundary evaluation was performed for an unrated ceiling hatch to Fire Area AA3 - Fire Zone 52 (Engineering Equivalency Evaluation 9-18). The only access to this fire zone is by the ceiling hatch from Fire Area AA3 - Fire Zone 52.

In Fire Zone 60, a fire area boundary evaluation was performed for unrated floor hatches to Fire Area AA43 and AA45A - Fire Zones 45 and 47B, respectively (Engineering Equivalency Evaluations 9-19 and 9-20). A fire door having a 3-hour rating is provided at the stairway to adjacent Fire Area AA43 - Fire Zone 45. Fire doors having a 3-hour rating are provided to the CD Battery Room and between the panel area and cable spreading area.

#### 3.1.3 Penetrations

In Fire Zone 59, penetrations in fire barriers between this fire zone and adjacent fire areas are provided with fire seals.

In Fire Zone 60, penetrations in fire barriers between this fire zone and adjacent fire areas are provided with fire seals. Additionally, fire seals are provided for penetrations in the interior walls of the Charger Room, CD Battery Room, Panel Room and Stairway. Also fire seals are provided in the south and east exterior walls. A fire area boundary evaluation was performed for the unrated fire barrier penetrations between Fire Area AA43 - Fire Zone 45, Fire Area AA44 - Fire Zones 46A, 46B, 46C, 46D, Fire Area AA45A - Fire Zones 47A, Fire Area AA45B - Fire Zone 47B and Fire Area AA52 - Fire Zone 60 (Engineering Equivalency Evaluation 11-6).

A fire area evaluation was prepared to evaluate a fire seal design between Fire Area AA43 - Fire Zone 45 and Fire Area AA52 - Fire Zone 60 (Engineering Equivalency Evaluation 11-28).



Seismic gaps are sealed with a glass fiber reinforced silicone sheeting.

### 3.1.4 Detection

The table below outlines the fire detection system(s) provided in the Fire Area:

Table 3-1, Fire Area AA52 Detection Systems									
Fire Zone	Type of System	Local (L) / Remote (R)	Detection Actuates Suppression?	Required System?					
				S	L	E	R	D	
59	Ionization	L/R	Y	N	N	Y	Y	N	
60	Infrared	L/R	Y	N	N	Y	Y	N	
60	Ionization	L/R	Y	N	N	Y	Y	N	

Table 3-1 Legend:	
Table Field: "Required System?"	
S	- Required for Chapter 4 Separation Criteria
L	- Required for NRC Approved Licensing Action
E	- Required for Engineering Equivalency Evaluation
R	- Required for Risk Significance
D	- Required to maintain adequate balance of Defense-in-Depth in a Change Evaluation or Fire Risk Evaluation

For Fire Zone 59, six ionization detectors are provided which alarm in the Unit 2 Control Room.

For Fire Zone 60, cross zoned ionization smoke detectors (22) and infra-red flame detectors (10) are provided which alarm in the Unit 2 Control Room. The infra-red flame detectors annunciate in the Control Room on 2 separate circuits. No infra-red flame detectors are located in the CD Battery Room.

### 3.1.5 Fixed Suppression

The table below outlines the fixed fire suppression system(s) provided in the Fire Area:

Table 3-2, Fire Area AA52 Suppression Systems								
Fire Zone	Type of System	Full (F) / Partial (P)	Required System?					
			S	L	E	R	D	
59	Automatic CO2	F	N	N	Y	Y	N	
60	Automatic CO2	P	N	N	Y	Y	N	
Table 3-2 Legend:								
Table Field: "Required System?"								
S	- Required for Chapter 4 Separation Criteria							
L	- Required for NRC Approved Licensing Action							
E	- Required for Engineering Equivalency Evaluation							
R	- Required for Risk Significance							
D	- Required to maintain adequate balance of Defense-in-Depth in a Change Evaluation or Fire Risk Evaluation							

A low pressure CO2 total flooding system supplied from the 17 ton tank is provided. This system

is actuated by operation of both types of detection. No CO<sub>2</sub> protection is provided in the CD Battery Room (Fire Zone 60).

### 3.1.6 Manual Suppression / Response Strategy

A postulated fire will be identified by early detection using ionization type smoke detection, infra-red detection or by plant personnel using plant communication system to notify the control room. The automatic detection systems alarm in the control room. The Control Room operator will dispatch the fire brigade for initiation of manual fire fighting. A fire in this fire area will be contained by the construction features discussed in Section 3.1.1. Manual suppression is provided by the CNP Fire Brigade.

Fire extinguishers are located in Fire Zone 59 and 60, one of which is located in the panel area of Fire Zone 60.

Water hose reels are located in Fire Zone 60 in the panel area and the cable spreading area. For Fire Zone 59, a continuous water hose reel is located in adjacent Fire Zone 52.

Floor drains are not available in this fire area. The Fire Brigade is equipped with a sump pump that may be used to remove an accumulation of water.

### 3.1.7 Ventilation

A fire in this area will be contained by the fire barriers. Smoke can be removed by portable fans and flexible ducting to other areas of the Auxiliary Building and outdoors if not contaminated. Contaminated smoke can be removed by portable fans and flexible ducting to other areas of the Auxiliary Building per the Fire Pre-Plans. The normal building ventilating systems in the Auxiliary Building will then exhaust the smoke via filtered monitored pathways.

In Fire Zone 59, Fire dampers having a 1 1/2-hour rating are provided to adjacent Fire Area AA36/42 - Fire Zone 44S and Fire Area AA3 - Fire Zone 52. Fire dampers having a 3-hour rating are provided to adjacent Fire Area AA36/42 - Fire Zone 44N and Fire Area AA3 - Fire Zone 52.

In Fire Zone 60, a fire damper having a 3-hour rating is provided to adjacent Fire Area AA43 - Fire Zone 45. Fire dampers having a 3-hour rating are provided in interior boundaries: 1) between the cable spreading area and the panel area, 2) between the cable spreading area and the CD Battery Room and 3) between the Charging Room and the CD Battery Room.

### 3.1.8 Other Features

Some cable trays within Fire Area AA52 are provided with bottom covers and/or are fully enclosed.

This fire area is procedurally controlled as a transient combustible and hot work free zone.

## 3.2 Fire Hazards Identification

The fire area contains both ignition sources and combustible fire hazards. The ignition sources consist of battery chargers, battery control panels and distribution panels. Combustibles consist primarily of exposed electrical cables in trays, rubber, battery cells and plastics.

The exterior fire hazards that are adjacent to exterior walls are the Unit 2 Main and Auxiliary

Transformers. The Main Transformers are approximately 25ft away and the Auxiliary Transformers are approximately 10ft away. The Auxiliary Transformers are provided with missile barriers but the elevation of AA52 is such that line of site from the top of the transformer to the Fire Area is possible. Water spray suppression systems are provided for the transformers. In addition, this Fire Area is constructed of reinforced concrete with no penetrations in the south wall and penetrations in the east wall are grouted, adjacent to the transformers. The missile barriers around the Auxiliary Transformers also provide a measure of fire barrier protection, limiting radiant heat in the direction of the Fire Area. The fixed suppression, spatial separation and rated construction are sufficient to provide protection for credited equipment within the plant.

The roof of this Fire Area does not require a rating for protection. The orientation of the Fire Area prevents direct impact from radiant heat. The orientation of the Fire Area as well as the reinforced concrete construction is sufficient to prevent an exposure to credited equipment inside the plant through the roof of this Fire Area.

The current fire loading classification is low.

### 3.3 NSCA Compliance Summary

Fire Area AA52 is the Unit 2 Switchgear Rooms Cable Vault and as such contains Unit 2 Red (AB) and Green (CD) Train safe shutdown cables; controls for valves, pumps, electrical Bus/MCCs, diesel generators, and instrumentation; as well as 250VDC power supplies.

Compliance with the nuclear safety performance criteria is achieved using the performance based approach in accordance with NFPA 805, Section 4.2.4.2.

Unit 2 safe and stable is accomplished by crediting crossties to the unaffected Unit 1 via the following: Alternate AFW to Steam Generators 1 and 4 via the Unit 1 East Motor Driven Auxiliary Feedwater Pump, Alternate CVCS via the Unit 1 East or West Pump and ESW crosstie via normally available crosstie lineup. Unit 1 CCW is credited to support the required Unit 1 crosstie systems. Local Shutdown Indicating Panels are credited to provide process and source range monitoring with Unit 2 power crosstie.

The Nuclear Safety Performance Criteria compliance strategy for AA52 is documented within the NSCA Report.

#### 3.3.1 Variances

The variances identified for evaluation for this fire area are grouped as follows:

##### 3.3.1.1 VFDR No. AA52-001

2-PP-3E, 2-PP-3W and 2-PP-4 - A Unit 2 AFW Pump is required to be operable to support decay heat removal. Decay heat removal is required to be capable of removing sufficient heat from the reactor core such that the fuel is maintained in a safe and stable condition. A full area fire in Fire Area AA52 may cause the loss of the Unit 2 East and West MDAFW Pumps and the Unit 2 TDAFW Pump. The East MDAFW Pump, 2-PP-3E may fail due to fire induced damage of 250VDC Cabinet 1-MCCD, 4kV Bus 1-T11D and cables 8378G-2, 9286G-2, 9287G-2, 9288G-2, 9289G-2 and 9290G-2. The West MDAFW Pump, 2-PP-3W may fail due to fire induced damage of cables 8377R-2, 8488R-2, 8723R-2 and 8743R-2. The TDAFW Pump, 2-PP-4 may fail due to fire induced damage of the TDAFW Pump Trip and Throttle Valve 2-QT-506. This condition represents a variance from the deterministic

requirements of NFPA 805, Section 4.2.3. This is a separation issue.

This VFDR has been evaluated and it was determined that the risk, safety margin and defense-in-depth meet the acceptance criteria of NFPA 805 Section 4.2.4 with a recovery action credited and plant modifications to implement transient free areas.

#### **3.3.1.2 VFDR No. AA52-002**

2-FMO-212 and 2-FMO-242 - SG 1 and 4 AFW Supply Valves are required to be operable to support decay heat removal for Unit 2. Decay heat removal shall be capable of removing heat from the reactor core such that the fuel is maintained in a safe and stable condition. Decay heat removal requires a set of 2 supply valves be operable with their corresponding AFW pump. The following sets of Unit 1 SG AFW Supply Valves may fail due to a full area fire within Fire Area AA52; 2-FMO-212 and 2-FMO-242, 2-FMO-222 and 2-FMO-232, 2-FMO-221 and 2-FMO-231. The Unit 1 East AFW Pump is credited to provide decay heat removal through Unit 2 SGs 1 and 4 for a fire within Fire Area AA52. This requires 2-FMO-212 and 2-FMO-242 be operable. 2-FMO-212 may fail due to fire induced damage of 600V VCC 2-AZV-A. 2-FMO-242 may fail due to fire induced damage of 600V VCC 2-AZV-A. This condition represents a variance from the deterministic requirements of NFPA 805, Section 4.2.3. This is a separation issue.

This VFDR has been evaluated and it was determined that the risk, safety margin and defense-in-depth meet the acceptance criteria of NFPA 805 Section 4.2.4 with a recovery action credited and plant modifications to implement transient free areas.

#### **3.3.1.3 VFDR No. AA52-003**

2-MRV-210 and 2-MRV-240 – The SG 1 and 4 Main Steam Stop Valves are required to be closed to support main steam isolation. Main steam isolation is required to prevent the uncontrolled cooldown through over-steaming. SGs 1 and 4 are credited for decay heat removal due to a fire within Fire Area AA52. 2-MRV-210 may fail due to fire induced damage of 2-MMO-210, 2-MRV-211 and 2-MRV-212. 2-MMO-210, 3 Way Air Open Valve for SG 1 Stop Valve vents air from the Main Steam Stop Valve to either 2-MRV-211 or 2-MRV-212. Cable failures to the 3 way stop valve will spuriously operate it to either position. Failure of 2-MRV-211 and 2-MRV-212 will require either valve to be manually failed to the open position dependent upon the 3 way valve's position. 2-MRV-240 may fail due to fire induced damage of 2-MMO-240, 2-MRV-241 and 2-MRV-242. 2-MMO-240, 3 Way Air Open Valve for SG 4 Stop Valve vents air from the Main Steam Stop Valve to either 2-MRV-241 or 2-MRV-242. Cable failures to the 3 way stop valve will spuriously operate it to either position. Failure of 2-MRV-241 and 2-MRV-242 will require either valve to be manually failed to the open position dependent upon the 3 way valve's position. This condition represents a variance from the deterministic requirements of NFPA 805, Section 4.2.3. This is a separation issue.

This VFDR has been evaluated and it was determined that the risk, safety margin and defense-in-depth meet the acceptance criteria of NFPA 805 Section 4.2.4 with a recovery action credited and plant modifications to implement transient free areas.

**3.3.1.4 VFDR No. AA52-004**

2-MRV-220 and 2-MRV-230 – Main Steam Stop Valves for SGs 2 and 3 are required to be closed to support main steam isolation. Main steam isolation is required to prevent uncontrolled cooldown through over-steaming. SGs 2 and 3 are not credited for decay heat removal due to a fire within Fire Area AA52. 2-MRV-220 may fail due to fire induced damage of 2-MRV-221. 2-MRV-230 may fail due to fire induced damage of 2-MMO-230, 2-MRV-231 and 2-MRV-232. 2-MMO-230, 3 Way Air Open Valve for SG 3 Stop Valve vents air from the main steam stop valve to either 2-MRV-231 or 2-MRV-232. Cable failures to the 3 way stop valve will spuriously operate it to either position. Failure of 2-MRV-231 and 2-MRV-232 will require either valve to be manually failed to the open position dependent upon the 3 way valve's position. This condition represents a variance from the deterministic requirements of NFPA 805, Section 4.2.3. This is a separation issue.

This VFDR has been evaluated and it was determined that the risk, safety margin and defense-in-depth meet the acceptance criteria of NFPA 805 Section 4.2.4 with a defense-in-depth action credited and plant modifications to implement transient free areas.

**3.3.1.5 VFDR No. AA52-005**

2-PP-50E and 2-PP-50W - The Unit 2 East or West Charging Pump is required to be operable to support CVCS for inventory, reactivity and pressure control and seal cooling. The Unit 2 charging pumps may fail due to a full area fire within Fire Area AA52. 2-PP-50E may fail due to fire induced damage of its power supply, cooling and cables. 2-PP-50W may fail due to fire induced damage of its power supply, cooling and cables. Failure of both Unit 2 Charging Pumps requires cross-tying to the Unit 1 Charging Pumps to provide CVCS. Cross-tying requires the operation of manual valves 2-CS-302, 2-CS-534 and 1-CS-536. This condition represents a variance from the deterministic requirements of NFPA 805, Section 4.2.3. This is a separation issue.

This VFDR has been evaluated and it was determined that the risk, safety margin and defense-in-depth meet the acceptance criteria of NFPA 805 Section 4.2.4 with a recovery action credited and plant modifications to implement transient free areas.

**3.3.1.6 VFDR No. AA52-006**

2-ICM-250 and 2-ICM-251 – The BIT Outlet Shutoff Valves are required to be open to support Unit 2 alternate CVCS. CVCS is required to be operable to support inventory reactivity and pressure control. The Unit 2 alternate charging flow path injects borated water from the Unit 1 RWST with the Unit 1 pumps through the Unit 2 BIT into the cold leg loops. These valves are normally closed and fails as-is on the loss of power. 2-ICM-250 may fail due to fire induced damage of 600V MCC 2-AM-D. 2-ICM-251 may fail due to fire induced damage of 600V VCC 2-AZV-A. These failures could prevent the valves from opening. This condition represents a variance from the deterministic requirements of NFPA 805, Section 4.2.3. This is a separation issue.

This VFDR has been evaluated and it was determined that the risk, safety margin and defense-in-depth meet the acceptance criteria of NFPA 805 Section 4.2.4 with a recovery action credited and plant modifications to implement transient free areas.

### 3.3.1.7 VFDR No. AA52-007

2-IMO-51, 2-IMO-52, 2-IMO-53 and 2-IMO-54 - Boron Injection Line to Cold Leg Shutoff Valves are required to be open to support Unit 2 alternate CVCS. CVCS is required to be operable to support inventory, reactivity and pressure control. 1 of the 4 boron injection line valves is required to be open to support Unit 2 alternate CVCS. All 4 of the valves may fail due to a full area fire within Fire Area AA52. The Unit 2 alternate charging flow path injects borated water from the Unit 1 RWST with the Unit 1 pumps through the Unit 2 BIT into the cold leg loops. These valves are normally open and fails as-is on the loss of power. 2-IMO-51 may fail due to fire induced damage of cable 8370G-2. 2-IMO-52 may fail due to fire induced damage of cable 8372R-2. 2-IMO-53 may fail due to fire induced damage of cable 8396G-2. 2-IMO-54 may fail due to fire induced damage of cable 8314R-2. These cable failures could spuriously close the valves. This condition represents a variance from the deterministic requirements of NFPA 805, Section 4.2.3. This is a separation issue.

This VFDR has been evaluated and it was determined that the risk, safety margin and defense-in-depth meet the acceptance criteria of NFPA 805 Section 4.2.4 with plant modifications to implement transient free areas.

### 3.3.1.8 VFDR No. AA52-008

2-PP-45-1, 2-PP-45-2, 2-PP-45-3 and 2-PP-45-4 – The RCPs are required to be tripped to prevent a loss of coolant accident if seal cooling and thermal barrier cooling are lost. A full area fire within Fire Area AA52 may cause the loss of seal cooling, thermal barrier cooling and Control Room trip capability of the RCPs. 2-PP-45-1 may lose Control Room trip capability due to fire induced damage of cables 14321-2, 3422R-2, 4448P-2 and 6783-2. 2-PP-45-2 may lose Control Room trip capability due to fire induced damage of cables 12364G-2, 3496G-2, 4959-2 and 7960P-2. 2-PP-45-3 may lose Control Room trip capability due to fire induced damage of cables 14621-2, 3497G-2, 5649-2 and 7957P-2. 2-PP-45-4 may lose Control Room trip capability due to fire induced damage of cables 12884-4, 3421R-2, 4963-2 and 79992P-2. This condition represents a variance from the deterministic requirements of NFPA 805, Section 4.2.3. This is a separation issue.

This VFDR has been evaluated and it was determined that the risk, safety margin and defense-in-depth meet the acceptance criteria of NFPA 805 Section 4.2.4 with a recovery action credited and plant modifications to implement transient free areas.



### 3.3.1.9 VFDR No. AA52-009

2-BLI-110-CRI, 2-BLI-140-CRI, 2-MPP-210-CRI, 2-MPP-240-CRI, 2-NLP-151-CRI, 2-NPS-110-CRI, 2-NTR-140, 2-NTR-240 and 2-NRI-1 - Control Room process monitoring and source range monitoring may not be available due to a fire in Fire Area AA52. Process monitoring is required to be available to monitor key primary and secondary parameters. Source Range is required to provide indication of fission activity to ensure sub-criticality. The instrumentation is not available within the Unit 2 Control Room due a fire within Fire Area AA52. Alternate process and source range monitoring powered from Unit 1 is required at the Unit 2 LSI panels. The LSI panels require manual actions to transfer to the Unit 1 power supply. A transfer switch at 2-LSI-6XX feeds both 1-LSI-6XX and 2-LSI-2. A transfer switch at 2-LSI-5XX feeds both 2-LSI-5XX and 2-LSI-1. A transfer switch at 2-LSI-4 feeds both 2-LSI-4 and 2-LSI-3. Local monitoring of instruments in support of SGs 1 and 4 is required because SGs 1 and 4 are credited for decay heat removal due to a fire within Fire Area AA52. This condition represents a variance from the deterministic requirements of NFPA 805, Section 4.2.3. This is a separation issue.

This VFDR has been evaluated and it was determined that the risk, safety margin and defense-in-depth meet the acceptance criteria of NFPA 805 Section 4.2.4 with a recovery action credited and plant modifications to implement transient free areas.

### 3.3.1.10 VFDR No. AA52-010

2-NRV-153 - Pressurizer PORVs are required to be closed to support RCS integrity. RCS integrity is required to maintain positive control over RCS inventory and pressure. 2-NRV-153 may fail due to fire induced damage of cable 8757PG-2. Failure of this cables could spuriously open the valve. This condition represents a variance from the deterministic requirements of NFPA 805, Section 4.2.3. This is a separation issue.

This VFDR has been evaluated and it was determined that the risk, safety margin and defense-in-depth meet the acceptance criteria of NFPA 805 Section 4.2.4 with a defense-in-depth action credited.

### 3.3.1.11 VFDR No. AA52-011

2-NSO-021 and 2-NSO-022 - The RX Head Vent Valves are required to be closed to support RCS integrity. RCS integrity is required to maintain positive control over RCS inventory and pressure. 2-NSO-021 and 2-NSO-022 are in series, requiring 1 of the valves to remain closed to provide RCS integrity. 2-NSO-021 may fail due to fire induced damage of cable 9801PG-2. 2-NSO-022 may fail due to fire induced damage of cable 9807PG-2. These cable failures could spuriously open the valves. This condition represents a variance from the deterministic requirements of NFPA 805, Section 4.2.3. This is a separation issue.

This VFDR has been evaluated and it was determined that the risk, safety margin and defense-in-depth meet the acceptance criteria of NFPA 805 Section 4.2.4 with a defense-in-depth action credited.

**3.3.1.12 VFDR No. AA52-012**

2-NSO-061 and 2-NSO-062 - The Post Accident Valves are required to be closed to support RCS integrity. RCS integrity is required to maintain positive control over RCS inventory and pressure. 2-NSO-061 and 2-NSO-062 are in series, requiring 1 of the valves to remain closed to provide RCS integrity. 2-NSO-061 may fail due to fire induced damage of cable 9814PG-2. 2-NSO-062 may fail due to fire induced damage of cable 9820PG-2. These cable failures could spuriously open the valves. This condition represents a variance from the deterministic requirements of NFPA 805, Section 4.2.3. This is a separation issue.

This VFDR has been evaluated and it was determined that the risk, safety margin and defense-in-depth meet the acceptance criteria of NFPA 805 Section 4.2.4 with a defense-in-depth action credited.

**3.3.1.13 VFDR No. AA52-013**

2-QRV-20 and 2-QRV-30 - RCP Seal Water Return Isolation Valves are required to be open to support RCS integrity by maintaining the RCP seal. RCS integrity is required to maintain positive control over RCS inventory and pressure. 2-QRV-20 may fail due to fire induced damage of cable 4955-2. 2-QRV-30 may fail due to fire induced damage of cable 5654-2. These cables could cause spurious closure of these valves. This condition represents a variance from the deterministic requirements of NFPA 805, Section 4.2.3. This is a separation issue.

This VFDR has been evaluated and it was determined that the risk, safety margin and defense-in-depth meet the acceptance criteria of NFPA 805 Section 4.2.4 with a defense-in-depth action credited.

**3.3.2 Recovery Actions Credited**

For each VFDR, a Fire Risk Evaluation has been performed to assess the acceptability of risk, defense-in-depth, and safety margin. This evaluation determined whether or not recovery actions are required to ensure that one success path necessary to achieve and maintain the nuclear safety performance criteria is maintained free of fire damage by a single fire. Table 3-3 identifies the credited recovery actions for this area. Actions retained for DID are identified as “DID Actions” within Table 3-3. Additional information for DID actions is contained within Section 3.8 of this report. Note that, for completeness, all VFDRs are contained within Table 3-3, even if the Fire Risk Evaluation has determined that a recovery action is not required. In those instances where a recovery action has been determined to not be required, the word “None” is provided in the “Action” column in the table.

<b>Table 3-3, Recovery Actions Credited</b>		
<b>VFDR</b>	<b>Component</b>	<b>Action</b>
AA52-001	2-PP-3E 2-PP-3W 2-PP-4	1-FW-129-OPEN (Open manual valve 1-FW-129)
		1-FW-262-CLOSE (Close manual valve 1-FW-262)



Table 3-3, Recovery Actions Credited		
VFDR	Component	Action
AA52-002	2-FMO-212 2-FMO-242	2-FMO-212-OPERATE (De-energize and manually operate 2-FMO-212)  2-FMO-242-OPERATE (De-energize and manually operate 2-FMO-242)
AA52-003	2-MRV-210 2-MRV-240	2-MRV-211-OPEN (Manually open 2-MRV-211 to close valve 2-MRV-210)  or  2-MRV-212-OPEN (Manually open 2-MRV-212 to close valve 2-MRV-210)  and  2-MRV-241-OPEN (Manually open 2-MRV-241 to close valve 2-MRV-240)  or  2-MRV-242-OPEN (Manually open 2-MRV-242 to close valve 2-MRV-240)
AA52-004	2-MRV-220 2-MRV-230	DID ACTION 2-MRV-221-OPEN (Manually Open 2-MRV-221 to close 2-MRV-220)  and  2-MRV-231-OPEN (Manually Open 2-MRV-231 to close 2-MRV-230)  or  2-MRV-232-OPEN (Manually Open 2-MRV-232 to close 2-MRV-230)

Table 3-3, Recovery Actions Credited		
VFDR	Component	Action
AA52-005	2-PP-50E 2-PP-50W	2-CS-302-CLOSE (Close manual valve 2-CS-302)  2-CS-534-OPEN (Open manual valve 2-CS-534)  1-CS-536-OPEN (Open manual valve 1-CS-536)
AA52-006	2-ICM-250 2-ICM-251	2-ICM-250-OPEN (De-energize and manually open 2-ICM-250)
AA52-007	2-IMO-51 2-IMO-52 2-IMO-53 2-IMO-54	None
AA52-008	2-PP-45-1 2-PP-45-2 2-PP-45-3 2-PP-45-4	2-PP-45-1-TRIP (Locally trip RCP 1)  2-PP-45-2-TRIP (Locally trip RCP 2)  2-PP-45-3-TRIP (Locally trip RCP 3)  2-PP-45-4-TRIP (Locally trip RCP 4)
AA52-009	2-BLI-110-CRI 2-BLI-140-CRI 2-MPP-210-CRI 2-MPP-240-CRI 2-NLP-151-CRI 2-NPS-110-CRI 2-NTR-140 2-NTR-240 2-NRI-1	2-LSI-4-ALT-PWR (Align unaffected Unit Power to LSI Panel)  2-LSI-5XX-ALT-PWR (Align unaffected Unit Power to LSI Panel)  2-LSI-1-LOCAL (Locally monitor 2-LSI-1)  2-LSI-3-LOCAL (Locally monitor 2-LSI-3)  2-LSI-4-LOCAL (Locally monitor 2-LSI-4)  2-LSI-5XX-LOCAL (Locally monitor 2-LSI-5)

Table 3-3, Recovery Actions Credited		
VFDR	Component	Action
AA52-010	2-NRV-153	DID ACTION(S) 2-NRV-153-CLOSE (Remove fuses in MCR to fail closed PORV 2-NRV-153)
AA52-011	2-NSO-021	DID ACTION(S) 2-NSO-021-CLOSE (Remove fuses in MCR to fail closed AOV 2-NSO-021)
AA52-012	2-NSO-061	DID ACTION(S) 2-NSO-061-CLOSE (Remove fuses in MCR to fail closed AOV 2-NSO-061)
AA52-013	2-QRV-20 2-QRV-30	DID ACTION(S) 2-QRV-20-OPEN 2-QRV-30-OPEN (Remove fuses in MCR to fail open AOVs 2-QRV-20 and 2-QRV-30)

### 3.4 Non-Power Operational Modes Compliance Summary

A review of CNP for the potential effects of a fire in this Fire Area while in non-power modes of operation (NPO) was conducted. This review was conducted using the guidance provided in NEI 04-02 and FAQ 07-0040, "Non-Power Operations Clarifications".

The review determined that there are potential failures that affect certain Key Safety Functions (KSF) as a result of the fire in this area, and the fire could result in the loss of one or more KSF paths. Compensatory measures are required during high risk evolution periods to provide reasonable assurance a fire will not adversely affect key safety functions and the NFPA 805 performance goal for NPO is therefore satisfied. The results of the NPO analysis are contained within Technical Evaluation R1900-005-001, Non-Power Operation Modes Transition Review Report.

### 3.5 Radioactive Release Compliance Summary

The NFPA 805 radiological release goal is to provide reasonable assurance that a fire will not result in a radiological release that adversely affects the public, plant personnel or the environment. The NFPA 805 requirement is to ensure a radiation release to any unrestricted area due to the direct effects of fire suppression activities (but not involving fuel damage) shall be as low as reasonably achievable and shall not exceed applicable plant Technical Specification limits.

Fire Zone 59 of Fire Area AA52 is within the Radiological Controlled Area (RCA) and has been identified as a potential fire area for radioactive release due to fire fighting activities. In accordance with NFPA 805 FAQ 09-0056, this potential has been reviewed to ensure that engineering controls, fire pre-plans, and fire brigade training materials are provided for containment and monitoring of gaseous and liquid effluents associated with fire suppression agents and products of combustion.

The review concludes that the steps to limit radiation release to other areas due to the direct effects of fire suppression activities, in addition to compliance with NFPA 805, Chapter 4, ensure that any

radioactive release will be as low as reasonably achievable and will not exceed limits designated in the CNP Technical Specifications.

Fire Zone 60 of Fire Area AA52 is located outside the RCA and is not a storage location for contaminated materials, therefore there is reasonable assurance a fire in this area will not result in any radiation release.

The review of this fire area, with respect to radioactive release, is documented in the NFPPM.

### **3.6 Probabilistic Risk Assessment-Summary of Results**

A Fire PRA (FPRA) quantification of Fire Area AA52 was performed and is documented in PRA-NB-FIRE-FQ, Fire PRA Model Quantification Notebook. The fire risk quantification for Fire Area AA52 is analyzed using detailed fire modeling to consider risk of fire scenarios of ignition sources. PRA-NB-FIRE-FQ includes a summary of all potentially risk-significant fire scenarios (i.e., CDF > 1.0E-7 or LERF > 1.0E-8). Bounding CDF / LERF per calendar year values are reported that are based on the risk values documented in PRA-NB-FIRE-FSS, Fire PRA Fire Scenario Selection.

Transient combustible and hot work free zones were credited in the FPRA for this fire area.

Fire Protection features credited in the Fire PRA are documented in R1900-0411-AA52, Detailed Fire Modeling Report: Fire Compartment: AA52 Unit 2 Switchgear Room Cable Vault and Auxiliary Cable Vault (EL. 625 FT 10 IN and 620 FT 6 IN). PRA-NB-FIRE-FSS documents the revision level of the fire modeling reports used in the most recent Fire PRA quantification.

### **3.7 Risk-Informed, Performance-Based Evaluations**

Fire Risk Evaluations (FREs) have been performed to ensure that variances from the NFPA 805 deterministic requirements are acceptable. The evaluation process consists of an integrated assessment of the acceptability of risk, defense-in-depth, and safety margins.

#### **3.7.1 Transition Risk-Informed, Performance-Based Evaluations**

The 'changes' associated with NFPA 805 transition were those variances from the deterministic requirements of NFPA 805 or with the existing fire protection licensing basis that were brought into compliance with the NFPA 805 performance based approach. The change identified for evaluation for Fire Area AA52 is as follows:

- Separation Issues

The Fire Risk Evaluation has determined that the change is acceptable based upon:

- The measured change in CDF and LERF.
- Adequate defense-in-depth and safety margins being maintained.

Refer to Attachment 2 for a summary of results associated with the Fire Risk Evaluations.

### 3.8 Defense-in-Depth

A comprehensive risk-informed, performance-based analysis includes consideration of defense-in-depth (DID) as part of an integrated evaluation of risk considerations. In general, defense-in-depth involves consideration of the extent to which fire protection systems and features are provided within the three echelons of fire-protection:

- Preventing fires from starting,
- Rapidly detecting fires and controlling and extinguishing promptly those fires that do occur, thereby limiting fire damage,
- Providing an adequate level of fire protection for structures, systems, and components important to safety, so that a fire that is not promptly extinguished will not prevent the nuclear safety performance criteria from being met.

Each VFDR was evaluated for DID. The following recovery actions have been retained for DID.

VFDR No. AA52-004: 2-MRV-220 and 1-MRV-230 – The SG 2 and 3 Main Steam Stop Valves are required to be closed to support main steam isolation. Main steam isolation is required to prevent the uncontrolled cooldown through over-steaming. Failure of the MSSV dump valves for both 2-MRV-220 and 1-MRV-230 may cause the inability to close the valves. These failures can be mitigated by manually opening the MSSV dump valves. These recovery actions are being retained for DID to ensure main steam isolation is maintained.

VFDR No. AA52-010: 2-NRV-153 - Pressurizer PORVs are required to be closed to support RCS integrity. RCS integrity is required to maintain positive control over RCS inventory and pressure. The spurious opening can be mitigated by de-energizing the valve to fail it closed. This recovery action is being retained for DID to ensure RCS pressure and inventory control is maintained.

VFDR No. AA52-011: 2-NSO-021 and 2-NSO-022 - The RX Head Vent Valves are required to be closed to support RCS integrity. RCS integrity is required to maintain positive control over RCS inventory and pressure. 2-NSO-021 and 2-NSO-022 are in series, requiring 1 of the valves to remain closed to provide RCS integrity. The spurious opening can be mitigated by de-energizing the valve to fail it closed. This recovery action is being retained for DID to ensure RCS pressure and inventory control is maintained.

VFDR No. AA52-012: 2-NSO-061 and 2-NSO-062 - The Post Accident Valves are required to be closed to support RCS integrity. RCS integrity is required to maintain positive control over RCS inventory and pressure. 2-NSO-061 and 2-NSO-062 are in series, requiring 1 of the valves to remain closed to provide RCS integrity. The spurious opening can be mitigated by de-energizing the valve to fail it closed. This recovery action is being retained for DID to ensure RCS pressure and inventory control is maintained.

VFDR No. AA52-013: 2-QVR-20 and 2-QVR-30 - RCP Seal Water Return Isolation Valves are required to be open to support RCS integrity by maintaining the RCP seal. RCS integrity is required to maintain positive control over RCS inventory and pressure. The spurious closing can be mitigated by de-energizing the valve to fail it open. This recovery action is being retained for DID to ensure RCS integrity is maintained.

Based on the assessment in support of the Fire Risk Evaluation, defense-in-depth is maintained for fire area AA52. Refer to Attachment 2 for details associated with the Fire Risk Evaluation.

### 3.9 Monitoring Program Input

A Monitoring Program will be developed in accordance with FAQ 10-0059, Rev. 1. Methods to monitor availability, reliability, and performance of fire protection program structures, systems, and components (SSCs), as well as programmatic elements will be provided. Additionally, effectiveness measures are established to review program related performance and trends. For AA52 the following systems and features are candidates for inclusion in the CNP Fire Protection Monitoring Program:

- Fire Area boundary barriers discussed in Section 3.1
- Fire Detection System
- Fire Suppression System (CO2)
- Transient Combustible and Hot Work Free Zone
- Cable tray covers

### 4.0 CONCLUSION

The nuclear safety and radioactive release performance criteria of NFPA 805 are met for a fire in Fire Area AA52. This Fire Risk Evaluation for Fire Area AA52 has demonstrated that

- The change in core damage frequency (delta CDF) is acceptable, and
- The change in large early release frequency (delta LERF) is acceptable, and
- Defense-in-depth and safety margins are maintained.

This is confirmation that a success path effectively remains free of fire damage and that the performance-based approach is acceptable per Section 4.2.4.2 of NFPA 805.

### 5.0 REFERENCES

- 5.1 Calculation PRA-FIRE-NB-CRE, Fire PRA Cumulative Risk Evaluations
- 5.2 CNP Fire Pre-Plans, Volumes I, II, and III, Revisions 17, 14, and 18 respectively
- 5.3 Fire Hazards Analysis
- 5.4 NFPA 805, Performance-Based Standard for Fire Protection for Light Water Reactor Electric Generating Plants
- 5.5 NFPPM, NFPA 805 Fire Protection Program Manual (NFPPM)
- 5.6 Nuclear Energy Institute (NEI) 04-02, Guidance for Implementing a Risk-Informed, Performance-Based Fire Protection Program under 10 CFR 50.48(c), Rev. 2
- 5.7 Nuclear Safety Capability Assessment Report
- 5.8 PRA-NB-FIRE-FQ, Fire PRA Model Quantification Notebook
- 5.9 PRA-NB-FIRE-FSS, Fire PRA Fire Scenario Selection
- 5.10 R1900-0411-AA54, AA54 - Detailed Fire Modeling Report
- 5.11 Regulatory Guide 1.205, Risk-Informed, Performance-Based Fire Protection for Existing Light-Water Nuclear Power Plants, Rev. Revision 1
- 5.12 Technical Evaluation R1900-005-001, Non-Power Operation Modes Transition Review

**Fire Area AA52 – Attachment 1 - Table B-3 - Fire Area Transition**

<u>Unit</u>	<u>Fire Area</u>	<u>Description</u>
2	AA52	Unit 2 Switchgear Room Cable Vault and Auxiliary Cable Vault (El. 625 ft. 10 in. and 620 ft. 6 in.)

**Fire Zone Description**

59	Auxiliary Cable Vault - El. 620 ft. 6 in. - Unit 2
60	Switchgear Room Cable Vault - El. 625 ft. 10 in. - Unit 2

**Regulatory Basis**

4.2.4.2 - Performance-Based Approach - Fire Risk Evaluation with simplifying deterministic assumptions

<b>Performance Goal</b>	<b>Method of Accomplishment</b>	<b>Comments</b>
Reactivity Control	Unit 2 - Trip the reactor from the Control Room. Borate using Unit 1 East or West Charging Pump supplied from the Unit 1 RWST injecting through the Unit 2 BIT. Use source range monitoring for indication.	None
Inventory and Pressure Control	Unit 2 - Control inventory using Unit 1 East or West Charging Pump through the Unit 2 BIT. Control pressure using Unit 2 Pressurizer Safety Relief Valves.	VFDRs identified for CVCS and RCS integrity.
Decay Heat Removal	Unit 2 - Feed SGs 1 & 4 with Unit 1 East MDAFW Pump. The DHR function also requires MS isolation with a steam release path through the Safety Relief Valves.	VFDRs identified for AFW and MS isolation.
Process Monitoring	Unit 2 Process Monitoring - Use Unit 2 alternate process monitoring powered from Unit 1 at the local shutdown panels for the following: Pressurizer level, RCS pressure and temperature, and S/G level and Pressure. Unit 2 Source Range Monitoring - Use Unit 2 alternate source range monitoring powered from Unit 1 at the local shutdown panels.	VFDRs identified for process and source range monitoring.
Vital Auxiliaries	Unit 2 Electrical - Control Unit 1 Red (AB) Train Electrical Distribution with Unit 1 Red (AB) DG. Control Unit 1 Green (CD) Train Electrical Distribution with Unit 1 Green (CD) DG. Unit 2 ESW - Operate Unit 1 East or West ESW to provide cooling to the Unit 1 CCW Heat Exchangers and the Unit 1 Red (AB) and Green (CD) DGs for alternate shutdown for Unit 2. Unit 2 CCW - Operate Unit 1 East or West CCW to provide cooling to the Unit 1 Charging Pumps for alternate shutdown for Unit 2.	None

**Fire Area AA52 – Attachment 1 - Table B-3 - Fire Area Transition**

<u>Unit</u>	<u>Fire Area</u>	<u>Description</u>
2	AA52	Unit 2 Switchgear Room Cable Vault and Auxiliary Cable Vault (El. 625 ft. 10 in. and 620 ft. 6 in.)
<p>Unit 2 HVAC - Unit 2 Control Room HVAC is not required as alternate shutdown is utilized for this area. Unit 2 Auxiliary Building HVAC is not operational, Unit 1 Auxiliary Building HVAC remains available and provides adequate cooling. Operate Unit 1 Red (AB) and Green (CD) DG HVAC. Operate Unit 1 Red (AB) and Green (CD) Switchgear HVAC. Operate Unit 1 East MDAFW Room HVAC system. Operate the Unit 1 East and West ESW Room HVAC system.</p>		

**Reference Documents**

Genesis Solution Suite, EDISON / SAFE-PB, DC Cook V 3.4.0

Nuclear Safety Capability Assessment Report

**Licensing Actions**

None

**Existing Engineering Equivalency Evaluations (EEEE)****EEEE Title Engineering Equivalency Evaluation 9-18 - Fire Zone 52 (Fire Area AA3) and Fire Zone 59 (Fire Area AA52) Hatch Evaluation**

**Summary** The purpose of this engineering equivalency evaluation is to document the acceptability of an unrated steel plate floor hatch located between the 633 ft. elevation of the Auxiliary Building and the Auxiliary Cable Vault in Fire Zones 52 (Fire Area AA3) and 59 (Fire Area AA52) respectively. A 3-hr fire-rated hatch assembly is not commercially available for use in this location.

Note: This engineering equivalency evaluation has been reviewed by the NRC. Refer to NRC SER dated June 17, 1988, for acceptance of unrated fire hatches in fire area boundaries. The NRC concluded that the level of fire safety is equivalent to that achieved by conformance with the guidelines of Section D.1.j of Appendix A to BTP APCSB 9.5-1, and, therefore, the deviations for the unrated fire hatches were found acceptable.

Reasonable assurance is provided that a fire in Fire Zone 52 or Fire Zone 59 would not impair safe shutdown capabilities of Unit 1 or Unit 2. This engineering equivalency evaluation does not adversely impact other engineering equivalency evaluations.

The hatch was evaluated and found to be acceptable based on the fire hazards and fire protection systems within the evaluated areas.



**Fire Area AA52 – Attachment 1 - Table B-3 - Fire Area Transition**

<b><u>Unit</u></b>	<b><u>Fire Area</u></b>	<b><u>Description</u></b>
2	AA52	Unit 2 Switchgear Room Cable Vault and Auxiliary Cable Vault (El. 625 ft. 10 in. and 620 ft. 6 in.)

<b><u>EEEE Title</u></b>	<b>Engineering Equivalency Evaluation 9-19 - Fire Zone 45 (Fire Area AA43) and Fire Zone 60 (Fire Area AA52) Hatch Evaluation</b>
<b><u>Summary</u></b>	<p>The purpose of this engineering equivalency evaluation is to document the acceptability of an unrated steel plate hatch located between the Unit 2 ESS and MCC Room and the Unit 2 Switchgear Room Cable Vault in Fire Zones 45 (Fire Area AA43) and 60 (Fire Area AA52) respectively. A 3-hr fire-rated hatch assembly is not commercially available for use in this location.</p> <p>Reasonable assurance is provided that a fire in Fire Zone 45 or Fire Zone 60 would not impair safe shutdown capabilities of Unit 2. This engineering equivalency evaluation does not adversely impact other engineering equivalency evaluations.</p> <p>The hatch was evaluated and found to be acceptable based on the fire hazards and fire protection systems within the evaluated areas.</p>
<b><u>EEEE Title</u></b>	<b>Engineering Equivalency Evaluation 9-20 - Fire Zone 47B (Fire Area AA45B) and Fire Zone 60 (Fire Area AA52) Hatch Evaluation</b>
<b><u>Summary</u></b>	<p>The purpose of this engineering equivalency evaluation is to document the acceptability of an unrated steel plate hatch located between the Unit 2 4kV Switchgear Room and the Unit 2 Switchgear Room Cable Vault in Fire Zone 47B (Fire Area AA45B) and Fire Zone 60 (Fire Area AA52) respectively. A 3-hr fire-rated hatch assembly is not commercially available for use in this location.</p> <p>Note: This engineering equivalency evaluation has been reviewed by the NRC. Refer to NRC SER dated June 17, 1988, for acceptance of unrated fire hatches in fire area boundaries. The NRC concluded that the level of fire safety is equivalent to that achieved by conformance with the guidelines of Section D.1.j of Appendix A to BTP APCSB 9.5-1, and, therefore, the deviations for the unrated fire hatches were found acceptable.</p> <p>Reasonable assurance is provided that a fire in Fire Zone 47B or Fire Zone 60 would not impair safe shutdown capabilities of Unit 2. This engineering equivalency evaluation does not adversely impact on other engineering equivalency evaluations.</p> <p>The hatch was evaluated and found to be acceptable based on the fire hazards and fire protection systems within the evaluated areas.</p>

**Fire Area AA52 – Attachment 1 - Table B-3 - Fire Area Transition**

<u>Unit</u>	<u>Fire Area</u>	<u>Description</u>
2	AA52	Unit 2 Switchgear Room Cable Vault and Auxiliary Cable Vault (El. 625 ft. 10 in. and 620 ft. 6 in.)

<b><u>EEEE Title</u></b>	<b>Engineering Equivalency Evaluation 11-6 - Unit 2 Emergency Power Systems/4 KV Switchgear Complex Ventilation Shaft Boundary Evaluation (Fire Areas AA45A, AA45B, AA43, AA44 and AA52).</b>
<b><u>Summary</u></b>	<p>The purpose of this engineering equivalency evaluation is to document the acceptability of unrated fire barrier penetration seals between the Unit 2 EPS/4KV switchgear complex ventilation shafts in Fire Zones 45 (Fire Area AA43), 46A through 46D (Fire Area AA44), 47A (Fire Area AA45A) and 47B (Fire Area AA45B), and the Unit 2 switchgear cable spreading room in Fire Zone 60 (Fire Area AA52).</p> <p>Reasonable assurance is provided that a fire in Fire Areas AA43, AA44, AA45A, AA45B or AA52 would not impair safe shutdown capabilities of Unit 2. This engineering equivalency evaluation does not impact other engineering equivalency evaluations.</p> <p>The fire barrier penetration seals were evaluated and found to be acceptable based on the fire hazards, fire protection systems and construction features within the evaluated areas.</p>
<b><u>EEEE Title</u></b>	<b>Engineering Equivalency Evaluation 11-9 - Turbine, Auxiliary and Containment Buildings Boundary Evaluation</b>
<b><u>Summary</u></b>	<p>The purpose of this engineering equivalency evaluation is to describe in general, the approach and existence of evaluations performed to determine and reconcile fire area boundaries having components or designs with less than a 3-hr fire rating on preventing the spread of fire. This engineering equivalency evaluation also specifically evaluates the impact of unrated door assemblies on the spread of fire.</p> <p>Reasonable assurance is provided that the fire area boundaries having components or design less than a 3-hr fire rating will not increase the spread of fire or impair the safe shutdown capabilities of Units 1 or 2. In addition, this engineering equivalency evaluation does not adversely impact on other engineering equivalency evaluations or exemption requests.</p> <p>This evaluation supports additional evaluations credited in this fire area.</p>

**Fire Area AA52 – Attachment 1 - Table B-3 - Fire Area Transition**

<u>Unit</u>	<u>Fire Area</u>	<u>Description</u>
2	AA52	Unit 2 Switchgear Room Cable Vault and Auxiliary Cable Vault (El. 625 ft. 10 in. and 620 ft. 6 in.)
<hr/>		
<b><u>EEEE Title</u></b>	<b>Engineering Equivalency Evaluation 11-14 - Cable Spreading Room Construction Boundary Evaluation (Fire Areas AA3, AA7, AA8, AA9, AA10, AA29, AA30, AA31, AA34, AA35, AA36/42, AA37, AA38, AA48, AA50, AA51 and AA52)</b>	
<b><u>Summary</u></b>	<p>The purpose of this engineering equivalency evaluation is to document the acceptability of the construction features of the cable spreading rooms which have a fire resistance rating of less than 3 hours for their impact on the spread. In particular, fire dampers having a 1 1/2-hr fire rating were analyzed by this evaluation. Other unrated construction features have been previously analyzed under separate engineering equivalency evaluations. The applicable fire areas include: AA3, AA7, AA8, AA9, AA10, AA29, AA30, AA31, AA34, AA35, AA36/42, AA37, AA38, AA48, AA50, AA51 and AA52.</p> <p>Reasonable assurance is provided that the construction features of the cable spreading rooms which have a fire resistance rating of less than 3 hours will prevent the spread of fire and not impair the safe shutdown capabilities of Unit 1 and Unit 2. In addition, this engineering equivalency evaluation does not adversely impact other engineering equivalency evaluations.</p> <p>The construction features of the cable spreading room were evaluated and found to be acceptable based on the fire hazards, fire protection systems and construction features within the areas.</p>	
<b><u>EEEE Title</u></b>	<b>Engineering Equivalency Evaluation 11-24 - Fire Retention Capability of Nonconforming Fire Seals in Fire Zones having a Low Combustible Loading Classification</b>	
<b><u>Summary</u></b>	<p>The purpose of this engineering equivalency evaluation is to document the acceptability of fire seal designs which do not meet the requirements of the installation specification or fire test data in fire zones having a low combustible loading classification would have on preventing the spread of fire.</p> <p>Reasonable assurance is provided that fire seals which do not meet the requirements of the installation specification or fire test data in fire zones having a low combustible loading classification, will provide adequate fire retention capabilities and will not impair the safe shutdown capabilities of CNP or increase the spread of fire between fire zones. In addition, this engineering equivalency evaluation does not adversely impact other engineering equivalency evaluations or exemptions.</p> <p>Refer to Engineering Equivalency Evaluation 11.28.</p>	

**Fire Area AA52 – Attachment 1 - Table B-3 - Fire Area Transition**

<u>Unit</u>	<u>Fire Area</u>	<u>Description</u>
2	AA52	Unit 2 Switchgear Room Cable Vault and Auxiliary Cable Vault (El. 625 ft. 10 in. and 620 ft. 6 in.)
<b><u>EEEE Title</u></b>	<b>Engineering Equivalency Evaluation 11-28 - Generic Fire Seal Design 2 (Fire Areas AA7, AA8, AA39A, AA40, AA43, AA45A, AA45B, AA48 and AA52)</b>	
<b><u>Summary</u></b>	<p>The purpose of this engineering equivalency evaluation is to document the acceptability of deviations to Generic Fire Seal Design 2 on preventing the spread of fire. The applicable Fire Areas include AA7, AA8, AA39A, AA40, AA43, AA54A, AA54B, AA48 and AA52.</p> <p>Reasonable assurance is provided that deviations to Generic Fire Seal Design 2, Fire Seals W7109, W7952, F8150, F8152, F8162, F8184, F8859, F8861, F8863, F8887 and W9058, and the attributes discussed in the engineering equivalency evaluation do not impair the safe shutdown capabilities of CNP or increase the ability of fire to spread between fire zones. This engineering equivalency evaluation does not impact other engineering equivalency evaluations.</p> <p>Attribute Nos. 2, 7, 9 and the 11 fire seals of Generic Fire Seal Design 2 were evaluated and found to be acceptable based on the fire hazards and fire protection systems within the evaluated areas.</p>	
<b><u>EEEE Title</u></b>	<b>Engineering Equivalency Evaluation 12-19 - CO2 Fire Suppression System Concentrations (Fire Areas AA7, AA8, AA9, AA10, AA29, AA30, AA31, AA37, AA38, AA39, AA40, AA41, AA43, AA44, AA45, AA48, AA49, AA50, AA51, AA52 and AA53)</b>	
<b><u>Summary</u></b>	<p>The purpose of this engineering equivalency evaluation is to document the acceptability of the CO2 fire suppression systems in fire zones containing concentrations of cable insulation and the potential for deep-seated fires. This engineering equivalency evaluation determines the CO2 system's impact on the spread of fire and previous engineering equivalency evaluations and exemption requests. Although there are other fire zones that use CO2 for fire suppression such as the DG Rooms, they are installed to suppress surface-type, combustible liquid fires and are not included in this analysis, because they do not contain significant concentrations of cable insulation capable of producing deep-seated fires.</p> <p>All of the CO2 systems included in this engineering equivalency evaluation are capable of performing their intended function, containing the fire until the Fire Brigade arrives, preventing fire spread to adjacent fire zones, and ensuring that safe shutdown of CNP can be achieved and maintained.</p> <p>The existing suppression systems were evaluated and found to be acceptable based on the fire hazards and fire protection systems within the evaluated areas.</p>	

**Fire Area AA52 – Attachment 1 - Table B-3 - Fire Area Transition**

<u>Unit</u>	<u>Fire Area</u>	<u>Description</u>
2	AA52	Unit 2 Switchgear Room Cable Vault and Auxiliary Cable Vault (El. 625 ft. 10 in. and 620 ft. 6 in.)

**Fire Suppression Effects on Nuclear Safety Performance Criteria**

The CNP fire brigade is trained to discharge water in a judicious manner and instructed to direct hose streams and portable extinguishers at the base of the fire to limit the amount of overspray beyond the immediate fire zone. For this reason, fire brigade activities are not expected to fail components not already considered damaged by fire. It has been concluded that water impingement on cables is not a concern. Electrical cabinets are provided with a seal at the conduit interface. Per visual inspection any side vents for this equipment are pointed downward to prevent water intrusion. The drainage features of the fire area mitigate the potential for flooding damage due to fire suppression, such that the standing water would not affect credited equipment.

In the event of discharge, the CO2 system will not adversely affect the equipment operating within the fire area. Potential condensation developing on electrical components is a long term issue that would be eliminated by ventilating the fire area after actuation. Per visual inspection, all CO2 nozzles are located greater than 5 ft. away from any credited equipment and therefore, the possibility of thermal shock due to CO2 actuation has been deemed to be a non-issue in this fire area in accordance to EPRI NP-7253 "Effects of Fire Suppressants on Electrical Components in Nuclear Power Plants". Since it is shown that suppression effects will not impact the nuclear safety performance criteria, the fire area configuration is deemed acceptable.

**References:**

Technical Evaluation 12.1, "Fire Suppression Effects Study"

Technical Evaluation 12.1, "Supplemental Information to Fire Suppression Effects Study – Supplement 1"

**Fire Area Comments**

Revise time requirement \ time basis per AR 2015-14147 for VFDR AA52-008

## Fire Area AA52 – Attachment 2 - Fire Risk Evaluation Results Summary

### A2.1 Introduction

The ‘changes’ associated with NFPA 805 transition were those variances from the deterministic requirements of NFPA 805. The changes identified for evaluation for fire area AA52 are grouped as follows:

- Separation Issues

This attachment is a summary of the Fire Risk Evaluation for the fire area. The complete results and methodology are contained in the Cumulative Fire Risk Evaluation, PRA-FIRE-NB-CRE. (FPCE 2017-0009)

### A2.2 Inputs/Assumptions

Fire modeling processes and inputs provided in NUREG/CR-6850 are appropriate for use in a risk-informed, performance-based evaluation. The complete list of assumptions used in the fire modeling methodology for this fire area is contained in Detailed Fire Modeling Technical Evaluation R1900-0411-AA52 [Ref 5.13].

### A2.3 Fire Modeling Methodology

Fire PRA fire modeling results are used as the initial input into this Fire Risk Evaluation. The process consists of conservative bounding analyses using NUREG/CR-6850 methods. As needed, refinements are made to utilize more realistic parameters. The complete fire modeling methodology for this fire area is contained in Detailed Fire Modeling Technical Evaluation R1900-0411-AA52.

### A2.4 Scenario Descriptions and Model Results

Fire Area AA52 was evaluated for the impact of fires originating from both fixed and transient ignition sources. Complete descriptions of each fire scenario is contained within the Detailed Fire Modeling Technical Evaluation R1900-0411-AA52.

#### A2.4.1 Ignition Sources

Fire Area AA52 contains 250VDC distribution panels MDCD and MCCD, ammeter shunt cabinet BC-CD-SH, battery chargers CD1 and CD2 and various other battery related equipment. Per discussion with plant personnel, the heat release rates for all switchgear, load centers, and MCC electrical cabinets have been characterized as qualified cable because items of this nature are generally constructed on-site. For other electrical cabinet types, where the internal cable qualification was unknown, the heat release rates have been assumed as non-qualified. Ignition sources in Fire Area AA52 were modeled using the 98th percentile fire as a screening approach and later refined based on the risk significance of the scenario. 75th percentile fires were also postulated for 1-BC-CD1 and 1-BC-CD2.

In Fire Area AA52, the 98th percentile HRR was used for all transient fires. The 98th percentile HRR bounds the possible transient ignition sources expected for this fire area, which were fire tested and identified in NUREG/CR-6850, Appendix G, Table G-7. For transient scenarios, the cable spreading room portion of Fire Zone 60 and all of Fire Zone 59 was analyzed as a combustibile and hot work free zone.

#### A2.4.2 Scenario Results

A delta risk calculation has been performed to quantify the risk associated with the VFDRs in the fire area.

### A2.5 Fire Risk Evaluation Results

### **Fire Area AA52 – Attachment 2 - Fire Risk Evaluation Results Summary**

PRA-FIRE-NB-CRE documents scenarios and corresponding impacted VFDRs that were evaluated for delta risk during the transition to NFPA 805 and also all changes to the Fire Protection Program that are currently incorporated into the Fire PRA model. The acceptability of the Cumulative Fire Risk Evaluations was based on calculated delta risk meeting the thresholds of NEI 04-02, RG 1.205 and RG 1.174. (FPCE 2017-0009)

**Fire Area AA52 – Attachment 2 - Fire Risk Evaluation Results Summary****A-2.6 Impact of VFDR on Defense-in-Depth**

Defense-in-Depth has been evaluated for this fire area. The impacts of this evaluation are summarized in the table below:

Defense-in-Depth Impact Review for AA52			
Method of Providing DID	Required to Support Deterministic Analysis or Fire PRA?	Changes or Improvements Necessary for DID?	Basis/Justification
Echelon 1: Prevent fires from starting			
Combustible Control is implemented in accordance with Procedure PMP-2270-CCM-001, Control of Combustible Materials.	Yes	No	• Combustible free zones have been implemented for the cable spreading portions of the Fire Area for the purposes of calculating risk. This element is adequate based on no perceived weakness of, or over-reliance on, another echelon of defense-in-depth.
Hot Work Control is implemented in accordance with Procedure PMP-2270-WBG-001, Welding, Burning and Grinding Activities.	Yes	No	
Echelon 2: Rapidly detect, control and extinguish promptly those fires that do occur thereby limiting fire damage			
Fire Detection System	Yes	No	• Suppression and detection are already required and fire fighting activities are not expected to be challenging; therefore, no changes or improvements to Echelon 2 attributes are necessary to maintain defense-in-depth.
Fixed Fire Suppression	Yes	No	
Portable Fire Extinguishers	Yes	No	
Hose stations and hydrants	Yes	No	
Pre-Fire Plan	Yes	No	
Echelon 3: Provide adequate level of fire protection for systems and structures so that a fire will not prevent essential safety functions from being performed			
Walls, floors ceilings and structural elements are rated or have been evaluated as adequate for the hazard.	Yes	No	• There are significant modeling differences between the Fire PRA and nuclear safety capability assessment (i.e., due to different success criteria, end states, etc.) and therefore a recovery action for VFDR AA52-004 has been credited to ensure that defense-in-depth is maintained.  • Where a variance can possibly be affected in a potentially high risk scenario, based on a detailed review, the VFDR is either not the cause for the high risk of the scenario or the mitigating recovery action is credited; therefore no changes or improvements to Echelon 3 attributes are necessary to maintain defense-in-depth.
Penetrations in the fire area barrier are rated or have been evaluated as adequate for the hazard.	Yes	No	
Supplemental barriers (e.g., ERFBS, cable tray covers, etc.)	Yes	No	
Guidance provided to operations personnel detailing the required success path(s) including recovery actions to achieve nuclear safety performance criteria.	Yes	Yes	
			• Defense in Depth actions were credited to remove fuses or open breakers in the Control Room to prevent spurious equipment operation due to internal shorts.



## Fire Area AA52 – Attachment 2 - Fire Risk Evaluation Results Summary

### A-2.7 Safety Margin Considerations

In accordance with NEI 04-02, the maintenance of adequate Safety Margin is assessed by the consideration categories of analyses utilized by this Fire Risk Evaluation.

Safety margins are considered to be maintained if:

- Codes and Standards or their alternatives accepted for use by the NRC are met.

AND

- Safety analyses acceptance criteria in the licensing basis (e.g., FSAR, supporting analyses) are met, or provides sufficient margin to account for analysis and data uncertainty.

The following summarizes the bases for ensuring the maintenance of safety margins:

- The risk-informed, performance based processes utilized are based upon NFPA 805, 2001 edition, endorsed by the NRC in 10 CFR 50.48(c).
- The Fire Risk Evaluation process is in accordance with NEI 04-02, Revision 2, which is endorsed by the NRC in Regulatory Guide 1.205, Revision 1.
- The Fire PRA is developed in accordance with NUREG/CR-6850, which was developed jointly between the NRC and EPRI.
- The Fire PRA has undergone an industry peer review, in order to ensure the Fire PRA meets the appropriate quality standards of ASME/ANS RA-Sa-2009, "Standard for Level 1/Large Early Release Frequency Probabilistic Risk Assessment for Nuclear Power Plant Applications," Dated February 2, 2009
- The "combined analysis approach" is used during transition (NEI 04-02, Section 5.3.4.3); therefore, MEFS/LFS is not analyzed separately from the Fire PRA results.
- The CNP internal events PRA model received two formal industry peer reviews conducted in accordance with applicable NEI guidelines. The initial peer review was performed in 2001, while a subsequent focused scope (i.e., limited scope) peer review was conducted in 2009. The initial, full-scope WOG peer review covered all aspects of the CNP PRA model and the administrative processes used to maintain and update the model. The CNP PRA model has been revised to address all significant issues (i.e., Category A and B Facts & Observations) identified during the initial peer review. None of the findings from the focused-scope peer review were judged to reach the significance level of a Category A or B Fact & Observation; as a result, no changes to the PRA model have yet been made to include resolutions for these latter issues.
- Fire protection systems and features determined to be required by NFPA 805 Chapter 4 have been confirmed to meet the requirements of NFPA 805 Chapter 3 and their associated referenced codes and listings, or provided with acceptable alternatives using processes accepted for use by the NRC (i.e., FAQ 06-0008, FAQ 06-0004, 07-0033).
- Fire modeling performed in support of the transition has been performed within the Fire PRA utilizing codes and standards developed by industry and NRC staff which have been verified and validated in authoritative publications, such as NUREG 1824, "Verification and Validation of Selected Fire Models for Nuclear Power Plant Applications". In general, the fire modeling performed in support of the Fire Risk Evaluations has been performed using conservative methods and input parameters that are based upon

## Fire Area AA52 – Attachment 2 - Fire Risk Evaluation Results Summary

NUREG/CR-6850 as documented in the AA52 Detailed Fire Modeling Report, section 7.2. While this is generally not ideal in the context of best estimate probabilistic risk analysis, it is a pragmatic approach given the current state of knowledge regarding the uncertainties related to the application of the fire modeling tools and associated input parameters for specific plant configurations.

- In accordance with the requirements of 10 CFR 50.48(c)(2)(iii), the Fire PRA results, including cutsets for the scenarios of concern, have been reviewed and it was verified that the results presented above do not rely solely on feed and bleed as the fire-protected safe shutdown path for maintaining reactor coolant inventory, pressure control, and decay heat removal capability for this fire area.

### A-2.8 Transition Risk Evaluation Conclusions

The transition change evaluation determined that these changes:

- Are acceptable based upon the measured change in CDF and LERF
- Maintained adequate defense-in-depth and safety margins

The results of this evaluation meet the requirements of NFPA 805 Risk Evaluation; therefore, the use of the performance based analysis approach is acceptable.

## D. C. Cook Nuclear Plant Fire Safety Analysis

# Fire Area: AA54

## Unit 1 Charging Pumps Area (El. 587 ft.)

## Table of Contents

<b>Purpose</b> .....	Section 1.0
<b>Analysis Methodology</b> .....	Section 2.0
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## Attachments

Fire Area AA54 – Attachment 1 - Table B-3 - Fire Area Transition

## Fire Area AA54 – Attachment 2 - Fire Risk Evaluation Results Summary

## 1.0 PURPOSE

This report documents the Fire Safety Analysis (FSA) for Cook Nuclear Plant (CNP) Fire Area AA54, Unit 1 Charging Pumps Area (El. 587 ft.) which comprises fire zone(s) 62A, 62B, 62C. The purpose of this analysis is to demonstrate the achievement of the nuclear safety and radioactive release performance criteria of NFPA 805 as required by 10 CFR 50.48(c). The Fire Safety Analysis is a key part of compliance with Section 2.7.1.2 Fire Protection Program Design Basis Document of NFPA 805. This analysis also documents results of risk-informed, performance-based Fire Risk Evaluations (FREs). These evaluations are associated with Variances from Deterministic Requirements (VFDRs) of NFPA 805 Chapter 4.

## 2.0 ANALYSIS METHODOLOGY

The FSA is the design basis document as described in NFPA 805 Section 2.7.1.2. The following steps are performed to develop the FSA on a fire area basis:

- Identify significant fire hazards in the fire area. This is based on NFPA 805 approach to analyze the plant from an ignition source and fuel package perspective.
- Summarize Nuclear Safety Capability Analysis (NSCA) compliance strategies. This is the result of the NEI 04-02 B-3 Table review of the Safe Shutdown Analysis.
- Summarize Non-Power Operations Modes compliance strategies.
- Summarize Radioactive Release compliance strategies. The transition review process required per NEI 04-02 is used to develop these results.
- Provide Fire Probabilistic Risk Assessment summary of results. This is based on the results from the plant Fire PRA.
- Perform risk informed, performance based evaluations if needed for the performance based approach.
- Summarize Defense-in-Depth strategy for each fire area.
- Determine key analysis assumptions which are candidates to be included in the NFPA 805 monitoring program.
- Provide conclusions relative to NFPA 805 compliance.

## 3.0 ANALYSIS

### 3.1 Classical Fire Protection

#### 3.1.1 Construction

For each fire zone within Fire Area AA54, walls, floors and ceilings to adjacent fire areas and fire zones are reinforced concrete in excess of a 3-hour rating with the exception noted below.

A fire area boundary evaluation was performed for the unrated removable unmortared high density concrete block walls installed between Fire Area AA5/6 - Fire Zone 5 and Fire Areas AA54 - Fire Zones 62A, 62B, 62C (Engineering Equivalency Evaluation 11-7).

Applicable Engineering Equivalency Evaluations are documented in Attachment 1.

#### 3.1.2 Doors and Access Openings

For Fire Zone 62A, a fire door having a 3-hour rating is provided to adjacent Fire Area AA5/6 - Fire Zone 5 which is normally held open by a fusible link for ventilation purposes. Fire Zone 62A is open to adjacent Fire Zone 62B through a passageway in the west wall. Access is provided to Fire Zone 62B by an opening in the east wall from Fire Zone 62A. Fire Zone 62B is also open to Fire Zone 62C through a passageway in the west wall. There are no door openings from this fire zone to adjacent fire areas. Access to Fire Zone 62C is provided by an opening in the east wall from Fire Zone 62B. There are no door openings from this fire zone to adjacent fire areas.

#### 3.1.3 Penetrations

For Fire Zone 62A, penetrations in fire barriers between this fire zone and adjacent fire areas are provided with fire seals. However, barriers between this fire zone and adjacent fire zones are not fire sealed. A fire area boundary evaluation was performed for an open penetration shaft which passes through this fire zone to Fire Area AA36/42 - Fire Zone 44A above, from Fire Area AA1 - Fire Zone 1A below (Engineering Equivalency Evaluation 9-31).

For Fire Zone 62B, penetrations in fire barriers between this fire zone and adjacent fire areas are provided with fire seals. However, barriers between this fire zone and adjacent fire zones are not fire sealed. A fire area boundary evaluation was performed for open penetration shafts which pass through this fire zone to Fire Area AA36/42 - Fire Zones 44B and 44C above, from Fire Area AA1 - Fire Zones 1B and 1C below (Engineering Equivalency Evaluation 9-31).

For Fire Zone 62C, penetrations in fire barriers between this fire zone and adjacent fire areas are provided with fire seals. However, barriers between this fire zone and adjacent fire zones are not fire sealed. A fire area boundary evaluation was performed for an open penetration shaft which passes through this fire zone to Fire Area AA36/42 - Fire Zone 44D above, from Fire Area AA1 - Fire Zone 1D below (Engineering Equivalency Evaluation 9-31).

### 3.1.4 Detection

The table below outlines the fire detection system(s) provided in the Fire Area:

Table 3-1, Fire Area AA54 Detection Systems									
Fire Zone	Type of System	Local (L) / Remote (R)	Detection Actuates Suppression?	Required System?					
				S	L	E	R	D	
62A	Ionization	L/R	N	N	N	Y	Y	N	
62B	Ionization	L/R	N	N	N	Y	Y	N	
62C	Ionization	L/R	N	N	N	Y	Y	N	

Table 3-1 Legend:	
Table Field: "Required System?"	
S	- Required for Chapter 4 Separation Criteria
L	- Required for NRC Approved Licensing Action
E	- Required for Engineering Equivalency Evaluation
R	- Required for Risk Significance
D	- Required to maintain adequate balance of Defense-in-Depth in a Change Evaluation or Fire Risk Evaluation

For each fire zone within Fire Area AA54, two ionization detectors are provided which alarm in the Unit 1 Control Room. These detectors are part of a larger detection circuit for the 587 ft. elevation of the Auxiliary Building which includes Fire Zones 3, 4, 5, 6M, 6N, 6S, 6I, 63A-C, 64A-B and 65A-B.

### 3.1.5 Fixed Suppression

The table below outlines the fixed fire suppression system(s) provided in the Fire Area:

Table 3-2, Fire Area AA54 Suppression Systems								
Fire Zone	Type of System	Full (F) / Partial (P)	Required System?					
			S	L	E	R	D	
62A	Pre-Action	F	N	N	Y	Y	N	
62B	Pre-Action	F	N	N	Y	Y	N	
62C	Pre-Action	F	N	N	Y	Y	N	

Table 3-2 Legend:	
Table Field: "Required System?"	
S	- Required for Chapter 4 Separation Criteria
L	- Required for NRC Approved Licensing Action
E	- Required for Engineering Equivalency Evaluation
R	- Required for Risk Significance
D	- Required to maintain adequate balance of Defense-in-Depth in a Change Evaluation or Fire Risk Evaluation

A dry pilot preaction sprinkler system is provided for each fire zone within this fire area. The pilot sprinklers are rated at 175°F and the water sprinklers are rated at 250°F. Manual release capability is provided on the 587 ft. elevation of the Auxiliary Building and at the valve station in the Turbine Building. These sprinklers are part of a larger sprinkler system for the 587 ft. elevation of

the Auxiliary Building which also includes Fire Zones 5, 6M, 6N, 6S, 63A-C, 64A-B and 65A-B. The pilot line provided for the charging pump cubicles also provides coverage for the safety injected pump cubicles (Fire Zones 64A and 64B). A high temperature sprinkler and pilot line detector are installed in each of the leakage detection penetration shafts at approximately the same elevation as the charging pump cubicle ceiling. These sprinklers are fed from the dry pilot preaction sprinkler system inside the Charging Pump Room.

### 3.1.6 Manual Suppression / Response Strategy

A postulated fire will be identified by early detection using ionization type smoke detection or by plant personnel using plant communication system to notify the control room. The automatic detection systems alarm in the control room. The Control Room operator will dispatch the fire brigade for initiation of manual fire fighting. A fire in this fire area will be contained by the construction features discussed in Section 3.1.1. Manual suppression is provided by the CNP Fire Brigade.

For each fire zone within Fire Area AA54, there are fire extinguishers and water hose reels located in adjacent Fire Zone 5.

Floor drains are provided in all fire zones within this fire area.

### 3.1.7 Ventilation

A fire in this area will be contained by the fire barriers. Smoke can be removed by portable fans and flexible ducting to other areas of the Auxiliary Building and outdoors if not contaminated. Contaminated smoke can be removed by portable fans and flexible ducting to other areas of the Auxiliary Building per the Fire Pre-Plans. The normal building ventilating systems in the Auxiliary Building will then exhaust the smoke via filtered monitored pathways.

For Fire Zones 62A and 62B, fire dampers having a 3-hour rating are provided to adjacent Fire Area AA11 - Fire Zone 12.

For Fire Zone 62C, fire dampers having a 3-hour rating are provided to adjacent Fire Areas AA5/6 and AA11 - Fire Zones 5 and 12, respectively.

### 3.1.8 Other Features

For Fire Zone 62A, an 8-inch high curb is provided at the entrance to the adjacent fire area and fire zone.

For Fire Zone 62B, an 8-inch high curb is provided at the entrance to the adjacent fire zones.

For Fire Zone 62C, an 8-inch high curb is provided at the entrance to the adjacent Fire Zone 62B.

6 in. high curbs are provided at the 587 ft. floor elevation of the access openings into each vertical chase/leakage detection box. These curbs will prevent fire spread down to the containment spray and RHR pump cubicles below.

## 3.2 Fire Hazards Identification

The fire area contains both ignition sources and combustible fire hazards. The ignition sources consist of the east, west and reciprocating charging pumps. Combustibles consist primarily of cable

insulation, cellulose, rubber, plastics and 79 gallons of lube oil in each fire zone.

Curbs are provided between each fire zone and aid in containing an oil spill/fire.

The combustible loading classification for all fire zones within this fire area is low.

### 3.3 NSCA Compliance Summary

Fire Area AA54, the Unit 1 Charging Pumps Area (EL. 587'), contains Unit 1 Red and Green Train Charging System pumps, valves, supporting cables, conduits and raceways.

Compliance with the nuclear safety performance criteria is achieved using the performance-based approach in accordance with NFPA 805, Section 4.2.4.2.

Safe and stable condition of Unit 1 can be accomplished using Steam Generators 2 and 3 via Unit 1 East Motor Driven Auxiliary Feedwater Pump or the Unit 1 Turbine Driven Auxiliary Feedwater Pump or Steam Generators 1 and 4 via the Unit 1 West Motor Driven Auxiliary Feedwater Pump, Control Room Process Monitoring, Alternate Charging via the Unit 2 West or East pump, Unit 1 West or East Component Cooling Water and Unit 2 West or East Component Cooling Water (supporting Unit 1 systems for Unit 2 crosstie) and Unit 1 West or East Essential Service Water and Unit 2 West or East Essential Service Water (supporting Unit 2 systems for Unit 1 crosstie). Electrical power for Unit 1 via the Red and Green Train from Offsite Power remains unaffected. Additionally, Unit 1 Red and Green Train Emergency Diesels remain unaffected.

The Nuclear Safety Performance Criteria compliance strategy for AA54 is documented within the NSCA Report.

#### 3.3.1 Variances

The variances identified for evaluation for this fire area are grouped as follows:

##### 3.3.1.1 VFDR No. AA54-001

1-PP-50E and 1-PP-50W - The Unit 1 East or West Charging Pump is required to be operable to support CVCS for inventory, reactivity and pressure control and seal cooling. The Unit 1 charging pumps may fail due to a full area fire within Fire Area AA54. 1-PP-50E may fail due to fire induced damage due to location and cable 8007G-1. 1-PP-50W may fail due to fire induced damage due to location and cable 8007R-1. Failure of both Unit 1 charging pumps requires cross-tying to the Unit 2 charging pumps to provide charging. Cross-tying requires the operation of manual valves 1-CS-302, 1-CS-534 and 2-CS-536. This condition represents a variance from the deterministic requirements of NFPA 805, Section 4.2.3. This is a separation issue.

This VFDR has been evaluated and it was determined that the risk, safety margin and defense-in-depth meet the acceptance criteria of NFPA 805 Section 4.2.4 with a defense-in-depth action credited.

#### 3.3.2 Recovery Actions Credited

For each VFDR, a Fire Risk Evaluation has been performed to assess the acceptability of risk, defense-in-depth, and safety margin. This evaluation determined whether or not recovery actions are required to ensure that one success path necessary to achieve and maintain the nuclear safety performance criteria is maintained free of fire damage by a single fire. Table 3-3 identifies the



credited recovery actions for this area. Actions retained for DID are identified as “DID Actions” within Table 3-3. Additional information for DID actions is contained within Section 3.8 of this report. Note that, for completeness, all VFDRs are contained within Table 3-3, even if the Fire Risk Evaluation has determined that a recovery action is not required. In those instances where a recovery action has been determined to not be required, the word “None” is provided in the “Action” column in the table.

Table 3-3, Recovery Actions Credited		
VFDR	Component	Action
AA54-001	1-PP-50E	DID ACTION
	1-PP-50W	1-CS-302-CLOSE (Close manual valve 1-CS-302)
		1-CS-534-OPEN (Open manual valve 1-CS-534)
		2-CS-536-OPEN (Open manual valve 2-CS-536)

### 3.4 Non-Power Operational Modes Compliance Summary

A review of CNP for the potential effects of a fire in this Fire Area while in non-power modes of operation (NPO) was conducted. This review was conducted using the guidance provided in NEI 04-02 and FAQ 07-0040, “Non-Power Operations Clarifications”.

The review determined that there are potential failures that affect certain Key Safety Functions (KSF) as a result of the fire in this area, and the fire could result in the loss of one or more KSF paths. Compensatory measures are required during high risk evolution periods to provide reasonable assurance a fire will not adversely affect key safety functions and the NFPA 805 performance goal for NPO is therefore satisfied. The results of the NPO analysis are contained within Technical Evaluation R1900-005-001, Non-Power Operation Modes Transition Review Report.

### 3.5 Radioactive Release Compliance Summary

The NFPA 805 radiological release goal is to provide reasonable assurance that a fire will not result in a radiological release that adversely affects the public, plant personnel or the environment. The NFPA 805 requirement is to ensure a radiation release to any unrestricted area due to the direct effects of fire suppression activities (but not involving fuel damage) shall be as low as reasonably achievable and shall not exceed applicable plant Technical Specification limits.

AA54 is within the Radiological Controlled Area (RCA) and has been identified as a potential fire area for radioactive release due to fire fighting activities. In accordance with NFPA 805 FAQ 09-0056, this potential has been reviewed to ensure that engineering controls, fire pre-plans, and fire brigade training materials are provided for containment and monitoring of gaseous and liquid effluents associated with fire suppression agents and products of combustion.

The review concludes that the steps to limit radiation release to other areas due to the direct effects of fire suppression activities, in addition to compliance with NFPA 805, Chapter 4, ensure that any radioactive release will be as low as reasonably achievable and will not exceed limits designated in the CNP Technical Specifications.

The review of this fire area, with respect to radioactive release, is documented in the NFPPM.

### 3.6 Probabilistic Risk Assessment-Summary of Results

A Fire PRA (FPRA) quantification of Fire Area AA54 was performed and is documented in PRA-NB-FIRE-FQ, Fire PRA Model Quantification Notebook. The fire risk quantification for Fire Area AA54 is analyzed using detailed fire modeling to consider risk of fire scenarios of ignition sources. PRA-NB-FIRE-FQ includes a summary of all potentially risk-significant fire scenarios (i.e., CDF > 1.0E-7 or LERF > 1.0E-8). Bounding CDF / LERF per calendar year values are reported that are based on the risk values documented in PRA-NB-FIRE-FSS, Fire PRA Fire Scenario Selection.

Fire Protection features credited in the Fire PRA are documented in R1900-0411-AA54, Detailed Fire Modeling Report: Fire Compartment: AA54 Unit 1 Charging Pumps Area (EL. 587 FT.). PRA-NB-FIRE-FSS documents the revision level of the fire modeling reports used in the most recent Fire PRA quantification.

### 3.7 Risk-Informed, Performance-Based Evaluations

Fire Risk Evaluations (FREs) have been performed to ensure that variances from the NFPA 805 deterministic requirements are acceptable. The evaluation process consists of an integrated assessment of the acceptability of risk, defense-in-depth, and safety margins.

#### 3.7.1 Transition Risk-Informed, Performance-Based Evaluations

The 'changes' associated with NFPA 805 transition were those variances from the deterministic requirements of NFPA 805 or with the existing fire protection licensing basis that were brought into compliance with the NFPA 805 performance based approach. The change identified for evaluation for Fire Area AA54 is as follows:

- Separation Issues

The Fire Risk Evaluation has determined that the change is acceptable based upon:

- The measured change in CDF and LERF.
- Adequate defense-in-depth and safety margins being maintained.

Refer to Attachment 2 for a summary of results associated with the Fire Risk Evaluations.

### 3.8 Defense-in-Depth

A comprehensive risk-informed, performance-based analysis includes consideration of defense-in-depth (DID) as part of an integrated evaluation of risk considerations. In general, defense-in-depth involves consideration of the extent to which fire protection systems and features are provided within the three echelons of fire-protection:

- Preventing fires from starting,
- Rapidly detecting fires and controlling and extinguishing promptly those fires that do occur, thereby limiting fire damage,
- Providing an adequate level of fire protection for structures, systems, and components important to safety, so that a fire that is not promptly extinguished will not prevent the nuclear safety performance criteria from being met.

Each VFDR was evaluated for DID. The following recovery actions have been retained for DID.

VFDR No. AA54-001: 1-PP-50E and 1-PP-50W - The Unit 1 East and West Charging Pumps are required to be operable to support CVCS. Fire scenarios within AA54 are causing the loss of the Unit 1 Charging Pumps. Failure of the Unit 1 Charging Pumps can be mitigated by aligning the Unit 2 Charging Pumps to inject through the Unit 1 BIT. This requires manual valves 1-CS-534 and 2-CS-536 be opened and manual valve 1-CS-302 be closed. These recovery actions are being retained for DID to ensure Unit 1 CVCS is available.

Based on the assessment in support of the Fire Risk Evaluation, defense-in-depth is maintained for fire area AA54. Refer to Attachment 2 for details associated with the Fire Risk Evaluation.

### 3.9 Monitoring Program Input

A Monitoring Program will be developed in accordance with FAQ 10-0059, Rev. 1. Methods to monitor availability, reliability, and performance of fire protection program structures, systems, and components (SSCs), as well as programmatic elements will be provided. Additionally, effectiveness measures are established to review program related performance and trends. For AA54 the following systems and features are candidates for inclusion in the CNP Fire Protection Monitoring Program:

- Fire Area boundary barriers discussed in Section 3.1
- Fire Detection System (ionization detection)
- Fire Suppression System (preaction suppression)

### 4.0 CONCLUSION

The nuclear safety and radioactive release performance criteria of NFPA 805 are met for a fire in Fire Area AA54. This Fire Risk Evaluation for Fire Area AA54 has demonstrated that

- The change in core damage frequency (delta CDF) is acceptable, and
- The change in large early release frequency (delta LERF) is acceptable, and
- Defense-in-depth and safety margins are maintained.

This is confirmation that a success path effectively remains free of fire damage and that the performance-based approach is acceptable per Section 4.2.4.2 of NFPA 805.

## 5.0 REFERENCES

- 5.1 CNP Fire Pre-Plans, Volumes I, II, and III, Revisions 17, 14, and 18 respectively
- 5.2 Fire Hazards Analysis
- 5.3 NFPA 805, Performance-Based Standard for Fire Protection for Light Water Reactor Electric Generating Plants
- 5.4 NFPPM, NFPA 805 Fire Protection Program Manual (NFPPM)
- 5.5 Nuclear Energy Institute (NEI) 04-02, Guidance for Implementing a Risk-Informed, Performance-Based Fire Protection Program under 10 CFR 50.48(c), Rev. 2
- 5.6 Nuclear Safety Capability Assessment Report
- 5.7 PRA-FIRE-17663-701-AA54, AA54 - Fire Risk Evaluation, Rev. Revision 0
- 5.8 PRA-NB-FIRE-FQ, Fire PRA Model Quantification Notebook
- 5.9 PRA-NB-FIRE-FSS, Fire PRA Fire Scenario Selection
- 5.10 R1900-0411-AA55, AA55 - Detailed Fire Modeling Report
- 5.11 Regulatory Guide 1.205, Risk-Informed, Performance-Based Fire Protection for Existing Light-Water Nuclear Power Plants, Rev. Revision 1
- 5.12 Technical Evaluation R1900-005-001, Non-Power Operation Modes Transition Review

**Fire Area AA54 – Attachment 1 - Table B-3 - Fire Area Transition**

<u>Unit</u>	<u>Fire Area</u>	<u>Description</u>
1	AA54	Unit 1 Charging Pumps Area (El. 587 ft.)

<u>Fire Zone</u>	<u>Description</u>
62A	Reciprocating Charging Pump - El. 587 ft. 0 in. - Unit 1
62B	Centrifugal Charging Pump - El. 587 ft. 0 in. - Unit 1
62C	Centrifugal Charging Pump - El. 587 ft. 0 in. - Unit 1

**Regulatory Basis**

4.2.4.2 - Performance-Based Approach - Fire Risk Evaluation with simplifying deterministic assumptions

<b>Performance Goal</b>	<b>Method of Accomplishment</b>	<b>Comments</b>
Reactivity Control	Unit 1 - Trip the reactor from the Control Room. Borate using Unit 2 East or West Charging Pump supplied from the Unit 2 RWST through the Unit 1 BIT. Use source range monitoring for indication.	None
Inventory and Pressure Control	Unit 1 - Control inventory using Unit 2 East or West Charging Pump through the Unit 1 BIT. Control pressure using Unit 1 Pressurizer Safety Relief Valves.	VFDR identified for CVCS.
Decay Heat Removal	Unit 1 - Feed SGs 1 & 4 with Unit 1 West MDAFW Pump or feed SGs 2 & 3 with Unit 1 East MDAFW Pump or Unit 1 TDAFW Pump. The DHR function also requires MS isolation with a steam release path through the Safety Relief Valves.	None
Process Monitoring	Unit 1 Process Monitoring - Use Unit 1 process monitoring in the Control Room for the following: Pressurizer level, RCS pressure and temperature, and S/G level and Pressure. Unit 1 Source Range Monitoring - Use Unit 1 source range monitoring in the Control Room.	None
Vital Auxiliaries	Unit 1 Electrical - Control Unit 1 Red (AB) Train Electrical Distribution with Unit 1 Red (AB) Train Offsite Power or Unit 1 Red (AB) DG. Control Unit 1 Green (CD) Train Electrical Distribution with Unit 1 Green (CD) Train Offsite Power or Unit 1 Green (CD) DG. To support Unit 2 charging pumps control Unit 2 Red (AB) Train Electrical Distribution with Unit 2 Red (AB) Train Offsite Power or Unit 2 Red (AB) DG. Control Unit 2 Green (CD) Train Electrical Distribution with Unit 2 Green (CD) Train Offsite Power or Unit 2	None

**Fire Area AA54 – Attachment 1 - Table B-3 - Fire Area Transition**

<u>Unit</u>	<u>Fire Area</u>	<u>Description</u>
1	AA54	Unit 1 Charging Pumps Area (El. 587 ft.)
		<p>Green (CD) DG.</p> <p>Unit 1 ESW - Operate Unit 1 and Unit 2 East or West ESW.</p> <p>Unit 1 CCW - Operate Unit 1 and Unit 2 East or West CCW.</p> <p>Unit 1 HVAC - Operate Unit 1 Control Room HVAC. Operate Unit 1 Auxiliary Building HVAC. Operate Unit 1 and Unit 2 Red (AB) and Green (CD) DG HVAC. Operate Unit 1 and Unit 2 Switchgear HVAC. Operate Unit 1 East and West MDAFW and TDAFW Room HVAC systems. Operate the Unit 1 East and West ESW Room HVAC systems.</p>

**Reference Documents**

Genesis Solution Suite, EDISON / SAFE-PB, DC Cook V 3.4.0

Nuclear Safety Capability Assessment Report

**Licensing Actions**

None

**Existing Engineering Equivalency Evaluations (EEEE)**

**EEEE Title** Engineering Equivalency Evaluation 9-4 - Auxiliary Building Vertical Air Shafts Evaluation: Fire Zones 12 (Fire Area AA11) and 22 (Fire Area AA27)

**Summary** The purpose of this engineering equivalency evaluation is to document the acceptability of two vertical air shafts, located in the Auxiliary Building (Fire Areas AA11 and AA27), that extend from the 573 ft. elevation to just below the 650 ft. elevation with dampered and undampered ventilation openings.

Reasonable assurance is provided that a fire in any of the adjoining fire areas to the Auxiliary Building air shafts with undampered or unrated duct penetrations or a fire in either air shaft will not adversely impact on safe shutdown capabilities of CNP. In addition, this engineering equivalency evaluation does not adversely impact other engineering equivalency evaluations.

The air shafts were evaluated and found to be acceptable based on the fire hazards, fire protection systems and construction features within the evaluated areas.

**Fire Area AA54 – Attachment 1 - Table B-3 - Fire Area Transition**

<u>Unit</u>	<u>Fire Area</u>	<u>Description</u>
1	AA54	Unit 1 Charging Pumps Area (El. 587 ft.)

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**EEEE Title** **Engineering Equivalency Evaluation 9-31 - Fire Zones 62A, 62B and 62C (Fire Area AA54) Boundary Evaluation**

**Summary** The purpose of this engineering equivalency evaluation is to document the acceptability of steel plate covered access openings to vertical chases/leakage detection boxes in Fire Zones 62A, 62B, and 62C (all from Fire Area AA54) that connect the RHR and containment spray pumps below with their heat exchangers above.

Reasonable assurance is provided that a fire in the vicinity of the vertical chases/leakage detection boxes passing through Fire Zones 62A, 62B and 62C would not impair safe shutdown capabilities of CNP. This engineering equivalency evaluation does not adversely impact other engineering equivalency evaluations.

The openings were evaluated and found to be acceptable based on the fire hazards, fire protection systems and construction features within the evaluated areas.

**EEEE Title** **Engineering Equivalency Evaluation 11-7 - Fire Zone 5 (Fire Area AA5/6) to Unit 1 Fire Zones 62A, 62B and 62C (Fire Area AA54) and Unit 2 Fire Zones 63A, 63B and 63C (Fire Area AA5) Removable Block Walls**

**Summary** The purpose of this engineering equivalency evaluation is to document the acceptability of unrated fire area boundaries between the common Unit 1 and Unit 2 east end of the Auxiliary Building at elevation 587 ft. (Fire Zone 5), and the Unit 1 charging pump cubicles (Fire Zones 62A, 62B and 62C) and the Unit 2 charging pump cubicles (Fire Zones 63A, 63B and 63C) for their impact on preventing the spread of fire.

Reasonable assurance is provided that a fire developing in either the Unit 1 charging pump cubicles (Fire Zones 62A, 62B and 62C), the Unit 2 charging pump cubicles (Fire Zones 63A, 63B and 63C) or the east end of the Auxiliary Building at elevation 587 ft. (Fire Zone 5) will not impair the safe shutdown capabilities of Unit 1 or Unit 2. In addition, this engineering equivalency evaluation does not adversely impact other engineering equivalency evaluations.

The boundaries were evaluated and found to be acceptable based on the fire hazards, fire protection systems and construction features within the evaluated areas.

**Fire Area AA54 – Attachment 1 - Table B-3 - Fire Area Transition**

<u>Unit</u>	<u>Fire Area</u>	<u>Description</u>
1	AA54	Unit 1 Charging Pumps Area (El. 587 ft.)

**EEEE Title Engineering Equivalency Evaluation 11-9 - Turbine, Auxiliary and Containment Buildings Boundary Evaluation**

**Summary** The purpose of this engineering equivalency evaluation is to describe in general, the approach and existence of evaluations performed to determine and reconcile fire area boundaries having components or designs with less than a 3-hr fire rating on preventing the spread of fire. This engineering equivalency evaluation also specifically evaluates the impact of unrated door assemblies on the spread of fire.

Reasonable assurance is provided that the fire area boundaries having components or design less than a 3-hr fire rating will not increase the spread of fire or impair the safe shutdown capabilities of Units 1 or 2. In addition, this engineering equivalency evaluation does not adversely impact on other engineering equivalency evaluations or exemption requests.

This evaluation supports additional evaluations credited in this fire area.

**Fire Suppression Effects on Nuclear Safety Performance Criteria**

The CNP fire brigade is trained to discharge water in a judicious manner and instructed to direct hose streams and portable extinguishers at the base of the fire to limit the amount of overspray beyond the immediate fire zone. For this reason, fire brigade activities are not expected to fail components which are not immediately involved in the fire scenario. It has been concluded that water impingement on cables is not a concern. Electrical cabinets are provided with a seal at the conduit interface to prevent water intrusion. Per visual inspection any side vents for this equipment are pointed downward to prevent water intrusion. Therefore, in the event of discharge, the pre-action system will not adversely effect the other equipment operating within the fire zone. The drainage features of the fire area mitigate the potential for flooding damage due to fire suppression, such that the standing water would not affect credited equipment.

Since it is shown that suppression effects will not impact the nuclear safety performance criteria, the fire area configuration is deemed acceptable.

**References:**

Technical Evaluation 12.1, "Fire Suppression Effects Study"

Technical Evaluation 12.1, "Supplemental Information to Fire Suppression Effects Study – Supplement 1"

**Fire Area Comments**

None



## Fire Area AA54 – Attachment 2 - Fire Risk Evaluation Results Summary

### A2.1 Introduction

The ‘changes’ associated with NFPA 805 transition were those variances from the deterministic requirements of NFPA 805. The changes identified for evaluation for fire area AA54 are grouped as follows:

- Separation Issues

This attachment is a summary of the Fire Risk Evaluation for the fire area. The complete results and methodology are contained in Fire Risk Evaluation PRA-FIRE-17663-701-AA54.

### A2.2 Inputs/Assumptions

Fire modeling processes and inputs provided in NUREG/CR-6850 are appropriate for use in a risk-informed, performance-based evaluation. The complete list of assumptions used in the fire modeling methodology for this fire area is contained in Detailed Fire Modeling Technical Evaluation R1900-0411-AA54.

### A2.3 Fire Modeling Methodology

Fire PRA fire modeling results are used as the initial input into this Fire Risk Evaluation. The process consists of conservative bounding analyses using NUREG/CR-6850 methods. As needed, refinements are made to utilize more realistic parameters. The complete fire modeling methodology for this fire area is contained in Detailed Fire Modeling Technical Evaluation R1900-0411-AA54.

### A2.4 Scenario Descriptions and Model Results

Fire Area AA54 was evaluated for the impact of fires originating from both fixed and transient ignition sources. Complete descriptions of each fire scenario is contained within the Detailed Fire Modeling Technical Evaluation R1900-0411-AA54.

For AA54, a total of 4 scenarios involving fixed ignition sources were generated. Three of these scenarios result in whole fire zone damage for the respective source pump and one results in whole fire area damage.

#### A2.4.1 Ignition Sources

Fire Area AA54 contains the charging pumps and the reciprocating charging pump. Ignition sources in Fire Area AA54 were modeled using the 98th percentile fire as a screening approach and refined to utilize the 75th percentile fire. The 75th percentile was used to represent a 10% oil spill in all 3 pumps.

In Fire Area AA54, the 98th percentile HRR was used for all transient fires. The 98th percentile HRR bounds the possible transient ignition sources expected for this fire area, which were fire tested and identified in NUREG/CR-6850, Appendix G, Table G-7.

#### A2.4.2 Scenario Results

The PRA analyzed the VFDRs and determined them to be risk insignificant, therefore, a quantitative delta risk calculation was not performed.

### A2.5 Fire Risk Evaluation Results

R1900-007-AA54, Revision 0 documented scenarios and corresponding impacted VFDRs that were evaluated for delta risk during transition to NFPA 805. The acceptability of the Fire Risk Evaluations was

**Fire Area AA54 – Attachment 2 - Fire Risk Evaluation Results Summary**

based on calculated delta risk meeting the thresholds of NEI 04-02, RG 1.205 and RG 1.174.

**Fire Area AA54 – Attachment 2 - Fire Risk Evaluation Results Summary****A-2.6 Impact of VFDR on Defense-in-Depth**

Defense-in-Depth has been evaluated for this fire area. The impacts of this evaluation are summarized in the table below:

Defense-in-Depth Impact Review for AA54			
Method of Providing DID	Required to Support Deterministic Analysis or Fire PRA?	Changes or Improvements Necessary for DID?	Basis/Justification
Echelon 1: Prevent fires from starting			
Combustible Control is implemented in accordance with Procedure PMP-2270-CCM-001, Control of Combustible Materials.	Yes	No	• This element is adequate based on no perceived weakness of, or over-reliance on, another echelon of defense-in-depth.
Hot Work Control is implemented in accordance with Procedure PMP-2270-WBG-001, Welding, Burning and Grinding Activities.	Yes	No	
Echelon 2: Rapidly detect, control and extinguish promptly those fires that do occur thereby limiting fire damage			
Fire Detection System	Yes	No	• Suppression and detection are already required and fire fighting activities are not expected to be challenging; therefore, no changes or improvements to Echelon 2 attributes are necessary to maintain defense-in-depth.
Fixed Fire Suppression	Yes	No	
Portable Fire Extinguishers	Yes	No	
Hose stations and hydrants	Yes	No	
Pre-Fire Plan	Yes	No	
Echelon 3: Provide adequate level of fire protection for systems and structures so that a fire will not prevent essential safety functions from being performed			
Walls, floors ceilings and structural elements are rated or have been evaluated as adequate for the hazard.	Yes	No	• There are significant modeling differences between the Fire PRA and nuclear safety capability assessment (i.e., due to different success criteria, end states, etc.) and therefore a recovery action for VFDR AA54-001 has been credited to ensure that defense-in-depth is maintained.
Penetrations in the fire area barrier are rated or have been evaluated as adequate for the hazard.	Yes	No	
Supplemental barriers (e.g., ERFBS, cable tray covers, etc.)	No	No	
Guidance provided to operations personnel detailing the required success path(s) including recovery actions to achieve nuclear safety performance criteria.	No	Yes	

## Fire Area AA54 – Attachment 2 - Fire Risk Evaluation Results Summary

### A-2.7 Safety Margin Considerations

In accordance with NEI 04-02, the maintenance of adequate Safety Margin is assessed by the consideration categories of analyses utilized by this Fire Risk Evaluation.

Safety margins are considered to be maintained if:

- Codes and Standards or their alternatives accepted for use by the NRC are met.

AND

- Safety analyses acceptance criteria in the licensing basis (e.g., FSAR, supporting analyses) are met, or provides sufficient margin to account for analysis and data uncertainty.

The following summarizes the bases for ensuring the maintenance of safety margins:

- The risk-informed, performance based processes utilized are based upon NFPA 805, 2001 edition, endorsed by the NRC in 10 CFR 50.48(c).
- The Fire Risk Evaluation process is in accordance with NEI 04-02, Revision 2, which is endorsed by the NRC in Regulatory Guide 1.205, Revision 1.
- The Fire PRA is developed in accordance with NUREG/CR-6850, which was developed jointly between the NRC and EPRI.
- The Fire PRA has undergone an industry peer review, in order to ensure the Fire PRA meets the appropriate quality standards of ASME/ANS RA-Sa-2009, "Standard for Level 1/Large Early Release Frequency Probabilistic Risk Assessment for Nuclear Power Plant Applications," Dated February 2, 2009
- The "combined analysis approach" is used during transition (NEI 04-02, Section 5.3.4.3); therefore, MEFS/LFS is not analyzed separately from the Fire PRA results.
- The CNP internal events PRA model received two formal industry peer reviews conducted in accordance with applicable NEI guidelines. The initial peer review was performed in 2001, while a subsequent focused scope (i.e., limited scope) peer review was conducted in 2009. The initial, full-scope WOG peer review covered all aspects of the CNP PRA model and the administrative processes used to maintain and update the model. The CNP PRA model has been revised to address all significant issues (i.e., Category A and B Facts & Observations) identified during the initial peer review. None of the findings from the focused-scope peer review were judged to reach the significance level of a Category A or B Fact & Observation; as a result, no changes to the PRA model have yet been made to include resolutions for these latter issues.
- Fire protection systems and features determined to be required by NFPA 805 Chapter 4 have been confirmed to meet the requirements of NFPA 805 Chapter 3 and their associated referenced codes and listings, or provided with acceptable alternatives using processes accepted for use by the NRC (i.e., FAQ 06-0008, FAQ 06-0004, 07-0033).
- Fire modeling performed in support of the transition has been performed within the Fire PRA utilizing codes and standards developed by industry and NRC staff which have been verified and validated in authoritative publications, such as NUREG 1824, "Verification and Validation of Selected Fire Models for Nuclear Power Plant Applications". In general, the fire modeling performed in support of the Fire Risk Evaluations has been performed using conservative methods and input parameters that are based upon

### Fire Area AA54 – Attachment 2 - Fire Risk Evaluation Results Summary

NUREG/CR-6850 as documented in the AA54 Detailed Fire Modeling Report, section 7.2. While this is generally not ideal in the context of best estimate probabilistic risk analysis, it is a pragmatic approach given the current state of knowledge regarding the uncertainties related to the application of the fire modeling tools and associated input parameters for specific plant configurations.

- In accordance with the requirements of 10 CFR 50.48(c)(2)(iii), the Fire PRA results, including cutsets for the scenarios of concern, have been reviewed and it was verified that the results presented above do not rely solely on feed and bleed as the fire-protected safe shutdown path for maintaining reactor coolant inventory, pressure control, and decay heat removal capability for this fire area.

#### A-2.8 Transition Risk Evaluation Conclusions

The transition change evaluation determined that these changes:

- Are acceptable based upon the measured change in CDF and LERF
- Maintained adequate defense-in-depth and safety margins

The results of this evaluation meet the requirements of NFPA 805 Risk Evaluation; therefore, the use of the performance based analysis approach is acceptable.

## D. C. Cook Nuclear Plant Fire Safety Analysis

## Fire Area: AA55

Unit 2 Charging Pumps Area (El. 587 ft.)

## Table of Contents

<b>Purpose</b> .....	Section 1.0
<b>Analysis Methodology</b> .....	Section 2.0
<b>Analysis</b> .....	Section 3.0
<b>Conclusion</b> .....	Section 4.0
<b>References</b> .....	Section 5.0

## Attachments

Fire Area AA55 – Attachment 1 - Table B-3 - Fire Area Transition

## Fire Area AA55 – Attachment 2 - Fire Risk Evaluation Results Summary

## 1.0 PURPOSE

This report documents the Fire Safety Analysis (FSA) for Cook Nuclear Plant (CNP) Fire Area AA55, Unit 2 Charging Pumps Area (El. 587 ft.) which comprises fire zone(s) 63A, 63B, 63C. The purpose of this analysis is to demonstrate the achievement of the nuclear safety and radioactive release performance criteria of NFPA 805 as required by 10 CFR 50.48(c). The Fire Safety Analysis is a key part of compliance with Section 2.7.1.2 Fire Protection Program Design Basis Document of NFPA 805. This analysis also documents results of risk-informed, performance-based Fire Risk Evaluations (FREs). These evaluations are associated with Variances from Deterministic Requirements (VFDRs) of NFPA 805 Chapter 4.

## 2.0 ANALYSIS METHODOLOGY

The FSA is the design basis document as described in NFPA 805 Section 2.7.1.2. The following steps are performed to develop the FSA on a fire area basis:

- Identify significant fire hazards in the fire area. This is based on NFPA 805 approach to analyze the plant from an ignition source and fuel package perspective.
- Summarize Nuclear Safety Capability Analysis (NSCA) compliance strategies. This is the result of the NEI 04-02 B-3 Table review of the Safe Shutdown Analysis.
- Summarize Non-Power Operations Modes compliance strategies.
- Summarize Radioactive Release compliance strategies. The transition review process required per NEI 04-02 is used to develop these results.
- Provide Fire Probabilistic Risk Assessment summary of results. This is based on the results from the plant Fire PRA.
- Perform risk informed, performance based evaluations if needed for the performance based approach.
- Summarize Defense-in-Depth strategy for each fire area.
- Determine key analysis assumptions which are candidates to be included in the NFPA 805 monitoring program.
- Provide conclusions relative to NFPA 805 compliance.

## 3.0 ANALYSIS

### 3.1 Classical Fire Protection

#### 3.1.1 Construction

For each fire zone in Fire Area AA55, walls, floors and ceilings to adjacent fire areas and fire zones are reinforced concrete in excess of a 3-hour rating with the exception noted below.

A fire area boundary evaluation was performed for the unrated removable unmortared high density concrete block walls installed between Fire Area AA5/6 - Fire Zone 5 and Fire Areas AA55 - Fire Zones 63A, 63B, 63C (Engineering Equivalency Evaluation 11-7).

Applicable Engineering Equivalency Evaluations are documented in Attachment 1.

#### 3.1.2 Doors and Access Openings

For Fire Zone 63A, a fire door having a 3-hour rating is provided to adjacent Fire Area AA5/6 - Fire Zone 5 which is normally held open by a fusible link for ventilation purposes. Access to Fire Zone 63B is provided by an opening in the east wall from Fire Zone 63A. Fire Zone 63B is also open to Fire Zone 63C through a passageway in the west wall. There are no door openings from this fire zone to adjacent fire areas. Access to Fire Zone 63C is provided by an opening in the east wall from Fire Zone 63B. There are no door openings from this fire zone to adjacent fire areas.

#### 3.1.3 Penetrations

For Fire Zone 63A, penetrations in fire barriers between this fire zone and adjacent fire areas are provided with fire seals. However, barriers between this fire zone and adjacent fire zones are not fire sealed. A fire area boundary evaluation was performed for an open penetration shaft which passes through this fire zone to Fire Area AA36/42 - Fire Zone 44E above, from Fire Area AA1 - Fire Zone 1E below (Engineering Equivalency Evaluation 9-32).

For Fire Zone 63B, penetrations in fire barriers between this fire zone and adjacent fire areas are provided with fire seals. However, barriers between this fire zone and adjacent fire zones are not fire sealed. A fire area boundary evaluation was performed for open penetration shafts which pass through this fire zone to Fire Area AA36/42 - Fire Zones 44F and 44G above, from Fire Area AA1 - Fire Zones 1F and 1G below (Engineering Equivalency Evaluation 9-32)

For Fire Zone 63C, penetrations in fire barriers between this fire zone and adjacent fire areas are provided with fire seals. However, barriers between this fire zone and adjacent fire zones are not fire sealed. A fire area boundary evaluation was performed for an open penetration shaft which passes through this fire zone to Fire Area AA36/42 - Fire Zone 44H above, from Fire Area AA1 - Fire Zone 1H below (Engineering Equivalency Evaluation 9-32).



### 3.1.4 Detection

The table below outlines the fire detection system(s) provided in the Fire Area:

Table 3-1, Fire Area AA55 Detection Systems								
Fire Zone	Type of System	Local (L) / Remote (R)	Detection Actuates Suppression?	Required System?				
				S	L	E	R	D
63A	Ionization	L/R	N	N	N	Y	Y	N
63B	Ionization	L/R	N	N	N	Y	Y	N
63C	Ionization	L/R	N	N	N	Y	Y	N

Table 3-1 Legend:	
Table Field: "Required System?"	
S	- Required for Chapter 4 Separation Criteria
L	- Required for NRC Approved Licensing Action
E	- Required for Engineering Equivalency Evaluation
R	- Required for Risk Significance
D	- Required to maintain adequate balance of Defense-in-Depth in a Change Evaluation or Fire Risk Evaluation

For each fire zone within Fire Area AA55, two ionization detectors are provided which alarm in the Unit 2 Control Room. These detectors are part of a larger detection circuit for the 587 ft. elevation of the Auxiliary Building which includes Fire Zones 3, 4, 5, 6M, 6N, 6S, 6I, 62A-C, 64A-B and 65A-B.

### 3.1.5 Fixed Suppression

The table below outlines the fixed fire suppression system(s) provided in the Fire Area:

Table 3-2, Fire Area AA55 Suppression Systems								
Fire Zone	Type of System	Full (F) / Partial (P)	Required System?					
			S	L	E	R	D	
63A	Pre-Action	F	N	N	Y	Y	N	
63B	Pre-Action	F	N	N	Y	Y	N	
63C	Pre-Action	F	N	N	Y	Y	N	

Table 3-2 Legend:	
Table Field: "Required System?"	
S	- Required for Chapter 4 Separation Criteria
L	- Required for NRC Approved Licensing Action
E	- Required for Engineering Equivalency Evaluation
R	- Required for Risk Significance
D	- Required to maintain adequate balance of Defense-in-Depth in a Change Evaluation or Fire Risk Evaluation

A dry pilot preaction sprinkler system is provided for each fire zone within this fire area. The pilot sprinklers are rated at 175°F and the water sprinklers are rated at 250°F. Manual release capability is provided on the 587 ft. elevation of the Auxiliary Building and at the valve station in the Turbine Building. These sprinklers are part of a larger sprinkler system for the 587 ft. elevation of

the Auxiliary Building which also includes Fire Zones 5, 6M, 6N, 6S, 62A-C, 64A-B and 65A-B. The pilot line provided for the charging pump cubicles also provides coverage for the safety injected pump cubicles (Fire Zones 64A and 64B). A high temperature sprinkler and pilot line detector are installed in each of the leakage detection penetration shafts at approximately the same elevation as the charging pump cubicle ceiling. These sprinklers are fed from the dry pilot preaction sprinkler system inside the Charging Pump Room.

### **3.1.6 Manual Suppression / Response Strategy**

A postulated fire will be identified by early detection using ionization type smoke detection or by plant personnel using plant communication system to notify the control room. The automatic detection systems alarm in the control room. The Control Room operator will dispatch the fire brigade for initiation of manual fire fighting. A fire in this fire area will be contained by the construction features discussed in Section 3.1.1. Manual suppression is provided by the CNP Fire Brigade.

For each fire zone within Fire Area AA55, there are fire extinguishers and water hose reels located in adjacent Fire Zone 5.

Floor drains are provided in all fire zones within this fire area.

### **3.1.7 Ventilation**

A fire in this area will be contained by the fire barriers. Smoke can be removed by portable fans and flexible ducting to other areas of the Auxiliary Building and outdoors if not contaminated. Contaminated smoke can be removed by portable fans and flexible ducting to other areas of the Auxiliary Building per the Fire Pre-Plans. The normal building ventilating systems in the Auxiliary Building will then exhaust the smoke via filtered monitored pathways.

For Fire Zones 63A and 63B, fire dampers having a 3-hour rating are provided to adjacent Fire Area AA27 - Fire Zone 22.

For Fire Zone 63C, fire dampers having a 3-hour rating are provided to adjacent Fire Areas AA5/6 and AA27 - Fire Zones 5 and 22, respectively.

### **3.1.8 Other Features**

For Fire Zone 63A, an 8-inch high curb is provided at the entrance to the adjacent fire area and fire zone.

For Fire Zone 63B, an 8-inch high curb is provided at the entrance to the adjacent fire zones.

For Fire Zone 63C, an 8-inch high curb is provided at the entrance to the adjacent Fire Zone 63B.

6 in. high curbs are provided at the 587 ft. floor elevation of the access openings into each vertical chase/leakage detection box. These curbs will prevent fire spread down to the containment spray and RHR pump cubicles below.

## **3.2 Fire Hazards Identification**

The fire area contains both ignition sources and combustible fire hazards. The ignition sources consist of the east, west and reciprocating charging pumps. Combustibles consist primarily of cable

insulation, cellulose, rubber, plastics and 79 gallons of lube oil in each fire zone.

Curbs are provided between each fire zone and aid in containing an oil spill/fire.

The combustible loading classification for all fire zones within this fire area is low.

### 3.3 NSCA Compliance Summary

Fire Area AA55, the Unit 2 Charging Pumps Area (EL. 587'), contains Unit 2 Red and Green Train Charging System pumps, valves, supporting cables, conduits and raceways.

Compliance with the nuclear safety performance criteria is achieved using the performance-based approach in accordance with NFPA 805, Section 4.2.4.2.

Safe and stable condition of Unit 2 can be accomplished using Steam Generators 2 and 3 via Unit 2 East Motor Driven Auxiliary Feedwater Pump or the Unit 2 Turbine Driven Auxiliary Feedwater Pump or Steam Generators 1 and 4 via the Unit 2 West Motor Driven Auxiliary Feedwater Pump, Control Room Process Monitoring, crosstie to Unit 1 Charging using the Unit 1 West or East Pump, Unit 2 West or East Component Cooling Water and Unit 1 West or East Component Cooling Water (supporting Unit 1 systems for Unit 2 crosstie) and Unit 2 West or East Essential Service Water and Unit 1 West or East Essential Service Water (supporting Unit 1 systems for Unit 2 crosstie). Electrical power for Unit 2 via the Red and Green Train from Offsite Power remains unaffected. Additionally, Unit 2 Red and Green Train Emergency Diesels remain unaffected.

The Nuclear Safety Performance Criteria compliance strategy for AA55 is documented within the NSCA Report.

#### 3.3.1 Variances

The variances identified for evaluation for this fire area are grouped as follows:

##### 3.3.1.1 VFDR No. AA55-001

2-PP-50E and 2-PP-50W - The Unit 2 East or West Charging Pump is required to be operable to support CVCS for inventory, reactivity and pressure control and seal cooling. The Unit 2 charging pumps may fail due to a full area fire within Fire Area AA55. 2-PP-50E may fail due to fire induced damage due to location and cable 8007G-2. 2-PP-50W may fail due to fire induced damage due to location and cable 8007R-2. Failure of both Unit 2 charging pumps requires cross-tying to the Unit 1 charging pumps to provide charging. Cross-tying requires the operation of manual valves 2-CS-302, 2-CS-534 and 1-CS-536. This condition represents a variance from the deterministic requirements of NFPA 805, Section 4.2.3. This is a separation issue.

This VFDR has been evaluated and it was determined that the risk, safety margin and defense-in-depth meet the acceptance criteria of NFPA 805 Section 4.2.4 with a defense-in-depth action credited.

#### 3.3.2 Recovery Actions Credited

For each VFDR, a Fire Risk Evaluation has been performed to assess the acceptability of risk, defense-in-depth, and safety margin. This evaluation determined whether or not recovery actions are required to ensure that one success path necessary to achieve and maintain the nuclear safety performance criteria is maintained free of fire damage by a single fire. Table 3-3 identifies the

credited recovery actions for this area. Actions retained for DID are identified as “DID Actions” within Table 3-3. Additional information for DID actions is contained within Section 3.8 of this report. Note that, for completeness, all VFDRs are contained within Table 3-3, even if the Fire Risk Evaluation has determined that a recovery action is not required. In those instances where a recovery action has been determined to not be required, the word “None” is provided in the “Action” column in the table.

Table 3-3, Recovery Actions Credited		
VFDR	Component	Action
AA55-001	2-PP-50E	DID ACTION
	2-PP-50W	2-CS-302-CLOSE (Close manual valve 2-CS-302)
		2-CS-534-OPEN (Open manual valve 2-CS-534)
		1-CS-536-OPEN (Open manual valve 1-CS-536)

### 3.4 Non-Power Operational Modes Compliance Summary

A review of CNP for the potential effects of a fire in this Fire Area while in non-power modes of operation (NPO) was conducted. This review was conducted using the guidance provided in NEI 04-02 and FAQ 07-0040, “Non-Power Operations Clarifications”.

The review determined that there are potential failures that affect certain Key Safety Functions (KSF) as a result of the fire in this area, and the fire could result in the loss of one or more KSF paths. Compensatory measures are required during high risk evolution periods to provide reasonable assurance a fire will not adversely affect key safety functions and the NFPA 805 performance goal for NPO is therefore satisfied. The results of the NPO analysis are contained within Technical Evaluation R1900-005-001, Non-Power Operation Modes Transition Review Report.

### 3.5 Radioactive Release Compliance Summary

The NFPA 805 radiological release goal is to provide reasonable assurance that a fire will not result in a radiological release that adversely affects the public, plant personnel or the environment. The NFPA 805 requirement is to ensure a radiation release to any unrestricted area due to the direct effects of fire suppression activities (but not involving fuel damage) shall be as low as reasonably achievable and shall not exceed applicable plant Technical Specification limits.

AA55 is within the Radiological Controlled Area (RCA) and has been identified as a potential fire area for radioactive release due to fire fighting activities. In accordance with NFPA 805 FAQ 09-0056, this potential has been reviewed to ensure that engineering controls, fire pre-plans, and fire brigade training materials are provided for containment and monitoring of gaseous and liquid effluents associated with fire suppression agents and products of combustion.

The review concludes that the steps to limit radiation release to other areas due to the direct effects of fire suppression activities, in addition to compliance with NFPA 805, Chapter 4, ensure that any radioactive release will be as low as reasonably achievable and will not exceed limits designated in the CNP Technical Specifications.

The review of this fire area, with respect to radioactive release, is documented in the NFPPM.

### 3.6 Probabilistic Risk Assessment-Summary of Results

A Fire PRA (FPRA) quantification of Fire Area AA55 was performed and is documented in PRA-NB-FIRE-FQ, Fire PRA Model Quantification Notebook. The fire risk quantification for Fire Area AA55 is analyzed using detailed fire modeling to consider risk of fire scenarios of ignition sources. PRA-NB-FIRE-FQ includes a summary of all potentially risk-significant fire scenarios (i.e., CDF > 1.0E-7 or LERF > 1.0E-8). Bounding CDF / LERF per calendar year values are reported that are based on the risk values documented in PRA-NB-FIRE-FSS, Fire PRA Fire Scenario Selection.

Fire Protection features credited in the Fire PRA are documented in R1900-0411-AA55, Detailed Fire Modeling Report: Fire Compartment: AA55 Unit 2 Charging Pumps Area (EL. 587 FT.). PRA-NB-FIRE-FSS documents the revision level of the fire modeling reports used in the most recent Fire PRA quantification.

### 3.7 Risk-Informed, Performance-Based Evaluations

Fire Risk Evaluations (FREs) have been performed to ensure that variances from the NFPA 805 deterministic requirements are acceptable. The evaluation process consists of an integrated assessment of the acceptability of risk, defense-in-depth, and safety margins.

#### 3.7.1 Transition Risk-Informed, Performance-Based Evaluations

The 'changes' associated with NFPA 805 transition were those variances from the deterministic requirements of NFPA 805 or with the existing fire protection licensing basis that were brought into compliance with the NFPA 805 performance based approach. The change identified for evaluation for Fire Area AA55 is as follows:

- Separation Issues

The Fire Risk Evaluation has determined that the change is acceptable based upon:

- The measured change in CDF and LERF.
- Adequate defense-in-depth and safety margins being maintained.

Refer to Attachment 2 for a summary of results associated with the Fire Risk Evaluations.

### 3.8 Defense-in-Depth

A comprehensive risk-informed, performance-based analysis includes consideration of defense-in-depth (DID) as part of an integrated evaluation of risk considerations. In general, defense-in-depth involves consideration of the extent to which fire protection systems and features are provided within the three echelons of fire-protection:

- Preventing fires from starting,
- Rapidly detecting fires and controlling and extinguishing promptly those fires that do occur, thereby limiting fire damage,
- Providing an adequate level of fire protection for structures, systems, and components important to safety, so that a fire that is not promptly extinguished will not prevent the nuclear safety performance criteria from being met.

Each VFDR was evaluated for DID. The following recovery actions have been retained for DID.

VFDR No. AA55-001: 2-PP-50E and 2-PP-50W - The Unit 2 East and West Charging Pumps are required to be operable to support CVCS. Fire scenarios within AA55 are causing the loss of the Unit 2 Charging Pumps. Failure of the Unit 2 Charging Pumps can be mitigated by aligning the Unit 1 Charging Pumps to inject through the Unit 2 BIT. This requires manual valves 2-CS-534 and 2-CS-536 be opened and manual valve 2-CS-302 be closed. These recovery actions are being retained for DID to ensure Unit 2 CVCS is available.

Based on the assessment in support of the Fire Risk Evaluation, defense-in-depth is maintained for fire area AA55. Refer to Attachment 2 for details associated with the Fire Risk Evaluation.

### 3.9 Monitoring Program Input

A Monitoring Program will be developed in accordance with FAQ 10-0059, Rev. 1. Methods to monitor availability, reliability, and performance of fire protection program structures, systems, and components (SSCs), as well as programmatic elements will be provided. Additionally, effectiveness measures are established to review program related performance and trends. For AA55 the following systems and features are candidates for inclusion in the CNP Fire Protection Monitoring Program:

- Fire Area boundary barriers discussed in Section 3.1
- Fire Detection System (ionization detection)
- Fire Suppression System (preaction suppression)

### 4.0 CONCLUSION

The nuclear safety and radioactive release performance criteria of NFPA 805 are met for a fire in Fire Area AA55. This Fire Risk Evaluation for Fire Area AA55 has demonstrated that

- The change in core damage frequency (delta CDF) is acceptable, and
- The change in large early release frequency (delta LERF) is acceptable, and
- Defense-in-depth and safety margins are maintained.

This is confirmation that a success path effectively remains free of fire damage and that the performance-based approach is acceptable per Section 4.2.4.2 of NFPA 805.

## **5.0 REFERENCES**

- 5.1 Calculation PRA-FIRE-NB-CRE, Fire PRA Cumulative Risk Evaluations
- 5.2 CNP Fire Pre-Plans, Volumes I, II, and III, Revisions 17, 14, and 18 respectively
- 5.3 Fire Hazards Analysis
- 5.4 NFPA 805, Performance-Based Standard for Fire Protection for Light Water Reactor Electric Generating Plants
- 5.5 NFPPM, NFPA 805 Fire Protection Program Manual (NFPPM)
- 5.6 Nuclear Energy Institute (NEI) 04-02, Guidance for Implementing a Risk-Informed, Performance-Based Fire Protection Program under 10 CFR 50.48(c), Rev. 2
- 5.7 Nuclear Safety Capability Assessment Report
- 5.8 PRA-NB-FIRE-FQ, Fire PRA Model Quantification Notebook
- 5.9 PRA-NB-FIRE-FSS, Fire PRA Fire Scenario Selection
- 5.10 R1900-0411-AA5-6, AA5-6 - Detailed Fire Modeling Report
- 5.11 Regulatory Guide 1.205, Risk-Informed, Performance-Based Fire Protection for Existing Light-Water Nuclear Power Plants, Rev. Revision 1
- 5.12 Technical Evaluation R1900-005-001, Non-Power Operation Modes Transition Review

**Fire Area AA55 – Attachment 1 - Table B-3 - Fire Area Transition**

<u>Unit</u>	<u>Fire Area</u>	<u>Description</u>
2	AA55	Unit 2 Charging Pumps Area (El. 587 ft.)

<u>Fire Zone</u>	<u>Description</u>
63A	Reciprocating Charging Pump - El. 587 ft. 0 in. - Unit 2
63B	Centrifugal Charging Pump - El. 587 ft. 0 in. - Unit 2
63C	Centrifugal Charging Pump - El. 587 ft. 0 in. - Unit 2

**Regulatory Basis**

4.2.4.2 - Performance-Based Approach - Fire Risk Evaluation with simplifying deterministic assumptions

<b>Performance Goal</b>	<b>Method of Accomplishment</b>	<b>Comments</b>
Reactivity Control	Unit 2 - Trip the reactor from the Control Room. Borate using Unit 1 East or West Charging Pump supplied from the Unit 1 RWST through the Unit 2 BIT. Use source range monitoring for indication.	None
Inventory and Pressure Control	Unit 2 - Control inventory using Unit 1 East or West Charging Pump through the Unit 2 BIT. Control pressure using Unit 2 Pressurizer Safety Relief Valves.	VFDR identified for CVCS.
Decay Heat Removal	Unit 2 - Feed SGs 1 & 4 with Unit 2 West MDAFW Pump or feed SGs 2 & 3 with Unit 2 East MDAFW Pump or TDAFW Pump. The DHR function also requires MS isolation with a steam release path through the Safety Relief Valves.	None
Process Monitoring	Unit 2 Process Monitoring - Use Unit 2 process monitoring in the Control Room for the following: Pressurizer level, RCS pressure and temperature, and S/G level and Pressure. Unit 2 Source Range Monitoring - Use Unit 2 source range monitoring in the Control Room.	None
Vital Auxiliaries	Unit 2 Electrical - Control Unit 2 Red (AB) Train Electrical Distribution with Unit 2 Red (AB) Train Offsite Power or Unit 2 Red (AB) DG. Control Unit 2 Green (CD) Train Electrical Distribution with Unit 2 Green (CD) Train Offsite Power or Unit 2 Green (CD) DG. To support Unit 1 charging pumps control Unit 1 Red (AB) Train Electrical Distribution with Unit 1 Red (AB) Train Offsite Power or Unit 1 Red (AB) DG. Control Unit 1 Green (CD) Train Electrical Distribution with Unit 1 Green (CD) Train Offsite Power or Unit 1	None



**Fire Area AA55 – Attachment 1 - Table B-3 - Fire Area Transition**

<u>Unit</u>	<u>Fire Area</u>	<u>Description</u>
2	AA55	Unit 2 Charging Pumps Area (El. 587 ft.)
		<p>Green (CD) DG.</p> <p>Unit 2 ESW - Operate Unit 1 and Unit 2 East or West ESW.</p> <p>Unit 2 CCW - Operate Unit 1 and Unit 2 East or West CCW.</p> <p>Unit 2 HVAC - Operate Unit 2 Control Room HVAC. Operate Unit 2 Auxiliary Building HVAC. Operate Unit 1 and Unit 2 Red (AB) and Green (CD) DG HVAC. Operate Unit 1 and Unit 2 Switchgear HVAC. Operate Unit 2 East and West MDAFW and TDAFW Room HVAC systems. Operate the Unit 2 East and West ESW HVAC systems.</p>

**Reference Documents**

Genesis Solution Suite, EDISON / SAFE-PB, DC Cook V 3.4.0

Nuclear Safety Capability Assessment Report

**Licensing Actions**

None

**Existing Engineering Equivalency Evaluations (EEEE)**

**EEEE Title** Engineering Equivalency Evaluation 9-4 - Auxiliary Building Vertical Air Shafts Evaluation: Fire Zones 12 (Fire Area AA11) and 22 (Fire Area AA27)

**Summary** The purpose of this engineering equivalency evaluation is to document the acceptability of two vertical air shafts, located in the Auxiliary Building (Fire Areas AA11 and AA27), that extend from the 573 ft. elevation to just below the 650 ft. elevation with dampered and undampered ventilation openings.

Reasonable assurance is provided that a fire in any of the adjoining fire areas to the Auxiliary Building air shafts with undampered or unrated duct penetrations or a fire in either air shaft will not adversely impact on safe shutdown capabilities of CNP. In addition, this engineering equivalency evaluation does not adversely impact other engineering equivalency evaluations.

The air shafts were evaluated and found to be acceptable based on the fire hazards, fire protection systems and construction features within the evaluated areas.

**Fire Area AA55 – Attachment 1 - Table B-3 - Fire Area Transition**

<u>Unit</u>	<u>Fire Area</u>	<u>Description</u>
2	AA55	Unit 2 Charging Pumps Area (El. 587 ft.)

<b><u>EEEE Title</u></b>	<b>Engineering Equivalency Evaluation 9-32 - Fire Zones 63A, 63B and 63C (Fire Area AA56) Boundary Evaluations</b>
<b><u>Summary</u></b>	<p>The purpose of this engineering equivalency evaluation is to document the acceptability of steel plate covered access openings to vertical chases/leakage detection boxes in Fire Zones 63A, 63B and 63C (all in Fire Area AA56) that connect the RHR and containment spray pumps below with their heat exchangers above.</p> <p>Reasonable assurance is provided that a fire in the vicinity of the vertical chases/leakage detection boxes passing through Fire Zones 63A, 63B and 63C would not impair safe shutdown capabilities of CNP or impact on the full area suppression exemption request for the 573 ft. elevation of the Auxiliary Building. This engineering equivalency evaluation does not adversely impact other engineering equivalency evaluations.</p> <p>The unprotected access opening steel plate covers were evaluated and found to be acceptable based on the fire hazards, fire protection systems and construction features within the evaluated areas.</p>
<b><u>EEEE Title</u></b>	<b>Engineering Equivalency Evaluation 11-7 - Fire Zone 5 (Fire Area AA5/6) to Unit 1 Fire Zones 62A, 62B and 62C (Fire Area AA54) and Unit 2 Fire Zones 63A, 63B and 63C (Fire Area AA5) Removable Block Walls</b>
<b><u>Summary</u></b>	<p>The purpose of this engineering equivalency evaluation is to document the acceptability of unrated fire area boundaries between the common Unit 1 and Unit 2 east end of the Auxiliary Building at elevation 587 ft. (Fire Zone 5), and the Unit 1 charging pump cubicles (Fire Zones 62A, 62B and 62C) and the Unit 2 charging pump cubicles (Fire Zones 63A, 63B and 63C) for their impact on preventing the spread of fire.</p> <p>Reasonable assurance is provided that a fire developing in either the Unit 1 charging pump cubicles (Fire Zones 62A, 62B and 62C), the Unit 2 charging pump cubicles (Fire Zones 63A, 63B and 63C) or the east end of the Auxiliary Building at elevation 587 ft. (Fire Zone 5) will not impair the safe shutdown capabilities of Unit 1 or Unit 2. In addition, this engineering equivalency evaluation does not adversely impact other engineering equivalency evaluations.</p> <p>The boundaries were evaluated and found to be acceptable based on the fire hazards, fire protection systems and construction features within the evaluated areas.</p>

**Fire Area AA55 – Attachment 1 - Table B-3 - Fire Area Transition**

<u>Unit</u>	<u>Fire Area</u>	<u>Description</u>
2	AA55	Unit 2 Charging Pumps Area (El. 587 ft.)

**EEEE Title Engineering Equivalency Evaluation 11-9 - Turbine, Auxiliary and Containment Buildings Boundary Evaluation**

**Summary** The purpose of this engineering equivalency evaluation is to describe in general, the approach and existence of evaluations performed to determine and reconcile fire area boundaries having components or designs with less than a 3-hr fire rating on preventing the spread of fire. This engineering equivalency evaluation also specifically evaluates the impact of unrated door assemblies on the spread of fire.

Reasonable assurance is provided that the fire area boundaries having components or design less than a 3-hr fire rating will not increase the spread of fire or impair the safe shutdown capabilities of Units 1 or 2. In addition, this engineering equivalency evaluation does not adversely impact on other engineering equivalency evaluations or exemption requests.

This evaluation supports additional evaluations credited in this fire area.

**Fire Suppression Effects on Nuclear Safety Performance Criteria**

The CNP fire brigade is trained to discharge water in a judicious manner and instructed to direct hose streams and portable extinguishers at the base of the fire to limit the amount of overspray beyond the immediate fire zone. For this reason, fire brigade activities are not expected to fail components which are not immediately involved in the fire scenario. It has been concluded that water impingement on cables is not a concern. Electrical cabinets are provided with a seal at the conduit interface to prevent water intrusion. Per visual inspection any side vents for this equipment are pointed downward to prevent water intrusion. Therefore, in the event of discharge, the pre-action system will not adversely effect the other equipment operating within the fire zone. The drainage features of the fire area mitigate the potential for flooding damage due to fire suppression, such that the standing water would not affect credited equipment.

Since it is shown that suppression effects will not impact the nuclear safety performance criteria, the fire area configuration is deemed acceptable.

**References:**

Technical Evaluation 12.1, "Fire Suppression Effects Study"

Technical Evaluation 12.1, "Supplemental Information to Fire Suppression Effects Study – Supplement 1"

**Fire Area Comments**

None

## Fire Area AA55 – Attachment 2 - Fire Risk Evaluation Results Summary

### A2.1 Introduction

The ‘changes’ associated with NFPA 805 transition were those variances from the deterministic requirements of NFPA 805. The changes identified for evaluation for fire area AA55 are grouped as follows:

- Separation Issues

This attachment is a summary of the Fire Risk Evaluation for the fire area. The complete results and methodology are contained in the Cumulative Fire Risk Evaluation, PRA-FIRE-NB-CRE. (FPCE 2017-0009)

### A2.2 Inputs/Assumptions

Fire modeling processes and inputs provided in NUREG/CR-6850 are appropriate for use in a risk-informed, performance-based evaluation. The complete list of assumptions used in the fire modeling methodology for this fire area is contained in Detailed Fire Modeling Technical Evaluation R1900-0411-AA55.

### A2.3 Fire Modeling Methodology

Fire PRA fire modeling results are used as the initial input into this Fire Risk Evaluation. The process consists of conservative bounding analyses using NUREG/CR-6850 methods. As needed, refinements are made to utilize more realistic parameters. The complete fire modeling methodology for this fire area is contained in Detailed Fire Modeling Technical Evaluation R1900-0411-AA55.

### A2.4 Scenario Descriptions and Model Results

Fire Area AA55 was evaluated for the impact of fires originating from both fixed and transient ignition sources. Complete descriptions of each fire scenario is contained within the Detailed Fire Modeling Technical Evaluation R1900-0411-AA55.

For AA55, a total of 4 scenarios involving fixed ignition sources were generated. Three of these scenarios result in whole fire zone damage for the respective source pump and one results in whole fire area damage.

#### A2.4.1 Ignition Sources

Fire Area AA55 contains the charging pumps and the reciprocating charging pump. Per discussion with plant personnel, the heat release rates for all switchgear, load centers, and MCC electrical cabinets have been characterized as qualified cable because items of this nature are generally constructed on-site. For other electrical cabinet types, where the internal cable qualification was unknown, the heat release rates have been assumed as non-qualified. Ignition sources in Fire Area AA55 were modeled using the 98th percentile fire as a screening approach and refined to utilize the 75th percentile fire. The 75th percentile was used to represent a 10% oil spill in all 3 pumps.

In Fire Area AA55, the 98th percentile HRR was used for all transient fires. The 98th percentile HRR bounds the possible transient ignition sources expected for this fire area, which were fire tested and identified in NUREG/CR-6850, Appendix G, Table G-7.

#### A2.4.2 Scenario Results

The PRA analyzed the VFDRs and determined them to be risk insignificant, therefore, a quantitative delta

## **Fire Area AA55 – Attachment 2 - Fire Risk Evaluation Results Summary**

risk calculation was not performed.

### **A2.5 Fire Risk Evaluation Results**

PRA-FIRE-NB-CRE documents scenarios and corresponding impacted VFDRs that were evaluated for delta risk during the transition to NFPA 805 and also all changes to the Fire Protection Program that are currently incorporated into the Fire PRA model. The acceptability of the Cumulative Fire Risk Evaluations was based on calculated delta risk meeting the thresholds of NEI 04-02, RG 1.205 and RG 1.174. (FPCE 2017-0009)

**Fire Area AA55 – Attachment 2 - Fire Risk Evaluation Results Summary****A-2.6 Impact of VFDR on Defense-in-Depth**

Defense-in-Depth has been evaluated for this fire area. The impacts of this evaluation are summarized in the table below:

Defense-in-Depth Impact Review for AA55			
Method of Providing DID	Required to Support Deterministic Analysis or Fire PRA?	Changes or Improvements Necessary for DID?	Basis/Justification
Echelon 1: Prevent fires from starting			
Combustible Control is implemented in accordance with Procedure PMP-2270-CCM-001, Control of Combustible Materials.	Yes	No	• This element is adequate based on no perceived weakness of, or over-reliance on, another echelon of defense-in-depth.
Hot Work Control is implemented in accordance with Procedure PMP-2270-WBG-001, Welding, Burning and Grinding Activities.	Yes	No	
Echelon 2: Rapidly detect, control and extinguish promptly those fires that do occur thereby limiting fire damage			
Fire Detection System	Yes	No	• Suppression and detection are already required and fire fighting activities are not expected to be challenging; therefore, no changes or improvements to Echelon 2 attributes are necessary to maintain defense-in-depth.
Fixed Fire Suppression	Yes	No	
Portable Fire Extinguishers	Yes	No	
Hose stations and hydrants	Yes	No	
Pre-Fire Plan	Yes	No	
Echelon 3: Provide adequate level of fire protection for systems and structures so that a fire will not prevent essential safety functions from being performed			
Walls, floors ceilings and structural elements are rated or have been evaluated as adequate for the hazard.	Yes	No	• There are significant modeling differences between the Fire PRA and nuclear safety capability assessment (i.e., due to different success criteria, end states, etc.) and therefore a recovery action for VFDR AA55-001 has been credited to ensure that defense-in-depth is maintained.
Penetrations in the fire area barrier are rated or have been evaluated as adequate for the hazard.	Yes	No	
Supplemental barriers (e.g., ERFBS, cable tray covers, etc.)	No	No	
Guidance provided to operations personnel detailing the required success path(s) including recovery actions to achieve nuclear safety performance criteria.	No	Yes	

## Fire Area AA55 – Attachment 2 - Fire Risk Evaluation Results Summary

### A-2.7 Safety Margin Considerations

In accordance with NEI 04-02, the maintenance of adequate Safety Margin is assessed by the consideration categories of analyses utilized by this Fire Risk Evaluation.

Safety margins are considered to be maintained if:

- Codes and Standards or their alternatives accepted for use by the NRC are met.

AND

- Safety analyses acceptance criteria in the licensing basis (e.g., FSAR, supporting analyses) are met, or provides sufficient margin to account for analysis and data uncertainty.

The following summarizes the bases for ensuring the maintenance of safety margins:

- The risk-informed, performance based processes utilized are based upon NFPA 805, 2001 edition, endorsed by the NRC in 10 CFR 50.48(c).
- The Fire Risk Evaluation process is in accordance with NEI 04-02, Revision 2, which is endorsed by the NRC in Regulatory Guide 1.205, Revision 1.
- The Fire PRA is developed in accordance with NUREG/CR-6850, which was developed jointly between the NRC and EPRI.
- The Fire PRA has undergone an industry peer review, in order to ensure the Fire PRA meets the appropriate quality standards of ASME/ANS RA-Sa-2009, "Standard for Level 1/Large Early Release Frequency Probabilistic Risk Assessment for Nuclear Power Plant Applications," Dated February 2, 2009
- The "combined analysis approach" is used during transition (NEI 04-02, Section 5.3.4.3); therefore, MEFS/LFS is not analyzed separately from the Fire PRA results.
- The CNP internal events PRA model received two formal industry peer reviews conducted in accordance with applicable NEI guidelines. The initial peer review was performed in 2001, while a subsequent focused scope (i.e., limited scope) peer review was conducted in 2009. The initial, full-scope WOG peer review covered all aspects of the CNP PRA model and the administrative processes used to maintain and update the model. The CNP PRA model has been revised to address all significant issues (i.e., Category A and B Facts & Observations) identified during the initial peer review. None of the findings from the focused-scope peer review were judged to reach the significance level of a Category A or B Fact & Observation; as a result, no changes to the PRA model have yet been made to include resolutions for these latter issues.
- Fire protection systems and features determined to be required by NFPA 805 Chapter 4 have been confirmed to meet the requirements of NFPA 805 Chapter 3 and their associated referenced codes and listings, or provided with acceptable alternatives using processes accepted for use by the NRC (i.e., FAQ 06-0008, FAQ 06-0004, 07-0033).
- Fire modeling performed in support of the transition has been performed within the Fire PRA utilizing codes and standards developed by industry and NRC staff which have been verified and validated in authoritative publications, such as NUREG 1824, "Verification and Validation of Selected Fire Models for Nuclear Power Plant Applications". In general, the fire modeling performed in support of the Fire Risk Evaluations has been performed using conservative methods and input parameters that are based upon

## Fire Area AA55 – Attachment 2 - Fire Risk Evaluation Results Summary

NUREG/CR-6850 as documented in the AA55 Detailed Fire Modeling Report, section 7.2. While this is generally not ideal in the context of best estimate probabilistic risk analysis, it is a pragmatic approach given the current state of knowledge regarding the uncertainties related to the application of the fire modeling tools and associated input parameters for specific plant configurations.

- In accordance with the requirements of 10 CFR 50.48(c)(2)(iii), the Fire PRA results, including cutsets for the scenarios of concern, have been reviewed and it was verified that the results presented above do not rely solely on feed and bleed as the fire-protected safe shutdown path for maintaining reactor coolant inventory, pressure control, and decay heat removal capability for this fire area.

### A-2.8 Transition Risk Evaluation Conclusions

The transition change evaluation determined that these changes:

- Are acceptable based upon the measured change in CDF and LERF
- Maintained adequate defense-in-depth and safety margins

The results of this evaluation meet the requirements of NFPA 805 Risk Evaluation; therefore, the use of the performance based analysis approach is acceptable.



D. C. Cook Nuclear Plant  
Fire Safety Analysis

Fire Area: AA56

Unit 1 Containment

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Purpose ..... Section 1.0

Analysis Methodology ..... Section 2.0

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References ..... Section 5.0

Attachments

Fire Area AA56 – Attachment 1 - Table B-3 - Fire Area Transition

Fire Area AA56 – Attachment 2 - Fire Risk Evaluation Results Summary

## 1.0 PURPOSE

This report documents the Fire Safety Analysis (FSA) for Cook Nuclear Plant (CNP) Fire Area AA56, Unit 1 Containment which comprises fire zone(s) 66, 67, 68, 101, 103, 118, 120, 122, 132, 134. The purpose of this analysis is to demonstrate the achievement of the nuclear safety and radioactive release performance criteria of NFPA 805 as required by 10 CFR 50.48(c). The Fire Safety Analysis is a key part of compliance with Section 2.7.1.2 Fire Protection Program Design Basis Document of NFPA 805. This analysis also documents results of risk-informed, performance-based Fire Risk Evaluations (FREs). These evaluations are associated with Variances from Deterministic Requirements (VFDRs) of NFPA 805 Chapter 4.

## 2.0 ANALYSIS METHODOLOGY

The FSA is the design basis document as described in NFPA 805 Section 2.7.1.2. The following steps are performed to develop the FSA on a fire area basis:

- Identify significant fire hazards in the fire area. This is based on NFPA 805 approach to analyze the plant from an ignition source and fuel package perspective.
- Summarize Nuclear Safety Capability Analysis (NSCA) compliance strategies. This is the result of the NEI 04-02 B-3 Table review of the Safe Shutdown Analysis.
- Summarize Non-Power Operations Modes compliance strategies.
- Summarize Radioactive Release compliance strategies. The transition review process required per NEI 04-02 is used to develop these results.
- Provide Fire Probabilistic Risk Assessment summary of results. This is based on the results from the plant Fire PRA.
- Perform risk informed, performance based evaluations if needed for the performance based approach.
- Summarize Defense-in-Depth strategy for each fire area.
- Determine key analysis assumptions which are candidates to be included in the NFPA 805 monitoring program.
- Provide conclusions relative to NFPA 805 compliance.

### 3.0 ANALYSIS

#### 3.1 Classical Fire Protection

##### 3.1.1 Construction

For Fire Zones 66, 101, 118, 120, and 122, walls and floors to adjacent fire areas and fire zones are reinforced concrete in excess of a 3-hour rating. The structural steel columns supporting the ceiling slab are unprotected (Engineering Equivalency Evaluation 12-11).

For Fire Zone 66, the steel beams supporting the ceiling slab are fully embedded within the concrete slab.

For Fire Zone 68, walls, floors and ceilings to adjacent fire areas and fire zones are reinforced concrete in excess of a 3-hour rating.

For Fire Zone 132, walls, floors and ceilings to adjacent fire zones are reinforced concrete in excess of a 3-hour rating. Ceiling of this fire zone consists of blow open panels to relieve high pressure steam from an accident.

For Fire Zone 134, there are no walls, floors, or ceilings to adjacent fire areas. Walls, floors and ceilings to the adjacent yard and fire zones are reinforced concrete in excess of a 3-hour rating.

For Fire Zones 67 and 103, there are no walls, floors, or ceilings to adjacent fire areas. Walls, floors and ceilings to adjacent fire zones are reinforced concrete in excess of a 3-hour rating. In Fire Zone 103, a removable precast concrete slab cover is provided over the reactor head.

Applicable Licensing Actions and Engineering Equivalency Evaluations are documented in Attachment 1.

##### 3.1.2 Doors and Access Openings

For Fire Zone 66, there are no door openings to adjacent fire areas or fire zones. An unrated submarine style ceiling hatch provides access down into this fire zone from Fire Zone 122 above. Fire Zone 66 provides access by means of laddered manways to Fire Zone 101, 118 and 120 above.

For Fire Zone 67, there are no door openings to adjacent fire areas. An unrated watertight door provides access into this fire zone from the containment instrumentation room, Fire Zone 122. Similar, submarine style doors have been evaluated as robust (Engineering Equivalency Evaluation 11-56). Fire Zone 67 provides access down into Fire Zone 134 by a laddered floor opening.

For Fire Zone 68, upper containment access is provided into this fire zone from Fire Area AA3 - Fire Zone 69 by the equipment hatch air lock.

For Fire Zones 101, 118, and 120 there are no door openings to adjacent fire areas or fire zones. Access to these fire zones is by a laddered manway up from Fire Zone 66. There is also access by the stairs at the 180° azimuth for Fire Zone 101 and by the stairs at the 0° azimuth for Fire Zone 120.

For Fire Zone 103, there are no access openings to this fire zone.

For Fire Zone 122, lower containment access is provided into this fire zone from Fire Area AA34 - Fire Zone 33A by the personnel airlock. An unrated submarine style door provides access from this fire zone into lower containment Fire Zone 67. An unrated submarine style floor hatch provides access from this fire zone down into the containment piping annulus Fire Zone 66.

For Fire Zone 132, access doors are provided to the upper and lower levels of the ice condenser. Steel inlet doors are provided at elevation 633 ft. for steam entry into the ice condenser during a LOCA.

For Fire Zone 134, there are no door openings to adjacent fire areas or fire zones. Access down into this fire zone is provided by a laddered floor opening from Fire Zone 67.

### **3.1.3 Penetrations**

Note: Statements regarding fire resistance rating of penetration seals are not applicable to seals in barriers to Analysis Area YD.

For Fire Zones 66 and 68, 120, 122, and 132, all penetrations into containment are adequately sealed to prevent the spread of fire through the containment barrier. There are no fire seals provided in the fire barriers between this fire zone and adjacent fire zones.

For Fire Zone 67, the sealing of penetrations in fire barriers is not required in this fire zone.

For Fire Zone 101, all penetrations into containment are adequately sealed to prevent the spread of fire through the containment barrier. There are no fire seals provided in the fire barriers between this fire zone and adjacent fire zones inside containment.

For Fire Zone 103, penetrations in fire barriers between this fire zone and adjacent fire zones are not provided with fire seals.

For Fire Zone 118, there are no penetrations into containment in this fire zone. There are no fire seals provided in the fire barriers between this fire zone and adjacent fire zones.

For Fire Zone 134, there are no penetrations to the adjacent yard. There are no fire seals provided in the fire barriers between this fire zone and adjacent fire zones.

### 3.1.4 Detection

The table below outlines the fire detection system(s) provided in the Fire Area:

Table 3-1, Fire Area AA56 Detection Systems									
Fire Zone	Type of System	Local (L) / Remote (R)	Detection Actuates Suppression?	Required System?					
				S	L	E	R	D	
66	Thermal	L/R	No Auto Supp. (N/A)	N	N	Y	Y	N	
67	Thermal	L/R	No Auto Supp. (N/A)	N	N	Y	Y	N	
68	Thermal	L/R	No Auto Supp. (N/A)	N	N	Y	Y	N	
101	Thermal	L/R	No Auto Supp. (N/A)	N	N	Y	Y	N	
103	Thermal	L/R	No Auto Supp. (N/A)	N	N	Y	Y	N	
118	None	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
120	None	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
122	None	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
132	None	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
134	None	N/A	N/A	N/A	N/A	N/A	N/A	N/A	

**Table 3-1 Legend:**

Table Field: "Required System?"	
S	- Required for Chapter 4 Separation Criteria
L	- Required for NRC Approved Licensing Action
E	- Required for Engineering Equivalency Evaluation
R	- Required for Risk Significance
D	- Required to maintain adequate balance of Defense-in-Depth in a Change Evaluation or Fire Risk Evaluation

For Fire Zones 66, 68, 101, 103, 120, and 122, line type thermistor heat sensors are installed in the cable trays. These thermistors alarm in the Unit 1 Control Room on the Containment Auxiliary Sub-Panel.

For Fire Zone 67, line type thermistor heat sensors are installed in cable trays and around the reactor coolant pumps. These thermistors alarm in the Unit 1 Control Room on the Containment Auxiliary Sub-Panel.

Fire Zones 118, 132 and 134 are not provided with an automatic fire detection system.

### 3.1.5 Fixed Suppression

The table below outlines the fixed fire suppression system(s) provided in the Fire Area:

Table 3-2, Fire Area AA56 Suppression Systems								
Fire Zone	Type of System	Full (F) / Partial (P)	Required System?					
			S	L	E	R	D	
66	None	N/A	N/A	N/A	N/A	N/A	N/A	
67	None	N/A	N/A	N/A	N/A	N/A	N/A	
68	None	N/A	N/A	N/A	N/A	N/A	N/A	
101	None	N/A	N/A	N/A	N/A	N/A	N/A	
103	None	N/A	N/A	N/A	N/A	N/A	N/A	
118	None	N/A	N/A	N/A	N/A	N/A	N/A	
120	None	N/A	N/A	N/A	N/A	N/A	N/A	
122	None	N/A	N/A	N/A	N/A	N/A	N/A	
132	None	N/A	N/A	N/A	N/A	N/A	N/A	
134	None	N/A	N/A	N/A	N/A	N/A	N/A	
Table 3-2 Legend:								
Table Field: "Required System?"								
S	- Required for Chapter 4 Separation Criteria							
L	- Required for NRC Approved Licensing Action							
E	- Required for Engineering Equivalency Evaluation							
R	- Required for Risk Significance							
D	- Required to maintain adequate balance of Defense-in-Depth in a Change Evaluation or Fire Risk Evaluation							

Fire Area AA56 is not provided with automatic fire suppression.

### 3.1.6 Manual Suppression / Response Strategy

For fire zones within AA56 equipped with automatic detection systems, a postulated fire will be identified by early detection using thermistor heat sensors or by plant personnel using plant communication system to notify the control room. The automatic detection systems alarm in the control room. For fire zones within AA56 which are not equipped with automatic detection systems, a postulated fire will be identified by plant personnel using plant communication system to notify the control room. The Control Room operator will dispatch the fire brigade for initiation of manual fire fighting. A fire in this fire area will be contained by the construction features discussed in Section 3.1.1. Manual suppression is provided by the CNP Fire Brigade.

Fire extinguishers for all fire zones within this fire area are located in adjacent Fire Zones 33A and 69.

For Lower Containment Fire Zones 66, 67, 101, 118, 122 and 134 water hose reels and a breathing apparatus are located in the lower containment access area in adjacent Fire Zone 33A.

For Upper Containment Fire Zones 68, 103 and 132, water hose reels and a breathing apparatus are located in the adjacent Fire Zone 69.

For Fire Zone 120, water hose reels located at the lower and upper containment access areas in adjacent Fire Zones 33A and 69.

For Fire Zones 67 and 68, floor drains are not available. The containment sump system at the basement level is available.

For Fire Zone 134, floor drains are not available. The Fire Brigade is equipped with a sump pump that may be used to remove an accumulation of water.

For Fire Zone 103, floor drains are not available, the fire brigade is equipped with a sump pump that may be used to remove an accumulation of water.

For Fire Zone 120, floor drains are available for the accumulator enclosure east and associated access ways east and west of the refueling cavity. Drainage is to the containment sump system at the basement level. The drains are not available for the refueling cavity only.

Other fire zones within this fire area are equipped with floor drains.

### **3.1.7 Ventilation**

A fire in this area will be contained by the fire barriers. Contaminated smoke can be removed by portable fans and flexible ducting to other the lower or upper containment airlocks. This smoke will then pass through the Contractors Access Control Building or the Auxiliary Building roof vents and will be monitored before being vented to the outside per the Fire Pre-Plans.

For Fire Zones 66 and 67, 103, 120 and 134, there are no ventilation penetrations to adjacent fire areas. All ventilation penetrations to adjacent fire zones in the containment are undampened.

For Fire Zones 68 and 101, there are ventilation penetrations to adjacent fire areas provided with isolation valves on the outside of containment. These valves are assumed to provide adequate protection; therefore, the undampened ventilation ducts to Fire Area AA3 - Fire Zones 49 and 69 do not require fire dampers.

For Fire Zone 118, there are no ducted ventilation penetrations to adjacent fire areas or fire zones.

For Fire Zone 122, there are ventilation penetrations to adjacent fire areas provided with isolation valves on the outside of containment. These valves are assumed to provide adequate protection; therefore, the undampened ventilation ducts to Fire Area AA34 - Fire Zone 33A do not require fire dampers.

For Fire Zone 132, there are no ventilation penetrations to adjacent fire areas.

### **3.1.8 Other Features**

No other fire protection features provided for Fire Zones 66, 67, 68, 101, 103, 118, 120 or 134.

For Fire Zone 122, one channel of pressurizer liquid level indication is protected with a radiant energy shield, and the cable trays that are intervening combustibles between channels have been fire-stopped.

For Fire Zone 132, blow open floor hatches are provided at the top of the ice baskets between the

lower and upper ice condenser sections.

The reactor coolant pumps are equipped with a totally enclosed system to collect and contain the lube oil that is provided for each pump (Exemption 7.15).

### 3.2 Fire Hazards Identification

The fire area contains both ignition sources and combustible fire hazards. The ignition sources consist of the waste evaporator condensate pump, reactor coolant pumps, control rod vent fans and blowers.

Combustibles consist primarily of cable insulation, polyurethane foam, plastics and rubber. Fire Zone 67 also includes 1060 gallons of lube oil for the four RCP Pumps. Fire Zone 68 also includes wood, anti-Cs (located inside Knach boxes), and 50 gallons of lube oil for the polar crane. Fire Zone 122 also contains Thermo-Lag retired in place. Fire Zones 118 and 134 do not contain combustibles.

Containment purge ductwork that penetrates containment with isolation valves inside and outside of containment are adequate to prevent the passage of fire through the containment barrier. Fire dampers are not required at the point where the ducts penetrate containment.

All containment penetration assemblies are satisfactory to prevent the passage of fire through the containment barrier. While the penetration assemblies do not constitute a rated fire seal, they are designed and constructed to meet radiological and pressure boundary requirements and qualifications which provide an acceptable level of protection.

Minimal exterior hazards are present around the Containment Building. The building is mostly surrounded by other fire zones with only a small portion of the building subject to Yard, ground level fire hazards. No fixed fire hazards are in the area and transient fires would not impact the thick reinforced concrete exterior or any penetration assemblies in the area. Spatial separation is enough protection for the exposed Containment Building above ground level. No fire rating is required for Containment Building penetrations.

The combustible loading classification of all fire zones within this fire area is low.

### 3.3 NSCA Compliance Summary

Fire Area AA56, the Unit 1 Containment, contains numerous Unit 1 Red and Green Train supporting equipment and Red and Green train cables, conduits and raceways necessary to maintain safe and stable condition of the unit.

Compliance with the nuclear safety performance criteria is achieved using the performance-based approach in accordance with NFPA 805, Section 4.2.4.2. This area credits separation of required cables and equipment by a horizontal distance of more than 20 feet with no intervening combustibles or by radiant energy shields. Automatic detection and suppression is not required to credit separation within containment per NFPA 805, Section 4.2.3.2.a.

Safe and stable condition of Unit 1 can be accomplished using Steam Generator 2 and 3 via the Unit 1 East Motor Driven Auxiliary Feedwater Pump or Steam Generators 1 and 4 via the Unit 1 West Motor Driven Auxiliary Feedwater Pump, Control Room Process Monitoring, Unit 1 Charging via the West or East Pump, Unit 1 Component Cooling Water via the West or East Pump, and Unit 1 Essential Service Water via the East or West Pump. Electrical power is available to both the Red



and Green Train via Offsite Power. Additionally, Red and Green Train Emergency Diesels are available.

The Nuclear Safety Performance Criteria compliance strategy for AA56 is documented within the NSCA Report.

### 3.3.1 Variances

The variances identified for evaluation for this fire area are grouped as follows:

#### 3.3.1.1 VFDR No. AA56-001

1-ICM-129.P and 1-IMO-128.P - RHR Boundary Isolation Valves are required closed to support RCS integrity. RCS integrity is required to control coolant level such that inventory and pressure control is maintained. 1-ICM-129.P or 1-IMO-128.P are in series and one of the valves is required to be closed to support RCS Integrity. 1-ICM-129.P and 1-IMO-128.P may fail due to a full area fire within Fire Area AA56. 1-ICM-129.P may fail due to fire induced damage of cable 9188CG-1. 1-IMO-128.P due to fire induced damage of cable 8086CR-1. These cable failures could spuriously open the valves. This condition represents a variance from the deterministic requirements of NFPA 805, Section 4.2.3. This is a separation issue.

This VFDR has been evaluated and it was determined that the risk, safety margin and defense-in-depth meet the acceptance criteria of NFPA 805 Section 4.2.4 with no further action required.

#### 3.3.1.2 VFDR No. AA56-002

1-NLI-151-CRI, 1-NLP-151-CRI, 1-NPS-121-CRI and 1-NPS-122-LSI - Pressurizer level and RCS pressure indication are required to be operable to support process monitoring. Process monitoring is required to be available to monitor key primary and secondary parameters. 1-NLI-151-CRI may fail due to fire induced damage of sense line 1-NLI-151-LSI-SL and cable 6691C-1. 1-NLP-151-CRI may fail due to fire induced damage of sense line 1-NLP-151-CRI-SL and cable 8734CO-1. 1-NPS-121-CRI may fail due to fire induced damage of sense line 1-NPS-121-CRI-SL and cable 9765CB-1. 1-NPS-122-LSI may fail due to fire induced damage of sense line 1-NPS-122-LSI-SL and cable 9766CY-1. The cables associated with these components credit 20 feet of separation and the use of radiant energy shields. This condition represents a variance from the deterministic requirements of NFPA 805, Section 4.2.3. This is a separation issue.

This VFDR has been evaluated and it was determined that the risk, safety margin and defense-in-depth meet the acceptance criteria of NFPA 805 Section 4.2.4 with no further action required.

**3.3.1.3 VFDR No. AA56-003**

1-QRV- 113, 1-QRV- 114 and 1-QRV- 170 - Excess Letdown Isolation Valves are required to be closed to support CVCS isolation. CVCS isolation is required to maintain positive control over inventory and pressure. In order to achieve excess letdown isolation the following valves need to be closed; 1-QRV- 113 or 1-QRV- 114 or 1-QRV- 170. All of these valves may fail due to a fire within Fire Area AA56. 1-QRV- 113 may fail due to fire induced damage of cables 16308R-1 and 16309-1. 1-QRV-114 may fail due to fire induced damage of cables 16313G-1, 16314-1 and 6239PG-1. 1-QRV-170 may fail due to fire induced damage cable 5779C-1. These cable failures could spuriously open the valves. This condition represents a variance from the deterministic requirements of NFPA 805, Section 4.2.3. This is a separation issue.

This VFDR has been evaluated and it was determined that the risk, safety margin and defense-in-depth meet the acceptance criteria of NFPA 805 Section 4.2.4 with a defense-in-depth action credited.

**3.3.1.4 VFDR No. AA56-004**

1-NRV-151, 1-NRV-152 and 1-NRV-153 - Pressurizer PORVs are required to be closed to support RCS integrity. RCS integrity is required to maintain positive control over RCS inventory and pressure. 1-NRV-151 may fail due to fire induced damage of cable 8754R-1. 1-NRV-152 may fail due to fire induced damage of cable 8759R-1. 1-NRV-153 may fail due to fire induced damage of cable 8766G-1. Failure of these cables could spuriously open the valves. This condition represents a variance from the deterministic requirements of NFPA 805, Section 4.2.3. This is a separation issue.

This VFDR has been evaluated and it was determined that the risk, safety margin and defense-in-depth meet the acceptance criteria of NFPA 805 Section 4.2.4 with a defense-in-depth action credited.

**3.3.1.5 VFDR No. AA56-005**

1-NSO-021 and 1-NSO-022 - RX Head Vent Valves are required to be closed to support RCS Integrity. RCS integrity is required to maintain positive control over RCS inventory and pressure. 1-NSO-021 and 1-NSO-022 are in series requiring one of the valves to remain closed to provide RCS integrity. 1-NSO-021 may fail due to cables 9914CG-1, 80390G-1, 80391G-1 and 9916G-1. 1-NSO-022 may fail due to fire induce damage of cables 80392G-1, 80393G-1, 9914CG-1 and 9917G-1. Failure of these cables could spuriously open the valves. This condition represents a variance from the deterministic requirements of NFPA 805, Section 4.2.3. This is a separation issue.

This VFDR has been evaluated and it was determined that the risk, safety margin and defense-in-depth meet the acceptance criteria of NFPA 805 Section 4.2.4 with a defense-in-depth action credited.

**3.3.1.6 VFDR No. AA56-006**

1-NSO-023 and 1-NSO-024 - RX Head Vent Valves are required to be closed to support RCS Integrity. RCS integrity is required to maintain positive control over RCS inventory and pressure. 1-NSO-023 and 1-NSO-024 are in series requiring one of the valves to remain closed to provide RCS integrity. 1-NSO-023 may fail due to cables 9914CR-1, 80390R-1 and 80391R-1. 1-NSO-024 may fail due to fire induce damage of cables 80392R-1, 80393R-1, 9918R-1 and 9920CR-1. Failure of these cables could spuriously open the valves. This condition represents a variance from the deterministic requirements of NFPA 805, Section 4.2.3. This is a separation issue.

This VFDR has been evaluated and it was determined that the risk, safety margin and defense-in-depth meet the acceptance criteria of NFPA 805 Section 4.2.4 with a defense-in-depth action credited.

**3.3.1.7 VFDR No. AA56-007**

1-NSO-061 and 1-NSO-062 - Post Accident Vent Valves are required to be closed to support RCS integrity. RCS integrity is required to maintain positive control over RCS inventory and pressure. 1-NSO-061 and 1-NSO-062 are in series requiring one of the valves to remain closed to provide RCS integrity. 1-NSO-061 may fail due to fire induced damage of cables 9903G-1 and 9901CG-1. 1-NSO-062 may fail due to fire induced damage of cables 9903R-1, 9907CG-1 and 9909G-1. Failure of these cables could spuriously open the valves. This condition represents a variance from the deterministic requirements of NFPA 805, Section 4.2.3. This is a separation issue.

This VFDR has been evaluated and it was determined that the risk, safety margin and defense-in-depth meet the acceptance criteria of NFPA 805 Section 4.2.4 with a defense-in-depth action credited.

**3.3.1.8 VFDR No. AA56-008**

1-NSO-063 and 1-NSO-064 - Post Accident Vent Valves are required to be closed to support RCS integrity. RCS integrity is required to maintain positive control over RCS inventory and pressure. 1-NSO-063 and 1-NSO-064 are in series requiring one of the valves to remain closed to provide RCS integrity. 1-NSO-063 may fail due to fire induced damage of cable 9901CR-1. 1-NSO-064 may fail due to fire induced damage of cables 9907CR-1 and 9909R-1. Failure of these cables could spuriously open the valves. This condition represents a variance from the deterministic requirements of NFPA 805, Section 4.2.3. This is a separation issue.

This VFDR has been evaluated and it was determined that the risk, safety margin and defense-in-depth meet the acceptance criteria of NFPA 805 Section 4.2.4 with a defense-in-depth action credited.

**3.3.1.9 VFDR No. AA56-009**

1-QRV-111, 1-QRV-112, 1-QRV-160, 1-QRV-161 and 1-QRV-162 - Letdown Isolation Valves are required to be closed to support CVCS isolation. CVCS isolation is required to maintain positive control over inventory and pressure. In order to achieve letdown isolation the following valves need to be closed; 1-QRV-111 or 1-QRV-112 or (1-QRV-160 and 1-QRV-161 and 1-QRV-162). All of these valves may fail due to a full area fire within Fire Area AA56. 1-QRV-111 may fail due to location and cables 9036G-1 and 9038G-1. 1-QRV-112 may fail due to location and cables 9032R-1 and 9034R-1. 1-QRV-160 may fail due to fire induced damage of cable 9106CG-1. 1-QRV-161 may fail due to fire induced damage of cable 8470CG-1. 1-QRV-162 may fail due to fire induced damage of cable 8473CG-1. These failures could spuriously open the valves. This condition represents a variance from the deterministic requirements of NFPA 805, Section 4.2.3. This is a separation issue.

This VFDR has been evaluated and it was determined that the risk, safety margin and defense-in-depth meet the acceptance criteria of NFPA 805 Section 4.2.4 with a defense-in-depth action credited.

**3.3.1.10 VFDR No. AA56-010**

1-QRV-10, 1-QRV-20, 1-QRV-30 and 1-QRV-40 - RCP Seal Water Return Isolation Valves are required to be open to support RCS integrity by maintaining the RCP seal. RCS integrity is required to maintain positive control over RCS inventory and pressure. 1-QVR-10 may fail due to fire induced damage of cables 14421R-1 and 4418CR-1. 1-QVR-20 may fail due to fire induced damage of cables 14451G-1, 14452-1 and 4955CG-1. 1-QVR-30 may fail due to fire induced damage of cables 14469G-1, 14471-1 and 5654CG-1. 1-QVR-40 may fail due to fire induced damage of cables 14473R-1 and 14475-1. These cables could cause spurious closure of these valves. This condition represents a variance from the deterministic requirements of NFPA 805, Section 4.2.3. This is a separation issue.

This VFDR has been evaluated and it was determined that the risk, safety margin and defense-in-depth meet the acceptance criteria of NFPA 805 Section 4.2.4 with a defense-in-depth action credited.

**3.3.2 Recovery Actions Credited**

For each VFDR, a Fire Risk Evaluation has been performed to assess the acceptability of risk, defense-in-depth, and safety margin. This evaluation determined whether or not recovery actions are required to ensure that one success path necessary to achieve and maintain the nuclear safety performance criteria is maintained free of fire damage by a single fire. Table 3-3 identifies the credited recovery actions for this area. Actions retained for DID are identified as "DID Actions" within Table 3-3. Additional information for DID actions is contained within Section 3.8 of this report. Note that, for completeness, all VFDRs are contained within Table 3-3, even if the Fire Risk Evaluation has determined that a recovery action is not required. In those instances where a recovery action has been determined to not be required, the word "None" is provided in the "Action" column in the table.

<b>Table 3-3, Recovery Actions Credited</b>		
<b>VFDR</b>	<b>Component</b>	<b>Action</b>
AA56-001	1-ICM-129.P 1-IMO-128.P	None

<b>Table 3-3, Recovery Actions Credited</b>		
<b>VFDR</b>	<b>Component</b>	<b>Action</b>
AA56-002	1-NLI-151-CRI 1-NLP-151-CRI 1-NSP-121-CRI 1-NPS-122-LSI	None
AA56-003	1-QRV-113	DID ACTION(S) 1-QRV-113-CLOSE (Remove fuses from MCR to fail closed AOV 1-QRV-113)
AA56-004	1-NRV-151 1-NRV-152 1-NRV-153	DID ACTION(S) 1-NRV-151-CLOSE 1-NRV-152-CLOSE 1-NRV-153-CLOSE (Remove fuses in MCR to fail closed PORVs 1-NRV-151, 1-NRV-152, and 1-NRV-153)
AA56-005	1-NSO-021	DID ACTION(S) 1-NSO-021-CLOSE (Remove fuses in MCR to fail closed AOV 1-NSO-021)
AA56-006	1-NSO-023	DID ACTION(S) 1-NSO-023-CLOSE (Remove fuses in MCR to fail closed AOV 1-NSO-023)
AA56-007	1-NSO-061	DID ACTION(S) 1-NSO-061-CLOSE (Remove fuses in MCR to fail closed AOV 1-NSO-061)
AA56-008	1-NSO-063	DID ACTION(S) 1-NSO-063-CLOSE (Remove fuses in MCR to fail closed AOV 1-NSO-063)
AA56-009	1-QRV-111	DID ACTION(S) 1-QRV-111-CLOSE (Remove fuses in MCR to fail closed AOV 1-QRV-111)
AA56-010	1-QRV-10 1-QRV-20 1-QRV-30 1-QRV-40	DID ACTION(S) 1-QRV-10-OPEN 1-QRV-20-OPEN 1-QRV-30-OPEN 1-QRV-40-OPEN (Remove fuses in MCR to fail open AOVs 1-QRV-10, 1-QRV-20, 1-QRV-30, and 1-QRV-40)

### 3.4 Non-Power Operational Modes Compliance Summary

A review of CNP for the potential effects of a fire in this Fire Area while in non-power modes of

operation (NPO) was conducted. This review was conducted using the guidance provided in NEI 04-02 and FAQ 07-0040, "Non-Power Operations Clarifications".

The review determined that there are potential failures that affect certain Key Safety Functions (KSF) as a result of the fire in this area, and the fire could result in the loss of one or more KSF paths. Compensatory measures are required during high risk evolution periods to provide reasonable assurance a fire will not adversely affect key safety functions and the NFPA 805 performance goal for NPO is therefore satisfied. The results of the NPO analysis are contained within Technical Evaluation R1900-005-001, Non-Power Operation Modes Transition Review Report.

### 3.5 Radioactive Release Compliance Summary

The NFPA 805 radiological release goal is to provide reasonable assurance that a fire will not result in a radiological release that adversely affects the public, plant personnel or the environment. The NFPA 805 requirement is to ensure a radiation release to any unrestricted area due to the direct effects of fire suppression activities (but not involving fuel damage) shall be as low as reasonably achievable and shall not exceed applicable plant Technical Specification limits.

AA56 is within the Radiological Controlled Area (RCA) and has been identified as a potential fire area for radioactive release due to fire fighting activities. In accordance with NFPA 805 FAQ 09-0056, this potential has been reviewed to ensure that engineering controls, fire pre-plans, and fire brigade training materials are provided for containment and monitoring of gaseous and liquid effluents associated with fire suppression agents and products of combustion.

The review concludes that the steps to limit radiation release to other areas due to the direct effects of fire suppression activities, in addition to compliance with NFPA 805, Chapter 4, ensure that any radioactive release will be as low as reasonably achievable and will not exceed limits designated in the CNP Technical Specifications.

The review of this fire area, with respect to radioactive release, is documented in the NFPPM.

### 3.6 Probabilistic Risk Assessment-Summary of Results

A Fire PRA (FPRA) quantification of Fire Area AA56 was performed and is documented in PRA-NB-FIRE-FQ, Fire PRA Model Quantification Notebook. The fire risk quantification for Fire Area AA56 is analyzed using detailed fire modeling to consider risk of fire scenarios of ignition sources. PRA-NB-FIRE-FQ includes a summary of all potentially risk-significant fire scenarios (i.e., CDF > 1.0E-7 or LERF > 1.0E-8). Bounding CDF / LERF per calendar year values are reported that are based on the risk values documented in PRA-NB-FIRE-FSS, Fire PRA Fire Scenario Selection.

Fire Protection features credited in the Fire PRA are documented in R1900-0411-AA56, Detailed Fire Modeling Report: Fire Compartment: AA56 Unit 1 Containment. PRA-NB-FIRE-FSS documents the revision level of the fire modeling reports used in the most recent Fire PRA quantification.

### **3.7 Risk-Informed, Performance-Based Evaluations**

Fire Risk Evaluations (FREs) have been performed to ensure that variances from the NFPA 805 deterministic requirements are acceptable. The evaluation process consists of an integrated assessment of the acceptability of risk, defense-in-depth, and safety margins.

#### **3.7.1 Transition Risk-Informed, Performance-Based Evaluations**

The ‘changes’ associated with NFPA 805 transition were those variances from the deterministic requirements of NFPA 805 or with the existing fire protection licensing basis that were brought into compliance with the NFPA 805 performance based approach. The change identified for evaluation for Fire Area AA56 is as follows:

- Separation Issues

The Fire Risk Evaluation has determined that the change is acceptable based upon:

- The measured change in CDF and LERF.
- Adequate defense-in-depth and safety margins being maintained.

Refer to Attachment 2 for a summary of results associated with the Fire Risk Evaluations.



### 3.8 Defense-in-Depth

A comprehensive risk-informed, performance-based analysis includes consideration of defense-in-depth (DID) as part of an integrated evaluation of risk considerations. In general, defense-in-depth involves consideration of the extent to which fire protection systems and features are provided within the three echelons of fire-protection:

- Preventing fires from starting,
- Rapidly detecting fires and controlling and extinguishing promptly those fires that do occur, thereby limiting fire damage,
- Providing an adequate level of fire protection for structures, systems, and components important to safety, so that a fire that is not promptly extinguished will not prevent the nuclear safety performance criteria from being met.

Each VFDR was evaluated for DID. The following recovery actions have been retained for DID.

VFDR No. AA56-003: 1-QRV- 113, 1-QRV- 114 and 1-QRV- 170 - Excess Letdown Isolation Valves are required to be closed to support CVCS isolation. CVCS isolation is required to maintain positive control over inventory and pressure. In order to achieve excess letdown isolation the following valves need to be closed; 1-QRV- 113 or 1-QRV- 114 or 1-QRV- 170. All of these valves may fail due to a fire within Fire Area AA56. These failures can be mitigated by locally de-energizing valve 1-QRV-113 to fail the valve closed. This recovery action is being retained to ensure CVCS isolation is maintained.

VFDR No. AA56-004: 1-NRV-151, 1-NRV-152 and 1-NRV-153 - Pressurizer PORVs are required to be closed to support RCS integrity. RCS integrity is required to maintain positive control over RCS inventory and pressure. The spurious opening can be mitigated by de-energizing the valve to fail it closed. This recovery action is being retained for DID to ensure RCS pressure and inventory control is maintained.

VFDR No. AA56-005: 1-NSO-021 and 1-NSO-022 - RX Head Vent Valves are required to be closed to support RCS Integrity. RCS integrity is required to maintain positive control over RCS inventory and pressure. The spurious opening can be mitigated by de-energizing the valve to fail it closed. This recovery action is being retained for DID to ensure RCS pressure and inventory control is maintained.

VFDR No. AA56-006: 1-NSO-023 and 1-NSO-024 - RX Head Vent Valves are required to be closed to support RCS Integrity. RCS integrity is required to maintain positive control over RCS inventory and pressure. The spurious opening can be mitigated by de-energizing the valve to fail it closed. This recovery action is being retained for DID to ensure RCS pressure and inventory control is maintained.

VFDR No. AA56-007: 1-NSO-061 and 1-NSO-062 - Post Accident Vent Valves are required to be closed to support RCS integrity. RCS integrity is required to maintain positive control over RCS inventory and pressure. 1-NSO-061 and 1-NSO-062 are in series requiring one of the valves to remain closed to provide RCS integrity. The spurious opening can be mitigated by de-energizing the valve to fail it closed. This recovery action is being retained for DID to ensure RCS pressure and inventory control is maintained.

VFDR No. AA56-008: 1-NSO-063 and 1-NSO-064 - Post Accident Vent Valves are required to be



closed to support

RCS integrity. RCS integrity is required to maintain positive control over RCS inventory and pressure. 1-NSO-063 and 1-NSO-064 are in series requiring one of the valves to remain closed to provide RCS integrity. The spurious opening can be mitigated by de-energizing the valve to fail it closed. This recovery action is being retained for DID to ensure RCS pressure and inventory control is maintained.

VFDR No. AA56-009: 1-QRV-111, 1-QRV-112, 1-QRV-160, 1-QRV-161 and 1-QRV-162 - Letdown Isolation Valves are required to be closed to support CVCS isolation. CVCS isolation is required to maintain positive control over inventory and pressure. In order to achieve letdown isolation the following valves need to be closed; 1-QRV-111 or 1-QRV-112 or (1-QRV-160 and 1-QRV-161 and 1-QRV-162). All of these valves may fail due to a full area fire within Fire Area AA56. These failures can be mitigated by locally de-energizing valve 1-QRV-111 to fail the valve closed. This recovery action is being retained to ensure CVCS isolation is maintained.

VFDR No. AA56-010: 1-QVR-10, 1-QVR-20, 1-QVR-30 and 1-QVR-40 - RCP Seal Water Return Isolation Valves are required to be open to support RCS integrity by maintaining the RCP seal. RCS integrity is required to maintain positive control over RCS inventory and pressure. The spurious closing can be mitigated by de-energizing the valve to fail it open. This recovery action is being retained for DID to ensure RCS integrity is maintained.

Based on the assessment in support of the Fire Risk Evaluation, defense-in-depth is maintained for fire area AA56. Refer to Attachment 2 for details associated with the Fire Risk Evaluation.

### 3.9 Monitoring Program Input

A Monitoring Program will be developed in accordance with FAQ 10-0059, Rev. 1. Methods to monitor availability, reliability, and performance of fire protection program structures, systems, and components (SSCs), as well as programmatic elements will be provided. Additionally, effectiveness measures are established to review program related performance and trends. For AA56 the following systems and features are candidates for inclusion in the CNP Fire Protection Monitoring Program:

- Fire area and zone boundary barriers discussed in Section 3.1
- Fire Detection System (heat detection)
- Reactor Coolant Pump Oil Collection System
- Radiant Heat Shield (Fire Zone 122)

### 4.0 CONCLUSION

The nuclear safety and radioactive release performance criteria of NFPA 805 are met for a fire in Fire Area AA56. This Fire Risk Evaluation for Fire Area AA56 has demonstrated that

- The change in core damage frequency (delta CDF) is acceptable, and
- The change in large early release frequency (delta LERF) is acceptable, and
- Defense-in-depth and safety margins are maintained.

This is confirmation that a success path effectively remains free of fire damage and that the performance-based approach is acceptable per Section 4.2.4.2 of NFPA 805.

## **5.0 REFERENCES**

- 5.1 Calculation PRA-FIRE-NB-CRE, Fire PRA Cumulative Risk Evaluations
- 5.2 CNP Fire Pre-Plans, Volumes I, II, and III, Revisions 17, 14, and 18 respectively
- 5.3 Fire Hazards Analysis
- 5.4 NFPA 805, Performance-Based Standard for Fire Protection for Light Water Reactor Electric Generating Plants
- 5.5 NFPPM, NFPA 805 Fire Protection Program Manual (NFPPM)
- 5.6 Nuclear Energy Institute (NEI) 04-02, Guidance for Implementing a Risk-Informed, Performance-Based Fire Protection Program under 10 CFR 50.48(c), Rev. 2
- 5.7 Nuclear Safety Capability Assessment Report
- 5.8 PRA-NB-FIRE-FQ, Fire PRA Model Quantification Notebook
- 5.9 PRA-NB-FIRE-FSS, Fire PRA Fire Scenario Selection
- 5.10 R1900-0411-AA56, AA56 - Detailed Fire Modeling Report
- 5.11 Regulatory Guide 1.205, Risk-Informed, Performance-Based Fire Protection for Existing Light-Water Nuclear Power Plants, Rev. Revision 1
- 5.12 Technical Evaluation R1900-005-001, Non-Power Operation Modes Transition Review

**Fire Area AA56 – Attachment 1 - Table B-3 - Fire Area Transition**

<u>Unit</u>	<u>Fire Area</u>	<u>Description</u>
1	AA56	Unit 1 Containment

**Fire Zone** **Description**

66	Containment Piping Annulus - El. 598 ft. 9-3/8 in. - Unit 1
67	Containment Lower Volume - El. 598 ft. 9-3/8 in. - Unit 1
68	Containment Upper Volume - El. 650 ft. 0 in. - Unit 1
101	Containment Accumulator Enc. West - Unit 1 - El. 612 ft. 0 in.
103	Reactor Head Enclosure - Unit 1 - El. 567 ft. 2 in.
118	Containment Regen Heat Exchanger Room - Unit 1 - El. 612 ft. 0 in.
120	Containment Accumulator Enclosure East - Unit 1 - El. 612 ft. 0 in.
122	Containment Instrumentation Room - Unit 1 - El. 612 ft. 0 in.
132	Unit 1 Ice Condenser - El. 640 ft. 0 in.
134	Unit 1 Reactor Vessel Pit - El. 567 ft. 0 in.

**Regulatory Basis**

4.2.4.2 - Performance-Based Approach - Fire Risk Evaluation with simplifying deterministic assumptions

<b>Performance Goal</b>	<b>Method of Accomplishment</b>	<b>Comments</b>
Reactivity Control	Unit 1 - Trip the reactor from the Control Room. Borate using Unit 1 East or West Charging Pump supplied from the RWST. Use source range monitoring for indication.	None
Inventory and Pressure Control	Unit 1 - Control inventory using Unit 1 East or West Charging Pump. Control pressure using Unit 1 Pressurizer Safety Relief Valves.	VFDRs identified for RCS integrity and CVCS isolation.
Decay Heat Removal	Unit 1 - Feed SGs 1 & 4 with Unit 1 West MDAFW Pump or feed SGs 2 & 3 with Unit 1 East MDAFW Pump. The DHR function also requires MS isolation with a steam release path through the Safety Relief Valves.	None
Process Monitoring	Unit 1 Process Monitoring - Use Unit 1 process monitoring in the Control Room for the following: Pressurizer level, RCS pressure and temperature, and S/G level and Pressure. Unit 1 Source Range Monitoring - Use Unit 1 source range monitoring in the Control Room.	None

**Fire Area AA56 – Attachment 1 - Table B-3 - Fire Area Transition**

<u>Unit</u>	<u>Fire Area</u>	<u>Description</u>
1	AA56	Unit 1 Containment
<hr/>		
Vital Auxiliaries		<p>Unit 1 Electrical - Control Unit 1 Red (AB) Train Electrical Distribution with Unit 1 Red (AB) Train Offsite Power or Unit 1 Red (AB) DG. Control Unit 1 Green (CD) Train Electrical Distribution with Unit 1 Green (CD) Train Offsite Power or Unit 1 Green (CD) DG.</p> <p>Unit 1 ESW - Operate Unit 1 East or West ESW.</p> <p>Unit 1 CCW - Operate Unit 1 East or West CCW.</p> <p>Unit 1 HVAC - Operate Unit 1 Control Room HVAC. Operate Unit 1 Auxiliary Building HVAC. Operate Unit 1 Red (AB) and Green (CD) DG HVAC. Operate Unit 1 Switchgear HVAC. Operate Unit 1 East and West MDAFW Room HVAC systems. Operate the Unit 1 East and West ESW HVAC systems.</p>

None

**Reference Documents**

Genesis Solution Suite, EDISON / SAFE-PB, DC Cook V 3.4.0

Nuclear Safety Capability Assessment Report

**Licensing Actions****Licensing Action Title Appendix R Exemption, RCP Lube Oil Collection System (Criteria III.O) - Exemption 7.15****Summary**

Exemption approval per the NRC SER letter dated 12/23/1983 provides the following justification for RCP lube oil collection system as required by Section III.O of Appendix R, which was submitted by AEP in a letter dated 12/30/1982.

- No ignition sources at the floor level of the lower containment.
- Oil system is capable of withstanding a safe shutdown earthquake.
- Tank has the capacity to hold the total lube oil inventory for one pump.

**Existing Engineering Equivalency Evaluations (EEEE)****EEEE Title Engineering Equivalency Evaluation 11-9 - Turbine, Auxiliary and Containment Buildings Boundary Evaluation****Summary**

The purpose of this engineering equivalency evaluation is to describe in general, the approach and existence of evaluations performed to

**Fire Area AA56 – Attachment 1 - Table B-3 - Fire Area Transition**

<u>Unit</u>	<u>Fire Area</u>	<u>Description</u>
1	AA56	Unit 1 Containment

determine and reconcile fire area boundaries having components or designs with less than a 3-hr fire rating on preventing the spread of fire. This engineering equivalency evaluation also specifically evaluates the impact of unrated door assemblies on the spread of fire.

Reasonable assurance is provided that the fire area boundaries having components or design less than a 3-hr fire rating will not increase the spread of fire or impair the safe shutdown capabilities of Units 1 or 2. In addition, this engineering equivalency evaluation does not adversely impact on other engineering equivalency evaluations or exemption requests.

This evaluation supports additional evaluations credited in this fire area.

**EEEE Title Engineering Equivalency Evaluation 12-11 - Structural Steel Evaluations in Fire Areas AA2, AA3, AA34, AA35, AA56 and AA58.**

**Summary** The purpose of this engineering equivalency evaluation is to document the acceptability of the unprotected structural steel located throughout CNP and ensure its ability to withstand the fire exposure presented by combustibles present in the area. This engineering equivalency evaluation is concerned with structural steel members that form a part of or support fire barriers required by NFPA 805, Chapter 4.

Reasonable assurance is provided that exposed structural steel supporting fire barriers will not be adversely impacted by the combustibles or hazards present in the areas evaluated. In addition, reasonable assurance is provided that falling structures supported by structural steel will not have an adverse impact on other fire barriers inside the area that are required for separation of safe shutdown components.

The unprotected structural steel was evaluated and found to be acceptable based on the fire hazards and fire protection systems within the evaluated areas.

**Fire Area AA56 – Attachment 1 - Table B-3 - Fire Area Transition**

<u>Unit</u>	<u>Fire Area</u>	<u>Description</u>
1	AA56	Unit 1 Containment

**Fire Suppression Effects on Nuclear Safety Performance Criteria**

The CNP fire brigade is trained to discharge water in a judicious manner and instructed to direct hose streams and portable extinguishers at the base of the fire to limit the amount of overspray beyond the immediate fire zone. For this reason, fire brigade activities are not expected to fail components not already considered damaged by fire. It has been concluded that water impingement on cables is not a concern. Electrical cabinets are provided with a seal at the conduit interface. Per visual inspection any side vents for this equipment are pointed downward to prevent water intrusion. The drainage features of the fire area mitigate the potential for flooding damage due to fire suppression, such that the standing water would not affect credited equipment.

This fire area is not equipped with a fixed fire suppression system. Since it is shown that suppression effects will not impact the nuclear safety performance criteria, the fire area configuration is deemed acceptable.

## References:

Technical Evaluation 12.1, "Fire Suppression Effects Study"

Technical Evaluation 12.1, "Supplemental Information to Fire Suppression Effects Study – Supplement 1"

**Fire Area Comments**

None

## Fire Area AA56 – Attachment 2 - Fire Risk Evaluation Results Summary

### A2.1 Introduction

The ‘changes’ associated with NFPA 805 transition were those variances from the deterministic requirements of NFPA 805. The changes identified for evaluation for fire area AA56 are grouped as follows:

- Separation Issues

This attachment is a summary of the Fire Risk Evaluation for the fire area. The complete results and methodology are contained in the Cumulative Fire Risk Evaluation, PRA-FIRE-NB-CRE. (FPCE 2017-0009)

### A2.2 Inputs/Assumptions

Fire modeling processes and inputs provided in NUREG/CR-6850 are appropriate for use in a risk-informed, performance-based evaluation. The complete list of assumptions used in the fire modeling methodology for this fire area is contained in Detailed Fire Modeling Technical Evaluation R1900-0411-AA56.

### A2.3 Fire Modeling Methodology

Fire PRA fire modeling results are used as the initial input into this Fire Risk Evaluation. The process consists of conservative bounding analyses using NUREG/CR-6850 methods. As needed, refinements are made to utilize more realistic parameters. The complete fire modeling methodology for this fire area is contained in Detailed Fire Modeling Technical Evaluation R1900-0411-AA56.

### A2.4 Scenario Descriptions and Model Results

Fire Area AA56 was evaluated for the impact of fires originating from both fixed and transient ignition sources. Complete descriptions of each fire scenario is contained within the Detailed Fire Modeling Technical Evaluation R1900-0411-AA56.

#### A2.4.1 Ignition Sources

Fire Area AA56 contains the reactor coolant pumps, control rod vent fans, the containment pipe tunnel sump pump, the fan for the crane wall sleeve cooling, blowers and various other fans. Per discussion with plant personnel, the heat release rates for all switchgear, load centers, and MCC electrical cabinets have been characterized as qualified cable because items of this nature are generally constructed on-site. For other electrical cabinet types, where the internal cable qualification was unknown, the heat release rates have been assumed as non-qualified. Ignition sources in Fire Area AA56 were modeled using the 98th percentile fire as a screening approach and refined to utilize the 75th percentile fire. The 75th percentile was used to represent a 10% oil spill in the reactor coolant pumps. The oil collection system provided for the reactor coolant pumps was credited in the fire modeling to reduce the frequency of a 100% oil spill.

In Fire Area AA56, the 98th percentile HRR was used for all transient fires. The 98th percentile HRR bounds the possible transient ignition sources expected for this fire area, which were fire tested and identified in NUREG/CR-6850, Appendix G, Table G-7.

#### A2.4.2 Scenario Results

A delta risk calculation has been performed to quantify the risk associated with the VFDRs in the fire area.

### A2.5 Fire Risk Evaluation Results

### **Fire Area AA56 – Attachment 2 - Fire Risk Evaluation Results Summary**

PRA-FIRE-NB-CRE documents scenarios and corresponding impacted VFDRs that were evaluated for delta risk during the transition to NFPA 805 and also all changes to the Fire Protection Program that are currently incorporated into the Fire PRA model. The acceptability of the Cumulative Fire Risk Evaluations was based on calculated delta risk meeting the thresholds of NEI 04-02, RG 1.205 and RG 1.174. (FPCE 2017-0009)



## Fire Area AA56 – Attachment 2 - Fire Risk Evaluation Results Summary

### A-2.6 Impact of VFDR on Defense-in-Depth

Defense-in-Depth has been evaluated for this fire area. The impacts of this evaluation are summarized in the table below:

Defense-in-Depth Impact Review for AA56			
Method of Providing DID	Required to Support Deterministic Analysis or Fire PRA?	Changes or Improvements Necessary for DID?	Basis/Justification
Echelon 1: Prevent fires from starting			
Combustible Control is implemented in accordance with Procedure PMP-2270-CCM-001, Control of Combustible Materials.	Yes	No	• This element is adequate based on no perceived weakness of, or over-reliance on, another echelon of defense-in-depth.
Hot Work Control is implemented in accordance with Procedure PMP-2270-WBG-001, Welding, Burning and Grinding Activities.	Yes	No	
Echelon 2: Rapidly detect, control and extinguish promptly those fires that do occur thereby limiting fire damage			
Fire Detection System	Yes	No	• Since fire fighting activities are expected to be challenging, detection and manual suppression are required. No changes or improvements to Echelon 2 attributes are necessary to maintain defense-in-depth.
Fixed Fire Suppression	No	No	
Portable Fire Extinguishers	Yes	No	
Hose stations and hydrants	Yes	No	
Pre-Fire Plan	Yes	No	
Echelon 3: Provide adequate level of fire protection for systems and structures so that a fire will not prevent essential safety functions from being performed			
Walls, floors ceilings and structural elements are rated or have been evaluated as adequate for the hazard.	Yes	No	• Based on a detailed review, the variance is not the cause for the risk of the scenario, therefore implementing additional DID Echelon 3 attributes for this VFDR would provide negligible risk improvement.
Penetrations in the fire area barrier are rated or have been evaluated as adequate for the hazard.	Yes	No	
Supplemental barriers (e.g., ERFBS, cable tray covers, etc.)	No	No	• Defense in Depth actions were credited to remove fuses or open breakers in the Control Room to prevent spurious equipment operation due to internal shorts.
Guidance provided to operations personnel detailing the required success path(s) including recovery actions to achieve nuclear safety performance criteria.	No	No	
• Internal fire separation is adequate. No additional reliance on recovery actions is necessary to support defense-in-depth, therefore, no changes or improvements to Echelon 3 attributes are necessary to maintain defense-in-depth.			

## Fire Area AA56 – Attachment 2 - Fire Risk Evaluation Results Summary

### A-2.7 Safety Margin Considerations

In accordance with NEI 04-02, the maintenance of adequate Safety Margin is assessed by the consideration categories of analyses utilized by this Fire Risk Evaluation.

Safety margins are considered to be maintained if:

- Codes and Standards or their alternatives accepted for use by the NRC are met.

AND

- Safety analyses acceptance criteria in the licensing basis (e.g., FSAR, supporting analyses) are met, or provides sufficient margin to account for analysis and data uncertainty.

The following summarizes the bases for ensuring the maintenance of safety margins:

- The risk-informed, performance based processes utilized are based upon NFPA 805, 2001 edition, endorsed by the NRC in 10 CFR 50.48(c).
- The Fire Risk Evaluation process is in accordance with NEI 04-02, Revision 2, which is endorsed by the NRC in Regulatory Guide 1.205, Revision 1.
- The Fire PRA is developed in accordance with NUREG/CR-6850, which was developed jointly between the NRC and EPRI.
- The Fire PRA has undergone an industry peer review, in order to ensure the Fire PRA meets the appropriate quality standards of ASME/ANS RA-Sa-2009, "Standard for Level 1/Large Early Release Frequency Probabilistic Risk Assessment for Nuclear Power Plant Applications," Dated February 2, 2009
- The "combined analysis approach" is used during transition (NEI 04-02, Section 5.3.4.3); therefore, MEFS/LFS is not analyzed separately from the Fire PRA results.
- The CNP internal events PRA model received two formal industry peer reviews conducted in accordance with applicable NEI guidelines. The initial peer review was performed in 2001, while a subsequent focused scope (i.e., limited scope) peer review was conducted in 2009. The initial, full-scope WOG peer review covered all aspects of the CNP PRA model and the administrative processes used to maintain and update the model. The CNP PRA model has been revised to address all significant issues (i.e., Category A and B Facts & Observations) identified during the initial peer review. None of the findings from the focused-scope peer review were judged to reach the significance level of a Category A or B Fact & Observation; as a result, no changes to the PRA model have yet been made to include resolutions for these latter issues.
- Fire protection systems and features determined to be required by NFPA 805 Chapter 4 have been confirmed to meet the requirements of NFPA 805 Chapter 3 and their associated referenced codes and listings, or provided with acceptable alternatives using processes accepted for use by the NRC (i.e., FAQ 06-0008, FAQ 06-0004, 07-0033).
- Fire modeling performed in support of the transition has been performed within the Fire PRA utilizing codes and standards developed by industry and NRC staff which have been verified and validated in authoritative publications, such as NUREG 1824, "Verification and Validation of Selected Fire Models for Nuclear Power Plant Applications". In general, the fire modeling performed in support of the Fire Risk Evaluations has been performed using conservative methods and input parameters that are based upon

### Fire Area AA56 – Attachment 2 - Fire Risk Evaluation Results Summary

NUREG/CR-6850 as documented in the AA56 Detailed Fire Modeling Report, section 7.2. While this is generally not ideal in the context of best estimate probabilistic risk analysis, it is a pragmatic approach given the current state of knowledge regarding the uncertainties related to the application of the fire modeling tools and associated input parameters for specific plant configurations.

- In accordance with the requirements of 10 CFR 50.48(c)(2)(iii), the Fire PRA results, including cutsets for the scenarios of concern, have been reviewed and it was verified that the results presented above do not rely solely on feed and bleed as the fire-protected safe shutdown path for maintaining reactor coolant inventory, pressure control, and decay heat removal capability for this fire area.

#### A-2.8 Transition Risk Evaluation Conclusions

The transition change evaluation determined that these changes:

- Are acceptable based upon the measured change in CDF and LERF
- Maintained adequate defense-in-depth and safety margins

The results of this evaluation meet the requirements of NFPA 805 Risk Evaluation; therefore, the use of the performance based analysis approach is acceptable.

D. C. Cook Nuclear Plant  
Fire Safety Analysis  
  
Fire Area: AA57A

Unit 1 Control Room HVAC Equipment and Computer Areas (El. 650 ft.)

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Purpose ..... Section 1.0

Analysis Methodology ..... Section 2.0

Analysis ..... Section 3.0

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Attachments

Fire Area AA57A – Attachment 1 - Table B-3 - Fire Area Transition

Fire Area AA57A – Attachment 2 - Fire Risk Evaluation Results Summary

## 1.0 PURPOSE

This report documents the Fire Safety Analysis (FSA) for Cook Nuclear Plant (CNP) Fire Area AA57A, Unit 1 Control Room HVAC Equipment and Computer Areas (El. 650 ft.) which comprises fire zone(s) 70, 71. The purpose of this analysis is to demonstrate the achievement of the nuclear safety and radioactive release performance criteria of NFPA 805 as required by 10 CFR 50.48(c). The Fire Safety Analysis is a key part of compliance with Section 2.7.1.2 Fire Protection Program Design Basis Document of NFPA 805. This analysis also documents results of risk-informed, performance-based Fire Risk Evaluations (FREs). These evaluations are associated with Variances from Deterministic Requirements (VFDRs) of NFPA 805 Chapter 4.

## 2.0 ANALYSIS METHODOLOGY

The FSA is the design basis document as described in NFPA 805 Section 2.7.1.2. The following steps are performed to develop the FSA on a fire area basis:

- Identify significant fire hazards in the fire area. This is based on NFPA 805 approach to analyze the plant from an ignition source and fuel package perspective.
- Summarize Nuclear Safety Capability Analysis (NSCA) compliance strategies. This is the result of the NEI 04-02 B-3 Table review of the Safe Shutdown Analysis.
- Summarize Non-Power Operations Modes compliance strategies.
- Summarize Radioactive Release compliance strategies. The transition review process required per NEI 04-02 is used to develop these results.
- Provide Fire Probabilistic Risk Assessment summary of results. This is based on the results from the plant Fire PRA.
- Perform risk informed, performance based evaluations if needed for the performance based approach.
- Summarize Defense-in-Depth strategy for each fire area.
- Determine key analysis assumptions which are candidates to be included in the NFPA 805 monitoring program.
- Provide conclusions relative to NFPA 805 compliance.

### 3.0 ANALYSIS

#### 3.1 Classical Fire Protection

##### 3.1.1 Construction

For Fire Zone 70, walls, floors and ceilings to adjacent fire areas are reinforced concrete in excess of a 3-hour rating. An 8-inch concrete block wall of an unspecified rating is provided between this fire zone and the Computer Room (Fire Zone 71). The roof is constructed of concrete covered with built-up roofing materials meeting UL Class A/FM Class 1 construction.

For Fire Zone 71, walls, floors and ceilings to adjacent fire areas are reinforced concrete in excess of a 3-hour rating. An 8-inch concrete block wall of an unspecified rating is provided between this fire zone and the HVAC Equipment Room (Fire Zone 70). The roof is constructed of concrete covered with built-up roofing materials meeting UL Class A/ FM Class 1 construction.

Applicable Engineering Equivalency Evaluations are documented in Attachment 1.

##### 3.1.2 Doors and Access Openings

For Fire Zone 70, a fire area boundary evaluation was performed for an unrated floor hatch fire door to Fire Area AA46 - Fire Zone 53 (Engineering Equivalency Evaluation 9-5). An unrated door is provided to the adjacent Computer Room, Fire Zone 71.

For Fire Zone 71, there are door openings to adjacent fire areas (AR 2016-14495). A fire door having a 3-hour rating is provided to adjacent Fire Zone 72. An unrated door is provided to adjacent Fire Zone 70.

##### 3.1.3 Penetrations

Note: Statements regarding fire resistance rating of penetration seals are not applicable to seals in barriers to Analysis Area YD.

For both fire zones in Fire Area AA57A, penetrations in fire barriers between these fire zones and adjacent fire areas and fire zones are provided with fire seals (Technical Evaluation 11-25).

### 3.1.4 Detection

The table below outlines the fire detection system(s) provided in the Fire Area:

Table 3-1, Fire Area AA57A Detection Systems								
Fire Zone	Type of System	Local (L) / Remote (R)	Detection Actuates Suppression?	Required System?				
				S	L	E	R	D
70	Ionization	L/R	N	N	N	Y	Y	N
71	Ionization	L/R	N	N	N	Y	Y	N

**Table 3-1 Legend:**

Table Field: "Required System?"	
S	- Required for Chapter 4 Separation Criteria
L	- Required for NRC Approved Licensing Action
E	- Required for Engineering Equivalency Evaluation
R	- Required for Risk Significance
D	- Required to maintain adequate balance of Defense-in-Depth in a Change Evaluation or Fire Risk Evaluation

For Fire Zone 70, twelve ionization detectors, six of which are located in the ventilation ducts, are provided and alarm in the Unit 1 Control Room.

For Fire Zone 71, six low voltage ionization detectors, three of which are located under the raised floor, are provided which alarm on the local control panel. These detectors are installed on two circuits (cross-zoned) of three detectors each. The local control panel relays a fire signal to the Unit 1 Control Room. There are 4 high voltage ionization detectors, 2 of which are located under the raised floor. The high voltage detectors alarm in the Unit 1 Control Room.

### 3.1.5 Fixed Suppression

The table below outlines the fixed fire suppression system(s) provided in the Fire Area:

Table 3-2, Fire Area AA57A Suppression Systems								
Fire Zone	Type of System	Full (F) / Partial (P)	Required System?					
			S	L	E	R	D	
70	None	N/A	N/A	N/A	N/A	N/A	N/A	
71	None	N/A	N/A	N/A	N/A	N/A	N/A	
Table 3-2 Legend:								
Table Field: "Required System?"								
S	- Required for Chapter 4 Separation Criteria							
L	- Required for NRC Approved Licensing Action							
E	- Required for Engineering Equivalency Evaluation							
R	- Required for Risk Significance							
D	- Required to maintain adequate balance of Defense-in-Depth in a Change Evaluation or Fire Risk Evaluation							

Fire Area AA57A is not provided with automatic fire suppression.

### 3.1.6 Manual Suppression / Response Strategy

A postulated fire will be identified by early detection using ionization type smoke detection, thermistor heat detection or by plant personnel using plant communication system to notify the control room. The automatic detection systems alarm in the control room. The Control Room operator will dispatch the fire brigade for initiation of manual fire fighting. A fire in this fire area will be contained by the construction features discussed in Section 3.1.1. Manual suppression is provided by the CNP Fire Brigade.

For Fire Zone 70, fire extinguishers and a water hose reel are located in this fire zone.

For Fire Zone 71, a fire extinguisher is provided in this fire zone with an additional extinguisher in adjacent Fire Zone 70. A water hose reel is also located in adjacent Fire Zone 70.

Floor Drains are provided in Fire Zone 70. Floor drains are not available in Fire Zone 71. Drainage is via door to Fire Zone 70.

### 3.1.7 Ventilation

A fire in this area will be contained by the fire barriers. Smoke can be removed by venting to the outdoors or to other parts of the Auxiliary Building. The normal building ventilating systems in the Auxiliary Building will then exhaust the smoke via filtered monitored pathways. This fire area is listed as a non-controlled area in the Fire Pre Plans and therefore there is reasonable assurance that products of combustion will not be contaminated.

For Fire Zone 70, fire dampers having a 3-hour rating are provided to adjacent Fire Area AA46 - Fire Zone 53. Fire dampers having a 3-hour rating are provided to adjacent Fire Zone 71.

For Fire Zone 71, there are no ventilation penetrations to adjacent fire areas. Fire dampers having a 3-hour rating are provided to adjacent Fire Zone 70.

### 3.1.8 Other Features

For Fire Zone 70, a manual deluge water spray system is provided for the charcoal filter unit. The system isolating valve is normally closed and must be manually opened. Each charcoal filter unit is provided with a thermistor heat detector. The thermistor has a pre-alarm temperature setting and a high temperature alarm setting. The high temperature thermistor alarm automatically opens the suppression system valve. The water flow period is timed to run for approximately 20-30 seconds after the opening of the suppression system valve and then shut off. Subsequent temperatures above the thermistor high temperature setting will restart the water application for as many times as is necessary until the temperature is lowered below the high temperature setting.

For Fire Zone 71, there is a raised floor and a suspended ceiling.

## 3.2 Fire Hazards Identification

The fire area contains both ignition sources and combustible fire hazards. The ignition sources consist of the refrigerant compressors, control room ventilation units, control room ventilation sub panels and the north and south circulating pumps.

Combustibles consist primarily of cable insulation, cellulose, rubber and plastics. Fire Zone 70 also contains charcoal, duct insulation, 7 gallon of lube oil for the refrigerant compressors, and



damper hydraulic fluid.

The roof and exterior wall penetrations of this Fire Area do not require a rating for protection. The spatial separation between this Fire Area and the yard prevents any fire hazards from impacting the Fire Area. The impact of a fire in the yard on AA57A would be limited to radiant heat with no ceiling to contain the fire plume. Spatial separation as well as the reinforced concrete construction of the Fire Area is sufficient to prevent an exposure to credited equipment inside the plant through the roof or exterior wall penetrations of this Fire Area.

The combustible loading classification for Fire Zone 70 is low. The combustible loading classification for Fire Zone 71 is moderate.

### 3.3 NSCA Compliance Summary

Fire Area AA57A, the Unit 1 Control Room HVAC Equipment & Computer Areas (El. 650') , contains both Unit 1 Red and Green Train Control Room HVAC supporting equipment, cables, conduits and raceways.

Compliance with the nuclear safety performance criteria is achieved using the performance-based approach in accordance with NFPA 805, Section 4.2.4.2.

Safe and stable condition of Unit 1 can be accomplished using Steam Generators 2 and 3 via Unit 1 East Motor Driven Auxiliary Feedwater Pump or the Unit 1 Turbine Driven Auxiliary Feedwater Pump or Steam Generators 1 and 4 via the Unit 1 West Motor Driven Auxiliary Feedwater Pump, Control Room Process Monitoring, Unit 1 Charging via the West or East Pump, Unit 1 Component Cooling Water via the West or East Pump, and Unit 1 Essential Service Water via the East or West Pump. Electrical power is available to both the Red and Green Train via Offsite Power. Additionally, Red and Green Train Emergency Diesels are available.

The Nuclear Safety Performance Criteria compliance strategy for AA57A is documented within the NSCA Report.

#### 3.3.1 Variances

The variances identified for evaluation for this fire area are grouped as follows:

##### 3.3.1.1 VFDR No. AA57A-001

1-HV-ACR-1, 1-HV-ACRA-1, 1-PP-82N and 1-XSO-315 - Control Room HVAC is required to be operable for habitability. Control Room HVAC may be lost due to a full area fire within Fire Area AA57A. The following equipment is required to be operable to support Control Room HVAC: 1-HV-ACR-1, 1-HV-ACRA-1, 1-PP-82N and 1-XSO-315 or 1-HV-ACR-2, 1-HV-ACRA-2, 1-PP-82S and 1-XSO-325. All the equipment may fail due to location. 1-HV-ACR-1 may fail due to fire induced damage of cables 14430G-1, 14436G-1, 3010G-1 and 6124G-1. 1-HV-ACR-2 may fail due to fire induced damage of cables 14440R-1, 14445R-1, 2356R-1 and 6120R-1. 1-HV-ACRA-1 may fail due to fire induced damage of cables 8987G-1, 8989G-1 and 8992G-1. 1-HV-ACRA-2 may fail due to fire induced damage of cables 8987R-1, 8989R-1 and 8992R-1. 1-PP-82N may fail due to fire induced damage of cables 14430G-1, 3010G-1 and 6124G-1. 1-PP-82S may fail due to fire induced damage of cables 14440R-1, 2355R-1 and 6121R-1. 1-XSO-315 may fail due to fire induced damage of cable 8976G-1. 1-XSO-325 may fail due to fire induced damage of cable 8974R-1. This condition represents a variance from the deterministic requirements of NFPA 805, Section

4.2.3. This is a separation issue.

This VFDR has been evaluated and it was determined that the risk, safety margin and defense-in-depth meet the acceptance criteria of NFPA 805 Section 4.2.4 with a recovery action credited.

### 3.3.2 Recovery Actions Credited

For each VFDR, a Fire Risk Evaluation has been performed to assess the acceptability of risk, defense-in-depth, and safety margin. This evaluation determined whether or not recovery actions are required to ensure that one success path necessary to achieve and maintain the nuclear safety performance criteria is maintained free of fire damage by a single fire. Table 3-3 identifies the credited recovery actions for this area. Actions retained for DID are identified as “DID Actions” within Table 3-3. Additional information for DID actions is contained within Section 3.8 of this report. Note that, for completeness, all VFDRs are contained within Table 3-3, even if the Fire Risk Evaluation has determined that a recovery action is not required. In those instances where a recovery action has been determined to not be required, the word “None” is provided in the “Action” column in the table.

Table 3-3, Recovery Actions Credited		
VFDR	Component	Action
AA57A-001	1-HV-ACR-1 1-HV-ACRA-1 1-PP-82N 1-XSO-315	1-CR-HVAC-TEMP (Establish temporary control room ventilation)

### 3.4 Non-Power Operational Modes Compliance Summary

A review of CNP for the potential effects of a fire in this Fire Area while in non-power modes of operation (NPO) was conducted. This review was conducted using the guidance provided in NEI 04-02 and FAQ 07-0040, “Non-Power Operations Clarifications”.

The review determined that there are potential failures that affect certain Key Safety Functions (KSF) as a result of the fire in this area, and the fire could result in the loss of one or more KSF paths. Compensatory measures are required during high risk evolution periods to provide reasonable assurance a fire will not adversely affect key safety functions and the NFPA 805 performance goal for NPO is therefore satisfied. The results of the NPO analysis are contained within Technical Evaluation R1900-005-001, Non-Power Operation Modes Transition Review Report.

### 3.5 Radioactive Release Compliance Summary

The NFPA 805 radiological release goal is to provide reasonable assurance that a fire will not result in a radiological release that adversely affects the public, plant personnel or the environment. The NFPA 805 requirement is to ensure a radiation release to any unrestricted area due to the direct effects of fire suppression activities (but not involving fuel damage) shall be as low as reasonably achievable and shall not exceed applicable plant Technical Specification limits.

AA57A is located outside the Radiological Controlled Area (RCA) and is not a storage location for contaminated materials, therefore there is reasonable assurance a fire in this area will not result in radiation release. The review of this fire area, with respect to radioactive release, is documented in the NFPPM.

### 3.6 Probabilistic Risk Assessment-Summary of Results

A Fire PRA (FPRA) quantification of Fire Area AA57A was performed and is documented in PRA-NB-FIRE-FQ, Fire PRA Model Quantification Notebook. The fire risk quantification for Fire Area AA57A is analyzed using detailed fire modeling to consider risk of fire scenarios of ignition sources. PRA-NB-FIRE-FQ includes a summary of all potentially risk-significant fire scenarios (i.e., CDF > 1.0E-7 or LERF > 1.0E-8). Bounding CDF / LERF per calendar year values are reported that are based on the risk values documented in PRA-NB-FIRE-FSS, Fire PRA Fire Scenario Selection.

Fire Protection features credited in the Fire PRA are documented in R1900-0411-AA57A, Detailed Fire Modeling Report: Fire Compartment: AA57A Unit 1 Control Room HVAC Equipment and Computer Areas (EL. 650 FT.). PRA-NB-FIRE-FSS documents the revision level of the fire modeling reports used in the most recent Fire PRA quantification.

### 3.7 Risk-Informed, Performance-Based Evaluations

Fire Risk Evaluations (FREs) have been performed to ensure that variances from the NFPA 805 deterministic requirements are acceptable. The evaluation process consists of an integrated assessment of the acceptability of risk, defense-in-depth, and safety margins.

#### 3.7.1 Transition Risk-Informed, Performance-Based Evaluations

The ‘changes’ associated with NFPA 805 transition were those variances from the deterministic requirements of NFPA 805 or with the existing fire protection licensing basis that were brought into compliance with the NFPA 805 performance based approach. The change identified for evaluation for Fire Area AA57A is as follows:

- Separation Issues

The Fire Risk Evaluation has determined that the change is acceptable based upon:

- The measured change in CDF and LERF.
- Adequate defense-in-depth and safety margins being maintained.

Refer to Attachment 2 for a summary of results associated with the Fire Risk Evaluations.

### 3.8 Defense-in-Depth

A comprehensive risk-informed, performance-based analysis includes consideration of defense-in-depth (DID) as part of an integrated evaluation of risk considerations. In general, defense-in-depth involves consideration of the extent to which fire protection systems and features are provided within the three echelons of fire-protection:

- Preventing fires from starting,
- Rapidly detecting fires and controlling and extinguishing promptly those fires that do occur, thereby limiting fire damage,
- Providing an adequate level of fire protection for structures, systems, and components important to safety, so that a fire that is not promptly extinguished will not prevent the nuclear safety performance criteria from being met.

Each VFDR was evaluated for DID. No recovery actions have been retained for DID.

Based on the assessment in support of the Fire Risk Evaluation, defense-in-depth is maintained for fire area AA57A. Refer to Attachment 2 for details associated with the Fire Risk Evaluation.

### 3.9 Monitoring Program Input

A Monitoring Program will be developed in accordance with FAQ 10-0059, Rev. 1. Methods to monitor availability, reliability, and performance of fire protection program structures, systems, and components (SSCs), as well as programmatic elements will be provided. Additionally, effectiveness measures are established to review program related performance and trends. For AA57A the following systems and features are candidates for inclusion in the CNP Fire Protection Monitoring Program:

- Fire Area boundary barriers discussed in Section 3.1
- Fire Detection System (Ionization)

## 4.0 CONCLUSION

The nuclear safety and radioactive release performance criteria of NFPA 805 are met for a fire in Fire Area AA57A. This Fire Risk Evaluation for Fire Area AA57A has demonstrated that

- The change in core damage frequency (delta CDF) is acceptable, and
- The change in large early release frequency (delta LERF) is acceptable, and
- Defense-in-depth and safety margins are maintained.

This is confirmation that a success path effectively remains free of fire damage and that the performance-based approach is acceptable per Section 4.2.4.2 of NFPA 805.

## **5.0 REFERENCES**

- 5.1 Calculation PRA-FIRE-NB-CRE, Fire PRA Cumulative Risk Evaluations
- 5.2 CNP Fire Pre-Plans, Volumes I, II, and III, Revisions 17, 14, and 18 respectively
- 5.3 Fire Hazards Analysis
- 5.4 NFPA 805, Performance-Based Standard for Fire Protection for Light Water Reactor Electric Generating Plants
- 5.5 NFPPM, NFPA 805 Fire Protection Program Manual (NFPPM)
- 5.6 Nuclear Energy Institute (NEI) 04-02, Guidance for Implementing a Risk-Informed, Performance-Based Fire Protection Program under 10 CFR 50.48(c), Rev. 2
- 5.7 Nuclear Safety Capability Assessment Report
- 5.8 PRA-NB-FIRE-FQ, Fire PRA Model Quantification Notebook
- 5.9 PRA-NB-FIRE-FSS, Fire PRA Fire Scenario Selection
- 5.10 R1900-0411-AA57A, AA57A - Detailed Fire Modeling Report
- 5.11 Regulatory Guide 1.205, Risk-Informed, Performance-Based Fire Protection for Existing Light-Water Nuclear Power Plants, Rev. Revision 1
- 5.12 Technical Evaluation R1900-005-001, Non-Power Operation Modes Transition Review

**Fire Area AA57A – Attachment 1 - Table B-3 - Fire Area Transition**

<u>Unit</u>	<u>Fire Area</u>	<u>Description</u>
1	AA57A	Unit 1 Control Room HVAC Equipment and Computer Areas (El. 650 ft.)

<u>Fire Zone</u>	<u>Description</u>
70	Control Room HVAC Equipment - El. 650 ft. 0 in. - Unit 1
71	Unit 1 Computer Room - El. 650 ft. 0 in.

**Regulatory Basis**

4.2.4.2 - Performance-Based Approach - Fire Risk Evaluation with simplifying deterministic assumptions

<b>Performance Goal</b>	<b>Method of Accomplishment</b>	<b>Comments</b>
Reactivity Control	Unit 1 - Trip the reactor from the Control Room. Borate using Unit 1 East or West Charging Pump supplied from the RWST. Use source range monitoring for indication.	None
Inventory and Pressure Control	Unit 1 - Control inventory using Unit 1 East or West Charging Pump. Control pressure using Unit 1 Pressurizer Safety Relief Valves.	None
Decay Heat Removal	Unit 1 - Feed SGs 1 & 4 with Unit 1 West MDAFW Pump or feed SGs 2 & 3 with Unit 1 East MDAFW Pump or Unit 1 TDAFW Pump. The DHR function also requires MS isolation with a steam release path through the Safety Relief Valves.	None
Process Monitoring	Unit 1 Process Monitoring - Use Unit 1 process monitoring in the Control Room for the following: Pressurizer level, RCS pressure and temperature, and S/G level and Pressure. Unit 1 Source Range Monitoring - Use Unit 1 source range monitoring in the Control Room.	None
Vital Auxiliaries	Unit 1 Electrical - Control Unit 1 Red (AB) Train Electrical Distribution with Unit 1 Red (AB) Train Offsite Power or Unit 1 Red (AB) DG. Control Unit 1 Green (CD) Train Electrical Distribution with Unit 1 Green (CD) Train Offsite Power or Unit 1 Green (CD) DG. Unit 1 ESW - Operate Unit 1 East or West ESW. Unit 1 CCW - Operate Unit 1 East or West CCW. Unit 1 HVAC - Temporary Ventilation required for Unit 1 Control Room HVAC. Operate Unit 1 Auxiliary Building HVAC. Operate Unit 1 Red (AB) and Green (CD) DG HVAC. Operate Unit 1 Switchgear HVAC. Operate	VFDR identified for Control Room HVAC.

**Fire Area AA57A – Attachment 1 - Table B-3 - Fire Area Transition**

<u>Unit</u>	<u>Fire Area</u>	<u>Description</u>
1	AA57A	Unit 1 Control Room HVAC Equipment and Computer Areas (El. 650 ft.)
Unit 1 East and West MDAFW and TDAFW Room HVAC systems. Operate the Unit 1 East and West ESW Room HVAC systems.		

**Reference Documents**

Genesis Solution Suite, EDISON / SAFE-PB, DC Cook V 3.4.0

Nuclear Safety Capability Assessment Report

**Licensing Actions**

None

**Existing Engineering Equivalency Evaluations (EEEE)****EEEE Title Engineering Equivalency Evaluation 9-5 - Fire Zones 70 (Fire Area AA57A) and 73 (Fire Area AA57B) Hatch Evaluations**

**Summary** The purpose of this engineering equivalency evaluation is to document the acceptability of unrated floor hatches located between the HVAC Equipment Rooms (Fire Zones 70 and 73) and the Unit 1 and Unit 2 Main Control Rooms (Fire Zones 53 and 54), and the fixed suppression exemption requests for the Main Control Rooms or other engineering equivalency evaluations. Fire Zones 70 and 73 are located in Fire Areas AA57A and AA57B, respectively, while Fire Zones 53 and 54 are located in Fire Areas AA46 and AA47, respectively. A 3-hr fire-rated hatch assembly is not commercially available for use in this location.

Note: This engineering equivalency evaluation has been reviewed by the NRC. Refer to NRC SER dated June 17, 1988, for acceptance of unrated fire hatches in fire area boundaries. The NRC concluded that the level of fire safety is equivalent to that achieved by conformance with the guidelines of Section D.1.j of Appendix A to BTP APCSB 9.5-1, and, therefore, the deviations for the unrated fire hatches were found acceptable.

Reasonable assurance is provided that a fire in Fire Zones 70, 71, 72 and 73 would not impair the safe shutdown capabilities in either unit. This engineering equivalency evaluation does not adversely impact other engineering equivalency evaluations.

The hatches were evaluated and found to be acceptable based on the fire hazards, fire protection systems and construction features within the evaluated areas. Also, some areas being evaluated are continuously manned.

**Fire Area AA57A – Attachment 1 - Table B-3 - Fire Area Transition**

<u>Unit</u>	<u>Fire Area</u>	<u>Description</u>
1	AA57A	Unit 1 Control Room HVAC Equipment and Computer Areas (El. 650 ft.)
<hr/>		
<b><u>EEEE Title</u></b>	<b>Engineering Equivalency Evaluation 9-39 - Fire Zone 70 (Fire Area AA57A) to Fire Zone 129 (Fire Area AA2) Boundary Evaluation</b>	
<b><u>Summary</u></b>	<p>The purpose of this engineering equivalency evaluation is to document the acceptability of an unrated door connecting the Unit 1 Turbine Deck in Fire Zone 129 (Fire Area AA2) and the Unit 1 Control Room HVAC Room in Fire Zone 70 (Fire Area AA57A).</p> <p>Reasonable assurance is provided that the unrated door between Fire Zones 129 and 70 does not adversely impact redundant safe shutdown capabilities. This engineering equivalency evaluation does not adversely impact other engineering equivalency evaluations or exemption requests</p> <p>The door was evaluated and found to be acceptable based on the construction features within the evaluated areas. Also, one of the fire zones being evaluated does not contain systems, components or cables important to nuclear safety.</p>	
<b><u>EEEE Title</u></b>	<b>Engineering Equivalency Evaluation 11-9 - Turbine, Auxiliary and Containment Buildings Boundary Evaluation</b>	
<b><u>Summary</u></b>	<p>The purpose of this engineering equivalency evaluation is to describe in general, the approach and existence of evaluations performed to determine and reconcile fire area boundaries having components or designs with less than a 3-hr fire rating on preventing the spread of fire. This engineering equivalency evaluation also specifically evaluates the impact of unrated door assemblies on the spread of fire.</p> <p>Reasonable assurance is provided that the fire area boundaries having components or design less than a 3-hr fire rating will not increase the spread of fire or impair the safe shutdown capabilities of Units 1 or 2. In addition, this engineering equivalency evaluation does not adversely impact on other engineering equivalency evaluations or exemption requests.</p> <p>This evaluation supports additional evaluations credited in this fire area.</p>	



**Fire Area AA57A – Attachment 1 - Table B-3 - Fire Area Transition**

<u>Unit</u>	<u>Fire Area</u>	<u>Description</u>
1	AA57A	Unit 1 Control Room HVAC Equipment and Computer Areas (El. 650 ft.)

**Fire Suppression Effects on Nuclear Safety Performance Criteria**

The CNP fire brigade is trained to discharge water in a judicious manner and instructed to direct hose streams and portable extinguishers at the base of the fire to limit the amount of overspray beyond the immediate fire zone. For this reason, fire brigade activities are not expected to fail components not already considered damaged. It has been concluded that water impingement on cables is not a concern. Electrical cabinets are provided with a seal at the conduit interface. Possible impacts to surrounding equipment due to manual fire fighting activities is bounded by the analysis approach of postulating whole room damage. The drainage features of the fire area mitigate the potential for flooding damage due to fire suppression, such that the standing water would not affect credited equipment.

Since it is shown that suppression effects will not impact the nuclear safety performance criteria, the fire area configuration is deemed acceptable.

**References:**

Technical Evaluation 12.1, "Fire Suppression Effects Study"

Technical Evaluation 12.1, "Supplemental Information to Fire Suppression Effects Study – Supplement 1"

**Fire Area Comments**

None

## Fire Area AA57A – Attachment 2 - Fire Risk Evaluation Results Summary

### A2.1 Introduction

The ‘changes’ associated with NFPA 805 transition were those variances from the deterministic requirements of NFPA 805. The changes identified for evaluation for fire area AA57A are grouped as follows:

- Separation Issues

This attachment is a summary of the Fire Risk Evaluation for the fire area. The complete results and methodology are contained in the Cumulative Fire Risk Evaluation, PRA-FIRE-NB-CRE. (FPCE 2017-0009)

### A2.2 Inputs/Assumptions

Fire modeling processes and inputs provided in NUREG/CR-6850 are appropriate for use in a risk-informed, performance-based evaluation. The complete list of assumptions used in the fire modeling methodology for this fire area is contained in Detailed Fire Modeling Technical Evaluation R1900-0411-AA57A.

### A2.3 Fire Modeling Methodology

Fire PRA fire modeling results are used as the initial input into this Fire Risk Evaluation. The process consists of conservative bounding analyses using NUREG/CR-6850 methods. As needed, refinements are made to utilize more realistic parameters. The complete fire modeling methodology for this fire area is contained in Detailed Fire Modeling Technical Evaluation R1900-0411-AA57A.

### A2.4 Scenario Descriptions and Model Results

Fire Area AA57A was evaluated for the impact of fires originating from both fixed and transient ignition sources. Complete descriptions of each fire scenario is contained within the Detailed Fire Modeling Technical Evaluation R1900-0411-AA57A.

#### A2.4.1 Ignition Sources

Fire Area AA57A contains the control room ventilation sub panels, control room ventilation units, refrigerant compressors and the north and south circulating pumps. Per discussion with plant personnel, the heat release rates for all switchgear, load centers, and MCC electrical cabinets have been characterized as qualified cable because items of this nature are generally constructed on-site. For other electrical cabinet types, where the internal cable qualification was unknown, the heat release rates have been assumed as non-qualified. Ignition sources in Fire Area AA57A were modeled using the 98th percentile fire as a screening approach and did not require further refinement.

In Fire Area AA57A, the 98th percentile HRR was used for all transient fires. The 98th percentile HRR bounds the possible transient ignition sources expected for this fire area, which were fire tested and identified in NUREG/CR-6850, Appendix G, Table G-7.

#### A2.4.2 Scenario Results

A delta risk calculation has been performed to quantify the risk associated with the VFDRs in the fire area.

### A2.5 Fire Risk Evaluation Results

PRA-FIRE-NB-CRE documents scenarios and corresponding impacted VFDRs that were evaluated for

### **Fire Area AA57A – Attachment 2 - Fire Risk Evaluation Results Summary**

delta risk during the transition to NFPA 805 and also all changes to the Fire Protection Program that are currently incorporated into the Fire PRA model. The acceptability of the Cumulative Fire Risk Evaluations was based on calculated delta risk meeting the thresholds of NEI 04-02, RG 1.205 and RG 1.174. (FPCE 2017-0009)

## Fire Area AA57A – Attachment 2 - Fire Risk Evaluation Results Summary

### A-2.6 Impact of VFDR on Defense-in-Depth

Defense-in-Depth has been evaluated for this fire area. The impacts of this evaluation are summarized in the table below:

Defense-in-Depth Impact Review for AA57A			
Method of Providing DID	Required to Support Deterministic Analysis or Fire PRA?	Changes or Improvements Necessary for DID?	Basis/Justification
Echelon 1: Prevent fires from starting			
Combustible Control is implemented in accordance with Procedure PMP-2270-CCM-001, Control of Combustible Materials.	Yes	No	• This element is adequate based on no perceived weakness of, or over-reliance on, another echelon of defense-in-depth.
Hot Work Control is implemented in accordance with Procedure PMP-2270-WBG-001, Welding, Burning and Grinding Activities.	Yes	No	
Echelon 2: Rapidly detect, control and extinguish promptly those fires that do occur thereby limiting fire damage			
Fire Detection System	Yes	No	• Detection is already required and fire fighting activities are not expected to be challenging, therefore, no changes or improvements to Echelon 2 attributes are necessary to maintain defense-in-depth.
Fixed Fire Suppression	No	No	
Portable Fire Extinguishers	Yes	No	
Hose stations and hydrants	Yes	No	
Pre-Fire Plan	Yes	No	
Echelon 3: Provide adequate level of fire protection for systems and structures so that a fire will not prevent essential safety functions from being performed			
Walls, floors ceilings and structural elements are rated or have been evaluated as adequate for the hazard.	Yes	No	• The variance credits a recovery action to achieve nuclear safety performance criteria. No changes or improvements to Echelon 3 attributes are necessary to maintain defense-in-depth.
Penetrations in the fire area barrier are rated or have been evaluated as adequate for the hazard.	Yes	No	
Supplemental barriers (e.g., ERFBS, cable tray covers, etc.)	No	No	
Guidance provided to operations personnel detailing the required success path(s) including recovery actions to achieve nuclear safety performance criteria.	Yes	No	

## Fire Area AA57A – Attachment 2 - Fire Risk Evaluation Results Summary

### A-2.7 Safety Margin Considerations

In accordance with NEI 04-02, the maintenance of adequate Safety Margin is assessed by the consideration categories of analyses utilized by this Fire Risk Evaluation.

Safety margins are considered to be maintained if:

- Codes and Standards or their alternatives accepted for use by the NRC are met.

AND

- Safety analyses acceptance criteria in the licensing basis (e.g., FSAR, supporting analyses) are met, or provides sufficient margin to account for analysis and data uncertainty.

The following summarizes the bases for ensuring the maintenance of safety margins:

- The risk-informed, performance based processes utilized are based upon NFPA 805, 2001 edition, endorsed by the NRC in 10 CFR 50.48(c).
- The Fire Risk Evaluation process is in accordance with NEI 04-02, Revision 2, which is endorsed by the NRC in Regulatory Guide 1.205, Revision 1.
- The Fire PRA is developed in accordance with NUREG/CR-6850, which was developed jointly between the NRC and EPRI.
- The Fire PRA has undergone an industry peer review, in order to ensure the Fire PRA meets the appropriate quality standards of ASME/ANS RA-Sa-2009, "Standard for Level 1/Large Early Release Frequency Probabilistic Risk Assessment for Nuclear Power Plant Applications," Dated February 2, 2009
- The "combined analysis approach" is used during transition (NEI 04-02, Section 5.3.4.3); therefore, MEFS/LFS is not analyzed separately from the Fire PRA results.
- The CNP internal events PRA model received two formal industry peer reviews conducted in accordance with applicable NEI guidelines. The initial peer review was performed in 2001, while a subsequent focused scope (i.e., limited scope) peer review was conducted in 2009. The initial, full-scope WOG peer review covered all aspects of the CNP PRA model and the administrative processes used to maintain and update the model. The CNP PRA model has been revised to address all significant issues (i.e., Category A and B Facts & Observations) identified during the initial peer review. None of the findings from the focused-scope peer review were judged to reach the significance level of a Category A or B Fact & Observation; as a result, no changes to the PRA model have yet been made to include resolutions for these latter issues.
- Fire protection systems and features determined to be required by NFPA 805 Chapter 4 have been confirmed to meet the requirements of NFPA 805 Chapter 3 and their associated referenced codes and listings, or provided with acceptable alternatives using processes accepted for use by the NRC (i.e., FAQ 06-0008, FAQ 06-0004, 07-0033).
- Fire modeling performed in support of the transition has been performed within the Fire PRA utilizing codes and standards developed by industry and NRC staff which have been verified and validated in authoritative publications, such as NUREG 1824, "Verification and Validation of Selected Fire Models for Nuclear Power Plant Applications". In general, the fire modeling performed in support of the Fire Risk Evaluations has been performed using conservative methods and input parameters that are based upon

### **Fire Area AA57A – Attachment 2 - Fire Risk Evaluation Results Summary**

NUREG/CR-6850 as documented in the AA57A Detailed Fire Modeling Report, section 7.2. While this is generally not ideal in the context of best estimate probabilistic risk analysis, it is a pragmatic approach given the current state of knowledge regarding the uncertainties related to the application of the fire modeling tools and associated input parameters for specific plant configurations.

- In accordance with the requirements of 10 CFR 50.48(c)(2)(iii), the Fire PRA results, including cutsets for the scenarios of concern, have been reviewed and it was verified that the results presented above do not rely solely on feed and bleed as the fire-protected safe shutdown path for maintaining reactor coolant inventory, pressure control, and decay heat removal capability for this fire area.

#### **A-2.8 Transition Risk Evaluation Conclusions**

The transition change evaluation determined that these changes:

- Are acceptable based upon the measured change in CDF and LERF
- Maintained adequate defense-in-depth and safety margins

The results of this evaluation meet the requirements of NFPA 805 Risk Evaluation; therefore, the use of the performance based analysis approach is acceptable.

D. C. Cook Nuclear Plant  
Fire Safety Analysis  
  
Fire Area: AA57B

Unit 2 Control Room HVAC Equipment and Computer Areas (El. 650 ft.)

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Attachments

Fire Area AA57B – Attachment 1 - Table B-3 - Fire Area Transition

Fire Area AA57B – Attachment 2 - Fire Risk Evaluation Results Summary

## 1.0 PURPOSE

This report documents the Fire Safety Analysis (FSA) for Cook Nuclear Plant (CNP) Fire Area AA57B, Unit 2 Control Room HVAC Equipment and Computer Areas (El. 650 ft.) which comprises fire zone(s) 72, 73. The purpose of this analysis is to demonstrate the achievement of the nuclear safety and radioactive release performance criteria of NFPA 805 as required by 10 CFR 50.48(c). The Fire Safety Analysis is a key part of compliance with Section 2.7.1.2 Fire Protection Program Design Basis Document of NFPA 805. This analysis also documents results of risk-informed, performance-based Fire Risk Evaluations (FREs). These evaluations are associated with Variances from Deterministic Requirements (VFDRs) of NFPA 805 Chapter 4.

## 2.0 ANALYSIS METHODOLOGY

The FSA is the design basis document as described in NFPA 805 Section 2.7.1.2. The following steps are performed to develop the FSA on a fire area basis:

- Identify significant fire hazards in the fire area. This is based on NFPA 805 approach to analyze the plant from an ignition source and fuel package perspective.
- Summarize Nuclear Safety Capability Analysis (NSCA) compliance strategies. This is the result of the NEI 04-02 B-3 Table review of the Safe Shutdown Analysis.
- Summarize Non-Power Operations Modes compliance strategies.
- Summarize Radioactive Release compliance strategies. The transition review process required per NEI 04-02 is used to develop these results.
- Provide Fire Probabilistic Risk Assessment summary of results. This is based on the results from the plant Fire PRA.
- Perform risk informed, performance based evaluations if needed for the performance based approach.
- Summarize Defense-in-Depth strategy for each fire area.
- Determine key analysis assumptions which are candidates to be included in the NFPA 805 monitoring program.
- Provide conclusions relative to NFPA 805 compliance.



### 3.0 ANALYSIS

#### 3.1 Classical Fire Protection

##### 3.1.1 Construction

For Fire Zone 72, walls, floors and ceilings to adjacent fire areas are reinforced concrete in excess of a 3-hour rating. An 8-inch concrete block wall of an unspecified rating is provided between this fire zone and the HVAC Equipment Room (Fire Zone 73). The roof is constructed of concrete covered with built-up roofing materials meeting UL Class A/FM Class 1 construction.

For Fire Zone 73, walls, floors and ceilings to adjacent fire areas are reinforced concrete in excess of a 3-hour rating. An 8-inch concrete block wall of an unspecified rating is provided between this fire zone and the Computer Room (Fire Zone 72). The roof is constructed of concrete covered with built-up roofing materials meeting UL Class A/FM Class 1 construction.

Applicable Engineering Equivalency Evaluations are documented in Attachment 1.

##### 3.1.2 Doors and Access Openings

For Fire Zone 72, there are door openings to adjacent fire areas (AR 2016-14495). A fire door having a 3-hour rating is provided to adjacent Fire Zone 71. An unrated door is provided to adjacent Fire Zone 73.

For Fire Zone 73, fire doors having a 3-hour rating are provided to adjacent Fire Zone 70. A fire area boundary evaluation was performed for an unrated floor hatch fire door to Fire Area AA47 - Fire Zone 54 (Engineering Equivalency Evaluation 9-5). An unrated door is provided to the adjacent Computer Room, Fire Zone 72.

##### 3.1.3 Penetrations

Note: Statements regarding fire resistance rating of penetration seals are not applicable to seals in barriers to Analysis Area YD.

For both fire zones in Fire Area AA57B, penetrations in fire barriers between this fire zone and adjacent fire areas and fire zones are provided with fire seals (Technical Evaluation 11-25).

### 3.1.4 Detection

The table below outlines the fire detection system(s) provided in the Fire Area:

Table 3-1, Fire Area AA57B Detection Systems								
Fire Zone	Type of System	Local (L) / Remote (R)	Detection Actuates Suppression?	Required System?				
				S	L	E	R	D
72	Ionization	L/R	N	N	N	Y	Y	N
73	Ionization	L/R	N	N	N	Y	Y	N

**Table 3-1 Legend:**

Table Field: "Required System?"	
S	- Required for Chapter 4 Separation Criteria
L	- Required for NRC Approved Licensing Action
E	- Required for Engineering Equivalency Evaluation
R	- Required for Risk Significance
D	- Required to maintain adequate balance of Defense-in-Depth in a Change Evaluation or Fire Risk Evaluation

For Fire Zone 72, six low voltage ionization detectors, three of which are located under the raised floor, are provided which alarm on the local control panel. These detectors are installed on two circuits (cross-zoned) of three detectors each. The local control panel relays a fire signal to the Unit 2 Control Room. Four high voltage ionization detectors, two of which are located under the raised floor, are provided which alarm in the Unit 2 Control Room.

For Fire Zone 73, twelve ionization detectors, six of which are located in the ventilation ducts, are provided and alarm in the Unit 2 Control Room.

### 3.1.5 Fixed Suppression

The table below outlines the fixed fire suppression system(s) provided in the Fire Area:

Table 3-2, Fire Area AA57B Suppression Systems								
Fire Zone	Type of System	Full (F) / Partial (P)	Required System?					
			S	L	E	R	D	
72	None	N/A	N/A	N/A	N/A	N/A	N/A	N/A
73	None	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Table 3-2 Legend:								
Table Field: "Required System?"								
S	- Required for Chapter 4 Separation Criteria							
L	- Required for NRC Approved Licensing Action							
E	- Required for Engineering Equivalency Evaluation							
R	- Required for Risk Significance							
D	- Required to maintain adequate balance of Defense-in-Depth in a Change Evaluation or Fire Risk Evaluation							

Fire Area AA57A is not provided with automatic fire suppression.

### 3.1.6 Manual Suppression / Response Strategy

A postulated fire will be identified by early detection using ionization type smoke detection, thermistor heat detection or by plant personnel using plant communication system to notify the control room. The automatic detection systems alarm in the control room. The Control Room operator will dispatch the fire brigade for initiation of manual fire fighting. A fire in this fire area will be contained by the construction features discussed in Section 3.1.1. Manual suppression is provided by the CNP Fire Brigade.

For Fire Zone 72, there is a fire extinguisher in this fire zone with an additional extinguisher located in adjacent Fire Zone 73. A water hose reel is also located in adjacent Fire Zone 70.

For Fire Zone 73, fire extinguishers are provided, with a water hose reel located in adjacent Fire Zone 70.

Floor Drains are provided in Fire Zone 73. Floor drains are not available in Fire Zone 72. Drainage is via door to Fire Zone 73.

### 3.1.7 Ventilation

A fire in this area will be contained by the fire barriers. Smoke can be removed by venting to the outdoors or to other parts of the Auxiliary Building. The normal building ventilating systems in the Auxiliary Building will then exhaust the smoke via filtered monitored pathways]. This fire area is listed as a non-controlled area in the Fire Pre Plans and therefore there is reasonable assurance that products of combustion will not be contaminated.

For Fire Zone 72, there are no ventilation penetrations to adjacent fire areas. Fire dampers having a 3-hour rating are provided to adjacent Fire Zone 73.

For Fire Zone 73, a fire area boundary evaluation was performed for an undampered ventilation duct to Fire Area AA47 - Fire Zone 54 (Engineering Equivalency Evaluation 9-2). Fire dampers having a 3-hour rating are provided to adjacent Fire Area AA47 - Fire Zone 54. Fire dampers having a 3-hour rating are provided to adjacent Fire Zone 72.

### 3.1.8 Other Features

For Fire Zone 72, there is a raised floor and a suspended ceiling.

For Fire Zone 73, a manual deluge water spray system is provided for the charcoal filter unit. The system isolating valve is normally closed and must be manually opened. Each charcoal filter unit is provided with a thermistor heat detector. The thermistor has a pre-alarm temperature setting and a high temperature alarm setting. The high temperature thermistor alarm automatically opens the suppression system valve. The water flow period is timed to run for approximately 20-30 seconds after the opening of the suppression system valve and then shut off. Subsequent temperatures above the thermistor high temperature setting will restart the water application for as many times as is necessary until the temperature is lowered below the high temperature setting.

## 3.2 Fire Hazards Identification

The fire area contains both ignition sources and combustible fire hazards. The ignition sources consist of the refrigerant compressors, control room ventilation units, control room ventilation sub panels and the north and south circulating pumps.

Combustibles consist primarily of cable insulation, cellulose, rubber and plastics. Fire Zone 73 also contains charcoal, 7 gallon of lube oil for the refrigerant compressors, and damper hydraulic fluid.

The roof and exterior wall penetrations of this Fire Area do not require a rating for protection. The spatial separation between this Fire Area and the yard prevents any fire hazards from impacting the Fire Area. The impact of a fire in the yard on AA57B would be limited to radiant heat with no ceiling to contain the fire plume. Spatial separation as well as the reinforced concrete construction of the Fire Area is sufficient to prevent an exposure to credited equipment inside the plant through the roof or exterior wall penetrations of this Fire Area.

The combustible loading classification for Fire Zone 73 is low. The combustible loading classification for Fire Zone 72 is moderate.

### 3.3 NSCA Compliance Summary

Fire Area AA57B, the Unit 2 Control Room HVAC Equipment & Computer Areas (El. 650') , contains both Unit 2 Red and Green Train Control Room supporting equipment and Red and Green train cables, conduits and raceways.

Compliance with the nuclear safety performance criteria is achieved using the performance-based approach in accordance with NFPA 805, Section 4.2.4.2.

Safe and stable condition of Unit 2 can be accomplished using using Steam Generators 2 and 3 via Unit 2 East Motor Driven Auxiliary Feedwater Pump or the Unit 2 Turbine Driven Auxiliary Feedwater Pump or Steam Generators 1 and 4 via the Unit 2 West Motor Driven Auxiliary Feedwater Pump, Control Room Process Monitoring, Unit 2 Charging via the West or East Pump, Unit 2 Component Cooling Water via the West or East Pump and Unit 2 Essential Service Water via the East or West Pump. Electrical power is available to both the Red and Green Train via Offsite Power. Additionally, Red and Green Train Emergency Diesels are available.

The Nuclear Safety Performance Criteria compliance strategy for AA57B is documented within the NSCA Report.

#### 3.3.1 Variances

The variances identified for evaluation for this fire area are grouped as follows:

##### 3.3.1.1 VFDR No. AA57B-001

2-HV-ACR-1, 2-HV-ACRA-1, 2-PP-82N and 2-XSO-315 - Control Room HVAC is required to be operable for habitability. Control Room HVAC may be lost due to a full area fire within Fire Area AA57A. The following equipment is required to be operable to support Control Room HVAC: 2-HV-ACR-1, 2-HV-ACRA-1, 2-PP-82N and 2-XSO-315 or 2-HV-ACR-2, 2-HV-ACRA-2, 2-PP-82S and 2-XSO-325. All the equipment may fail due to location. 2-HV-ACR-1 may fail due to fire induced damage of cables 14430G-2, 14436G-2, 3014G-2 and 6123G-2. 2-HV-ACR-2 may fail due to fire induced damage of cables 14440R-2, 14445R-2, 2356R-2 and 6120R-2. 2-HV-ACRA-1 may fail due to fire induced damage of cables 8987G-2, 8989G-2 and 8992G-2. 2-HV-ACRA-2 may fail due to fire induced damage of cables 8987R-2, 8989R-2 and 8992R-2. 2-PP-82N may fail due to fire induced damage of cables 14430G-2, 3010G-2 and 6124G-2. 1-PP-82S may fail due to fire induced damage of

cables 14440R-2, 2355R-2 and 6121R-2. 2-XSO-315 may fail due to fire induced damage of cable 8976G-2. 2-XSO-325 may fail due to fire induced damage of cable 8974R-2. This condition represents a variance from the deterministic requirements of NFPA 805, Section 4.2.3. This is a separation issue.

This VFDR has been evaluated and it was determined that the risk, safety margin and defense-in-depth meet the acceptance criteria of NFPA 805 Section 4.2.4 with a recovery action credited.

### 3.3.2 Recovery Actions Credited

For each VFDR, a Fire Risk Evaluation has been performed to assess the acceptability of risk, defense-in-depth, and safety margin. This evaluation determined whether or not recovery actions are required to ensure that one success path necessary to achieve and maintain the nuclear safety performance criteria is maintained free of fire damage by a single fire. Table 3-3 identifies the credited recovery actions for this area. Actions retained for DID are identified as “DID Actions” within Table 3-3. Additional information for DID actions is contained within Section 3.8 of this report. Note that, for completeness, all VFDRs are contained within Table 3-3, even if the Fire Risk Evaluation has determined that a recovery action is not required. In those instances where a recovery action has been determined to not be required, the word “None” is provided in the “Action” column in the table.

Table 3-3, Recovery Actions Credited		
VFDR	Component	Action
AA57B-001	2-HV-ACR-1 2-HV-ACRA-1 2-PP-82N 2-XSO-315	2-CR-HVAC-TEMP (Establish temporary control room ventilation)

### 3.4 Non-Power Operational Modes Compliance Summary

A review of CNP for the potential effects of a fire in this Fire Area while in non-power modes of operation (NPO) was conducted. This review was conducted using the guidance provided in NEI 04-02 and FAQ 07-0040, “Non-Power Operations Clarifications”.

The review determined that there are potential failures that affect certain Key Safety Functions (KSF) as a result of the fire in this area, and the fire could result in the loss of one or more KSF paths. Compensatory measures are required during high risk evolution periods to provide reasonable assurance a fire will not adversely affect key safety functions and the NFPA 805 performance goal for NPO is therefore satisfied. The results of the NPO analysis are contained within Technical Evaluation R1900-005-001, Non-Power Operation Modes Transition Review Report.

### 3.5 Radioactive Release Compliance Summary

The NFPA 805 radiological release goal is to provide reasonable assurance that a fire will not result in a radiological release that adversely affects the public, plant personnel or the environment. The NFPA 805 requirement is to ensure a radiation release to any unrestricted area due to the direct effects of fire suppression activities (but not involving fuel damage) shall be as low as reasonably achievable and shall not exceed applicable plant Technical Specification limits.

AA57B is located outside the Radiological Controlled Area (RCA) and is not a storage location for contaminated materials, therefore there is reasonable assurance a fire in this area will not result in

radiation release. The review of this fire area, with respect to radioactive release, is documented in the NFPPM.

### 3.6 Probabilistic Risk Assessment-Summary of Results

A Fire PRA (FPRA) quantification of Fire Area AA57B was performed and is documented in PRA-NB-FIRE-FQ, Fire PRA Model Quantification Notebook. The fire risk quantification for Fire Area AA57B is analyzed using detailed fire modeling to consider risk of fire scenarios of ignition sources. PRA-NB-FIRE-FQ includes a summary of all potentially risk-significant fire scenarios (i.e., CDF > 1.0E-7 or LERF > 1.0E-8). Bounding CDF / LERF per calendar year values are reported that are based on the risk values documented in PRA-NB-FIRE-FSS, Fire PRA Fire Scenario Selection.

Fire Protection features credited in the Fire PRA are documented in R1900-0411-AA57B, Detailed Fire Modeling Report: Fire Compartment: AA57B Unit 2 Control Room HVAC Equipment and Computer Areas (EL. 650 FT.). PRA-NB-FIRE-FSS documents the revision level of the fire modeling reports used in the most recent Fire PRA quantification.

### 3.7 Risk-Informed, Performance-Based Evaluations

Fire Risk Evaluations (FREs) have been performed to ensure that variances from the NFPA 805 deterministic requirements are acceptable. The evaluation process consists of an integrated assessment of the acceptability of risk, defense-in-depth, and safety margins.

#### 3.7.1 Transition Risk-Informed, Performance-Based Evaluations

The 'changes' associated with NFPA 805 transition were those variances from the deterministic requirements of NFPA 805 or with the existing fire protection licensing basis that were brought into compliance with the NFPA 805 performance based approach. The change identified for evaluation for Fire Area AA57B is as follows:

- Separation Issues

The Fire Risk Evaluation has determined that the change is acceptable based upon:

- The measured change in CDF and LERF.
- Adequate defense-in-depth and safety margins being maintained.

Refer to Attachment 2 for a summary of results associated with the Fire Risk Evaluations.

### 3.8 Defense-in-Depth

A comprehensive risk-informed, performance-based analysis includes consideration of defense-in-depth (DID) as part of an integrated evaluation of risk considerations. In general, defense-in-depth involves consideration of the extent to which fire protection systems and features are provided within the three echelons of fire-protection:

- Preventing fires from starting,
- Rapidly detecting fires and controlling and extinguishing promptly those fires that do occur, thereby limiting fire damage,
- Providing an adequate level of fire protection for structures, systems, and components important to safety, so that a fire that is not promptly extinguished will not prevent the nuclear safety performance criteria from being met.

Each VFDR was evaluated for DID. No recovery actions have been retained for DID.

Based on the assessment in support of the Fire Risk Evaluation, defense-in-depth is maintained for fire area AA57B. Refer to Attachment 2 for details associated with the Fire Risk Evaluation.

### 3.9 Monitoring Program Input

A Monitoring Program will be developed in accordance with FAQ 10-0059, Rev. 1. Methods to monitor availability, reliability, and performance of fire protection program structures, systems, and components (SSCs), as well as programmatic elements will be provided. Additionally, effectiveness measures are established to review program related performance and trends. For AA57B the following systems and features are candidates for inclusion in the CNP Fire Protection Monitoring Program:

- Fire Area boundary barriers discussed in Section 3.1
- Fire Detection System (Ionization)

## 4.0 CONCLUSION

The nuclear safety and radioactive release performance criteria of NFPA 805 are met for a fire in Fire Area AA57B. This Fire Risk Evaluation for Fire Area AA57B has demonstrated that

- The change in core damage frequency (delta CDF) is acceptable, and
- The change in large early release frequency (delta LERF) is acceptable, and
- Defense-in-depth and safety margins are maintained.

This is confirmation that a success path effectively remains free of fire damage and that the performance-based approach is acceptable per Section 4.2.4.2 of NFPA 805.

## **5.0 REFERENCES**

- 5.1 Calculation PRA-FIRE-NB-CRE, Fire PRA Cumulative Risk Evaluations
- 5.2 CNP Fire Pre-Plans, Volumes I, II, and III, Revisions 17, 14, and 18 respectively
- 5.3 Fire Hazards Analysis
- 5.4 NFPA 805, Performance-Based Standard for Fire Protection for Light Water Reactor Electric Generating Plants
- 5.5 NFPPM, NFPA 805 Fire Protection Program Manual (NFPPM)
- 5.6 Nuclear Energy Institute (NEI) 04-02, Guidance for Implementing a Risk-Informed, Performance-Based Fire Protection Program under 10 CFR 50.48(c), Rev. 2
- 5.7 Nuclear Safety Capability Assessment Report
- 5.8 PRA-NB-FIRE-FQ, Fire PRA Model Quantification Notebook
- 5.9 PRA-NB-FIRE-FSS, Fire PRA Fire Scenario Selection
- 5.10 R1900-0411-AA57B, AA57B - Detailed Fire Modeling Report
- 5.11 Regulatory Guide 1.205, Risk-Informed, Performance-Based Fire Protection for Existing Light-Water Nuclear Power Plants, Rev. Revision 1
- 5.12 Technical Evaluation R1900-005-001, Non-Power Operation Modes Transition Review



**Fire Area AA57B – Attachment 1 - Table B-3 - Fire Area Transition**

<u>Unit</u>	<u>Fire Area</u>	<u>Description</u>
2	AA57B	Unit 2 Control Room HVAC Equipment and Computer Areas (El. 650 ft.)

<u>Fire Zone</u>	<u>Description</u>
72	Unit 2 Computer Room - El. 650 ft. 0 in.
73	Control Room HVAC Equipment - El. 650 ft. 0 in. - Unit 2

**Regulatory Basis**

4.2.4.2 - Performance-Based Approach - Fire Risk Evaluation with simplifying deterministic assumptions

<b>Performance Goal</b>	<b>Method of Accomplishment</b>	<b>Comments</b>
Reactivity Control	Unit 2 - Trip the reactor from the Control Room. Borate using Unit 2 East or West Charging Pump supplied from the RWST. Use source range monitoring for indication.	None
Inventory and Pressure Control	Unit 2 - Control inventory using Unit 2 East or West Charging Pump. Control pressure using Unit 2 Pressurizer Safety Relief Valves.	None
Decay Heat Removal	Unit 2 - Feed SGs 1 & 4 with Unit 2 West MDAFW Pump or feed SGs 2 & 3 with Unit 2 East MDAFW Pump or Unit 2 TDAFW Pump. The DHR function also requires MS isolation with a steam release path through the Safety Relief Valves.	None
Process Monitoring	Unit 2 Process Monitoring - Use Unit 2 process monitoring in the Control Room for the following: Pressurizer level, RCS pressure and temperature, and S/G level and Pressure. Unit 2 Source Range Monitoring - Use Unit 2 source range monitoring in the Control Room.	None
Vital Auxiliaries	Unit 2 Electrical - Control Unit 2 Red (AB) Train Electrical Distribution with Unit 2 Red (AB) Train Offsite Power or Unit 2 Red (AB) DG. Control Unit 2 Green (CD) Train Electrical Distribution with Unit 2 Green (CD) Train Offsite Power or Unit 2 Green (CD) DG. Unit 2 ESW - Operate Unit 2 East or West ESW. Unit 2 CCW - Operate Unit 2 East or West CCW. Unit 2 HVAC - Temporary Ventilation required for Unit 2 Control Room HVAC. Operate Unit 2 Auxiliary Building HVAC. Operate Unit 2 Red (AB) and Green (CD) DG HVAC. Operate Unit 2 Switchgear HVAC. Operate	VFDR identified for Control Room HVAC.

**Fire Area AA57B – Attachment 1 - Table B-3 - Fire Area Transition**

<u>Unit</u>	<u>Fire Area</u>	<u>Description</u>
2	AA57B	Unit 2 Control Room HVAC Equipment and Computer Areas (El. 650 ft.)
Unit 2 East and West MDAPW and TDAFW Room HVAC systems. Operate the Unit 2 East and West ESW Room HVAC systems.		

**Reference Documents**

Genesis Solution Suite, EDISON / SAFE-PB, DC Cook V 3.4.0

Nuclear Safety Capability Assessment Report

**Licensing Actions**

None

**Existing Engineering Equivalency Evaluations (EEEE)****EEEE Title Engineering Equivalency Evaluation 9-2 - Fire Zone 54 (Fire Area AA47) and Fire Zone 73 (Fire Area AA57B) Duct Evaluation**

**Summary** The purpose of this engineering equivalency evaluation is to document the acceptability of an undampened HVAC steel duct that penetrates the ceiling/floor assembly between the Unit 2 Control Room and Unit 2 HVAC Equipment Room, Fire Zone 54 (Fire Area AA47) and Fire Zone 73 (Fire Area AA57B), respectively.

Reasonable assurance is provided that a fire in Fire Zone 54 or Fire Zones 72 and 73 would not impair the safe shutdown capabilities of CNP Unit 2. This engineering equivalency evaluation does not adversely impact other engineering equivalency evaluations.

The duct was evaluated and found to be acceptable based on the fire protection systems and construction features within the evaluated areas.

**Fire Area AA57B – Attachment 1 - Table B-3 - Fire Area Transition**

<u>Unit</u>	<u>Fire Area</u>	<u>Description</u>
2	AA57B	Unit 2 Control Room HVAC Equipment and Computer Areas (El. 650 ft.)

**EEEE Title Engineering Equivalency Evaluation 9-5 - Fire Zones 70 (Fire Area AA57A) and 73 (Fire Area AA57B) Hatch Evaluations**

**Summary** The purpose of this engineering equivalency evaluation is to document the acceptability of unrated floor hatches located between the HVAC Equipment Rooms (Fire Zones 70 and 73) and the Unit 1 and Unit 2 Main Control Rooms (Fire Zones 53 and 54), and the fixed suppression exemption requests for the Main Control Rooms or other engineering equivalency evaluations. Fire Zones 70 and 73 are located in Fire Areas AA57A and AA57B, respectively, while Fire Zones 53 and 54 are located in Fire Areas AA46 and AA47, respectively. A 3-hr fire-rated hatch assembly is not commercially available for use in this location.

Note: This engineering equivalency evaluation has been reviewed by the NRC. Refer to NRC SER dated June 17, 1988, for acceptance of unrated fire hatches in fire area boundaries. The NRC concluded that the level of fire safety is equivalent to that achieved by conformance with the guidelines of Section D.1.j of Appendix A to BTP APCSB 9.5-1, and, therefore, the deviations for the unrated fire hatches were found acceptable.

Reasonable assurance is provided that a fire in Fire Zones 70, 71, 72 and 73 would not impair the safe shutdown capabilities in either unit. This engineering equivalency evaluation does not adversely impact other engineering equivalency evaluations.

The hatches were evaluated and found to be acceptable based on the fire hazards, fire protection systems and construction features within the evaluated areas. Also, some areas being evaluated are continuously manned.

**EEEE Title Engineering Equivalency Evaluation 11-9 - Turbine, Auxiliary and Containment Buildings Boundary Evaluation**

**Summary** The purpose of this engineering equivalency evaluation is to describe in general, the approach and existence of evaluations performed to determine and reconcile fire area boundaries having components or designs with less than a 3-hr fire rating on preventing the spread of fire. This engineering equivalency evaluation also specifically evaluates the impact of unrated door assemblies on the spread of fire.

Reasonable assurance is provided that the fire area boundaries having components or design less than a 3-hr fire rating will not increase the spread of fire or impair the safe shutdown capabilities of Units 1 or 2. In addition, this engineering equivalency evaluation does not adversely impact on other engineering equivalency evaluations or exemption requests.

This evaluation supports additional evaluations credited in this fire area.

**Fire Area AA57B – Attachment 1 - Table B-3 - Fire Area Transition**

<u>Unit</u>	<u>Fire Area</u>	<u>Description</u>
2	AA57B	Unit 2 Control Room HVAC Equipment and Computer Areas (El. 650 ft.)

**Fire Suppression Effects on Nuclear Safety Performance Criteria**

The CNP fire brigade is trained to discharge water in a judicious manner and instructed to direct hose streams and portable extinguishers at the base of the fire to limit the amount of overspray beyond the immediate fire zone. For this reason, fire brigade activities are not expected to fail components not already considered damaged. It has been concluded that water impingement on cables is not a concern. Electrical cabinets are provided with a seal at the conduit interface. Possible impacts to surrounding equipment due to manual fire fighting activities is bounded by the analysis approach of postulating whole room damage. The drainage features of the fire area mitigate the potential for flooding damage due to fire suppression, such that the standing water would not affect credited equipment.

Since it is shown that suppression effects will not impact the nuclear safety performance criteria, the fire area configuration is deemed acceptable.

**References:**

Technical Evaluation 12.1, "Fire Suppression Effects Study"

Technical Evaluation 12.1, "Supplemental Information to Fire Suppression Effects Study – Supplement 1"

**Fire Area Comments**

None

## Fire Area AA57B – Attachment 2 - Fire Risk Evaluation Results Summary

### A2.1 Introduction

The ‘changes’ associated with NFPA 805 transition were those variances from the deterministic requirements of NFPA 805. The changes identified for evaluation for fire area AA57B are grouped as follows:

- Separation Issues

This attachment is a summary of the Fire Risk Evaluation for the fire area. The complete results and methodology are contained in the Cumulative Fire Risk Evaluation, PRA-FIRE-NB-CRE. (FPCE 2017-0009)

### A2.2 Inputs/Assumptions

Fire modeling processes and inputs provided in NUREG/CR-6850 are appropriate for use in a risk-informed, performance-based evaluation. The complete list of assumptions used in the fire modeling methodology for this fire area is contained in Detailed Fire Modeling Technical Evaluation R1900-0411-AA57B.

### A2.3 Fire Modeling Methodology

Fire PRA fire modeling results are used as the initial input into this Fire Risk Evaluation. The process consists of conservative bounding analyses using NUREG/CR-6850 methods. As needed, refinements are made to utilize more realistic parameters. The complete fire modeling methodology for this fire area is contained in Detailed Fire Modeling Technical Evaluation R1900-0411-AA57B.

### A2.4 Scenario Descriptions and Model Results

Fire Area AA57B was evaluated for the impact of fires originating from both fixed and transient ignition sources. Complete descriptions of each fire scenario is contained within the Detailed Fire Modeling Technical Evaluation R1900-0411-AA57B.

#### A2.4.1 Ignition Sources

Fire Area AA57B contains the control room ventilation sub panels, control room ventilation units, refrigerant compressors and the north and south circulating pumps. Per discussion with plant personnel, the heat release rates for all switchgear, load centers, and MCC electrical cabinets have been characterized as qualified cable because items of this nature are generally constructed on-site. For other electrical cabinet types, where the internal cable qualification was unknown, the heat release rates have been assumed as non-qualified. Ignition sources in Fire Area AA57B were modeled using the 98th percentile fire as a screening approach and did not require further refinement.

In Fire Area AA57B, the 98th percentile HRR was used for all transient fires. The 98th percentile HRR bounds the possible transient ignition sources expected for this fire area, which were fire tested and identified in NUREG/CR-6850, Appendix G, Table G-7.

#### A2.4.2 Scenario Results

A delta risk calculation has been performed to quantify the risk associated with the VFDRs in the fire area.

### A2.5 Fire Risk Evaluation Results

PRA-FIRE-NB-CRE documents scenarios and corresponding impacted VFDRs that were evaluated for

**Fire Area AA57B – Attachment 2 - Fire Risk Evaluation Results Summary**

delta risk during the transition to NFPA 805 and also all changes to the Fire Protection Program that are currently incorporated into the Fire PRA model. The acceptability of the Cumulative Fire Risk Evaluations was based on calculated delta risk meeting the thresholds of NEI 04-02, RG 1.205 and RG 1.174. (FPCE 2017-0009)

**Fire Area AA57B – Attachment 2 - Fire Risk Evaluation Results Summary****A-2.6 Impact of VFDR on Defense-in-Depth**

Defense-in-Depth has been evaluated for this fire area. The impacts of this evaluation are summarized in the table below:

Defense-in-Depth Impact Review for AA57B			
Method of Providing DID	Required to Support Deterministic Analysis or Fire PRA?	Changes or Improvements Necessary for DID?	Basis/Justification
Echelon 1: Prevent fires from starting			
Combustible Control is implemented in accordance with Procedure PMP-2270-CCM-001, Control of Combustible Materials.	Yes	No	• This element is adequate based on no perceived weakness of, or over-reliance on, another echelon of defense-in-depth.
Hot Work Control is implemented in accordance with Procedure PMP-2270-WBG-001, Welding, Burning and Grinding Activities.	Yes	No	
Echelon 2: Rapidly detect, control and extinguish promptly those fires that do occur thereby limiting fire damage			
Fire Detection System	Yes	No	• Detection is already required and fire fighting activities are not expected to be challenging, therefore, no changes or improvements to Echelon 2 attributes are necessary to maintain defense-in-depth.
Fixed Fire Suppression	No	No	
Portable Fire Extinguishers	Yes	No	
Hose stations and hydrants	Yes	No	
Pre-Fire Plan	Yes	No	
Echelon 3: Provide adequate level of fire protection for systems and structures so that a fire will not prevent essential safety functions from being performed			
Walls, floors ceilings and structural elements are rated or have been evaluated as adequate for the hazard.	Yes	No	• The variance credits a recovery action to achieve nuclear safety performance criteria. No changes or improvements to Echelon 3 attributes are necessary to maintain defense-in-depth.
Penetrations in the fire area barrier are rated or have been evaluated as adequate for the hazard.	Yes	No	
Supplemental barriers (e.g., ERFBS, cable tray covers, etc.)	No	No	
Guidance provided to operations personnel detailing the required success path(s) including recovery actions to achieve nuclear safety performance criteria.	Yes	No	

## Fire Area AA57B – Attachment 2 - Fire Risk Evaluation Results Summary

### A-2.7 Safety Margin Considerations

In accordance with NEI 04-02, the maintenance of adequate Safety Margin is assessed by the consideration categories of analyses utilized by this Fire Risk Evaluation.

Safety margins are considered to be maintained if:

- Codes and Standards or their alternatives accepted for use by the NRC are met.

AND

- Safety analyses acceptance criteria in the licensing basis (e.g., FSAR, supporting analyses) are met, or provides sufficient margin to account for analysis and data uncertainty.

The following summarizes the bases for ensuring the maintenance of safety margins:

- The risk-informed, performance based processes utilized are based upon NFPA 805, 2001 edition, endorsed by the NRC in 10 CFR 50.48(c).
- The Fire Risk Evaluation process is in accordance with NEI 04-02, Revision 2, which is endorsed by the NRC in Regulatory Guide 1.205, Revision 1.
- The Fire PRA is developed in accordance with NUREG/CR-6850, which was developed jointly between the NRC and EPRI.
- The Fire PRA has undergone an industry peer review, in order to ensure the Fire PRA meets the appropriate quality standards of ASME/ANS RA-Sa-2009, "Standard for Level 1/Large Early Release Frequency Probabilistic Risk Assessment for Nuclear Power Plant Applications," Dated February 2, 2009
- The "combined analysis approach" is used during transition (NEI 04-02, Section 5.3.4.3); therefore, MEFS/LFS is not analyzed separately from the Fire PRA results.
- The CNP internal events PRA model received two formal industry peer reviews conducted in accordance with applicable NEI guidelines. The initial peer review was performed in 2001, while a subsequent focused scope (i.e., limited scope) peer review was conducted in 2009. The initial, full-scope WOG peer review covered all aspects of the CNP PRA model and the administrative processes used to maintain and update the model. The CNP PRA model has been revised to address all significant issues (i.e., Category A and B Facts & Observations) identified during the initial peer review. None of the findings from the focused-scope peer review were judged to reach the significance level of a Category A or B Fact & Observation; as a result, no changes to the PRA model have yet been made to include resolutions for these latter issues.
- Fire protection systems and features determined to be required by NFPA 805 Chapter 4 have been confirmed to meet the requirements of NFPA 805 Chapter 3 and their associated referenced codes and listings, or provided with acceptable alternatives using processes accepted for use by the NRC (i.e., FAQ 06-0008, FAQ 06-0004, 07-0033).
- Fire modeling performed in support of the transition has been performed within the Fire PRA utilizing codes and standards developed by industry and NRC staff which have been verified and validated in authoritative publications, such as NUREG 1824, "Verification and Validation of Selected Fire Models for Nuclear Power Plant Applications". In general, the fire modeling performed in support of the Fire Risk Evaluations has been performed using conservative methods and input parameters that are based upon



### **Fire Area AA57B – Attachment 2 - Fire Risk Evaluation Results Summary**

NUREG/CR-6850 as documented in the AA57B Detailed Fire Modeling Report, section 7.2. While this is generally not ideal in the context of best estimate probabilistic risk analysis, it is a pragmatic approach given the current state of knowledge regarding the uncertainties related to the application of the fire modeling tools and associated input parameters for specific plant configurations.

- In accordance with the requirements of 10 CFR 50.48(c)(2)(iii), the Fire PRA results, including cutsets for the scenarios of concern, have been reviewed and it was verified that the results presented above do not rely solely on feed and bleed as the fire-protected safe shutdown path for maintaining reactor coolant inventory, pressure control, and decay heat removal capability for this fire area.

#### **A-2.8 Transition Risk Evaluation Conclusions**

The transition change evaluation determined that these changes:

- Are acceptable based upon the measured change in CDF and LERF
- Maintained adequate defense-in-depth and safety margins

The results of this evaluation meet the requirements of NFPA 805 Risk Evaluation; therefore, the use of the performance based analysis approach is acceptable.

D. C. Cook Nuclear Plant  
Fire Safety Analysis

Fire Area: AA58

Unit 2 Containment

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Attachments

Fire Area AA58 – Attachment 1 - Table B-3 - Fire Area Transition

Fire Area AA58 – Attachment 2 - Fire Risk Evaluation Results Summary

## 1.0 PURPOSE

This report documents the Fire Safety Analysis (FSA) for Cook Nuclear Plant (CNP) Fire Area AA58, Unit 2 Containment which comprises fire zone(s) 74, 75, 76, 102, 104, 119, 121, 123, 133, 135. The purpose of this analysis is to demonstrate the achievement of the nuclear safety and radioactive release performance criteria of NFPA 805 as required by 10 CFR 50.48(c). The Fire Safety Analysis is a key part of compliance with Section 2.7.1.2 Fire Protection Program Design Basis Document of NFPA 805. This analysis also documents results of risk-informed, performance-based Fire Risk Evaluations (FREs). These evaluations are associated with Variances from Deterministic Requirements (VFDRs) of NFPA 805 Chapter 4.

## 2.0 ANALYSIS METHODOLOGY

The FSA is the design basis document as described in NFPA 805 Section 2.7.1.2. The following steps are performed to develop the FSA on a fire area basis:

- Identify significant fire hazards in the fire area. This is based on NFPA 805 approach to analyze the plant from an ignition source and fuel package perspective.
- Summarize Nuclear Safety Capability Analysis (NSCA) compliance strategies. This is the result of the NEI 04-02 B-3 Table review of the Safe Shutdown Analysis.
- Summarize Non-Power Operations Modes compliance strategies.
- Summarize Radioactive Release compliance strategies. The transition review process required per NEI 04-02 is used to develop these results.
- Provide Fire Probabilistic Risk Assessment summary of results. This is based on the results from the plant Fire PRA.
- Perform risk informed, performance based evaluations if needed for the performance based approach.
- Summarize Defense-in-Depth strategy for each fire area.
- Determine key analysis assumptions which are candidates to be included in the NFPA 805 monitoring program.
- Provide conclusions relative to NFPA 805 compliance.

### 3.0 ANALYSIS

#### 3.1 Classical Fire Protection

##### 3.1.1 Construction

For Fire Zone 74, walls and floors to adjacent fire areas and fire zones are reinforced concrete in excess of a 3-hour rating.

For Fire Zone 75, there are no walls, floors, or ceilings to adjacent fire areas. Walls, floors and ceilings to adjacent fire zones are reinforced concrete in excess of a 3-hour rating.

For Fire Zone 76, walls, floors and ceilings to adjacent fire areas and fire zones are reinforced concrete in excess of a 3-hour rating.

For Fire Zone 102, 119, 121 and 123, walls and floors to adjacent fire areas and fire zones are reinforced concrete in excess of a 3-hour rating. The structural steel columns supporting the poured concrete ceiling slab are unprotected (Engineering Equivalency Evaluation 12-11).

For Fire Zone 104, there are no walls, floors, or ceilings to adjacent fire areas. Walls, floors and ceilings to adjacent fire zones are reinforced concrete in excess of a 3-hour rating. A removable precast concrete slab cover is provided over the reactor head.

For Fire Zone 133, walls to adjacent fire areas are reinforced concrete in excess of a 3-hour rating. Walls, floors and ceilings to adjacent fire zones are reinforced concrete in excess of a 3-hour rating. Ceiling of this fire zone consists of blow open panels to relieve high pressure steam from an accident.

For Fire Zone 135, there are no walls, floors, or ceilings to adjacent fire areas. Walls, floors and ceilings to the adjacent yard and fire zones are reinforced concrete in excess of a 3-hour rating.

Applicable Licensing Actions and Engineering Equivalency Evaluations are documented in Attachment 1.

##### 3.1.2 Doors and Access Openings

For Fire Zone 74, there are no door openings to adjacent fire areas or fire zones. An unrated submarine style ceiling hatch provides access down into this fire zone from Fire Zone 123 above. Fire Zone 74 provides access by means of laddered manways to Fire Zones 102, 119 and 121 above.

For Fire Zone 75, there are no door openings to adjacent fire areas. An unrated watertight door provides access into this fire zone from the containment instrumentation room, Fire Zone 123. Fire Zone 75 provides access down into Fire Zone 135 by a laddered floor opening.

For Fire Zone 76, upper containment access is provided into this fire zone from Fire Area AA3 - Fire Zone 69 by the equipment hatch air lock.

For Fire Zone 102, there are no door openings to adjacent fire areas. Access to this fire zone is by a laddered manway up from Fire Zone 74 and by the stairs at the 180° azimuth.

For Fire Zone 104, there are no access openings to this fire zone.

For Fire Zone 119, there are no door openings to adjacent fire areas. Access to this fire zone is by a laddered manway to from Fire Zone 74.

For Fire Zone 121, there are no door openings to adjacent fire areas or fire zone. Access to this fire zone is by a laddered manway up from Fire Zone 74.

For Fire Zone 123, lower containment access is provided into this fire zone from Fire Area AA35 - Fire Zone 34A by the personnel airlock. An unrated submarine style door provides access from this fire zone into lower containment Fire Zone 75. Similar, submarine style doors have been evaluated as robust (Engineering Equivalency Evaluation 11-56). An unrated submarine style floor hatch provides access from this fire zone down into the containment piping annulus Fire Zone 74.

For Fire Zone 133, access doors are provided to the upper and lower levels of the ice condenser. Steel inlet doors are provided at elevation 633 ft. for steam entry into the ice condenser during a LOCA.

For Fire Zone 135, there are no door openings to adjacent fire areas or fire zones. Access down into this fire zone is provided by a laddered floor opening from Fire Zone 75.

### 3.1.3 Penetrations

Note: Statements regarding fire resistance rating of penetration seals are not applicable to seals in barriers to Analysis Area YD.

For Fire Zones 74, 76, 121, 123 and 133, all penetrations into containment are adequately sealed to prevent the spread of fire through the containment barrier. There are no fire seals provided in the fire barriers between this fire zone and adjacent fire zones.

For Fire Zone 75, the sealing of penetrations in fire barriers is not required in this fire zone.

For Fire Zone 102, all penetrations into containment are adequately sealed to prevent the spread of fire through the containment barrier. There are no fire seals provided in the fire barriers between this fire zone and adjacent fire zones inside containment.

For Fire Zone 104, penetrations in fire barriers between this fire zone and adjacent fire zones are not provided with fire seals.

For Fire Zone 119, there are no penetrations into containment in this fire zone. There are no fire seals provided in the fire barriers between this fire zone and adjacent fire zones.

For Fire Zone 135, there are no penetrations to the adjacent yard. There are no fire seals provided in the fire barriers between this fire zone and adjacent fire zones.

### 3.1.4 Detection

The table below outlines the fire detection system(s) provided in the Fire Area:

Table 3-1, Fire Area AA58 Detection Systems									
Fire Zone	Type of System	Local (L) / Remote (R)	Detection Actuates Suppression?	Required System?					
				S	L	E	R	D	
74	Thermal	L/R	No Auto Supp. (N/A)	N	N	Y	Y	N	
75	Thermal	L/R	No Auto Supp. (N/A)	N	N	Y	Y	N	
76	Thermal	L/R	No Auto Supp. (N/A)	N	N	Y	Y	N	
102	Thermal	L/R	No Auto Supp. (N/A)	N	N	Y	Y	N	
104	Thermal	L/R	No Auto Supp. (N/A)	N	N	Y	Y	N	
119	None	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
121	None	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
123	None	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
133	None	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
135	None	N/A	N/A	N/A	N/A	N/A	N/A	N/A	

**Table 3-1 Legend:**

Table Field: "Required System?"	
S	- Required for Chapter 4 Separation Criteria
L	- Required for NRC Approved Licensing Action
E	- Required for Engineering Equivalency Evaluation
R	- Required for Risk Significance
D	- Required to maintain adequate balance of Defense-in-Depth in a Change Evaluation or Fire Risk Evaluation

For Fire Zone 74, 76, 102, 104, 121, and 123 line type thermistor heat sensors are installed in the cable trays. These thermistors alarm in the Unit 2 Control Room on the Containment Auxiliary Sub-Panel.

For Fire Zone 75, line type thermistor heat sensors are installed in cable trays and around the reactor coolant pumps. These thermistors alarm in the Unit 2 Control Room and on the Containment Auxiliary Sub-Panel.

Fire Zones 119, 133 and 135 are not provided with an automatic fire detection system.

### 3.1.5 Fixed Suppression

The table below outlines the fixed fire suppression system(s) provided in the Fire Area:

Table 3-2, Fire Area AA58 Suppression Systems							
Fire Zone	Type of System	Full (F) / Partial (P)	Required System?				
			S	L	E	R	D
74	None	N/A	N/A	N/A	N/A	N/A	N/A
75	None	N/A	N/A	N/A	N/A	N/A	N/A
76	None	N/A	N/A	N/A	N/A	N/A	N/A
102	None	N/A	N/A	N/A	N/A	N/A	N/A
104	None	N/A	N/A	N/A	N/A	N/A	N/A
119	None	N/A	N/A	N/A	N/A	N/A	N/A
121	None	N/A	N/A	N/A	N/A	N/A	N/A
123	None	N/A	N/A	N/A	N/A	N/A	N/A
133	None	N/A	N/A	N/A	N/A	N/A	N/A
135	None	N/A	N/A	N/A	N/A	N/A	N/A
<b>Table 3-2 Legend:</b>							
Table Field: "Required System?"							
S	- Required for Chapter 4 Separation Criteria						
L	- Required for NRC Approved Licensing Action						
E	- Required for Engineering Equivalency Evaluation						
R	- Required for Risk Significance						
D	- Required to maintain adequate balance of Defense-in-Depth in a Change Evaluation or Fire Risk Evaluation						

Fire Area AA58 is not provided with automatic fire suppression.

### 3.1.6 Manual Suppression / Response Strategy

For fire zones within AA58 equipped with automatic detection systems, a postulated fire will be identified by early detection using thermistor heat sensors or by plant personnel using plant communication system to notify the control room. The automatic detection systems alarm in the control room. For fire zones within AA58 which are not equipped with automatic detection systems, a postulated fire will be identified by plant personnel using plant communication system to notify the control room. The Control Room operator will dispatch the fire brigade for initiation of manual fire fighting. A fire in this fire area will be contained by the construction features discussed in Section 3.1.1. Manual suppression is provided by the CNP Fire Brigade.

Fire extinguishers for all fire zones within this fire area are located in adjacent Fire Zones 34A and 69.

For Lower Containment Fire Zones 74, 75, 102, 119, 123 and 135 water hose reels and a breathing apparatus are located in the lower containment access area in adjacent Fire Zone 34A.

For Upper Containment Fire Zones 76, 104 and 133, water hose reels and a breathing apparatus are located in the adjacent Fire Zone 69.

For Fire Zone 121, water hose reels located at the lower and upper containment access areas in adjacent Fire Zones 34A and 69.

For Fire Zone 75, 76 and 123 floor drains are not available. The containment sump system at the basement level is available.

For Fire Zone 135, floor drains are not available. The Fire Brigade is equipped with a sump pump that may be used to remove an accumulation of water.

For Fire Zone 104, floor drains are not available, the fire brigade is equipped with a sump pump that may be used to remove an accumulation of water.

For Fire Zone 121, floor drains are available for the accumulator enclosure east and associated access ways east and west of the refueling cavity. Drainage is to the containment sump system at the basement level. The drains are not available for the refueling cavity only. This part is not in Fire Zone 121.

Other fire zones within this fire area are equipped with floor drains.

### 3.1.7 Ventilation

A fire in this area will be contained by the fire barriers. Contaminated smoke can be removed by portable fans and flexible ducting to other the lower or upper containment airlocks. This smoke will then pass through the Contractors Access Control Building or the Auxiliary Building roof vents and will be monitored before being vented to the outside per the Fire Pre-Plans.

For Fire Zones 74, 75, 104, 121 and 135, there are no ventilation penetrations to adjacent fire areas. All ventilation penetrations to adjacent fire zones in the containment are undamped.

For Fire Zones 76 and 102, there are ventilation penetrations to adjacent fire areas provided with isolation valves on the outside of containment. These valves are assumed to provide adequate protection; therefore, the undamped ventilation ducts to Fire Areas AA3 - Fire Zone 50 and 69 do not require fire dampers.

For Fire Zone 119, there are no ducted ventilation penetrations to adjacent fire areas or fire zones.

For Fire Zone 123, there are ventilation penetrations to adjacent fire areas provided with isolation valves on the outside of containment. These valves are assumed to provide adequate protection; therefore, the undamped ventilation ducts to Fire Area AA35 - Fire Zone 34A do not require fire dampers.

For Fire Zone 133, there are no ventilation penetrations to adjacent fire areas.

### 3.1.8 Other Features

No other fire protection features are provided for Fire Zones 74, 75, 76, 102, 104, 119, 121 or 135.

For Fire Zone 123, one channel of pressurizer liquid level indication is protected with a radiant energy shield, and the cable trays that are intervening combustibles between channels have been fire-stopped.



For Fire Zone 133, blow open floor hatches are provided at the top of the ice baskets between the lower and upper ice condenser sections.

The reactor coolant pumps are equipped with a totally enclosed system to collect and contain the lube oil that is provided for each pump (Exemption 7.15).

### 3.2 Fire Hazards Identification

The fire area contains both ignition sources and combustible fire hazards. The ignition sources consist of the waste evaporator condensate pump, reactor coolant pumps, control rod vent fans and blowers.

Combustibles consist primarily of cable insulation, polyurethane foam, plastics and rubber. Fire Zone 75 also includes 1060 gallons of lube oil for the four RCP Pumps. Fire Zone 76 also includes wood, anti-Cs (located inside Knach boxes), and 50 gallons of lube oil for the polar crane. Fire Zone 121 also contains Styrofoam. Fire Zone 123 also contains Thermo-Lag retired in place. Fire Zones 119 and 135 do not contain combustibles.

Containment purge ductwork that penetrates containment with isolation valves inside and outside of containment are adequate to prevent the passage of fire through the containment barrier. Fire dampers are not required at the point where the ducts penetrate containment.

All containment penetration assemblies are satisfactory to prevent the passage of fire through the containment barrier. While the penetration assemblies do not constitute a rated fire seal, they are designed and constructed to meet radiological and pressure boundary requirements and qualifications which provide an acceptable level of protection.

Minimal exterior hazards are present around the Containment Building. The building is mostly surrounded by other fire zones with only a small portion of the building subject to yard, ground level fire hazards. No fixed fire hazards are in the area and transient fires would not impact the thick reinforced concrete exterior or any penetration assemblies in the area. Start-up Transformer 201AB is in excess of 50ft from the building. Spatial separation is enough protection for the exposed Containment Building above ground level. No fire rating is required for Containment Building penetrations.

The combustible loading classification for Fire Zone 75 is moderate. The combustible loading classification of all other fire zones within this fire area is low. [Ref. FPCE-2018-0009]

### 3.3 NSCA Compliance Summary

Fire Area AA58, the Unit 2 Containment, contains numerous Unit 2 Red and Green Train supporting equipment and Red and Green train cables, conduits and raceways necessary to maintain safe and stable condition of the unit.

Compliance with the nuclear safety performance criteria is achieved using the performance-based approach in accordance with NFPA 805, Section 4.2.4.2. This area credits separation of required cables and equipment by a horizontal distance of more than 20 feet with no intervening combustibles or by radiant energy shields. Automatic detection and suppression is not required to credit separation within containment per NFPA 805, Section 4.2.3.2.a.

Safe and stable condition of Unit 2 can be accomplished using Steam Generators 2 and 3 via the Unit 2 East Motor Driven Auxiliary Feedwater Pump or Steam Generators 1 and 4 via the Unit 2

West Motor Driven Auxiliary Feedwater Pump, Control Room Process Monitoring, Unit 2 Charging via the West or East Pump, Unit 2 Component Cooling Water via the West or East Pump, and Unit 2 Essential Service Water via the East or West Pump. Electrical power is available to both the Red and Green Train via Offsite Power. Additionally, Red and Green Train Emergency Diesels are available.

The Nuclear Safety Performance Criteria compliance strategy for AA58 is documented within the NSCA Report.

### 3.3.1 Variances

The variances identified for evaluation for this fire area are grouped as follows:

#### 3.3.1.1 VFDR No. AA58-001

2-ICM-129.P and 2-IMO-128.P - RHR Boundary Isolation Valves are required closed to support RCS integrity. RCS integrity is required to control coolant level such that inventory and pressure control is maintained. 2-ICM-129.P or 2-IMO-128.P are in series and one of the valves is required to be closed to support RCS integrity. 2-ICM-129.P and 2-IMO-128.P may fail due to a full area fire within Fire Area AA58. 2-ICM-129.P may fail due to fire induced damage of cable 9188CG-2. 2-IMO-128.P may fail due to fire induced damage of cable 8086CR-2. These cable failures could spuriously open the valves. This condition represents a variance from the deterministic requirements of NFPA 805, Section 4.2.3. This is a separation issue.

This VFDR has been evaluated and it was determined that the risk, safety margin and defense-in-depth meet the acceptance criteria of NFPA 805 Section 4.2.4 with no further action required.

#### 3.3.1.2 VFDR No. AA58-002

2-NLI-151-CRI, 2-NLP-151-CRI, 2-NPS-121-CRI and 2-NPS-122-LSI - Pressurizer level and RCS pressure indication are required to be operable to support process monitoring. Process monitoring is required to be available to monitor key primary and secondary parameters. 2-NLI-151-CRI may fail due to fire induced damage of sense line 2-NLI-151-LSI-SL and cable 6747-2. 2-NLP-151-CRI may fail due to fire induced damage of sense line 2-NLP-151-CRI-SL and cable 8734CO-2. 2-NPS-121-CRI may fail due to fire induced damage of sense line 2-NPS-121-CRI-SL and cable 9765CB-2. 2-NPS-122-LSI may fail due to fire induced damage of sense line 2-NPS-122-LSI-SL and cable 9766CY-2. The cables associated with these components credit 20 feet of separation and the use of radiant energy shields. This condition represents a variance from the deterministic requirements of NFPA 805, Section 4.2.3. This is a separation issue.

This VFDR has been evaluated and it was determined that the risk, safety margin and defense-in-depth meet the acceptance criteria of NFPA 805 Section 4.2.4 with no further action required.

**3.3.1.3 VFDR No. AA58-003**

2-QRV- 113, 2-QRV- 114 and 2-QRV- 170 - Excess Letdown Isolation Valves are required to be closed to support CVCS isolation. CVCS isolation is required to maintain positive control over inventory and pressure. In order to achieve excess letdown isolation the following valves need to be closed; 2-QRV- 113 or 2-QRV- 114 or 2-QRV- 170. All of these valves may fail due to a fire within Fire Area AA58. 2-QRV- 113 may fail due to fire induced damage of cables 16308-2 and 163090-2. 2-QRV-114 may fail due to fire induced damage of cables 16313-2 and 16314-2. 2-QRV-170 may fail due to fire induced damage cable 5779C-2. These cable failures could spuriously open the valves. This condition represents a variance from the deterministic requirements of NFPA 805, Section 4.2.3. This is a separation issue.

This VFDR has been evaluated and it was determined that the risk, safety margin and defense-in-depth meet the acceptance criteria of NFPA 805 Section 4.2.4 with a defense-in-depth action credited.

**3.3.1.4 VFDR No. AA58-004**

2-NRV-151, 2-NRV-152 and 2-NRV-153 - Pressurizer PORVs are required to be closed to support RCS integrity. RCS integrity is required to maintain positive control over RCS inventory and pressure. 2-NRV-151 may fail due to fire induced damage of cable 9705CR-2. 2-NRV-152 may fail due to fire induced damage of cable 9706CR-2. 2-NRV-153 may fail due to fire induced damage of cable 8757CG-2. Failure of these cables could spuriously open the valves. This condition represents a variance from the deterministic requirements of NFPA 805, Section 4.2.3. This is a separation issue.

This VFDR has been evaluated and it was determined that the risk, safety margin and defense-in-depth meet the acceptance criteria of NFPA 805 Section 4.2.4 with a defense-in-depth action credited.

**3.3.1.5 VFDR No. AA58-005**

2-NSO-021 and 2-NSO-022 - The RX Head Vent Valves are required to be closed to support RCS integrity. RCS integrity is required to maintain positive control over RCS inventory and pressure. 2-NSO-021 and 2-NSO-022 are in series, requiring 1 of the valves to remain closed to provide RCS integrity. 2-NSO-021 may fail due to fire induced damage of cables 9801CG-2 and 9803G-2. 2-NSO-022 may fail due to fire induced damage of cables 9807CG-2 and 9809G-2. These cable failures could spuriously open the valves. This condition represents a variance from the deterministic requirements of NFPA 805, Section 4.2.3. This is a separation issue.

This VFDR has been evaluated and it was determined that the risk, safety margin and defense-in-depth meet the acceptance criteria of NFPA 805 Section 4.2.4 with a defense-in-depth action credited.

**3.3.1.6 VFDR No. AA58-006**

2-NSO-023 and 2-NSO-024 - RX Head Vent Valves are required to be closed to support RCS integrity. RCS integrity is required to maintain positive control over RCS inventory and pressure. 2-NSO-023 and 2-NSO-024 are in series requiring one of the valves to be closed to maintain RCS integrity. 2-NSO-023 may fail due to fire induced damage of cables 9801CR-2 and 9803R-2. 2-NSO-024 may fail due to fire induced damage of cables 9807CR-2 and 9809R-2. Failure of these cables could spuriously open the valves. This condition represents a variance from the deterministic requirements of NFPA 805, Section 4.2.3. This is a separation issue.

This VFDR has been evaluated and it was determined that the risk, safety margin and defense-in-depth meet the acceptance criteria of NFPA 805 Section 4.2.4 with a defense-in-depth action credited.

**3.3.1.7 VFDR No. AA58-007**

2-NSO-061 and 2-NSO-062 - The Post Accident Valves are required to be closed to support RCS integrity. RCS integrity is required to maintain positive control over RCS inventory and pressure. 2-NSO-061 and 2-NSO-062 are in series, requiring 1 of the valves to remain closed to provide RCS integrity. 2-NSO-061 may fail due to fire induced damage of cables 9814CG-2 and 9816G-2. 2-NSO-062 may fail due to fire induced damage of cables 9820CG-2 and 9821G-2. These cable failures could spuriously open the valves. This condition represents a variance from the deterministic requirements of NFPA 805, Section 4.2.3. This is a separation issue.

This VFDR has been evaluated and it was determined that the risk, safety margin and defense-in-depth meet the acceptance criteria of NFPA 805 Section 4.2.4 with a defense-in-depth action credited.

**3.3.1.8 VFDR No. AA58-008**

2-NSO-063 and 2-NSO-064 - Post Accident Vent Valves are required to be closed to support RCS integrity. RCS integrity is required to maintain positive control over RCS inventory and pressure. 2-NSO-063 and 2-NSO-064 are in series requiring one of the valves to be closed to maintain RCS integrity. 2-NSO-063 may fail due to fire induced damage of cables 9814CR-2 and 9816R-2. 2-NSO-064 may fail due to fire induced damage of cables 9820CR-2 and 9821R-2. Failure of these cables could spuriously open the valves. This condition represents a variance from the deterministic requirements of NFPA 805, Section 4.2.3. This is a separation issue.

This VFDR has been evaluated and it was determined that the risk, safety margin and defense-in-depth meet the acceptance criteria of NFPA 805 Section 4.2.4 with a defense-in-depth action credited.

**3.3.1.9 VFDR No. AA58-009**

2-QRV-10, 2-QRV-20, 2-QRV-30 and 2-QRV-40 RCP Seal Water Return Isolation Valves are required to be open to support RCS integrity by maintaining the RCP seal. RCS integrity is required to maintain positive control over RCS inventory and pressure. 2-QRV-10 may fail due to fire induced damage of cable 14421-2. 2-QRV-20 may fail due to fire induced damage of cables 14451-2 and 14452-2. 2-QRV-30 may fail due to fire induced damage of cables 14469-2 and 14471-2. 2-QRV-40 may fail due to fire induced damage of cables 14473-2 and 14475-2. These cables could cause spurious closure of these valves. This condition represents a variance from the deterministic requirements of NFPA 805, Section 4.2.3. This is a separation issue.

This VFDR has been evaluated and it was determined that the risk, safety margin and defense-in-depth meet the acceptance criteria of NFPA 805 Section 4.2.4 with a defense-in-depth action credited.

**3.3.1.10 VFDR No. AA58-010**

2-QRV-111, 2-QRV-112, 2-QRV-160, 2-QRV-161 and 2-QRV-162 - Letdown Isolation Valves are required to be closed to support CVCS isolation. CVCS isolation is required to maintain positive control over inventory and pressure. In order to achieve letdown isolation the following valves need to be closed; 2-QRV-111 or 2-QRV-112 or (2-QRV-160 and 2-QRV-161 and 2-QRV-162). All of these valves may fail due to a full area fire within Fire Area AA58. 2-QRV-111 may fail due to location and cables 9036G-2 and 9038G-2. 2-QRV-112 may fail due to location and cable 9032R-2. 2-QRV-160 may fail due to fire induced damage of cable 9106CG-2. 2-QRV-161 may fail due to fire induced damage of cable 8470CG-2. 2-QRV-162 may fail due to fire induced damage of cable 8473CG-2. These cable failures could spuriously open the valves. This condition represents a variance from the deterministic requirements of NFPA 805, Section 4.2.3. This is a separation issue.

This VFDR has been evaluated and it was determined that the risk, safety margin and defense-in-depth meet the acceptance criteria of NFPA 805 Section 4.2.4 with a defense-in-depth action credited.

**3.3.2 Recovery Actions Credited**

For each VFDR, a Fire Risk Evaluation has been performed to assess the acceptability of risk, defense-in-depth, and safety margin. This evaluation determined whether or not recovery actions are required to ensure that one success path necessary to achieve and maintain the nuclear safety performance criteria is maintained free of fire damage by a single fire. Table 3-3 identifies the credited recovery actions for this area. Actions retained for DID are identified as “DID Actions” within Table 3-3. Additional information for DID actions is contained within Section 3.8 of this report. Note that, for completeness, all VFDRs are contained within Table 3-3, even if the Fire Risk Evaluation has determined that a recovery action is not required. In those instances where a recovery action has been determined to not be required, the word “None” is provided in the “Action” column in the table.

<b>Table 3-3, Recovery Actions Credited</b>		
<b>VFDR</b>	<b>Component</b>	<b>Action</b>
AA58-001	2-ICM-129.P 2-IMO-128.P	None

<b>Table 3-3, Recovery Actions Credited</b>		
<b>VFDR</b>	<b>Component</b>	<b>Action</b>
AA58-002	2-NLI-151-CRI 2-NLP-151-CRI 2-NPS-121-CRI 2-NPS-122-LSI	None
AA58-003	2-QRV-113	DID ACTION(S) 2-QRV-113-CLOSE (Remove fuses in MCR to fail closed AOV 2-QRV-113)
AA58-004	2-NRV-151 2-NRV-152 2-NRV-153	DID ACTION(S) 2-NRV-151-CLOSE 2-NRV-152-CLOSE 2-NRV-153-CLOSE (Remove fuses in MCR to fail closed PORVs 2-NRV-151, 2-NRV-152, and 2-NRV-153)
AA58-005	2-NSO-021	DID ACTION(S) 2-NSO-021-CLOSE (Remove fuses in MCR to fail closed AOV 2-NSO-021)
AA58-006	2-NSO-023	DID ACTION(S) 2-NSO-023-CLOSE (Remove fuses in MCR to fail closed AOV 2-NSO-023)
AA58-007	2-NSO-061	DID ACTION(S) 2-NSO-061-CLOSE (Remove fuses in MCR to fail closed AOV 2-NSO-061)
AA58-008	2-NSO-063	DID ACTION(S) 2-NSO-063-CLOSE (Remove fuses in MCR to fail closed AOV 2-NSO-063)
AA58-009	2-QRV-10 2-QRV-20 2-QRV-30 2-QRV-40	DID ACTION(S) 2-QRV-10-OPEN 2-QRV-20-OPEN 2-QRV-30-OPEN 2-QRV-40-OPEN (Remove fuses in MCR to fail open AOVs 2-QRV-10, 2-QRV-20, 2-QRV-30, and 2-QRV-40)
AA58-010	2-QRV-111	DID ACTION(S) 2-QRV-111-CLOSE (Remove fuses in MCR to fail closed AOV 2-QRV-111)

### 3.4 Non-Power Operational Modes Compliance Summary

A review of CNP for the potential effects of a fire in this Fire Area while in non-power modes of operation (NPO) was conducted. This review was conducted using the guidance provided in NEI 04-



02 and FAQ 07-0040, “Non-Power Operations Clarifications”.

The review determined that there are potential failures that affect certain Key Safety Functions (KSF) as a result of the fire in this area, and the fire could result in the loss of one or more KSF paths. Compensatory measures are required during high risk evolution periods to provide reasonable assurance a fire will not adversely affect key safety functions and the NFPA 805 performance goal for NPO is therefore satisfied. The results of the NPO analysis are contained within Technical Evaluation R1900-005-001, Non-Power Operation Modes Transition Review Report.

### 3.5 Radioactive Release Compliance Summary

The NFPA 805 radiological release goal is to provide reasonable assurance that a fire will not result in a radiological release that adversely affects the public, plant personnel or the environment. The NFPA 805 requirement is to ensure a radiation release to any unrestricted area due to the direct effects of fire suppression activities (but not involving fuel damage) shall be as low as reasonably achievable and shall not exceed applicable plant Technical Specification limits.

AA58 is within the Radiological Controlled Area (RCA) and has been identified as a potential fire area for radioactive release due to fire fighting activities. In accordance with NFPA 805 FAQ 09-0056, this potential has been reviewed to ensure that engineering controls, fire pre-plans, and fire brigade training materials are provided for containment and monitoring of gaseous and liquid effluents associated with fire suppression agents and products of combustion.

The review concludes that the steps to limit radiation release to other areas due to the direct effects of fire suppression activities, in addition to compliance with NFPA 805, Chapter 4, ensure that any radioactive release will be as low as reasonably achievable and will not exceed limits designated in the CNP Technical Specifications.

The review of this fire area, with respect to radioactive release, is documented in the NFPPM.

### 3.6 Probabilistic Risk Assessment-Summary of Results

A Fire PRA (FPRA) quantification of Fire Area AA58 was performed and is documented in PRA-NB-FIRE-FQ, Fire PRA Model Quantification Notebook. The fire risk quantification for Fire Area AA58 is analyzed using detailed fire modeling to consider risk of fire scenarios of ignition sources. PRA-NB-FIRE-FQ includes a summary of all potentially risk-significant fire scenarios (i.e., CDF > 1.0E-7 or LERF > 1.0E-8). Bounding CDF / LERF per calendar year values are reported that are based on the risk values documented in PRA-NB-FIRE-FSS, Fire PRA Fire Scenario Selection.

Fire Protection features credited in the Fire PRA are documented in R1900-0411-AA58, Detailed Fire Modeling Report: Fire Compartment: AA58 Unit 2 Containment. PRA-NB-FIRE-FSS documents the revision level of the fire modeling reports used in the most recent Fire PRA quantification.

### **3.7 Risk-Informed, Performance-Based Evaluations**

Fire Risk Evaluations (FREs) have been performed to ensure that variances from the NFPA 805 deterministic requirements are acceptable. The evaluation process consists of an integrated assessment of the acceptability of risk, defense-in-depth, and safety margins.

#### **3.7.1 Transition Risk-Informed, Performance-Based Evaluations**

The ‘changes’ associated with NFPA 805 transition were those variances from the deterministic requirements of NFPA 805 or with the existing fire protection licensing basis that were brought into compliance with the NFPA 805 performance based approach. The change identified for evaluation for Fire Area AA58 is as follows:

- Separation Issues

The Fire Risk Evaluation has determined that the change is acceptable based upon:

- The measured change in CDF and LERF.
- Adequate defense-in-depth and safety margins being maintained.

Refer to Attachment 2 for a summary of results associated with the Fire Risk Evaluations.



### 3.8 Defense-in-Depth

A comprehensive risk-informed, performance-based analysis includes consideration of defense-in-depth (DID) as part of an integrated evaluation of risk considerations. In general, defense-in-depth involves consideration of the extent to which fire protection systems and features are provided within the three echelons of fire-protection:

- Preventing fires from starting,
- Rapidly detecting fires and controlling and extinguishing promptly those fires that do occur, thereby limiting fire damage,
- Providing an adequate level of fire protection for structures, systems, and components important to safety, so that a fire that is not promptly extinguished will not prevent the nuclear safety performance criteria from being met.

Each VFDR was evaluated for DID. The following recovery actions have been retained for DID.

VFDR No. AA58-003: 2-QRV- 113, 2-QRV- 114 and 2-QRV- 170 - Excess Letdown Isolation Valves are required to be closed to support CVCS isolation. CVCS isolation is required to maintain positive control over inventory and pressure. In order to achieve excess letdown isolation the following valves need to be closed; 2-QRV- 113 or 2-QRV- 114 or 2-QRV- 170. All of these valves may fail due to a fire within Fire Area AA58. These failures can be mitigated by locally de-energizing valve 2-QRV-113 to fail the valve closed. This recovery action is being retained to ensure CVCS isolation is maintained.

VFDR No. AA58-004: 2-NRV-151, 2-NRV-152 and 2-NRV-153 - Pressurizer PORVs are required to be closed to support RCS integrity. RCS integrity is required to maintain positive control over RCS inventory and pressure. The spurious opening can be mitigated by de-energizing the valve to fail it closed. This recovery action is being retained for DID to ensure RCS pressure and inventory control is maintained.

VFDR No. AA58-005: 2-NSO-021 and 2-NSO-022 - The RX Head Vent Valves are required to be closed to support RCS integrity. RCS integrity is required to maintain positive control over RCS inventory and pressure. 2-NSO-021 and 2-NSO-022 are in series, requiring 1 of the valves to remain closed to provide RCS integrity. The spurious opening can be mitigated by de-energizing the valve to fail it closed. This recovery action is being retained for DID to ensure RCS pressure and inventory control is maintained.

VFDR No. AA58-006: 2-NSO-023 and 2-NSO-024 - RX Head Vent Valves are required to be closed to support RCS integrity. RCS integrity is required to maintain positive control over RCS inventory and pressure. 2-NSO-023 and 2-NSO-024 are in series requiring one of the valves to be closed to maintain RCS integrity. The spurious opening can be mitigated by de-energizing the valve to fail it closed. This recovery action is being retained for DID to ensure RCS pressure and inventory control is maintained.

VFDR No. AA58-007: 2-NSO-061 and 2-NSO-062 - The Post Accident Valves are required to be closed to support RCS integrity. RCS integrity is required to maintain positive control over RCS inventory and pressure. 2-NSO-061 and 2-NSO-062 are in series, requiring 1 of the valves to remain closed to provide RCS integrity. The spurious opening can be mitigated by de-energizing the valve to fail it closed. This recovery action is being retained for DID to ensure RCS pressure and inventory control is maintained.

VFDR No. AA58-008: 2-NSO-063 and 2-NSO-064 - Post Accident Vent Valves are required to be closed to support

RCS integrity. RCS integrity is required to maintain positive control over RCS inventory and pressure. 2-NSO-063 and 2-NSO-064 are in series requiring one of the valves to be closed to maintain RCS integrity. The spurious opening can be mitigated by de-energizing the valve to fail it closed. This recovery action is being retained for DID to ensure RCS pressure and inventory control is maintained.

VFDR No. AA58-009: 2-QVR-10, 2-QVR-20, 2-QVR-30 and 2-QVR-40 RCP Seal Water Return Isolation Valves are required to be open to support RCS integrity by maintaining the RCP seal. RCS integrity is required to maintain positive control over RCS inventory and pressure. The spurious closing can be mitigated by de-energizing the valve to fail it open. This recovery action is being retained for DID to ensure RCS integrity is maintained.

Based on the assessment in support of the Fire Risk Evaluation, defense-in-depth is maintained for fire area AA58. Refer to Attachment 2 for details associated with the Fire Risk Evaluation.

### 3.9 Monitoring Program Input

A Monitoring Program will be developed in accordance with FAQ 10-0059, Rev. 1. Methods to monitor availability, reliability, and performance of fire protection program structures, systems, and components (SSCs), as well as programmatic elements will be provided. Additionally, effectiveness measures are established to review program related performance and trends. For AA58 the following systems and features are candidates for inclusion in the CNP Fire Protection Monitoring Program:

- Fire area and zone boundary barriers discussed in Section 3.1
- Fire Detection System (heat detection)
- Reactor Coolant Pump Oil Collection System
- Radiant Heat Shield (Fire Zone 123)

### 4.0 CONCLUSION

The nuclear safety and radioactive release performance criteria of NFPA 805 are met for a fire in Fire Area AA58. This Fire Risk Evaluation for Fire Area AA58 has demonstrated that

- The change in core damage frequency (delta CDF) is acceptable, and
- The change in large early release frequency (delta LERF) is acceptable, and
- Defense-in-depth and safety margins are maintained.

This is confirmation that a success path effectively remains free of fire damage and that the performance-based approach is acceptable per Section 4.2.4.2 of NFPA 805.

## **5.0 REFERENCES**

- 5.1 Calculation PRA-FIRE-NB-CRE, Fire PRA Cumulative Risk Evaluations
- 5.2 CNP Fire Pre-Plans, Volumes I, II, and III, Revisions 17, 14, and 18 respectively
- 5.3 Fire Hazards Analysis
- 5.4 NFPA 805, Performance-Based Standard for Fire Protection for Light Water Reactor Electric Generating Plants
- 5.5 NFPPM, NFPA 805 Fire Protection Program Manual (NFPPM)
- 5.6 Nuclear Energy Institute (NEI) 04-02, Guidance for Implementing a Risk-Informed, Performance-Based Fire Protection Program under 10 CFR 50.48(c), Rev. 2
- 5.7 Nuclear Safety Capability Assessment Report
- 5.8 PRA-NB-FIRE-FQ, Fire PRA Model Quantification Notebook
- 5.9 PRA-NB-FIRE-FSS, Fire PRA Fire Scenario Selection
- 5.10 R1900-0411-AA58, AA58 - Detailed Fire Modeling Report
- 5.11 Regulatory Guide 1.205, Risk-Informed, Performance-Based Fire Protection for Existing Light-Water Nuclear Power Plants, Rev. Revision 1
- 5.12 Technical Evaluation R1900-005-001, Non-Power Operation Modes Transition Review

**Fire Area AA58 – Attachment 1 - Table B-3 - Fire Area Transition**

<u>Unit</u>	<u>Fire Area</u>	<u>Description</u>
2	AA58	Unit 2 Containment

<u>Fire Zone</u>	<u>Description</u>
74	Containment Piping Annulus - El. 598 ft. 9-3/8 in. - Unit 2
75	Containment Lower Volume - El. 598 ft. 9-3/8 in. - Unit 2
76	Containment Upper Volume - El. 650 ft. 0 in. - Unit 2
102	Containment Accumulator Enc. West - Unit 2 - El. 612 ft. 0 in.
104	Reactor Head Enclosure - Unit 2 - El. 567 ft. 2 in.
119	Containment Regen Heat Exchanger Room - Unit 2 - El. 612 ft. 0 in.
121	Containment Accumulator Enclosure East - Unit 2 - El. 612 ft. 0 in.
123	Containment Instrumentation Room - Unit 2 - El. 612 ft. 0 in.
133	Unit 2 Ice Condenser - El. 640 ft. 6 in.
135	Unit 2 Reactor Vessel Pit - El. 567 ft. 0 in.

**Regulatory Basis**

4.2.4.2 - Performance-Based Approach - Fire Risk Evaluation with simplifying deterministic assumptions

<b>Performance Goal</b>	<b>Method of Accomplishment</b>	<b>Comments</b>
Reactivity Control	Unit 2 - Trip the reactor from the Control Room. Borate using Unit 2 East or West Charging Pump supplied from the RWST. Use source range monitoring for indication.	None
Inventory and Pressure Control	Unit 2 - Control inventory using Unit 2 East or West Charging Pump. Control pressure using Unit 2 Pressurizer Safety Relief Valves.	VFDRs identified for RCS integrity and CVCS Isolation.
Decay Heat Removal	Unit 2 - Feed SGs 1 & 4 with Unit 2 West MDAFW Pump or feed SGs 2 & 3 with Unit 2 East MDAFW Pump. The DHR function also requires MS isolation with a steam release path through the Safety Relief Valves.	None
Process Monitoring	Unit 2 Process Monitoring - Use Unit 2 process monitoring in the Control Room for the following: Pressurizer level, RCS pressure and temperature, and S/G level and Pressure. Unit 2 Source Range Monitoring - Use Unit 2 source range monitoring in the Control Room.	None

**Fire Area AA58 – Attachment 1 - Table B-3 - Fire Area Transition**

<u>Unit</u>	<u>Fire Area</u>	<u>Description</u>	
2	AA58	Unit 2 Containment	
<hr/>			
Vital Auxiliaries		Unit 2 Electrical - Control Unit 2 Red (AB) Train Electrical Distribution with Unit 2 Red (AB) Train Offsite Power or Unit 2 Red (AB) DG. Control Unit 2 Green (CD) Train Electrical Distribution with Unit 2 Green (CD) Train Offsite Power or Unit 2 Green (CD) DG. Unit 2 ESW - Operate Unit 2 East ESW. West ESW is available to support Red (AB) DG cooling. Unit 2 CCW - Operate Unit 2 East CCW. Unit 2 HVAC - Operate Unit 2 Control Room HVAC. Operate Unit 2 Auxiliary Building HVAC. Operate Unit 2 Red (AB) DG and Green (CD) DG HVAC. Operate Unit 2 Switchgear HVAC. Operate Unit 2 East and West MDAFW Room HVAC systems. Operate the Unit 2 East and West ESW Room HVAC systems.	None

**Reference Documents**

Genesis Solution Suite, EDISON / SAFE-PB, DC Cook V 3.4.0

Nuclear Safety Capability Assessment Report

**Licensing Actions****Licensing Action Title Appendix R Exemption, RCP Lube Oil Collection System (Criteria III.O) - Exemption 7.15****Summary**

Exemption approval per the NRC SER letter dated 12/23/1983 provides the following justification for RCP lube oil collection system as required by Section III.O of Appendix R, which was submitted by AEP in a letter dated 12/30/1982.

- No ignition sources at the floor level of the lower containment.
- Oil system is capable of withstanding a safe shutdown earthquake.
- Tank has the capacity to hold the total lube oil inventory for one pump.

**Existing Engineering Equivalency Evaluations (EEEE)****EEEE Title Engineering Equivalency Evaluation 11-9 - Turbine, Auxiliary and Containment Buildings Boundary Evaluation**

**Fire Area AA58 – Attachment 1 - Table B-3 - Fire Area Transition**

<u>Unit</u>	<u>Fire Area</u>	<u>Description</u>
2	AA58	Unit 2 Containment

**Summary** The purpose of this engineering equivalency evaluation is to describe in general, the approach and existence of evaluations performed to determine and reconcile fire area boundaries having components or designs with less than a 3-hr fire rating on preventing the spread of fire. This engineering equivalency evaluation also specifically evaluates the impact of unrated door assemblies on the spread of fire.

Reasonable assurance is provided that the fire area boundaries having components or design less than a 3-hr fire rating will not increase the spread of fire or impair the safe shutdown capabilities of Units 1 or 2. In addition, this engineering equivalency evaluation does not adversely impact on other engineering equivalency evaluations or exemption requests.

This evaluation supports additional evaluations credited in this fire area.

**EEEE Title** **Engineering Equivalency Evaluation 12-11 - Structural Steel Evaluations in Fire Areas AA2, AA3, AA34, AA35, AA56 and AA58.**

**Summary** The purpose of this engineering equivalency evaluation is to document the acceptability of the unprotected structural steel located throughout CNP and ensure its ability to withstand the fire exposure presented by combustibles present in the area. This engineering equivalency evaluation is concerned with structural steel members that form a part of or support fire barriers required by NFPA 805, Chapter 4.

Reasonable assurance is provided that exposed structural steel supporting fire barriers will not be adversely impacted by the combustibles or hazards present in the areas evaluated. In addition, reasonable assurance is provided that falling structures supported by structural steel will not have an adverse impact on other fire barriers inside the area that are required for separation of safe shutdown components.

The unprotected structural steel was evaluated and found to be acceptable based on the fire hazards and fire protection systems within the evaluated areas.

**EEEE Title** **Engineering Equivalency Evaluation 12-16 - Supplement 1 - Radiant Heat Shields for Fire Area AA58**

**Summary** The purpose of this evaluation is to document the acceptability a gap on the sides of the radiant heat shield enclosure protecting safe shutdown related instrument 2-NLI-153 Pressurizer OME-4 Level Indicator Transmitter in Fire Area AA58.

In the event of a fire in Fire Area AA58, the gaps in the radiant shield will not prevent safe shutdown of CNP.

The gaps in the radiant heat shields were evaluated and found to be acceptable based on the fire hazards and construction features within the evaluated areas.

**Fire Area AA58 – Attachment 1 - Table B-3 - Fire Area Transition**

<u>Unit</u>	<u>Fire Area</u>	<u>Description</u>
2	AA58	Unit 2 Containment

**Fire Suppression Effects on Nuclear Safety Performance Criteria**

The CNP fire brigade is trained to discharge water in a judicious manner and instructed to direct hose streams and portable extinguishers at the base of the fire to limit the amount of overspray beyond the immediate fire zone. For this reason, fire brigade activities are not expected to fail components not already considered damaged by fire. It has been concluded that water impingement on cables is not a concern. Electrical cabinets are provided with a seal at the conduit interface. Per visual inspection any side vents for this equipment are pointed downward to prevent water intrusion. The drainage features of the fire area mitigate the potential for flooding damage due to fire suppression, such that the standing water would not affect credited equipment.

This fire area is not equipped with a fixed fire suppression system. Since it is shown that suppression effects will not impact the nuclear safety performance criteria, the fire area configuration is deemed acceptable.

**References:**

Technical Evaluation 12.1, "Fire Suppression Effects Study"

Technical Evaluation 12.1, "Supplemental Information to Fire Suppression Effects Study – Supplement 1"

**Fire Area Comments**

None

## Fire Area AA58 – Attachment 2 - Fire Risk Evaluation Results Summary

### A2.1 Introduction

The ‘changes’ associated with NFPA 805 transition were those variances from the deterministic requirements of NFPA 805. The changes identified for evaluation for fire area AA58 are grouped as follows:

- Separation Issues

This attachment is a summary of the Fire Risk Evaluation for the fire area. The complete results and methodology are contained in the Cumulative Fire Risk Evaluation, PRA-FIRE-NB-CRE. (FPCE 2017-0009)

### A2.2 Inputs/Assumptions

Fire modeling processes and inputs provided in NUREG/CR-6850 are appropriate for use in a risk-informed, performance-based evaluation. The complete list of assumptions used in the fire modeling methodology for this fire area is contained in Detailed Fire Modeling Technical Evaluation R1900-0411-AA58.

### A2.3 Fire Modeling Methodology

Fire PRA fire modeling results are used as the initial input into this Fire Risk Evaluation. The process consists of conservative bounding analyses using NUREG/CR-6850 methods. As needed, refinements are made to utilize more realistic parameters. The complete fire modeling methodology for this fire area is contained in Detailed Fire Modeling Technical Evaluation R1900-0411-AA58.

### A2.4 Scenario Descriptions and Model Results

Fire Area AA58 was evaluated for the impact of fires originating from both fixed and transient ignition sources. Complete descriptions of each fire scenario is contained within the Detailed Fire Modeling Technical Evaluation R1900-0411-AA58.

#### A2.4.1 Ignition Sources

Fire Area AA58 contains the reactor coolant pumps, control rod vent fans, the containment pipe tunnel sump pump, the fan for the crane wall sleeve cooling, blowers and various other fans. Per discussion with plant personnel, the heat release rates for all switchgear, load centers, and MCC electrical cabinets have been characterized as qualified cable because items of this nature are generally constructed on-site. For other electrical cabinet types, where the internal cable qualification was unknown, the heat release rates have been assumed as non-qualified. Ignition sources in Fire Area AA58 were modeled using the 98th percentile fire as a screening approach and refined to utilize the 75th percentile fire. The 75th percentile was used to represent a 10% oil spill in the reactor coolant pumps. The oil collection system provided for the reactor coolant pumps was credited in the fire modeling to reduce the frequency of a 100% oil spill.

In Fire Area AA58, the 98th percentile HRR was used for all transient fires. The 98th percentile HRR bounds the possible transient ignition sources expected for this fire area, which were fire tested and identified in NUREG/CR-6850, Appendix G, Table G-7.

#### A2.4.2 Scenario Results

A delta risk calculation has been performed to quantify the risk associated with the VFDRs in the fire area.

### A2.5 Fire Risk Evaluation Results



### **Fire Area AA58 – Attachment 2 - Fire Risk Evaluation Results Summary**

PRA-FIRE-NB-CRE documents scenarios and corresponding impacted VFDRs that were evaluated for delta risk during the transition to NFPA 805 and also all changes to the Fire Protection Program that are currently incorporated into the Fire PRA model. The acceptability of the Cumulative Fire Risk Evaluations was based on calculated delta risk meeting the thresholds of NEI 04-02, RG 1.205 and RG 1.174. (FPCE 2017-0009)

## Fire Area AA58 – Attachment 2 - Fire Risk Evaluation Results Summary

### A-2.6 Impact of VFDR on Defense-in-Depth

Defense-in-Depth has been evaluated for this fire area. The impacts of this evaluation are summarized in the table below:

Defense-in-Depth Impact Review for AA58			
Method of Providing DID	Required to Support Deterministic Analysis or Fire PRA?	Changes or Improvements Necessary for DID?	Basis/Justification
Echelon 1: Prevent fires from starting			
Combustible Control is implemented in accordance with Procedure PMP-2270-CCM-001, Control of Combustible Materials.	Yes	No	• This element is adequate based on no perceived weakness of, or over-reliance on, another echelon of defense-in-depth.
Hot Work Control is implemented in accordance with Procedure PMP-2270-WBG-001, Welding, Burning and Grinding Activities.	Yes	No	
Echelon 2: Rapidly detect, control and extinguish promptly those fires that do occur thereby limiting fire damage			
Fire Detection System	Yes	No	• Since fire fighting activities are expected to be challenging, detection and manual suppression are required. No changes or improvements to Echelon 2 attributes are necessary to maintain defense-in-depth.
Fixed Fire Suppression	No	No	
Portable Fire Extinguishers	Yes	No	
Hose stations and hydrants	Yes	No	
Pre-Fire Plan	Yes	No	
Echelon 3: Provide adequate level of fire protection for systems and structures so that a fire will not prevent essential safety functions from being performed			
Walls, floors ceilings and structural elements are rated or have been evaluated as adequate for the hazard.	Yes	No	• Based on a detailed review, the variance is not the cause for the risk of the scenario, therefore implementing additional DID Echelon 3 attributes for this VFDR would provide negligible risk improvement.
Penetrations in the fire area barrier are rated or have been evaluated as adequate for the hazard.	Yes	No	• Defense in Depth actions were credited to remove fuses or open breakers in the Control Room to prevent spurious equipment operation due to internal shorts.
Supplemental barriers (e.g., ERFBS, cable tray covers, etc.)	No	No	
Guidance provided to operations personnel detailing the required success path(s) including recovery actions to achieve nuclear safety performance criteria.	No	No	• Internal fire separation is adequate. No additional reliance on recovery actions is necessary to support defense-in-depth, therefore, no changes or improvements to Echelon 3 attributes are necessary to maintain defense-in-depth.

## Fire Area AA58 – Attachment 2 - Fire Risk Evaluation Results Summary

### A-2.7 Safety Margin Considerations

In accordance with NEI 04-02, the maintenance of adequate Safety Margin is assessed by the consideration categories of analyses utilized by this Fire Risk Evaluation.

Safety margins are considered to be maintained if:

- Codes and Standards or their alternatives accepted for use by the NRC are met.

AND

- Safety analyses acceptance criteria in the licensing basis (e.g., FSAR, supporting analyses) are met, or provides sufficient margin to account for analysis and data uncertainty.

The following summarizes the bases for ensuring the maintenance of safety margins:

- The risk-informed, performance based processes utilized are based upon NFPA 805, 2001 edition, endorsed by the NRC in 10 CFR 50.48(c).
- The Fire Risk Evaluation process is in accordance with NEI 04-02, Revision 2, which is endorsed by the NRC in Regulatory Guide 1.205, Revision 1.
- The Fire PRA is developed in accordance with NUREG/CR-6850, which was developed jointly between the NRC and EPRI.
- The Fire PRA has undergone an industry peer review, in order to ensure the Fire PRA meets the appropriate quality standards of ASME/ANS RA-Sa-2009, "Standard for Level 1/Large Early Release Frequency Probabilistic Risk Assessment for Nuclear Power Plant Applications," Dated February 2, 2009
- The "combined analysis approach" is used during transition (NEI 04-02, Section 5.3.4.3); therefore, MEFS/LFS is not analyzed separately from the Fire PRA results.
- The CNP internal events PRA model received two formal industry peer reviews conducted in accordance with applicable NEI guidelines. The initial peer review was performed in 2001, while a subsequent focused scope (i.e., limited scope) peer review was conducted in 2009. The initial, full-scope WOG peer review covered all aspects of the CNP PRA model and the administrative processes used to maintain and update the model. The CNP PRA model has been revised to address all significant issues (i.e., Category A and B Facts & Observations) identified during the initial peer review. None of the findings from the focused-scope peer review were judged to reach the significance level of a Category A or B Fact & Observation; as a result, no changes to the PRA model have yet been made to include resolutions for these latter issues.
- Fire protection systems and features determined to be required by NFPA 805 Chapter 4 have been confirmed to meet the requirements of NFPA 805 Chapter 3 and their associated referenced codes and listings, or provided with acceptable alternatives using processes accepted for use by the NRC (i.e., FAQ 06-0008, FAQ 06-0004, 07-0033).
- Fire modeling performed in support of the transition has been performed within the Fire PRA utilizing codes and standards developed by industry and NRC staff which have been verified and validated in authoritative publications, such as NUREG 1824, "Verification and Validation of Selected Fire Models for Nuclear Power Plant Applications". In general, the fire modeling performed in support of the Fire Risk Evaluations has been performed using conservative methods and input parameters that are based upon

### Fire Area AA58 – Attachment 2 - Fire Risk Evaluation Results Summary

NUREG/CR-6850 as documented in the AA58 Detailed Fire Modeling Report, section 7.2. While this is generally not ideal in the context of best estimate probabilistic risk analysis, it is a pragmatic approach given the current state of knowledge regarding the uncertainties related to the application of the fire modeling tools and associated input parameters for specific plant configurations.

- In accordance with the requirements of 10 CFR 50.48(c)(2)(iii), the Fire PRA results, including cutsets for the scenarios of concern, have been reviewed and it was verified that the results presented above do not rely solely on feed and bleed as the fire-protected safe shutdown path for maintaining reactor coolant inventory, pressure control, and decay heat removal capability for this fire area.

#### A-2.8 Transition Risk Evaluation Conclusions

The transition change evaluation determined that these changes:

- Are acceptable based upon the measured change in CDF and LERF
- Maintained adequate defense-in-depth and safety margins

The results of this evaluation meet the requirements of NFPA 805 Risk Evaluation; therefore, the use of the performance based analysis approach is acceptable.

D. C. Cook Nuclear Plant  
Fire Safety Analysis

Fire Area: YD

Yard

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Analysis ..... Section 3.0

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Attachments

    Fire Area YD – Attachment 1 - Table B-3 - Fire Area Transition

## 1.0 PURPOSE

This report documents the Fire Safety Analysis (FSA) for Cook Nuclear Plant (CNP) Fire Area YD, Yard which comprises fire zone(s) 143 and other locations inside the protected area fence which are not contained in another of the NSCA fire areas. Fire Zones 131, 146, and 147 are not considered part of Fire Area YD. The purpose of this analysis is to demonstrate the achievement of the nuclear safety and radioactive release performance criteria of NFPA 805 as required by 10 CFR 50.48(c). The Fire Safety Analysis is a key part of compliance with Section 2.7.1.2 Fire Protection Program Design Basis Document of NFPA 805.

## 2.0 ANALYSIS METHODOLOGY

The FSA is the design basis document as described in NFPA 805 Section 2.7.1.2. The following steps are performed to develop the FSA on a fire area basis:

- Identify significant fire hazards in the fire area. This is based on NFPA 805 approach to analyze the plant from an ignition source and fuel package perspective.
- Summarize Nuclear Safety Capability Analysis (NSCA) compliance strategies. This is the result of the NEI 04-02 B-3 Table review of the Safe Shutdown Analysis.
- Summarize Non-Power Operations Modes compliance strategies.
- Summarize Radioactive Release compliance strategies. The transition review process required per NEI 04-02 is used to develop these results.
- Provide Fire Probabilistic Risk Assessment summary of results. This is based on the results from the plant Fire PRA.
- Perform risk informed, performance based evaluations if needed for the performance based approach.
- Summarize Defense-in-Depth strategy for each fire area.
- Determine key analysis assumptions which are candidates to be included in the NFPA 805 monitoring program.
- Provide conclusions relative to NFPA 805 compliance.

### 3.0 ANALYSIS

#### 3.1 Classical Fire Protection

##### 3.1.1 Construction

This fire area encompasses the areas outside of the plant buildings within the protected area fence. The yard includes the outside areas above and below grade. All buildings are separated from the yard by barriers that are judged to be adequate to mitigate the hazard from a transient fire in the yard.

The fire pump house, which is located on the sound end of the yard, contains individual fire pump rooms which have 3-hour rated, 12 in. cast-in-place concrete walls. The switchgear room of the fire pump house is separated from the pegging room by 3-hour rated, 12 in. cast-in-place concrete walls. The exterior walls of the fire pump house are 12 in. cast-in-place concrete walls. The exterior walls of the fire pump house extend up 3 ft. above the roof, thus providing a parapet to eliminate the potential for damage to the pump house roof from an exterior fire. The roof of the fire pump has been designed so that a fire in any one room will only collapse the portion of the roof over that room. The roof is designed as a UL Class "A" roof assembly in accordance with Underwriters Laboratories (UL) requirements. Due to the rib design of the roof decking, 1 1/2 in. communicable openings exist at the top of the interior walls (Engineering Equivalency Evaluation 11-38).

A above ground 6,000 gallon Fuel Oil Storage Tank (FOST) -12-TK-70 - has been installed per EC-53218 in the YD-NW to provide fuel to the Plant Heating Boiler. The FOST is encased in concrete which gives the tank an integral 2 hour fire rating. (EC-0000053218)

Five (5) sub-compartments have been developed for the yard. Northwest, Northeast, Southwest, Southeast and a SDG compartment were developed. The SDG compartment is located east of the Southeast sub-compartment and contains the supplemental diesel generators. The compartments were divided up to separate groups of FPRA targets.

An insulated sheet metal walkway is provided between the concrete portion of Fire Area AA34 - Fire Zone 33 and adjacent Fire Area AA3 - Fire Zone 32. The walkway is a non-combustible, unrated structure that was erected through the yard area and permanently added as part of the plant in 1995. A fire area boundary evaluation was performed to evaluate the addition of this structure (Engineering Equivalency Evaluation 11-44).

Applicable Engineering Equivalency Evaluations are documented in Attachment 1.

##### 3.1.2 Doors and Access Openings

Doors and access openings from fire areas adjoining the Yard are considered adequate to prevent the spread of fire to the adjoining fire areas from the Yard.

A non-UL/FM approved electromagnetic door lock has been provided on four Class A doors (EEE-11-69).

##### 3.1.3 Penetrations

Penetration seals adjacent to safety related equipment in fire areas adjoining the Yard are

considered adequate to prevent the spread of fire to the adjoining fire areas from the Yard.

Penetrations in the walls between the rooms of the fire pump house are sealed to maintain the required 3-hour fire rating.

### 3.1.4 Detection

The table below outlines the fire detection system(s) provided in the Fire Area:

<b>Table 3-1, Fire Area YD Detection Systems</b>									
<b>Fire Zone</b>	<b>Type of System</b>	<b>Local (L) / Remote (R)</b>	<b>Detection Actuates Suppression?</b>	<b>Required System?</b>					
				<b>S</b>	<b>L</b>	<b>E</b>	<b>R</b>	<b>D</b>	
143	None	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Yard	Thermal	L/R	Y	N	N	Y	N	N	N
<b>Table 3-1 Legend:</b>									
Table Field: "Required System?"									
S	- Required for Chapter 4 Separation Criteria								
L	- Required for NRC Approved Licensing Action								
E	- Required for Engineering Equivalency Evaluation								
R	- Required for Risk Significance								
D	- Required to maintain adequate balance of Defense-in-Depth in a Change Evaluation or Fire Risk Evaluation								

The thermistor detection units open the deluge valve and give control room annunciation. These deluge systems are provided for each of the startup transformers and are discussed further in Section 3.1.5.

For the fire pump house, the dry pilot sprinkler portion of the automatic suppression system acts as a thermal fire detection system for the entire building (including the electrical equipment room).



### 3.1.5 Fixed Suppression

The table below outlines the fixed fire suppression system(s) provided in the Fire Area:

Table 3-2, Fire Area YD Suppression Systems							
Fire Zone	Type of System	Full (F) / Partial (P)	Required System?				
			S	L	E	R	D
143	None	N/A	N/A	N/A	N/A	N/A	N/A
Yard	Automatic CO2	P	N	N	N	N	N
Yard	Deluge	P	N	N	Y	N	N
Yard	Pre-Action	P	N	Y*	Y	N	N
Table 3-2 Legend:							
Table Field: "Required System?"							
S	- Required for Chapter 4 Separation Criteria						
L	- Required for NRC Approved Licensing Action						
E	- Required for Engineering Equivalency Evaluation						
R	- Required for Risk Significance						
D	- Required to maintain adequate balance of Defense-in-Depth in a Change Evaluation or Fire Risk Evaluation						

A CO2 total flooding system is installed in the alternate plant heating boilers, which are located in the yard.

Each of the startup transformers in the Yard are protected by an automatic open nozzle deluge water spray system. Each system is electrically actuated by continuous-strip thermistor detection units, which open the deluge valve and give control room annunciation. The systems are also installed on the exterior building walls adjacent to the transformers. The systems have a manual release located in the turbine building, elevation 609 ft. 0 in.

The fire pump house (with the exception of the electrical equipment room) is protected by an automatic dry pilot sprinkler system which alarms in the control room. This system is required per NFPA 805 Section 3.9.4, which states "Diesel-driven fire pumps shall be protected by automatic sprinklers."

### 3.1.6 Manual Suppression / Response Strategy

A postulated fire will be identified by plant personnel using plant communication system to notify the control room. The Control Room operator will dispatch the fire brigade for initiation of manual fire fighting. A fire in this fire area will be contained by the construction features discussed in Section 3.1.1. Manual suppression is provided by the CNP Fire Brigade.

The yard is provided with fire hydrants. The hydrants are installed approximately every 250 feet on the yard main system. When the spacing exceeds 250 feet, the hydrants are located appropriately for protection of the fixed hazards. Outside manual hose applications are sufficient to reach any location with an effective hose stream.

In the fire pump house, manual fire fighting equipment, in the form of fire extinguishers and outside hydrant/interior hose cabinets, is available.

### 3.1.7 Ventilation

This fire area is open to the outdoors and therefore ventilation is not provided.

For adjacent fire areas, the water spray systems are interlocked to trip ventilation system supply fans and dampers to prevent the introduction of smoke into buildings as a result of a transformer fire.

### 3.1.8 Other Features

Oil containment features are provided for the transformers which contain hydraulic oil. The oil containment features are capable of holding 100% of the hydraulic oil from the transformers as well as ten minutes of fire protection water.

In the fire pump house, the floor area beneath each tank is provided with a concrete dike to contain any spill. The entire contents of the oil in the fuel oil tank within each diesel fire pump room can be contained.

## 3.2 Fire Hazards Identification

The fire area contains both ignition sources and combustible fire hazards. The ignition sources consist of 4 transformers from 34.5kV buses to 4kV buses and several breakers. Combustibles consist primarily of hydraulic oil from the transformers and diesel fuel. The hydraulic oil from the transformers is accounted for in bin 28, yard transformer - non-catastrophic. In this bin, oil does not spill outside the transformer tank and the fire does not propagate beyond the fire source transformer. The Yard was divided up into five (5) scenarios to represent a portion of the yard where targets could be expected to be failed. The Southwest sub-compartment contains the Unit 1 auxiliary transformers. The Southeast sub-compartment contains the condensate and filling water storage tanks for Unit 1. The Northeast sub-compartment contains the condensate and filling water storage tanks for Unit 2. The Northwest sub-compartment contains the Unit 2 auxiliary transformers. The SDG sub-compartment is the supplemental diesel generator area.

For the fire pump house the combustible loading classification is low. The combustible loading in the rooms of the fire pump house is primarily due to the fuel oil day tanks. It has been assumed that the other combustible materials present in these rooms are insignificant.

## 3.3 NSCA Compliance Summary

Fire Area YD, considered the Yard area outside of plant fire zoned structures, contains Unit 1 and 2 Red and Green Train supporting equipment and cables such as the Unit and Reserve Auxiliary Transformers, the Offsite Power Distribution system, Refueling Water and Condensate storage tanks, etc.

Compliance with the nuclear safety performance criteria is achieved using the deterministic approach in accordance with NFPA 805, Section 4.2.3.2 .

Safe and stable condition of Unit 1 can be accomplished using Steam Generators 2 and 3 via Unit 1 East Motor Driven Auxiliary Feedwater Pump or Unit 1 Turbine Driven Auxiliary Feedwater Pump or Steam Generators 1 and 4 via the Unit 1 West Motor Driven Auxiliary Feedwater Pump, Control Room Process Monitoring, Unit 1 Charging via the West or East Pump, Unit 1 Component Cooling Water via the East and West Pump and Unit 1 Essential Service Water via the East or West Pump. Electrical power for Unit 1 is available via the Red and Green Train Emergency Diesels.

Safe and stable condition of Unit 2 can be accomplished using Steam Generators 2 and 3 via Unit 2 East Motor Driven Auxiliary Feedwater Pump or Unit 2 Turbine Driven Auxiliary Feedwater Pump or Steam Generators 1 and 4 via the Unit 2 West Motor Driven Auxiliary Feedwater Pump, Control Room Process Monitoring, Unit 2 Charging via the Unit 2 West or East Pump, Unit 2 Component Cooling Water via the East or West Pump and Unit 2 Essential Service Water via the East or West Pump. Electrical power for Unit 2 is available via the Red and Green Train Emergency Diesels.

The Nuclear Safety Performance Criteria compliance strategy for YD is documented within the NSCA Report.

### **3.3.1 Variances**

There are no variances for this fire area.

### **3.3.2 Recovery Actions Credited**

There are no recovery actions for this fire area.

## **3.4 Non-Power Operational Modes Compliance Summary**

A review of CNP for the potential effects of a fire in this Fire Area while in non-power modes of operation (NPO) was conducted. This review was conducted using the guidance provided in NEI 04-02 and FAQ 07-0040, "Non-Power Operations Clarifications".

The review determined that there are potential failures that affect certain Key Safety Functions (KSF) as a result of the fire in this area, and the fire could result in the loss of one or more KSF paths. Compensatory measures are required during high risk evolution periods to provide reasonable assurance a fire will not adversely affect key safety functions and the NFPA 805 performance goal for NPO is therefore satisfied. The results of the NPO analysis are contained within Technical Evaluation R1900-005-001, Non-Power Operation Modes Transition Review Report.

## **3.5 Radioactive Release Compliance Summary**

The NFPA 805 radiological release goal is to provide reasonable assurance that a fire will not result in a radiological release that adversely affects the public, plant personnel or the environment. The NFPA 805 requirement is to ensure a radiation release to any unrestricted area due to the direct effects of fire suppression activities (but not involving fuel damage) shall be as low as reasonably achievable and shall not exceed applicable plant Technical Specification limits.

The Yard is located outside the Radiological Controlled Area (RCA), however it has been identified as a potential fire area for radioactive release due to fire fighting activities. In accordance with NFPA 805 FAQ 09-0056, this potential has been reviewed to ensure that engineering controls, fire pre-plans, and fire brigade training materials are provided for containment and monitoring of gaseous and liquid effluents associated with fire suppression agents and products of combustion.

The review concludes that the steps to limit radiation release to other areas due to the direct effects of fire suppression activities, in addition to compliance with NFPA 805, Chapter 4, ensure that any radioactive release will be as low as reasonably achievable and will not exceed limits designated in the CNP Technical Specifications.

The review of this fire area, with respect to radioactive release, is documented in the NFPPM.

### 3.6 Probabilistic Risk Assessment-Summary of Results

A Fire PRA (FPRA) quantification of Fire Area YD was performed and is documented in PRA-NB-FIRE-FQ, Fire PRA Model Quantification Notebook. The fire risk quantification for Fire Area AAYD is analyzed using detailed fire modeling to consider risk of fire scenarios of ignition sources. PRA-NB-FIRE-FQ includes a summary of all potentially risk-significant fire scenarios (i.e., CDF > 1.0E-7 or LERF > 1.0E-8). Bounding CDF / LERF per calendar year values are reported that are based on the risk values documented in PRA-NB-FIRE-FSS.

Fire Protection features credited in the Fire PRA are documented in R1900-0411-YD, Detailed Fire Modeling Report: Fire Compartment: YD Yard. PRA-NB-FIRE-FSS documents the revision level of the fire modeling reports used in the most recent Fire PRA quantification.

### 3.7 Risk-Informed, Performance-Based Evaluations

There are no VFDRs for this fire area, and therefore, no Fire Risk Evaluations have been performed.

#### 3.7.1 Transition Risk-Informed, Performance-Based Evaluations

There are no VFDRs for this fire area, and therefore this section is not applicable to the Yard.

### 3.8 Defense-in-Depth

Per NFPA 805, section 2.4.4.2, "Defense-in-Depth": The deterministic approach for meeting the performance criteria shall be deemed to satisfy this defense-in-depth requirement.

### 3.9 Monitoring Program Input

A Monitoring Program will be developed in accordance with FAQ 10-0059, Rev. 1. Methods to monitor availability, reliability, and performance of fire protection program structures, systems, and components (SSCs), as well as programmatic elements will be provided. Additionally, effectiveness measures are established to review program related performance and trends. For the Yard the following systems and features are candidates for inclusion in the CNP Fire Protection Monitoring Program:

- Fire Area boundary barriers discussed in Section 3.1
- Fire Suppression System (Water Spray)
- Underground Yard Main Fire Loop

## 4.0 CONCLUSION

The nuclear safety and radioactive release performance criteria of NFPA 805 are met for a fire in Fire Area YD. This Fire Safety Analysis has demonstrated that for Fire Area YD a success path remains free of fire damage using the deterministic approach per Section 4.2.3 of NFPA 805.

## 5.0 REFERENCES

- 5.1 CNP Fire Pre-Plans, Volumes I, II, and III, Revisions 17, 14, and 18 respectively
- 5.2 Fire Hazards Analysis
- 5.3 NFPA 805, Performance-Based Standard for Fire Protection for Light Water Reactor Electric Generating Plants
- 5.4 NFPPM, NFPA 805 Fire Protection Program Manual (NFPPM)
- 5.5 Nuclear Energy Institute (NEI) 04-02, Guidance for Implementing a Risk-Informed, Performance-Based Fire Protection Program under 10 CFR 50.48(c), Rev. 2
- 5.6 Nuclear Safety Capability Assessment Report
- 5.7 PRA-NB-FIRE-FQ, Fire PRA Model Quantification Notebook
- 5.8 PRA-NB-FIRE-FSS, Fire PRA Fire Scenario Selection
- 5.9 R1900-0411-YD, R1900-0411-YD - Detailed Fire Modeling Report
- 5.10 Regulatory Guide 1.205, Risk-Informed, Performance-Based Fire Protection for Existing Light-Water Nuclear Power Plants, Rev. Revision 1
- 5.11 Technical Evaluation R1900-005-001, Non-Power Operation Modes Transition Review

**Fire Area YD – Attachment 1 - Table B-3 - Fire Area Transition**

<u>Unit</u>	<u>Fire Area</u>	<u>Description</u>
1, 2	YD	Yard

**Fire Zone Description**

143	Water Intake and Discharge System - El. 546 ft. 0 in. - Both Units
Yard	Yard Inside Protected Area Fence

**Regulatory Basis**

4.2.3.2 - Deterministic Approach

<b>Performance Goal</b>	<b>Method of Accomplishment</b>	<b>Comments</b>
Reactivity Control	Unit 1 - Trip the reactor from the Control Room. Borate using Unit 1 East or West Charging Pump supplied from the RWST. Use source range monitoring for indication.  Unit 2 - Trip the reactor from the Control Room. Borate using Unit 2 East or West Charging Pump supplied from the RWST. Use source range monitoring for indication.	None
Inventory and Pressure Control	Unit 1 - Control inventory using Unit 2 East or West Charging Pump. Control pressure using Unit 1 Pressurizer Safety Relief Valves.  Unit 2 - Control inventory using Unit 2 East or West Charging Pump. Control pressure using Unit 2 Pressurizer Safety Relief Valves.	None
Decay Heat Removal	Unit 1 - Feed SGs 1 & 4 with Unit 1 West MDAFW Pump or feed SGs 2 & 3 with Unit 1 East MDAFW Pump or Unit 1 TDAFW Pump. The DHR function also requires MS isolation with a steam release path through the Safety Relief Valves.  Unit 2 - Feed SGs 1 & 4 with Unit 2 West MDAFW Pump or feed SGs 2 & 3 with Unit 2 East MDAFW Pump or Unit 2 TDAFW Pump. The DHR function also requires MS isolation with a steam release path through the Safety Relief Valves.	None
Process Monitoring	Unit 1 Process Monitoring - Use Unit 1 process monitoring in the Control Room for the following: Pressurizer level, RCS pressure and temperature,	None

**Fire Area YD – Attachment 1 - Table B-3 - Fire Area Transition**

<u>Unit</u>	<u>Fire Area</u>	<u>Description</u>
1, 2	YD	Yard
Vital Auxiliaries		and S/G level and Pressure. Unit 1 Source Range Monitoring - Use Unit 1 source range monitoring in the Control Room.
		Unit 2 Process Monitoring - Use Unit 2 process monitoring in the Control Room for the following: Pressurizer level, RCS pressure and temperature, and S/G level and Pressure. Unit 2 Source Range Monitoring - Use Unit 2 source range monitoring in the Control Room.
		Unit 1 Electrical - Control Unit 1 Red (AB) Train Electrical Distribution with Unit 1 Red (AB) DG. Control Unit 1 Green (CD) Train Electrical Distribution with Unit 1 Green (CD) DG. Unit 1 ESW - Operate Unit 1 East or West ESW. Unit 1 CCW - Operate Unit 1 East or West CCW. Unit 1 HVAC - Operate Unit 1 Control Room HVAC. Operate Unit 1 Auxiliary Building HVAC. Operate Unit 1 Red (AB) and Green (CD) DG HVAC. Operate Unit 1 Switchgear HVAC. Operate Unit 1 East and West MDAFW and TDAFW Room HVAC systems. Operate the Unit 1 East and West ESW Room HVAC systems.
		Unit 2 Electrical - Control Unit 2 Red (AB) Train Electrical Distribution with Unit 2 Red (AB) DG. Control Unit 2 Green (CD) Train Electrical Distribution with Unit 2 Green (CD) DG. Unit 2 ESW - Operate Unit 2 East or West ESW. Unit 2 CCW - Operate Unit 2 East or West CCW. Unit 2 HVAC - Operate Unit 2 Control Room HVAC. Operate Unit 2 Auxiliary Building HVAC. Operate Unit 2 Red (AB) and Green (CD) DG HVAC. Operate Unit 2 Switchgear HVAC. Operate Unit 2 East and West MDAFW and TDAFW Room HVAC. Operate the Unit 2 East and West ESW Room HVAC.

**Fire Area YD – Attachment 1 - Table B-3 - Fire Area Transition**

<u>Unit</u>	<u>Fire Area</u>	<u>Description</u>
1, 2	YD	Yard

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**Reference Documents**

Genesis Solution Suite, EDISON / SAFE-PB, DC Cook V 3.4.0

Nuclear Safety Capability Assessment Report

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**Licensing Actions**

None

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**Existing Engineering Equivalency Evaluations (EEEE)**

**EEEE Title** Engineering Equivalency Evaluation 11-8 - Yard to Fire Zones 34 (Fire Area AA35), 34A (Fire Area AA35), 90 (Fire Area AA2), 97 (Fire Area AA2), 129 (Fire Area AA2) and 130 (Fire Area AA2) Boundary Evaluations

**Summary** The purpose of this engineering equivalency evaluation is to document the acceptability of fire barriers separating the oil filled transformers located in the yard and the Unit 1 and Unit 2 Turbine Building and Unit 2 Auxiliary Building for their impact on preventing the spread of fire. This engineering equivalency evaluation does not impact on other engineering equivalency evaluations or exemption requests.

Reasonable assurance is provided that a transformer fire will not impair the safe shutdown capabilities of Unit 1 or Unit 2. This engineering equivalency evaluation does not impact on other engineering equivalency evaluations.

The fire barriers were evaluated and found to be acceptable based on the fire hazards, fire protection systems and construction features within the evaluated areas.



**Fire Area YD – Attachment 1 - Table B-3 - Fire Area Transition**

<u>Unit</u>	<u>Fire Area</u>	<u>Description</u>
1, 2	YD	Yard

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**EEEE Title Engineering Equivalency Evaluation 11-9 - Turbine, Auxiliary and Containment Buildings Boundary Evaluation**

**Summary** The purpose of this engineering equivalency evaluation is to describe in general, the approach and existence of evaluations performed to determine and reconcile fire area boundaries having components or designs with less than a 3-hr fire rating on preventing the spread of fire. This engineering equivalency evaluation also specifically evaluates the impact of unrated door assemblies on the spread of fire.

Reasonable assurance is provided that the fire area boundaries having components or design less than a 3-hr fire rating will not increase the spread of fire or impair the safe shutdown capabilities of Units 1 or 2. In addition, this engineering equivalency evaluation does not adversely impact on other engineering equivalency evaluations or exemption requests.

This evaluation supports additional evaluations credited in this fire area.

**EEEE Title Engineering Equivalency Evaluation 11-11 - Storage of Flammable Gases in Fire Areas AA2 and YD**

**Summary** The purpose of this evaluation is to address a (1) Fire/Explosion within or outside of the Gas Cylinder Storage Building, (2) Fire/Explosion near the U1 & U2 Seal Oil Skid Area, (3) Fire/Explosion at the Generator Hydrogen Bulk Storage Containers. The Fire Protection Pump House was analyzed in the event of a fire/explosion in the Generator Bulk Hydrogen Bulk Storage Containers.

The bottle and bulk gas storage of compressed or cryogenic gases is acceptable for maintaining the fire safety of CNP. In addition, this engineering equivalency evaluation does not impact other engineering equivalency evaluations or exemption requests.

The hydrogen storage configuration was evaluated and found to be acceptable based on the fire hazards, fire protection systems and construction features within the areas. Also, some fire zones being evaluated do not contain systems, components or cables important to safe shutdown.

**Fire Area YD – Attachment 1 - Table B-3 - Fire Area Transition**

<u>Unit</u>	<u>Fire Area</u>	<u>Description</u>
1, 2	YD	Yard
<b><u>EEEE Title</u></b>	<b>Engineering Equivalency Evaluation 11-19 - Fire Barriers between the Service/Office Building and the Containment Cooling Chiller Equipment Room for Non-Standard Fire Barrier Configurations</b>	
<b><u>Summary</u></b>	<p>The purpose of this evaluation is to analyze the non-standard fire barriers separating the Service/Office Buildings from the Containment Cooling Chiller Equipment Room Fire Zone 131A/(AA2) for their impact on preventing the spread of fire.</p> <p>Based on this evaluation, the fire barriers between the Containment Cooling Chiller Equipment Room and the Service Building, adjacent to general storage, office areas and miscellaneous shops are adequate for the hazard. In addition, this evaluation does not adversely impact other evaluations or exemptions.</p> <p>The boundary configurations were evaluated and found to be acceptable based on the lack of NSCA credited equipment and cables within the Containment Cooling Chiller Equipment Room and additional fire barriers separating the Containment Cooling Chiller Equipment Room from the rest of the Turbine Building.</p>	
<b><u>EEEE Title</u></b>	<b>Engineering Equivalency Evaluation 11-38 - Fire Protection for the Pump House (Fire Area YD)</b>	
<b><u>Summary</u></b>	<p>The purpose of this engineering equivalency evaluation is to document the acceptability of CNP's fire pump house, located in the southwest corner of the protected area, for its impact on preventing the spread of fire. The engineering equivalency evaluation evaluates the north-south interior fire walls that do not extend through the roof and contain 1-1/2 in. communicable openings into adjacent rooms.</p> <p>The construction features of the fire pump house are acceptable for maintaining the fire safety of CNP and are adequate for the hazard based on automatic suppression, low combustible loading classification, and rooms being separated by 3-hr fire-rated walls.</p> <p>The fire pump house barriers were evaluated and found to be acceptable based on the fire hazards, fire protection systems and construction features within the evaluated area. Also, the fire pump house does not contain systems, components or cables importa</p>	

**Fire Area YD – Attachment 1 - Table B-3 - Fire Area Transition**

<u>Unit</u>	<u>Fire Area</u>	<u>Description</u>
1, 2	YD	Yard
<b><u>EEEE Title</u></b>	<b>Engineering Equivalency Evaluation 11-44 - Unrated Fire Doors (361 and 362) and Unrated Personnel Walkways (AA3, AA34, AA35, and AAYD)</b>	
<b><u>Summary</u></b>	<p>The purpose of this engineering equivalency evaluation is to document the acceptability of the impact the erection of new personnel walkways in each operating unit will have on the expansion of an existing fire area boundary and an existing area that neighbors other fire areas, on the potential spread of fire.</p> <p>The defense-in-depth fire protection philosophy installed in these areas adequately protects the fire safety of the plant and that the installed unrated personnel walkways and doors #361 and #362 are acceptable. The personnel walkways in each unit will not impair the safe shutdown capability of CNP, aid in the spread of fire between fire areas or jeopardize existing fire area boundaries. This engineering equivalency evaluation does not impact other engineering equivalency evaluations.</p> <p>The personnel walkways were evaluated and found to be acceptable based on the fire hazards, fire protection systems and construction features within the evaluated areas.</p>	
<b><u>EEEE Title</u></b>	<b>Engineering Equivalency Evaluation 11-52 - Acceptability of Selected Panel Removal for the Unit 1 Main Transformer Radiant Fire Wall</b>	
<b><u>Summary</u></b>	<p>The purpose of this evaluation is to document the acceptability of the removal of selected panels in the radiant fire wall between an Auxiliary Transformer and the Unit 1 345 kv Main Transformer that extends from the wall of one of the 4 kv Switchgear Rooms past the Aux Transformer into the adjacent parking area. The removal of one or more of the panels will allow air to flow into the 345 kv Transformer area to assist in reducing transformer ambient temperature.</p> <p>Additionally, this evaluation establishes the impact of the removal of selected panels in the radiant wall on:</p> <ul style="list-style-type: none"> <li>○ The spread of fire, and,</li> <li>○ previous evaluations and exemptions.</li> </ul> <p>The removal of the five bottom panels in the radiant fire wall between an Auxiliary Transformer and the Unit 1 345 kv Main Transformer is an acceptable change to facilitate air flow into the Main Transformer area to assist in reducing the transformer ambient temperature.</p> <p>The radiant fire wall was evaluated and found to be acceptable based on the fire protection systems and construction features within the evaluated area.</p>	

**Fire Area YD – Attachment 1 - Table B-3 - Fire Area Transition**

<u>Unit</u>	<u>Fire Area</u>	<u>Description</u>
1, 2	YD	Yard
<b><u>EEEE Title</u></b>	<b>Engineering Equivalency Evaluation 11-66 - Yard to Fire Zone 19 (Fire Area AA24) Boundary Evaluation</b>	
<b><u>Summary</u></b>	<p>The purpose of this evaluation is to document the acceptability of the fire area boundary between Fire Zone 19 (Fire Area AA24) and the Yard (YD) with respect to fire spread.</p> <p>Based on the evaluation, reasonable assurance is provided that a fire starting in Fire Zone 19 is not capable of propagating to Fire Zone Yard. Similarly, reasonable assurance can be provided that a fire starting in Fire Zone Yard is not capable of propagating to Fire Zone 19. Since a fire in either fire zone will not affect adjacent fire zones, the fire will not adversely impact safe shutdown capabilities of CNP.</p> <p>The fire area boundary was evaluated and found to be acceptable based on the fire hazards and construction features within the evaluated areas.</p>	
<b><u>EEEE Title</u></b>	<b>Engineering Equivalency Evaluation 11-69 - Electromagnetic Fire/Security Door Locks</b>	
<b><u>Summary</u></b>	<p>The purpose of this evaluation is to document acceptability of non-UL/FM approved DynaLock Model 2280 electromagnetic door locks that were installed under EC-0000050114. NFPA 80 1970 Ed. Section 516 Builders Hardware, sub-section b. Locks and Latches states, in part, "Only labeled fire exit hardware shall be used." The Dynalock Model 2280 magnetic door locks are installed primarily for Security purposes and are not UL/FM approved devices as required by code. Therefore, this evaluation is necessary to provide technical justification supporting acceptability of the Dynalock Model 2280 electromagnetic lock mechanism.</p> <p>This evaluation shows that the use of the DynaLock Model 2280 magnetic lock devices provides, reasonable assurance fire doors will remain closed and retain the required passive fire protection function. The use of the DynaLock Model 2280 magnetic lock devices has no impact on the ability of CNP to achieve and maintain a safe and stable condition, nor does it increase the risk of the spread of fire between plant fire zones.</p> <p>EEE-11-69 evaluated magnetic door latches installed on doors 1-DR-SCN216, 1-DR-TUR200, 2-DR-TUR221, 2-DR-TUR259, in this Analysis Area boundary. This evaluation shows that the use of the DynaLock Model 2280 magnetic lock devices provides reasonable assurance fire doors will remain closed and retain the required passive fire protection function.</p>	

**Fire Area YD – Attachment 1 - Table B-3 - Fire Area Transition**

<u>Unit</u>	<u>Fire Area</u>	<u>Description</u>
1, 2	YD	Yard

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**Fire Suppression Effects on Nuclear Safety Performance Criteria**

The CNP fire brigade is trained to discharge water in a judicious manner and instructed to direct hose streams and portable extinguishers at the base of the fire to limit the amount of overspray beyond the immediate fire zone. For this reason, fire brigade activities are not expected to fail components not already considered damaged. It has been concluded that water impingement on cables is not a concern. Electrical cabinets are provided with a seal at the conduit interface. This fire area is located outdoors and drainage is to the exterior environment. Equipment in this fire area is exposed to the atmosphere and is designed to withstand water impingement.

In the event of discharge, the water spray system will only impact the ignition source originally failed by the initiating fire.

Since it is shown that suppression effects will not impact the nuclear safety performance criteria, the fire area configuration is deemed acceptable.

**References:**

Technical Evaluation 12.1, "Fire Suppression Effects Study"

Technical Evaluation 12.1, "Supplemental Information to Fire Suppression Effects Study – Supplement 1"

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**Fire Area Comments**

None