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PNP 2014-080

August 14, 2014

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

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

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

References:
1. ENO letter, PNP 2012-106, "License Amendment Request to Adopt NFPA 805 Performance-Based Standard for Fire Protection for Light Water Reactors," dated December 12, 2012 (ADAMS Accession Number ML12348A455)
2. ENO letter, PNP 2013-013, "Response to Clarification Request — License Amendment Request to Adopt NFPA 805 Performance-Based Standard for Fire Protection for Light Water Reactors," dated February 21, 2013 (ADAMS Accession Number ML13079A090)
3. NRC electronic mail of August 8, 2013, "Palisades - Requests for Additional Information Regarding Transition to the Fire Protection Program to NFPA Standard 805 (TAC No. MF0382)" (ADAMS Accession Number ML13220B131)

Attachments 3 & 4 contain ~~Security-Related Information to be withheld from Public Disclosure in accordance with 10 CFR 2.390.~~
Upon removal of Attachments 3 & 4, this letter is uncontrolled.

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

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

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

7. NRC electronic mail of March 11, 2014, "Requests for Additional Information – Palisades – NFPA 805 Project LAR - MF0382" (ADAMS Accession Number ML14118A293)

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

9. ENO letter, PNP 2014-050, "Response to Request for Additional Information – License Amendment Request to Adopt NFPA 805 Performance-Based Standard for Fire Protection for Light Water Reactors", dated May 7, 2014

10. NRC electronic mail of May 21, 2014, "Requests for Additional Information – PRA - Palisades – NFPA 805 LAR - MF0382" (ADAMS Accession Number ML14142A104)

11. ENO letter, PNP 2014-063, "Response to Request for Additional Information – License Amendment Request to Adopt NFPA 805 Performance-Based Standard for Fire Protection for Light Water Reactors", dated June 17, 2014

Dear Sir or Madam:

In Reference 1, Entergy Nuclear Operations, Inc. (ENO) submitted a license amendment request to adopt the NFPA 805 performance-based standard for fire protection for light water reactors. In Reference 2, ENO responded to a clarification request. In Reference 3, ENO received electronic mail Request for Additional Information (RAIs). In Reference 4, ENO submitted the 60-day RAI responses. In Reference 5, ENO submitted the revised 90-day RAI responses. In Reference 6, ENO submitted the 120-day RAI responses. In Reference 7, ENO received electronic mail RAIs on Fire Modeling. In Reference 8, ENO submitted the revised response to RAI SSA 07. In Reference 9, ENO submitted responses to the Fire Modeling RAIs. In Reference 10, ENO received electronic mail RAIs on Fire Probabilistic Risk Assessment (PRA). In Reference 11, ENO submitted responses to the round 2 PRA 30-day RAIs.

In Attachment 1, ENO is providing 90-day responses to the RAIs noted below.

PRA RAIs due in 90 days (no later than August 19, 2014):

- PRA 01.j.01, PRA 01.l.01, PRA 17.b.01, PRA 20.01, PRA 23.01, PRA 23.a.01, PRA 23.c.01, PRA 28.a.01, PRA 30

In addition, ENO is also providing the following:

Attachment 2 – Licensee Identified Issues

Attachment 3 – Updated Attachment S (SUNSI)

This updated Attachment S supercedes, in its entirety, the Attachment S that was submitted with the NFPA 805 LAR on December 12, 2012 (Reference 1). Attachment 3 contains security-related information and should be withheld from public disclosure under 10 CFR 2.390.

Attachment 4 – Updated Attachment W Tables W-1 & W-2 (SUNSI)

The updated Attachment W Tables, W-1 & W-2, supercede, in their entirety, the Attachment W Tables W-1 & W-2 that were submitted with the NFPA 805 LAR on December 12, 2012. Attachment 4 contains security-related information and should be withheld from public disclosure under 10 CFR 2.390.

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

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

I declare under penalty of perjury that the foregoing is true and correct. Executed on August 14, 2014.

Sincerely,

ajv/jpm

Attachments:

1. Response to Request for Additional Information Regarding License Amendment Request to Adopt NFPA 805 Performance-Based Standard for Fire Protection for Light Water Reactors
2. Licensee Identified Issues
3. Updated Attachment S - Plant Modifications and Items to be Completed During Implementation
4. Updated Attachment W Tables - Fire PRA Insights Table W-1 & W-2

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

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

NRC REQUEST

PRA RAI 01.j.01

The response to PRA RAI 01.j in the letter dated December 2, 2013, ADAMS Accession No. ML13336A649, indicates that damage beyond the ignition source is not postulated for several 480V motor control center (MCCs). Per Section 6.5.6 of NUREG/CR-6850, "EPRI/NRC-RES Fire PRA Methodology for Nuclear Power Facilities: Volume 2: Detailed Methodology", postulated fires originating in all cabinets above 440V are considered "potentially challenging" and propagation outside of the cabinet should be evaluated.

Provide updated risk results, as part of the aggregate change-in-risk analysis requested in PRA RAI 30, following this or other accepted guidance. If other guidance is used, describe the method used.

ENO RESPONSE

Chapter 6 of NUREG/CR-6850 [2] is focused on the development of fire ignition frequencies. In accordance with this guidance, MCCs are included as fixed ignition sources in the fire probabilistic risk assessment (PRA) model. In order to evaluate propagation of fire damage outside of the cabinet, the guidance in FAQ 08-0042 was utilized [1].

As discussed in the response to PRA RAI 01.j, the several 480V motor control center (MCCs), referenced in response to PRA RAI 01.j, that are not postulated for damage beyond the ignition source are sealed, robust and have been evaluated using the guidance in FAQ 08-0042. Therefore scenarios modeling fire propagation for these MCCs are not included in the quantification update provided in response to PRA RAI 30.

References

[1] Fire Probabilistic Risk Assessment Methods Enhancements: Supplement 1 to NUREG/CR-6850 and EPRI 1011989. EPRI, Palo Alto, CA, and NRC, Washington, D.C.: December 2009. EPRI 1019259.

[2] EPRI/NRC-RES Fire PRA Methodology for Nuclear Power Facilities, EPRI 1011989, NUREG/CR-6850, Final Report, September 2005.

NRC REQUEST

PRA RAI 01.I.01

The response to PRA RAI 01.I, in the letter dated December 2, 2013, ADAMS Accession No. ML13336A649, indicates that the core damage frequency (CDF) and large early release frequency (LERF) associated with MCR abandonment scenarios are calculated using multiple scenarios. Provide the range of conditional core damage probability (CCDPs) and conditional large early release probability (CLERPs) that have been developed. In addition, explain how the process and the range of estimates developed relate to the MCR abandonment scenario bins below:

a. *Scenarios where the fire fails few functions aside from MCR habitability and successful shutdown is relatively uncomplicated by the fire scenario.*

b. *Scenarios where the fire could cause some recoverable functional failures or spurious operations that complicate the shutdown.*

c. *Scenarios where the fire induced failures cause great difficulty for shutdown by failing multiple functions and/or causing complex spurious operations.*

ENO RESPONSE

The process to determine the CCDP and CLERP for each Main Control Room (MCR) abandonment scenario involves quantifying the fire PRA model with the fire induced failures postulated. This is possible because the Palisades Nuclear Plant (PNP) fire PRA model includes the logic to perform the alternate shutdown strategy. The PRA model logic structure ensures that this logic is only credited for functional failures for which a viable redundant functional capability exists at the alternate shutdown panel.

MCR abandonment scenarios may lead to other induced consequential events (e.g. Seal Loss of Coolant Accidents (LOCAs)) for which some functions of the mitigation strategy are not available from the alternate shutdown panel. The results for this subset are unaffected by implementation of the alternate shutdown strategy. For example, operation of the turbine-driven auxiliary feedwater pump (P-8B) from the alternate shutdown panel is only credited as an alternative to the failure of normal heat removal via the steam generators from the control room). When heat removal via the steam generators is not part of the event mitigation strategy, quantification will not require these failures. This is embedded in the quantification results, which are provided in the revised Table W-2.

MCR abandonment scenarios were developed considering the potential for fire spread, the type of ignition source, the location in the MCR, and the impact on MCR HVAC.

These parameters result in different conditional probabilities of control room abandonment as described in the Main Control Room Abandonment report [1].

As discussed above, the MCR abandonment CCDPs and CLERPs were obtained by quantifying the fire PRA model with postulated fire induced failures. For the purposes of the MCR abandonment scenarios, the following approach was used to determine the fire induced failures for each scenario:

- Each scenario postulates functional failures based on the targets (cables and equipment) present in the MCR.
- Spurious operations due to hot shorts are limited to those scenarios that impact the associated cables directly.

  For example, the hot short induced spurious operations postulated in the scenario involving the MCB panels EC-01, 02, 03, and 08 (the MCB bench-board) are limited to those spurious operations that have associated cables routed through these panels.

- Each scenario also postulates failure of most operator actions performed in the MCR.
- The small set of MCR operator actions credited in each scenario are, or will be, directed in the MCR abandonment procedure to be performed prior to abandoning the MCR.
- The human error probabilities (HEPs) for credited ex-MCR operator actions were adjusted to consider the less favorable performance shaping factors that may occur with abandonment of the MCR.

The ranges of CCDPs and CLERPs for the postulated Main Control Room (MCR) abandonment scenarios are included in Table 1. The current fire PRA model postulates failure to control the pressurizer heaters and failure to de-energize the heaters in all MCR abandonment scenarios. These failures cause the pressurizer safeties to open and possibly stick open, resulting in a consequential LOCA. Therefore, all scenarios are categorized into Bin C, as defined in the RAI.

A sensitivity was performed to understand what the risk profile of the scenarios would be if the operator action was credited. The results of which are included in Table 2. The operator action represents a recovery (from the control room) to the fire induced loss of control of the pressurizer heaters and therefore many scenarios are reclassified as Bin B. Some scenarios remain in Bin C due to other fire induced failures. Several Bin B scenarios could be reclassified as Bin A if damage to the pressurizer heaters was not postulated.

Table 1 CCDP and CLERP Ranges for MCR Abandonment

Bin	Lower CCDP	Upper CCDP	Lower CLERP	Upper CLERP	Comment
A	N/A	N/A	N/A	N/A	The current fire PRA model does not include MCR abandonment scenarios that fail few functions aside from MCR habitability and for which successful shutdown is relatively uncomplicated by the fire scenario.
B	N/A	N/A	N/A	N/A	The current fire PRA model does not include MCR abandonment scenarios where the fire could cause some recoverable functional failures or spurious operations that complicate shutdown.
C	1.36E-01	1.72E-01	4.27E-02	5.57E-02	The current fire PRA model includes several scenarios where the fire induced failures cause great difficulty for shutdown by failing multiple functions and/or causing complex spurious operations. The lower CCDP represents scenarios that include failure to control the pressurizer heaters and a subsequent consequential LOCA due to random failure of the pressurizer safety relief valves to close. The higher CCDPs represent scenarios that additionally include fire induced hot shorts resulting in the failure to isolate letdown or the spurious opening of the pressurizer head vent valves. These fire-induced hot shorts further increase the conditional probability of a consequential LOCA.

Table 2 CCDP and CLERP Ranges for MCR Abandonment Sensitivity

Bin	Lower CCDP	Upper CCDP	Lower CLERP	Upper CLERP	Comment
A	N/A	N/A	N/A	N/A	The version of the fire PRA model used for this sensitivity does not include MCR abandonment scenarios that fail few functions aside from MCR habitability and for which successful shutdown is relatively uncomplicated by the fire scenario.
B	4.76E-03	4.76E-03	1.63E-03	1.63E-03	The version of the fire PRA model used for this sensitivity includes several scenarios where the fire could cause some recoverable functional failures or spurious operations that complicate shutdown. This CCDP represents scenarios that include failure to control the pressurizer heaters, the operator action to de-energize the pressurizer heaters, and a subsequent consequential LOCA due to random failure of the pressurizer safety relief valves to close. As the operator action represents a (control room) recovery of the fire induces failure, these scenarios are categorized into this bin.

Table 2 CCDP and CLERP Ranges for MCR Abandonment Sensitivity

Bin	Lower CCDP	Upper CCDP	Lower CLERP	Upper CLERP	Comment
C	5.33E-03	4.58E-02	2.00E-03	1.41E-02	The version of the fire PRA model used for this sensitivity includes several scenarios where the fire induced failures cause great difficulty for shutdown by failing multiple functions and/or causing complex spurious operations. The lower CCDP represents a scenario that includes fire induced hot shorts resulting in spurious opening of the pressurizer head vent valves and an increased likelihood of a consequential LOCA. The higher CCDPs represent scenarios that include fire induced hot shorts resulting in the failure to isolate letdown and an increased likelihood of a consequential LOCA.

References

[1] Report 0021-0019-000-001, Rev. 1, "Evaluation of Control Room Abandonment Times at the Palisades Nuclear Station," Hughes Associates, Inc., Baltimore, MD, April, 2014.

NRC REQUEST

PRA RAI 17.b.01

The response to PRA RAI 17.b, in the letter dated December 2, 2013 ADAMS Accession No. ML13336A649, states that "the plant-wide main control board (MCB) frequency is apportioned to each of the three MCB sections based on the length of the MCB sections". Appendix L of NUREG/CR-6850 assigns the MCB frequency to each scenario.

Provide updated risk results as part of the aggregate change-in-risk analysis requested in PRA RAI 30, applying the full Bin 4 frequency to each MCB scenario postulated per Appendix L of NUREG/CR-6850.

ENO RESPONSE

The latest guidance in Fire PRA FAQ 14-0008 [1] identifies that it is acceptable to subdivide the Fire Ignition Frequency (FIF) for MCB panels as long as the Appendix L factor is recalculated. The RAI response Fire PRA Model has been updated to ensure that in addition to subdividing the FIF to multiple panels of the MCB, that the Appendix L conditional probability is also recalculated using the appropriate MCB panel dimension. The height and width of the control surfaces of the panel are the two primary inputs needed to recalculate the Appendix L values for varying separation distances.

Therefore, these parameters are also chosen as the input to subdivide the MCB frequency to the separate panels. The count for each MCB panel is an area term calculated using the height and width of the control surfaces. Although this differs from the counting of other electrical cabinets, it is considered appropriate given the application of the Appendix L conditional probabilities and the input parameters to calculate these values. The counting of the MCB ignition sources does not impact the counting for other fixed ignition source bins.

Updated risk results as part of the aggregate change-in-risk analysis are provided in the the revised Attachment W Tables (Attachment 4).

References

[1] Fire PRA FAQ 14-0008, "Main Control Board Treatment"

Revision to PRA RAI 17.a

Based on the wording in FAQ 14-0008 [1], it is clear that the back panels of sub-enclosure 1 (panels C11-6, C11-3, C11-4, C11-5, C12-5, C12-6, C12-7, C12-8, C13-4, and C13-5) should be treated as part of the MCB and counted as such.

The ignition frequency calculation used to support the RAI Response Fire PRA Model is consistent with the guidance in the FAQ. The updated frequencies are included in the base case results of the RAI Response Fire PRA Model, which is provided in the revised Attachment W Tables (Attachment 4). Utilizing this approach for the base case which more closely matches the latest guidance means that a specific sensitivity study is not needed.

Revision to PRA RAI 17.b

Main Control Board (MCB) at PNP consists of three (3) distinctly separated sets of panels:

- Section 1 - the bench-board-type cabinets (C01, C02, C03, and C08),
- Section 2 - the main horseshoe which is made up of the front and back panels of sub-enclosure 1 (C11, C12, and C13),
- Section 3 - the front and back panels of sub-enclosure 2 (C04 and C06).

The plant-wide MCB frequency is apportioned to each of the three MCB sections based on the control surface area of the MCB sections.

NUREG/CR-6850 Appendix L guidance was used to analyze MCB fires. Consistent with the latest guidance in FAQ 14-0008, the MCB section frequencies and the Appendix L conditional probabilities are recalculated to the postulated fire scenarios within the applicable section.

Revision to PRA RAI 17.d

The treatment of MCB and electrical panel fire propagation credits the ionization smoke detectors and considers propagation to non-adjacent panels consistent with the guidance provided in NUREG/CR-6850 Appendix S. There are no open back panels outside of the sub-enclosures and all panels in the sub-enclosures are considered part of the MCB. Therefore, fire propagation within the MCB for non-abandonment scenarios was modeled using the NUREG/CR-6850 Appendix L approach. Fire propagation in the MCB for abandonment scenarios was modeled consistent with the guidance provided in NUREG/CR-6850 Appendix S (i.e., fire spread was modeled at 10 min.).

NRC REQUEST

PRA RAI 20.01

The response to PRA RAI 20, in the letter dated December 2, 2013, ADAMS Accession No. ML13336A649, indicates that the fire PRA model being updated in response to RAIs will use the fire ignition frequencies from NUREG/CR-6850 Supplement 1 and that the use of the original NUREG/CR-6850 frequencies is not expected to yield risk results that exceed the risk acceptance guidelines in RG 1.174, "An Approach for Using Probabilistic Risk Assessment in Risk-Informed Decisions on Plant-Specific Changes to the Licensing Basis". Updated risk results will be provided in the aggregate analysis requested in PRA RAI 30. Utilizing the updated fire PRA used to respond to PRA RAI 30, confirms that the risk results of the sensitivity study based on NUREG/CR-6850 ignition frequencies, consistent with Footnote 10 of Supplement 1 to NUREG/CR-6850, continue not to exceed the RG 1.174 risk acceptance guidelines.

If the guidelines are exceeded:

a. *Discuss what is exceeded;*

b. *Describe the fire protection, or related, measures that will be taken to provide additional defense-in-depth; and,*

c. *Discuss whether there are conservatisms in the analysis, and if so, the risk significance of the conservatisms.*

ENO RESPONSE

The discussion and results below, in Table PRA RAI 20.01-1, confirm that the use of NUREG/CR-6850 ignition frequencies per Footnote 10 of Supplement 1 does not result in exceeding the RG 1.174 risk acceptance guidelines.

The ΔCDF and ΔLERF results in PRA RAI 30 indicate a net decrease in CDF and LERF. The use of NUREG/CR-6850 ignition frequencies per Footnote 10 of Supplement 1 does not alter this conclusion: ΔCDF and ΔLERF results represent a net decrease in CDF and LERF. Therefore, the change in risk satisfies RG 1.174.

The overall baseline risk using NUREG/CR-6850 ignition frequencies per Footnote 10 of Supplement 1 for fires is summarized below. The results do not exceed the RG 1.174 risk acceptance guidelines when the risk reduction afforded by the NFPA 805 modifications in other hazard groups is considered. Therefore, the overall baseline risk satisfies RG 1.174.

Table PRA RAI 20.01-1: RG 1.174 Compliance Using NUREG/CR-6850 Original Fire Frequencies per Footnote 10 of Supplement 1

Hazard Group	CDF (/yr)	LERF (/yr)	Comments
Fire	4.7E-05	4.4E-06	Post-transition plant with NUREG/CR-6850 original fire ignition frequencies per Footnote 10 of Supplement 1.
FPIE	2.1E-05	n/a	Interim model crediting NFPA 805 Mods.
Internal Flooding	7.7E-06	n/a	Crediting NFPA 805 Mods.
Seismic	8.9E-06	n/a	IPEEE without crediting NFPA 805 Mods.
Total	8.5E-05	6.3E-06	LERF at Palisades is historically about 1 to 2 orders of magnitude lower than CDF for non-fire hazards. LERF total is estimated assuming LERF equals CDF divided by 20 for non-fire hazards.
Guideline	< 1E-4	< 1E-5	RG 1.174 guideline for baseline risk.

NRC REQUEST

PRA RAI 23.01

The response to PRA RAI 23, in the letter dated December 2, 2013, ADAMS Accession No. ML13336A649, states that, "the RAI Response Fire PRA Model will be quantified to provide updated Attachment W values as required for the LAR submittal once all issues that impact quantification have been identified and resolved via the RAI process." Section 3.2.5 of RG 1.205 states that risk decreases may be combined with risk increases for the purposes of evaluating combined changes in accordance with Regulatory Positions 2.1.1 (1.1 in RG 1.174 revision 2) and 2.1.2 (1.2 in RG 1.174 revision 2) of RG 1.174. Accordingly, both individual and cumulative risk effects should be evaluated.

Given that the submitted application represents a change that combines risk increases with risk decreases, provide and explain the total increase in CDF and LERF from unresolved fire area variances from deterministic requirements (VFDRs) (i.e., those that will be incorporated into the post-transition licensing basis), and total decrease in CDF

and LERF from modifications beyond compliance (i.e., unrelated to VFDRs and included to reduce risk).

ENO RESPONSE

PRA RAI 30 presents the change in risk results (ΔCDF and ΔLERF) for each fire area. The fire risk evaluation delta risk (Fire Risk Eval Δ CDF/LERF) is the post-transition plant risk minus the compliant plant risk, as defined in the response to PRA RAI 23, consistent with the guidance in FAQ 08-0054, and repeated below.

The NFPA 805 LAR represents a change that combines risk increases (those due to unresolved VFDRs) with risk decreases (those due to modifications beyond compliance). Modifications beyond compliance are modifications which do not resolve VFDRs (fully or partially) and are for risk reduction only. The fire risk evaluation delta risk represents the cumulative impact of the risk increases and risk decreases.

To individually provide (on a fire area total basis) the increases in CDF and LERF due to unresolved VFDRs and the decreases in CDF and LERF from modifications beyond compliance, an additional condition must be defined. The Compliance Mods Only plant is defined below.

The Compliance Mods Only Plant differs from the Compliant Plant in that all unresolved VFDRs are treated as unresolved: the individual VFDR components are not protected and recovery actions are not credited. The Compliance Mods Only Plant differs from the Post-Transition Plant in that modifications beyond compliance are not credited and recovery actions are not credited.

Table PRA RAI 23.01-1: RAI Response Fire PRA Model Delta Risk Case Definitions

Credit Taken in the RAI Response Fire PRA Model For:	Post-Transition Plant	Compliant Plant	Compliance Mods Only Plant
Modifications Required for Compliance	☑	☑	☑
Modifications Beyond Compliance	☑	☐	☐
Feasible Primary Control Station Operator Actions (Including Control Room Operator Actions)	☑	☑	☑
Feasible Ex-Primary Control Station Operator Actions not Associated with Recovering VFDRS (not RAs)	☑	☑	☑
Feasible Ex-Primary Control Stations Operator Actions that are Associated with Recovering VFDRS (RAs)	☑	☑[1]	☐
Protection of individual VFDR Components Beyond those Protected by Modifications Required for Compliance (Unresolved VFDRs)	☐	☑	☐

[1]Since fire-induced VFDR failures are eliminated; recovery is from random failures only.

Modifications beyond compliance (MBC) are defined as the subset of PRA modifications (LAR Attachment S, Table S-2, Items S2-1 through S2-15) considered as not required

for compliance, as indicated below. The modifications beyond compliance help ensure RG 1.174 is met.

Table PRA RAI 23.01-2: PRA Modifications Beyond Compliance (MBC)	
Mod	**Mod Title**
S2-1	Additional High Head Auxiliary Feedwater Pump
S2-8	Insulate Emergency Diesel Generator Exhaust
S2-12	Manual Bypass of the ADV Solenoids
S2-14	Replace cables associated with CV-0910, CV-0911 and CV-0940

The increases in CDF and LERF due to unresolved VFDRs (Unresolved VFDR Δ CDF/LERF) are calculated as the Compliance Mods Only Plant risk minus the Compliant Plant risk.

The decreases in CDF and LERF from modifications beyond compliance (Modifications Beyond Compliance Δ CDF/LERF) are calculated as the Post-Transition Plant risk minus the Compliance Mods Only Plant risk.

The fire risk evaluation delta risks (Fire Risk Eval Δ CDF/LERF) are the cumulative result of the individual risk increases and decreases.

See Table 23.01-3 below.

Table PRA RAI 23.01-3: Aggregate VFDR Delta Calculations per Fire Area

Fire Area	Area Description	Fire Area CDF/LERF	Unresolved VFDRs Δ CDF/LERF	Modifications Beyond Compliance Δ CDF/LERF	Fire Risk Eval Δ CDF/LERF
01	Control Room	4.1E-06 / 6.2E-07	5.8E-05 / 2.2E-05	-7.3E-05 / -2.2E-05	-1.4E-05 / 4.2E-07
02	Cable Spreading Room	1.1E-05 / 2.7E-06	5.2E-04 / 1.5E-04	-5.5E-04 / -1.6E-04	-2.7E-05 / -7.2E-06
03	1-D Switchgear Room	2.2E-06 / 6.2E-09	3.5E-05 / 9.3E-06	-4.0E-05 / -9.4E-06	-4.3E-06 / -6.5E-08
04	1-C Switchgear Room	2.2E-06 / 1.2E-08	1.8E-04 / 1.4E-05	-1.9E-04 / -1.4E-05	-1.9E-06 / -4.4E-08
05	1-1 Diesel Generator Room	2.5E-07 / 1.4E-08	3.6E-08 / 4.3E-11	-2.2E-08 / -3.2E-10	1.4E-08 / -2.8E-10
06	1-2 Diesel Generator Room	1.3E-06 / 3.4E-08	2.8E-09 / ε	-1.1E-07 / -3.2E-09	-1.0E-07 / -3.2E-09
07	Diesel Generator 1-1 Fuel Oil Day Tank Room	2.3E-09 / 9.5E-11	ε / ε	ε / ε	ε / ε
08	Diesel Generator 1-2 Fuel Oil Day Tank Room	2.3E-09 / 9.5E-11	ε / ε	ε / ε	ε / ε
09	Screen House (Intake Structure)	4.1E-08 / ε	3.8E-08 / ε	-1.3E-10 / ε	3.8E-08 / ε
10	East Engineered Safeguards Room	ε / ε	ε / ε	ε / ε	ε / ε
11	Battery Room #2 (A)	1.8E-08 / ε	ε / ε	-2.7E-09 / -1.3E-10	-2.7E-09 / -1.3E-10
12	Battery Room #1 (B)	2.5E-07 / 8.1E-10	ε / ε	-1.5E-07 / -6.5E-10	-1.5E-07 / -6.5E-10
13	Auxiliary Building	9.6E-06 / 3.1E-08	1.4E-04 / 1.2E-05	-1.5E-04 / -1.2E-05	-2.6E-06 / -3.5E-08
14	Reactor Containment Building	2.5E-06 / 2.8E-08	1.4E-05 / 2.9E-06	-3.8E-05 / -3.7E-06	-2.4E-05 / -7.6E-07
15	Engineered Safeguards Panel Room	3.8E-06 / 2.9E-09	1.6E-04 / 1.1E-05	-1.6E-04 / -1.1E-05	-4.8E-06 / -3.1E-08
16	Component Cooling Water Rooms	8.3E-07 / 2.8E-09	3.1E-06 / 2.1E-07	-3.1E-06 / -2.1E-07	-5.3E-08 / -5.3E-11
17	Refueling and Spent Fuel Pool Area	3.6E-08 / 1.0E-09	ε / ε	-1.4E-10 / ε	-1.4E-10 / ε
18	Demineralizer Area	1.5E-09 / ε	ε / ε	ε / ε	ε / ε

Fire Area	Area Description	Fire Area CDF/LERF	Unresolved VFDRs Δ CDF/LERF	Modifications Beyond Compliance Δ CDF/LERF	Fire Risk Eval Δ CDF/LERF
19	Track Alley	ε / ε	ε / ε	ε / ε	ε / ε
21	Electrical Equipment Room	3.7E-07 / 3.5E-09	2.3E-05 / 1.2E-07	-2.3E-05 / -1.1E-07	2.2E-07 / 6.9E-10
22	Turbine Lube Oil Room	2.0E-08 / 5.6E-10	ε / ε	-1.2E-10 / ε	-1.2E-10 / ε
23	Turbine Building	1.3E-06 / 2.1E-08	3.9E-03 / 8.9E-05	-4.1E-03 / -9.4E-05	-1.5E-04 / -4.6E-06
24	Auxiliary Feedwater Pump Room	1.5E-08 / 3.7E-10	ε / ε	ε / ε	ε / ε
25	South and North Heating Boiler Room	2.3E-08 / 6.8E-10	ε / ε	-1.3E-10 / ε	-1.3E-10 / ε
26	Southwest Cable Penetration Room	1.9E-08 / 2.5E-11	8.6E-09 / 1.2E-11	-6.3E-08 / -1.2E-10	-5.4E-08 / -1.0E-10
27	Radwaste Facilities Building VRS Rooms	1.5E-08 / 1.7E-10	ε / ε	-8.1E-10 / ε	-8.1E-10 / ε
28	West Engineered Safeguards Room	3.8E-07 / 4.4E-09	ε / ε	-4.8E-07 / -1.5E-09	-4.8E-07 / -1.5E-09
29	Center Mechanical Equipment Room	1.3E-09 / ε	ε / ε	ε / ε	ε / ε
30	East Mechanical Equipment Room	4.2E-09 / 3.8E-11	ε / ε	ε / ε	ε / ε
31	West Mechanical Equipment Room	4.2E-09 / 3.8E-11	ε / ε	ε / ε	ε / ε
32	SIRW Tank Roof Area	6.6E-07 / 3.0E-09	6.2E-08 / 5.3E-09	-6.7E-08 / -5.3E-09	-5.2E-09 / ε
33	Technical Support Center	ε / ε	ε / ε	ε / ε	ε / ε
34	Manhole #1	2.8E-07 / 1.4E-11	1.2E-07 / 1.4E-11	-4.4E-08 / ε	8.0E-08 / 1.4E-11
35	Manhole #2	5.2E-09 / ε	ε / ε	-1.2E-10 / ε	-1.2E-10 / ε
36	Manhole #3	1.2E-08 / 2.1E-11	ε / ε	ε / ε	ε / ε
38	Cooling Tower Pump House	ε / ε	ε / ε	ε / ε	ε / ε

Fire Area	Area Description	Fire Area CDF/LERF	Unresolved VFDRs Δ CDF/LERF	Modifications Beyond Compliance Δ CDF/LERF	Fire Risk Eval Δ CDF/LERF
39	Feedwater Purity Building	3.5E-08 / 3.4E-10	ε / ε	-1.5E-09 / -1.6E-11	-1.5E-09 / -1.6E-11
40	Switchyard	5.3E-08 / 2.0E-09	ε / ε	-6.9E-10 / ε	-6.9E-10 / ε
41	Outside Area within Protected Area (Yard)	1.8E-07 / 3.0E-10	ε / ε	-1.1E-07 / -1.2E-09	-1.1E-07 / -1.2E-09
56	Diesel Fire Pump Fuel Oil Day Tank Room	ε / ε	ε / ε	ε / ε	ε / ε
	Totals	**4.1E-05 / 3.4E-06**	**5.1E-03 / 3.1E-04**	**-5.3E-03 / -3.3E-04**	**-2.3E-04 / -1.2E-05**
	Multi-Compartment Analysis	**1.8E-07 / 3.4E-08**	**n/a**	**n/a**	**n/a**
	Post-Transition Plant	**4.1E-05 / 3.5E-6**			

The large calculated risk offset obtained from the beyond compliance modifications stems from the large calculated risks associated with being solely in deterministic compliance with the requirements of NFPA 805, 4.2.3.

Deterministic compliance means one success path of required cables and equipment to achieve and maintain the nuclear safety performance criteria without the use of recovery actions are protected from fire damage by meeting the deterministic separation requirements.

Deterministic compliance ensures only one train of safe shutdown equipment is protected free from fire damage and allows any number of feasible operator actions from the control room/primary control station to support this train. When random equipment failures and failures of reliable operator actions are considered, and are coupled with the frequency of challenging fires imposed by the regulations, simply ensuring one train is protected free from fire damage may not result in acceptable calculated risk.

Given the relatively high calculated risk associated with solely being in deterministic compliance, a large beneficial risk offset is obtained from the beyond compliance modifications due to the increased redundancy in decay heat removal. In general, the highest risk benefit for redundancy comes from increasing redundancy from one train to two trains. As the frequency of challenging fires is reduced, the risk offset obtained from beyond compliance modifications is also reduced.

NRC REQUEST

PRA RAI 23.a.01

Table PRA RAI 23.1, in the letter dated December 2, 2013, ADAMS Accession No. ML13336A649, in the response to PRA RAI 23, summarizes how the change in risk values will be estimated. The staff was unable to complete its review of the methods because the parameters defined and used in the response are not included in the guidance documents. Furthermore, it appears that the values in LAR Table W-2 would change considerably using Table PRA RAI 23.1 and no new values were provided.

a. *Define "protection of individual VFDR components beyond those protected by Modifications required for compliance" and provide some examples.*

b. *Summarize modeling simplifications that result in conservative risk estimates in the compliant plant and/or the post-transition plant.*

c. *Provide a detailed explanation for the large risk offset (i.e., 4.5E-4/5.7E-5) obtained from the beyond compliance modifications. As part of this explanation, characterize the top five cutsets from the two dominate scenarios for each of the*

two fires areas (excluding the MCR) that have the most negative change in risk value for the transition from the compliant to the post-transition plant . Provide this information for both CDF and LERF and for both the compliant plant and the post-transition plant (i.e., a total of 40 cut-sets for CDF and 40 for LERF).

ENO RESPONSE

a. New LAR Table W-2 values are provided in the response to PRA RAI 30.

VFDRs evaluated in the fire PRA are characterized as separation issues. These VFDRs can be binned into two categories: VFDRs that are resolved by modification and VFDRs that are not resolved by modification. Further, VFDRs that are not resolved by modification can be binned into two sub-categories: VFDRs that are addressed by recovery actions and VFDRs that are not addressed by recovery actions.

VFDRs that are resolved by modification in the Post-Transition Plant can be considered to no longer be variances from the deterministic requirements of NFPA 805 Section 4.2.3 once the modification is complete. Therefore, Palisades retains and refers to these items as VFDRs for documentation purposes throughout the transition process.

VFDRs that are not resolved by modification in the Post-Transition Plant can be considered resolved (with or without recovery actions) based on performance-based fire risk evaluations. However, Palisades refers to VFDRs that are not resolved by modification as unresolved VFDRs for documentation purposes throughout the transition process. The residual risk of unresolved VFDRs has been evaluated as acceptable, either with or without credit for recovery actions, as indicated in the response to PRA RAI 30.

The phrase "protection of individual VFDR components beyond those protected by modifications required for compliance (unresolved VFDRs)" can be understood by decomposing the different portions of the phrase. "Protection" refers to the assumption that the components are free from fire-damage (as if compliant separation were achieved) during quantification. "Individual VFDR components" refers to the set of components that if protected would eliminate the VFDR. "VFDR components beyond those protected by modifications required for compliance" means the VFDR components not associated with VFDRs that are resolved by modification. "Unresolved VFDRs" also means the set of VFDRs that are not resolved by modification.

The phrase "protection of individual VFDR components beyond those protected by modifications required for compliance (unresolved VFDRs)" is defined as: protecting free from fire-damage (during fire PRA quantification) the set of

components that if protected would eliminate the VFDR for all VFDRs that are not resolved by modification.

Representative examples of "unresolved VFDRs" (VFDRs not resolved by modification) and their components from the most risk significant fire area FA-02 (Cable Spreading Room) include:

Table PRA RAI 23.a.01-1: Examples of Unresolved VFDRs	
VFDR	**Description**
ENP-0983	Loss of SG E-50B isolation for decay heat removal.
ENP-0984	Loss of SG E-50A isolation for decay heat removal.
ENP-0987	Loss of pressurizer heater trip for inventory and pressure control.
ENP-0988	Loss of pressurizer heater trip for inventory and pressure control.
ENP-0989	Loss of EDG 1-1 room cooling fan normal power supply for vital auxiliaries.
ENP-0993	Loss of borated water supply to PCS for reactivity control and inventory and pressure control.
ENP-0994	Loss of borated water supply to PCS for reactivity control and inventory and pressure control.
ENP-0996	PCP controlled bleedoff isolation for inventory and pressure control.
ENP-0997	Loss of battery room HVAC for vital auxiliaries.
ENP-1000	Loss of switchgear room HVAC for vital auxiliaries.
ENP-1001	Loss of fuel oil supply to EDG 1-1 for vital auxiliaries.
ENP-1005	Loss of controlled AFW flow for decay heat removal.
ENP-1006	PCS high-low pressure interface isolation for inventory and pressure control.
ENP-1008	Loss of condensate and heater drain pump trip to achieve feedwater isolation for decay heat removal.
ENP-1009	MSO for early transfer of SIRWT to containment and loss of PCS inventory makeup for inventory and pressure control.
ENP-1352	Loss of hotwell isolation from CST for short term decay heat removal.
ENP-1388	Loss of SWS header B for vital auxiliaries.
ENP-1406	Alignment of EDG 1-1.

A complete list of VFDRs not resolved by modification is maintained in the NFPA 805 transition report [1].

The compliant plant (CP) at PNP is the plant that assumes "protection of individual VFDR components beyond those protected by modifications required for compliance (unresolved VFDRs)" and credits the modifications required for compliance. The CP is the deterministically compliant plant as defined in RG

1.205, Revision 1, and its risk is the deterministically compliant condition risk as defined in FAQ 08-0054, Revision 1.

The post-transition plant (PTP) at PNP is the proposed variant plant including the proposed modifications in LAR Attachment S. The PTP is the post-transition plant at the point of full implementation of NFPA 805 as defined in RG 1.205, Revision 1, and its risk is the variant condition risk as defined in FAQ 08-0054, Revision 1.

b. RAI Response Fire PRA Model has been developed using methodologies acceptable to the AHJ. The accepted methodologies tend towards the development of conservative fire risk estimates. Modeling simplifications have not been used to achieve conservative risk estimates in either the compliant plant or the post-transition plant.

c. The large risk benefit obtained from the beyond compliance modifications stems from the large calculated risks associated with being solely in deterministic compliance with the requirements of NFPA 805, 4.2.3.

   Deterministic compliance means one success path of required cables and equipment to achieve and maintain the nuclear safety performance criteria without the use of recovery actions are protected from fire damage by meeting the deterministic separation requirements.

   Deterministic compliance ensures only one train of safe shutdown equipment is protected free from fire damage and allows any number of feasible operator actions from the control room/primary control station to support this train. When random equipment failures and failures of reliable operator actions are considered, and are coupled with the frequency of challenging fires imposed by the regulations, simply ensuring one train is protected free from fire damage may not result in acceptable calculated risk.

   Given the relatively high calculated risk associated with solely being in deterministic compliance, a large beneficial risk offset is obtained from the beyond compliance modifications due to the increased redundancy in decay heat removal. In general, the highest risk benefit for redundancy comes from increasing redundancy from one train to two trains. As the frequency of challenging fires is reduced, the risk offset obtained from beyond compliance modifications is also reduced.

   The two fire areas that have the most negative change in risk value for the transition from the compliance plant to the post-transition plant are: FA-23 (Turbine Building) and FA-02 (Cable Spreading Room).

   The two most dominate scenarios in the post-transition plant in FA-23 are 23_FBF00-B and 23_FAO00-B:

- 23_FBF00-B – EB-13 2400V (non-HEAF) scenario with fire not suppressed prior to propagation to first target (23.5% of fire area CDF, 31.9% of fire area LERF).

- 23_FAO00-B – EB-21 4160V (non-HEAF) scenario with fire not suppressed prior to propagation to first target (15.5% of room CDF, 18.1% of fire area LERF).

The top five cutsets for these scenarios for CDF and LERF for the post-transition plant and compliant plant are given in the attachment below.

The cutsets can be understood as follows. These fires result in the loss of offsite power to the 2400V buses. The operator fails to manually locally re-align both emergency diesel generators, including via the use of the remote-local transfer switch on EDG 1-1. While the non-safety-related diesel is aligned to bus 1C in the long term, there is a short term loss of the available motor driven auxiliary feedwater pump. Since the fire is in the turbine building, local operation of the turbine driven AFW is not successful in the short term. The short term is the time-frame required to prevent primary coolant heatup and opening of a pressurizer safety relief valve. The PZR SRV is challenged, opens and fails to reclose after relieving pressure, resulting in a small break LOCA. The small break LOCA cannot be mitigated due to the unavailability of HPSI pumps. Thus, core damage occurs.

Alternatively, instead of the operator failure to manually locally align available diesels, the available diesel randomly fails to run. However, since the PZR SRV functions successfully and a HPSI pump remains available, inventory makeup is not threatened and decay heat removal can also occur via once-through-cooling. Decay heat removal fails when recirculation mode when operators fail to align spray pumps to HPSI pump suction to maintain HPSI pump NPSH.

For the CDF cutsets, the sequences and modification impacts can be understood as follows. The cutsets for scenarios 23_FBF00-B and 23_FAO00-B are identical with the exception of the scenario initiator, for both the compliant and post transition plant. Therefore these cutsets differ only due the relative importance of the initiator.

In the compliant plant the results for scenarios 23_FBF00-3 and 23_FAO00-B are dominated sequences 21-32, 17 and 20. Sequence 21-32 is a consequential LOCA through a pressurizer safety valve with successful secondary heat removal via the auxiliary feedwater system, failure of PCS inventory control via the high pressure injection system and failure of all four containment air coolers. Sequence 17 is a transient with failure of secondary heat removal, success of high pressure injection and a power-operated relief valve to provide PCS heat removal. Core damage occurs due to failure of containment heat removal. Sequence 20 is a transient with failure of secondary heat removal and failure of high pressure injection to provide PCS heat removal via once-through-cooling.

In the post transition plant the both scenarios are dominated by sequences 21-32, 27-32 and 14. Sequence 21-32 represents a consequential LOCA due to a failed open pressurizer safety valve, secondary heat removal is available initially but high pressure injection fails to provide inventory makeup.

The CDF for sequence 21-32 is reduced in the post-transition plant due to the presence of a modification to install an independent diesel driven AFW pump. Sequences 17 and 20 are no longer dominant contributors also due to the presence of the diesel driven pump in the post transition plant. The contribution of sequence 14 is also lowered by the diesel driven pump. Sequence 27-32 contribution is related to the ability to trip the charging pump(s) in scenarios where additional charging pumps have spuriously started and letdown could not be aligned to match the additional flow or the operating pump cannot be tripped when all letdown has spuriously isolated. The operator action to trip the pumps benefits from a modification to provide an alternate trip capability from the control room where the normal means of tripping the pumps is failed by fire.

For the LERF cutsets, the sequences and modification impacts can be understood as follows. For scenario 23_FBF00-B and 23_FAO00-B compliant plant results, the top 5 cutsets involve sequences 21-32 and 18. Sequence 21-32 is described above. Sequence 18 is similar to sequence 17 described above except that core damage occurs as a result of the failure of high pressure injection on depletion of the safety injection refueling water (SIRW) tank and failure to align pump suction to the containment sump. There are four sequence 18 cutsets which have lower probabilities in the post transition plant due to the modification to install the independent diesel drive AFW pump. In addition, the probability of the sequence 21-32 cutset was also reduced by the diesel driven pump. This cutset appears in the top five post transition cutsets for this scenario with the failure of the diesel driven to start.

In the post transition plant scenario 23_FBF00-B the top five cutsets are related to sequences 21-32 (discussed above), 27-32 and 14. Sequence 27-32 is similar to sequence 21-32 and differs only in the initial conditions that resulted in the challenge to the pressurizer safety valve. Sequence 14 is a transient with successful secondary heat removal initially but fails during the mission time and high pressure injection fails to provide PCS heat removal via once-through-cooling.

The modifications beyond compliance help significantly in these scenarios because having redundant decay heat removal in the short term via the additional AFW pump prevents a challenge to the PZR SRV and prevents one potential for a small break PZR SRV LOCA. The reduction in risk allows other small break LOCA mechanisms to become more dominant: namely, the PZR SRV LOCA due to excessive inventory addition from a spuriously started charging pump and operator failure to trip the pump.

The two most dominate scenarios in the post-transition plant FA-02 are 02_FAQ-2B and 02_FBC-1.

- 02_FAQ-2B – EB-12 480V load center scenario with fire not suppressed prior to propagation to first target (36.9% of fire area CDF, 46.8% of fire area LERF).

- 02_FBC-1 – EY-01 instrument ac panel scenario with no propagation to overhead trays (6.9% of room CDF, 0.1% of fire area LERF).

The top five cutsets for these scenarios for CDF and LERF for the post-transition plant and compliant plant are given in the attachment below.

The cutsets can be understood as follows. These fires result in the loss of offsite power to the 2400V buses. Emergency diesel generators automatically start and pick up safety-related loads. However, fire-induced spurious closure of valves supplying CCW water to containment results in loss of primary coolant pump cooling. The operator fails to manually trip the primary coolant pumps from the control room within the 20 minute time window, resulting in a PCP seal LOCA. Multiple fire-induced failures result in the loss of all three charging pumps and both HPSI pumps. The small break LOCA cannot be mitigated and core damage occurs.

Alternatively, the fire results in spurious opening of steam generator atmospheric steam dump valves. The operator failure to isolate the ADVs in the short term, results in a steam generator blowdown that fails the turbine driven AFW pump. Long loss of decay heat removal results in reheating and pressurizing the PCS. The PZR SRV is challenged, opens and fails to reclose after relieving pressure, resulting in a small break LOCA. The small break LOCA cannot be mitigated due to the unavailability of HPSI pumps. Thus, core damage occurs.

Successful operator isolation in the short term prevents the challenge to the PZR SRV. Operator failure to employ other long term decay heat removal options (P-8B from the EC-150 panel or the B.5.b pump) results in core damage.

Other sequences involve additional ways to induce a LOCA (e.g., excess charging, letdown isolation failure, etc.) and fail mitigation (e.g., HPSI pump NPSH failures).

For the CDF cutsets, the sequences and modification impacts can be understood as follows. For scenario 02_FAQ-2B the 1st cutset in each result (compliant and post-transition plant) is identical. This cutset is from sequence 25-17 which represents a loss of component cooling water cooling t the primary coolant pump seals. In the four remaining cutsets the compliant plant contribution are from sequences 21-32 and 14. Sequences 21-32 and 14 are described above.

In the post transition plant two of the four remaining cutsets are from sequence 25-17 (same as the 1st cutset) and two cutsets are from sequence 22-18-32. As noted above for fire area 23, sequences 21-32 and 14 contributions are reduced in the post transition plant due to the modification to install an independent diesel driven auxiliary feedwater pump. Consequently, for scenario 02_FAQ-2B results in the post transition plant, the dominant contribution changes to sequences 25-17 and 22-18-32. Sequence 22-18-32 is a consequential very small break LOCA as a consequence of failures in the letdown system and failure to provide PCS inventory control. Two of the remaining four cutsets are from sequence 25-17 which similar to the 1st cutsets represents a consequential LOCA due to primary coolant pump seal leakage due to loss of seal cooling.

For scenario 02_FBC-1 the top five cutsets in both the compliant and post transition plants are identical. The cutsets for scenario 02_FBC-1 have become more important contributors to the fire area 2 results because other sequences (02_FAO-2B, 02_FAY-02B, 02_FBC-2B, etc.) with lower individual contributions had their risk contribution reduced by the modification to install the independent diesel driven AFW pump.

For the LERF cutsets, the sequences and modification impacts can be understood as follows. For scenario 02_FAQ-2B the 1st cutset in each result (compliant and post-transition plant) is identical. Cutset 2 (sequence 21-32) and cutsets three and four (sequence 14) are reduced in importance by the modification to install an independent diesel drive AFW pump. Cutset five is cutset two in the post transition plant.

In the post transition plant cutset three is the next cutset of sequence 25-17 and cutsets four and five are sequence 22-18-32 cutsets. These three cutsets are lower probability cutsets that become dominant when the cutsets in the compliant plant are reduced in importance by the AFW pump modification.

For scenario 02_FBC-1 the top five cutsets in both the compliant and post transition plants are identical. The cutsets for scenario 02_FBC-1 have become more important contributors to the fire area 2 results because other sequences (02_FAQ-2B, 02_FAY-02B, 02_FBC-2B, 02_FAY-2A, 02_FAB-2A, etc.) with lower individual contributions had their risk contribution reduced by the modification to install the independent diesel driven AFW pump.

The modifications beyond compliance help less significantly in these scenarios. The dominant sequence is the primary coolant pump trip. Both the compliant plant and the post-transition plant ensure PCP trip is available from the control room so these sequences are not impacted. Sequences involving loss of decay heat removal and PZR SRV LOCAs are significantly benefited by having the additional AFW pump to provide redundant decay heat removal and prevent a challenge to the PZR SRV. However, other sequences which do not benefit

from the proposed modifications become the dominant contributors given modifications that impact current dominant contributors lower the risk contribution of the affected sequences.

For the 02_FBC-1 scenario, since it is dominated by sequences that are benefited by compliance modifications (i.e., charging pump trip) there is no impact in the top five sequences.

References

[1] PLP-RPT-12-00145, Revision 1, "NFPA 805 Nuclear Safety Performance Criteria - Fire Area Transition", August 2014.

Post-Transition Plant – FA-23 (Turbine Building) – Scenario 23_FBF00-B – Top Five Cutsets - CDF				
#	Cutset Prob	Event Prob	Event	Description
1	2.07E-08	1.02E-03	23_FBF00-B	EA-13 - 2400V Switchgear (non HEAF) Scenario. Fire is not suppressed prior to pr
		9.20E-03	AFW-PMOT-P-8D_M-FR	OP FT ALGN & OPERATE P-8D GIVEN NON-SBO EVENTS (LOC) (HEP)
		1.00E+00	EDG-DGOA-LDSHD_M-FR	OP FT ALGN EDG'S-LD SHD FAILS FOR NON-SIS EVNTS (LOC) (HEP)
		2.90E-02	EDG-DGOA-LOADSHD-FR	OP FT ALGN EDG'S-LD SHD FAILS FOR NON-SIS EVNTS (LOC) (HEP)
		1.00E+00	EDG-DGOA-LOCMAN-FR	OP FT ESTABLISH LOCAL MANUAL CONTROL OF EDG 1-1 (LOC) (HEP)
		7.62E-02	PZR-RVMB-RV-1041-DEV	PZR SAFETY VALVE RV-1041 FTC (ON SUBSEQUENT DEMANDS) (Dev Event)
		1.00E+00	TR-MCND-AV-21-32_LBL	Sequence Label
3	1.42E-08	1.02E-03	23_FBF00-B	EA-13 - 2400V Switchgear (non HEAF) Scenario. Fire is not suppressed prior to pr
		6.30E-03	CVC-PMOA-P55-TRP-FR	OP FT STOP CHARGING PUMP OPERATION (CR) (HEP)
		2.90E-02	EDG-DGOA-LOADSHD-FR	OP FT ALGN EDG'S-LD SHD FAILS FOR NON-SIS EVNTS (LOC) (HEP)
		1.00E+00	EDG-DGOA-LOCMAN-FR	OP FT ESTABLISH LOCAL MANUAL CONTROL OF EDG 1-1 (LOC) (HEP)
		1.00E+00	LOC-FLG-CNSEQ-ETREES	IF "1" - EVENT ADDED TO CNSQ LOCA ETREES/PREVNT SUBSUMING (Flag Event)
		7.62E-02	PZR-RVMB-RV-1041-DEV	PZR SAFETY VALVE RV-1041 FTC (ON SUBSEQUENT DEMANDS) (Dev Event)
		1.00E+00	TR-MCND-AV-27-32_LBL	Sequence Label
4	1.26E-08	1.02E-03	23_FBF00-B	EA-13 - 2400V Switchgear (non HEAF) Scenario. Fire is not suppressed prior to pr
		9.20E-03	AFW-PMOT-P-8D_M-FR	OP FT ALGN & OPERATE P-8D GIVEN NON-SBO EVENTS (LOC) (HEP)
		1.00E+00	EDG-DGOA-LDSHD_M-FR	OP FT ALGN EDG'S-LD SHD FAILS FOR NON-SIS EVNTS (LOC) (HEP)
		2.90E-02	EDG-DGOA-LOADSHD-FR	OP FT ALGN EDG'S-LD SHD FAILS FOR NON-SIS EVNTS (LOC) (HEP)
		1.00E+00	EDG-DGOA-LOCMAN-FR	OP FT ESTABLISH LOCAL MANUAL CONTROL OF EDG 1-1 (LOC) (HEP)
		4.63E-02	PZR-RVMB-RV-1041	PZR (T-72) SAFETY VALVE RV-1041 FTC (AFTER INITIAL DEMAND)
		1.00E+00	TR-MCND-AV-21-32_LBL	Sequence Label
7	1.09E-08	1.02E-03	23_FBF00-B	EA-13 - 2400V Switchgear (non HEAF) Scenario. Fire is not suppressed prior to pr
		4.20E-03	AFW-PMOT-P-8D_L-FR	OP FT ALGN & OPERATE P-8D GIVEN FPIE NON-SBO EVENTS (HEP)
		2.55E-03	EDG-C1MA-S-965	DISCONNECT AT P-965 FAILS TO OPEN
		1.00E+00	TR-MCND-AV-14_LBL	Sequence Label
12	8.63E-09	1.02E-03	23_FBF00-B	EA-13 - 2400V Switchgear (non HEAF) Scenario. Fire is not suppressed prior to pr
		6.30E-03	CVC-PMOA-P55-TRP-FR	OP FT STOP CHARGING PUMP OPERATION (CR) (HEP)
		2.90E-02	EDG-DGOA-LOADSHD-FR	OP FT ALGN EDG'S-LD SHD FAILS FOR NON-SIS EVNTS (LOC) (HEP)
		1.00E+00	EDG-DGOA-LOCMAN-FR	OP FT ESTABLISH LOCAL MANUAL CONTROL OF EDG 1-1 (LOC) (HEP)
		1.00E+00	LOC-FLG-CNSEQ-ETREES	IF "1" - EVENT ADDED TO CNSQ LOCA ETREES/PREVNT SUBSUMING (Flag Event)
		4.63E-02	PZR-RVMB-RV-1041	PZR (T-72) SAFETY VALVE RV-1041 FTC (AFTER INITIAL DEMAND)
		1.00E+00	TR-MCND-AV-27-32_LBL	Sequence Label

Compliant Plant – FA-23 (Turbine Building) – Scenario 23_FBF00-B – Top Five Cutsets - CDF				
#	Cutset Prob	Event Prob	Event	Description
2	2.25E-06	1.02E-03	23_FBF00-B	EA-13 - 2400V Switchgear (non HEAF) Scenario. Fire is not suppressed prior to pr
		1.00E+00	EDG-DGOA-LDSHD_M-FR	OP FT ALGN EDG'S-LD SHD FAILS FOR NON-SIS EVNTS (LOC) (HEP)
		2.90E-02	EDG-DGOA-LOADSHD-FR	OP FT ALGN EDG'S-LD SHD FAILS FOR NON-SIS EVNTS (LOC) (HEP)
		1.00E+00	EDG-DGOA-LOCMAN-FR	OP FT ESTABLISH LOCAL MANUAL CONTROL OF EDG 1-1 (LOC) (HEP)
		7.62E-02	PZR-RVMB-RV-1041-DEV	PZR SAFETY VALVE RV-1041 FTC (ON SUBSEQUENT DEMANDS) (Dev Event)
		1.00E+00	TR-MCND-AV-21-32_LBL	Sequence Label
9	1.44E-06	1.02E-03	23_FBF00-B	EA-13 - 2400V Switchgear (non HEAF) Scenario. Fire is not suppressed prior to pr
		2.57E-02	EDG-DGMG-K-6B	DIESEL GENERATOR 1-2 FAILS TO RUN
		5.50E-02	HPI-AVOA-NPSH-VS-FR	OP FT ALGN HPSI SUBCLG FOR NON- LB/MB/SB LOCA (CR) (HEP)
		1.00E+00	TR-MCND-AV-17_LBL	Sequence Label
10	1.37E-06	1.02E-03	23_FBF00-B	EA-13 - 2400V Switchgear (non HEAF) Scenario. Fire is not suppressed prior to pr
		1.00E+00	EDG-DGOA-LDSHD_M-FR	OP FT ALGN EDG'S-LD SHD FAILS FOR NON-SIS EVNTS (LOC) (HEP)
		2.90E-02	EDG-DGOA-LOADSHD-FR	OP FT ALGN EDG'S-LD SHD FAILS FOR NON-SIS EVNTS (LOC) (HEP)
		1.00E+00	EDG-DGOA-LOCMAN-FR	OP FT ESTABLISH LOCAL MANUAL CONTROL OF EDG 1-1 (LOC) (HEP)
		4.63E-02	PZR-RVMB-RV-1041	PZR (T-72) SAFETY VALVE RV-1041 FTC (AFTER INITIAL DEMAND)
		1.00E+00	TR-MCND-AV-21-32_LBL	Sequence Label
12	1.03E-06	1.02E-03	23_FBF00-B	EA-13 - 2400V Switchgear (non HEAF) Scenario. Fire is not suppressed prior to pr
		1.84E-02	EDG-DGOO-K-6B	DIESEL GENERATOR 1-2 OUT OF SERVICE
		5.50E-02	HPI-AVOA-NPSH-VS-FR	OP FT ALGN HPSI SUBCLG FOR NON- LB/MB/SB LOCA (CR) (HEP)
		1.00E+00	TR-MCND-AV-17_LBL	Sequence Label
16	8.58E-07	1.02E-03	23_FBF00-B	EA-13 - 2400V Switchgear (non HEAF) Scenario. Fire is not suppressed prior to pr
		2.90E-02	EDG-DGOA-LDSHD_L-FR	OP FT ALGN EDG'S-LD SHD FAILS FOR NON-SIS EVNTS (LOC) (HEP)
		1.00E+00	EDG-DGOA-LDSHD_M-FR	OP FT ALGN EDG'S-LD SHD FAILS FOR NON-SIS EVNTS (LOC) (HEP)
		2.90E-02	EDG-DGOA-LOADSHD-FR	OP FT ALGN EDG'S-LD SHD FAILS FOR NON-SIS EVNTS (LOC) (HEP)
		1.00E+00	EDG-DGOA-LOCMAN-FR	OP FT ESTABLISH LOCAL MANUAL CONTROL OF EDG 1-1 (LOC) (HEP)
		1.00E+00	TR-MCND-AV-20_LBL	Sequence Label

Post-Transition Plant – FA-23 (Turbine Building) – Scenario 23_FAO00-B – Top Five Cutsets - CDF				
#	Cutset Prob	Event Prob	Event	Description
2	1.46E-08	7.16E-04	23_FAO00-B	EA-21 4160 V (non HEAF) Scenario. Fire is not suppressed prior to propagation t
		9.20E-03	AFW-PMOT-P-8D_M-FR	OP FT ALGN & OPERATE P-8D GIVEN NON-SBO EVENTS (LOC) (HEP)
		1.00E+00	EDG-DGOA-LDSHD_M-FR	OP FT ALGN EDG'S-LD SHD FAILS FOR NON-SIS EVNTS (LOC) (HEP)
		2.90E-02	EDG-DGOA-LOADSHD-FR	OP FT ALGN EDG'S-LD SHD FAILS FOR NON-SIS EVNTS (LOC) (HEP)
		1.00E+00	EDG-DGOA-LOCMAN-FR	OP FT ESTABLISH LOCAL MANUAL CONTROL OF EDG 1-1 (LOC) (HEP)

Post-Transition Plant – FA-23 (Turbine Building) – Scenario 23_FAO00-B – Top Five Cutsets - CDF				
#	Cutset Prob	Event Prob	Event	Description
		7.62E-02	PZR-RVMB-RV-1041-DEV	PZR SAFETY VALVE RV-1041 FTC (ON SUBSEQUENT DEMANDS) (Dev Event)
		1.00E+00	TR-MCND-AV-21-32_LBL	Sequence Label
8	9.97E-09	7.16E-04	23_FAO00-B	EA-21 4160 V (non HEAF) Scenario. Fire is not suppressed prior to propagation t
		6.30E-03	CVC-PMOA-P55-TRP-FR	OP FT STOP CHARGING PUMP OPERATION (CR) (HEP)
		2.90E-02	EDG-DGOA-LOADSHD-FR	OP FT ALGN EDG'S-LD SHD FAILS FOR NON-SIS EVNTS (LOC) (HEP)
		1.00E+00	EDG-DGOA-LOCMAN-FR	OP FT ESTABLISH LOCAL MANUAL CONTROL OF EDG 1-1 (LOC) (HEP)
		1.00E+00	LOC-FLG-CNSEQ-ETREES	IF "1" - EVENT ADDED TO CNSQ LOCA ETREES/PREVNT SUBSUMING (Flag Event)
		7.62E-02	PZR-RVMB-RV-1041-DEV	PZR SAFETY VALVE RV-1041 FTC (ON SUBSEQUENT DEMANDS) (Dev Event)
		1.00E+00	TR-MCND-AV-27-32_LBL	Sequence Label
9	8.85E-09	7.16E-04	23_FAO00-B	EA-21 4160 V (non HEAF) Scenario. Fire is not suppressed prior to propagation t
		9.20E-03	AFW-PMOT-P-8D_M-FR	OP FT ALGN & OPERATE P-8D GIVEN NON-SBO EVENTS (LOC) (HEP)
		1.00E+00	EDG-DGOA-LDSHD_M-FR	OP FT ALGN EDG'S-LD SHD FAILS FOR NON-SIS EVNTS (LOC) (HEP)
		2.90E-02	EDG-DGOA-LOADSHD-FR	OP FT ALGN EDG'S-LD SHD FAILS FOR NON-SIS EVNTS (LOC) (HEP)
		1.00E+00	EDG-DGOA-LOCMAN-FR	OP FT ESTABLISH LOCAL MANUAL CONTROL OF EDG 1-1 (LOC) (HEP)
		4.63E-02	PZR-RVMB-RV-1041	PZR (T-72) SAFETY VALVE RV-1041 FTC (AFTER INITIAL DEMAND)
		1.00E+00	TR-MCND-AV-21-32_LBL	Sequence Label
15	7.67E-09	7.16E-04	23_FAO00-B	EA-21 4160 V (non HEAF) Scenario. Fire is not suppressed prior to propagation t
		4.20E-03	AFW-PMOT-P-8D_L-FR	OP FT ALGN & OPERATE P-8D GIVEN FPIE NON-SBO EVENTS (HEP)
		2.55E-03	EDG-C1MA-S-965	DISCONNECT AT P-965 FAILS TO OPEN
		1.00E+00	TR-MCND-AV-14_LBL	Sequence Label
21	6.06E-09	7.16E-04	23_FAO00-B	EA-21 4160 V (non HEAF) Scenario. Fire is not suppressed prior to propagation t
		6.30E-03	CVC-PMOA-P55-TRP-FR	OP FT STOP CHARGING PUMP OPERATION (CR) (HEP)
		2.90E-02	EDG-DGOA-LOADSHD-FR	OP FT ALGN EDG'S-LD SHD FAILS FOR NON-SIS EVNTS (LOC) (HEP)
		1.00E+00	EDG-DGOA-LOCMAN-FR	OP FT ESTABLISH LOCAL MANUAL CONTROL OF EDG 1-1 (LOC) (HEP)
		1.00E+00	LOC-FLG-CNSEQ-ETREES	IF "1" - EVENT ADDED TO CNSQ LOCA ETREES/PREVNT SUBSUMING (Flag Event)
		4.63E-02	PZR-RVMB-RV-1041	PZR (T-72) SAFETY VALVE RV-1041 FTC (AFTER INITIAL DEMAND)
		1.00E+00	TR-MCND-AV-27-32_LBL	Sequence Label

Compliant Plant – FA-23 (Turbine Building) – Scenario 23_FAO00-B – Top Five Cutsets - CDF				
#	Cutset Prob	Event Prob	Event	Description
6	1.58E-06	7.16E-04	23_FAO00-B	EA-21 4160 V (non HEAF) Scenario. Fire is not suppressed prior to propagation t
		1.00E+00	EDG-DGOA-LDSHD_M-FR	OP FT ALGN EDG'S-LD SHD FAILS FOR NON-SIS EVNTS (LOC) (HEP)
		2.90E-02	EDG-DGOA-LOADSHD-FR	OP FT ALGN EDG'S-LD SHD FAILS FOR NON-SIS EVNTS (LOC) (HEP)
		1.00E+00	EDG-DGOA-LOCMAN-FR	OP FT ESTABLISH LOCAL MANUAL CONTROL OF EDG 1-1 (LOC) (HEP)

Compliant Plant – FA-23 (Turbine Building) – Scenario 23_FAO00-B – Top Five Cutsets - CDF				
#	Cutset Prob	Event Prob	Event	Description
		7.62E-02	PZR-RVMB-RV-1041-DEV	PZR SAFETY VALVE RV-1041 FTC (ON SUBSEQUENT DEMANDS) (Dev Event)
		1.00E+00	TR-MCND-AV-21-32_LBL	Sequence Label
13	1.01E-06	7.16E-04	23_FAO00-B	EA-21 4160 V (non HEAF) Scenario. Fire is not suppressed prior to propagation t
		2.57E-02	EDG-DGMG-K-6B	DIESEL GENERATOR 1-2 FAILS TO RUN
		5.50E-02	HPI-AVOA-NPSH-VS-FR	OP FT ALGN HPSI SUBCLG FOR NON- LB/MB/SB LOCA (CR) (HEP)
		1.00E+00	TR-MCND-AV-17_LBL	Sequence Label
14	9.61E-07	7.16E-04	23_FAO00-B	EA-21 4160 V (non HEAF) Scenario. Fire is not suppressed prior to propagation t
		1.00E+00	EDG-DGOA-LDSHD_M-FR	OP FT ALGN EDG'S-LD SHD FAILS FOR NON-SIS EVNTS (LOC) (HEP)
		2.90E-02	EDG-DGOA-LOADSHD-FR	OP FT ALGN EDG'S-LD SHD FAILS FOR NON-SIS EVNTS (LOC) (HEP)
		1.00E+00	EDG-DGOA-LOCMAN-FR	OP FT ESTABLISH LOCAL MANUAL CONTROL OF EDG 1-1 (LOC) (HEP)
		4.63E-02	PZR-RVMB-RV-1041	PZR (T-72) SAFETY VALVE RV-1041 FTC (AFTER INITIAL DEMAND)
		1.00E+00	TR-MCND-AV-21-32_LBL	Sequence Label
19	7.25E-07	7.16E-04	23_FAO00-B	EA-21 4160 V (non HEAF) Scenario. Fire is not suppressed prior to propagation t
		1.84E-02	EDG-DGOO-K-6B	DIESEL GENERATOR 1-2 OUT OF SERVICE
		5.50E-02	HPI-AVOA-NPSH-VS-FR	OP FT ALGN HPSI SUBCLG FOR NON- LB/MB/SB LOCA (CR) (HEP)
		1.00E+00	TR-MCND-AV-17_LBL	Sequence Label
25	6.02E-07	7.16E-04	23_FAO00-B	EA-21 4160 V (non HEAF) Scenario. Fire is not suppressed prior to propagation t
		2.90E-02	EDG-DGOA-LDSHD_L-FR	OP FT ALGN EDG'S-LD SHD FAILS FOR NON-SIS EVNTS (LOC) (HEP)
		1.00E+00	EDG-DGOA-LDSHD_M-FR	OP FT ALGN EDG'S-LD SHD FAILS FOR NON-SIS EVNTS (LOC) (HEP)
		2.90E-02	EDG-DGOA-LOADSHD-FR	OP FT ALGN EDG'S-LD SHD FAILS FOR NON-SIS EVNTS (LOC) (HEP)
		1.00E+00	EDG-DGOA-LOCMAN-FR	OP FT ESTABLISH LOCAL MANUAL CONTROL OF EDG 1-1 (LOC) (HEP)
		1.00E+00	TR-MCND-AV-20_LBL	Sequence Label

Post-Transition Plant – FA-02 (Cable Spreading Room) – Scenario 02_FAQ-2B – Top Five Cutsets - CDF				
#	Cutset Prob	Event Prob	Event	Description
1	1.99E-06	3.01E-04	02_FAQ-2B	EB-12 480V Load Center - Fire is not suppressed prior to damage of first target
		1.00E+00	LOC-FLG-CNSEQ-ETREES	IF "1" - EVENT ADDED TO CNSQ LOCA ETREES/PREVNT SUBSUMING (Flag Event)
		6.60E-03	PCP-PMOF-P-50X-FR	OP FT TRIP PCP'S GIVEN LOSS OF CCW SEAL CLNG (CR) (HEP)
		1.00E+00	TR-MCND-AV-25-17_LBL	Sequence Label
3	3.13E-07	3.01E-04	02_FAQ-2B	EB-12 480V Load Center - Fire is not suppressed prior to damage of first target
		1.00E+00	LOC-FLG-CNSEQ-ETREES	IF "1" - EVENT ADDED TO CNSQ LOCA ETREES/PREVNT SUBSUMING (Flag Event)
		1.04E-03	PCP-PMMT-CCW-M-1	MULTIPLE SEAL FAILRE DURING A LOSS OF CCW W CBO ISOLA (Dev Event)
		1.00E+00	TR-MCND-AV-25-17_LBL	Sequence Label
4	3.01E-07	3.01E-04	02_FAQ-2B	EB-12 480V Load Center - Fire is not suppressed prior to damage of first target

Post-Transition Plant – FA-02 (Cable Spreading Room) – Scenario 02_FAQ-2B – Top Five Cutsets - CDF				
#	Cutset Prob	Event Prob	Event	Description
		9.99E-04	CVC-AVMB-CV-2003	LETDOWN ORIFICE STOP VALVE CV-2003 FTC
		1.00E+00	LOC-FLG-CNSEQ-ETREES	IF "1" - EVENT ADDED TO CNSQ LOCA ETREES/PREVNT SUBSUMING (Flag Event)
		1.00E+00	TR-MCND-AV-22-18-32_LBL	Sequence Label
5	2.87E-07	3.01E-04	02_FAQ-2B	EB-12 480V Load Center - Fire is not suppressed prior to damage of first target
		9.54E-04	CVC-KVMA-SV-2003	LETDOWN ORIFICE ISOL SV-2003 FAILS TO DEENERGIZE
		1.00E+00	LOC-FLG-CNSEQ-ETREES	IF "1" - EVENT ADDED TO CNSQ LOCA ETREES/PREVNT SUBSUMING (Flag Event)
		1.00E+00	TR-MCND-AV-22-18-32_LBL	Sequence Label
6	2.18E-07	3.01E-04	02_FAQ-2B	EB-12 480V Load Center - Fire is not suppressed prior to damage of first target
		1.00E+00	LOC-FLG-CNSEQ-ETREES	IF "1" - EVENT ADDED TO CNSQ LOCA ETREES/PREVNT SUBSUMING (Flag Event)
		7.25E-04	PCP-PMMT-CCW-M-2	MULTIPLE SEAL FAILRE DURING A LOSS OF CCW W/O CBO ISOLA (Dev Event)
		1.00E+00	TR-MCND-AV-25-17_LBL	Sequence Label

Compliant Plant – FA-02 (Cable Spreading Room) – Scenario 02_FAQ-2B – Top Five Cutsets - CDF				
#	Cutset Prob	Event Prob	Event	Description
1	1.99E-06	3.01E-04	02_FAQ-2B	EB-12 480V Load Center - Fire is not suppressed prior to damage of first target
		1.00E+00	LOC-FLG-CNSEQ-ETREES	IF "1" - EVENT ADDED TO CNSQ LOCA ETREES/PREVNT SUBSUMING (Flag Event)
		6.60E-03	PCP-PMOF-P-50X-FR	OP FT TRIP PCP'S GIVEN LOSS OF CCW SEAL CLNG (CR) (HEP)
		1.00E+00	TR-MCND-AV-25-17_LBL	Sequence Label
2	7.11E-07	3.01E-04	02_FAQ-2B	EB-12 480V Load Center - Fire is not suppressed prior to damage of first target
		3.10E-02	ADV-XVOB-MAN_M-FR	OP FT CLOSE MANUAL VALVES TO ISOLATE ADV (LOC) (HEP)
		1.00E+00	ESD-FLG-2SG-BLDN-B	SET TO "1" - ESDE W/2 SG BLWDWN W/AFW FEEDING 50B (Flag Event)
		1.00E+00	ESD-FLG-SGA-BLDN	SET TO "1" - ESDE ON SG E-50A (Flag Event)
		7.62E-02	PZR-RVMB-RV-1041-DEV	PZR SAFETY VALVE RV-1041 FTC (ON SUBSEQUENT DEMANDS) (Dev Event)
		1.00E+00	TR-MCND-AV-21-32_LBL	Sequence Label
5	5.60E-07	3.01E-04	02_FAQ-2B	EB-12 480V Load Center - Fire is not suppressed prior to damage of first target
		3.10E-02	ADV-XVOB-MAN_L-FR	OP FT CLOSE MANUAL VALVES TO ISOLATE ADV (LOC) (HEP)
		6.00E-02	AFW-PMOE-EC150_L-FR	OP FT XFR AFW PP START TO C-150 PNL (SCRNING VAL) (LOC) (HEP)
		1.00E+00	E50-FLG-LVL-INSTR-AV	IF "1" - PLACEHOLDER EC-150 INSTR CREDIT (Flag Event)
		1.00E+00	ESD-FLG-SGA-BLDN	SET TO "1" - ESDE ON SG E-50A (Flag Event)
		1.00E+00	TR-MCND-AV-14_LBL	Sequence Label
6	5.51E-07	3.01E-04	02_FAQ-2B	EB-12 480V Load Center - Fire is not suppressed prior to damage of first target
		3.10E-02	ADV-XVOB-MAN_L-FR	OP FT CLOSE MANUAL VALVES TO ISOLATE ADV (LOC) (HEP)
		5.90E-02	AFW-PMOE-P-990_L-FR	OP FT ALGN THE B.5.b PUMP FOR S/G MAKEUP (LOC) (HEP)
		1.00E+00	ESD-FLG-SGA-BLDN	SET TO "1" - ESDE ON SG E-50A (Flag Event)

Compliant Plant – FA-02 (Cable Spreading Room) – Scenario 02_FAQ-2B – Top Five Cutsets - CDF				
#	Cutset Prob	Event Prob	Event	Description
		1.00E+00	TR-MCND-AV-14_LBL	Sequence Label
9	4.32E-07	3.01E-04	02_FAQ-2B	EB-12 480V Load Center - Fire is not suppressed prior to damage of first target
		3.10E-02	ADV-XVOB-MAN_M-FR	OP FT CLOSE MANUAL VALVES TO ISOLATE ADV (LOC) (HEP)
		1.00E+00	ESD-FLG-2SG-BLDN-B	SET TO "1" - ESDE W/2 SG BLWDWN W/AFW FEEDING 50B (Flag Event)
		1.00E+00	ESD-FLG-SGA-BLDN	SET TO "1" - ESDE ON SG E-50A (Flag Event)
		4.63E-02	PZR-RVMB-RV-1041	PZR (T-72) SAFETY VALVE RV-1041 FTC (AFTER INITIAL DEMAND)
		1.00E+00	TR-MCND-AV-21-32_LBL	Sequence Label

Post-Transition Plant – FA-02 (Cable Spreading Room) – Scenario 02_FBC-1 – Top Five Cutsets - CDF				
#	Cutset Prob	Event Prob	Event	Description
2	6.27E-07	6.27E-05	02_FBC-1	EY-01 Instrument AC Panel - No propagation to overhead trays.
		1.00E+00	CVC-AVOB-CV-2001-FR	OP FT CLOSE CV-2001 ON HI TEMP AT LETDWN HX E-58 (CR) (HEP)
		1.00E-02	CVC-AVOB-CV-2009-FR	OP FAILS TO CLOSE CV-2009 (CR) (HEP)
		1.00E+00	CVC-PMOE-P-55ABC-FR	OP FT INITIATE CHARGING FLOW (CR) (HEP)
		1.00E+00	CVC-PMOE-P-55B-FR	OP FT ALGN CHARGING FOR SGTR (CR) (HEP)
		1.00E+00	HPI-PMOE-HPSI-FR	OP FAILS TO INITIATE HPSI AFTER AUTO START FAILURE (CR) (HEP)
		1.00E+00	LOC-FLG-CNSEQ-ETREES	IF "1" - EVENT ADDED TO CNSQ LOCA ETREES/PREVNT SUBSUMING (Flag Event)
		1.00E+00	TR-MCND-AV-22-02-19_LBL	Sequence Label
22	6.26E-08	6.27E-05	02_FBC-1	EY-01 Instrument AC Panel - No propagation to overhead trays.
		9.99E-04	CVC-AVMB-CV-2009	PCS LETDOWN ISOLATION VALVE CV-2009 FAILS TO CLOSE
		1.00E+00	CVC-AVOB-CV-2001-FR	OP FT CLOSE CV-2001 ON HI TEMP AT LETDWN HX E-58 (CR) (HEP)
		1.00E+00	CVC-PMOE-P-55ABC-FR	OP FT INITIATE CHARGING FLOW (CR) (HEP)
		1.00E+00	CVC-PMOE-P-55B-FR	OP FT ALGN CHARGING FOR SGTR (CR) (HEP)
		1.00E+00	HPI-PMOE-HPSI-FR	OP FAILS TO INITIATE HPSI AFTER AUTO START FAILURE (CR) (HEP)
		1.00E+00	LOC-FLG-CNSEQ-ETREES	IF "1" - EVENT ADDED TO CNSQ LOCA ETREES/PREVNT SUBSUMING (Flag Event)
		1.00E+00	TR-MCND-AV-22-02-19_LBL	Sequence Label
53	3.01E-08	6.27E-05	02_FBC-1	EY-01 Instrument AC Panel - No propagation to overhead trays.
		1.00E+00	CIS-AVOB-VLVS-CR-FR	OP FT CLOSE CONTAINMENT ISOLATION VALVES (CR) (HEP)
		6.30E-03	CVC-PMOA-P55-TRP-FR	OP FT STOP CHARGING PUMP OPERATION (CR) (HEP)
		1.00E+00	HPI-AVOA-NPSH-MB-FR	OP FT ALGN HPSI SUBCLG FOR MB/SBLOCA (CR) (HEP)
		1.00E+00	LOC-FLG-CNSEQ-ETREES	IF "1" - EVENT ADDED TO CNSQ LOCA ETREES/PREVNT SUBSUMING (Flag Event)
		7.62E-02	PZR-RVMB-RV-1041-DEV	PZR SAFETY VALVE RV-1041 FTC (ON SUBSEQUENT DEMANDS) (Dev Event)
		1.00E+00	TR-MCND-AV-27-27_LBL	Sequence Label
83	1.83E-08	6.27E-05	02_FBC-1	EY-01 Instrument AC Panel - No propagation to overhead trays.

Post-Transition Plant – FA-02 (Cable Spreading Room) – Scenario 02_FBC-1 – Top Five Cutsets - CDF				
#	Cutset Prob	Event Prob	Event	Description
		1.00E+00	CIS-AVOB-VLVS-CR-FR	OP FT CLOSE CONTAINMENT ISOLATION VALVES (CR) (HEP)
		6.30E-03	CVC-PMOA-P55-TRP-FR	OP FT STOP CHARGING PUMP OPERATION (CR) (HEP)
		1.00E+00	HPI-AVOA-NPSH-MB-FR	OP FT ALGN HPSI SUBCLG FOR MB/SBLOCA (CR) (HEP)
		1.00E+00	LOC-FLG-CNSEQ-ETREES	IF "1" - EVENT ADDED TO CNSQ LOCA ETREES/PREVNT SUBSUMING (Flag Event)
		4.63E-02	PZR-RVMB-RV-1041	PZR (T-72) SAFETY VALVE RV-1041 FTC (AFTER INITIAL DEMAND)
		1.00E+00	TR-MCND-AV-27-27_LBL	Sequence Label
237	5.25E-09	6.27E-05	02_FBC-1	EY-01 Instrument AC Panel - No propagation to overhead trays.
		6.30E-03	CVC-PMOA-P55-TRP-FR	OP FT STOP CHARGING PUMP OPERATION (CR) (HEP)
		1.00E+00	LOC-FLG-CNSEQ-ETREES	IF "1" - EVENT ADDED TO CNSQ LOCA ETREES/PREVNT SUBSUMING (Flag Event)
		1.33E-02	PZR-RVCC-1039-40-41MB	MULT PZR SAFTY VALVES FTC CC (ON 10 SUBSEQUENT DEMANDS) (Dev Event)
		1.00E+00	TR-MCND-AV-24-4_LBL	Sequence Label

Compliant Plant – FA-02 (Cable Spreading Room) – Scenario 02_FBC-1 – Top Five Cutsets - CDF				
#	Cutset Prob	Event Prob	Event	Description
3	6.27E-07	6.27E-05	02_FBC-1	EY-01 Instrument AC Panel - No propagation to overhead trays.
		1.00E+00	CVC-AVOB-CV-2001-FR	OP FT CLOSE CV-2001 ON HI TEMP AT LETDWN HX E-58 (CR) (HEP)
		1.00E-02	CVC-AVOB-CV-2009-FR	OP FAILS TO CLOSE CV-2009 (CR) (HEP)
		1.00E+00	CVC-PMOE-P-55ABC-FR	OP FT INITIATE CHARGING FLOW (CR) (HEP)
		1.00E+00	CVC-PMOE-P-55B-FR	OP FT ALGN CHARGING FOR SGTR (CR) (HEP)
		1.00E+00	HPI-PMOE-HPSI-FR	OP FAILS TO INITIATE HPSI AFTER AUTO START FAILURE (CR) (HEP)
		1.00E+00	LOC-FLG-CNSEQ-ETREES	IF "1" - EVENT ADDED TO CNSQ LOCA ETREES/PREVNT SUBSUMING (Flag Event)
		1.00E+00	TR-MCND-AV-22-02-19_LBL	Sequence Label
92	6.26E-08	6.27E-05	02_FBC-1	EY-01 Instrument AC Panel - No propagation to overhead trays.
		9.99E-04	CVC-AVMB-CV-2009	PCS LETDOWN ISOLATION VALVE CV-2009 FAILS TO CLOSE
		1.00E+00	CVC-AVOB-CV-2001-FR	OP FT CLOSE CV-2001 ON HI TEMP AT LETDWN HX E-58 (CR) (HEP)
		1.00E+00	CVC-PMOE-P-55ABC-FR	OP FT INITIATE CHARGING FLOW (CR) (HEP)
		1.00E+00	CVC-PMOE-P-55B-FR	OP FT ALGN CHARGING FOR SGTR (CR) (HEP)
		1.00E+00	HPI-PMOE-HPSI-FR	OP FAILS TO INITIATE HPSI AFTER AUTO START FAILURE (CR) (HEP)
		1.00E+00	LOC-FLG-CNSEQ-ETREES	IF "1" - EVENT ADDED TO CNSQ LOCA ETREES/PREVNT SUBSUMING (Flag Event)
		1.00E+00	TR-MCND-AV-22-02-19_LBL	Sequence Label
202	3.01E-08	6.27E-05	02_FBC-1	EY-01 Instrument AC Panel - No propagation to overhead trays.
		1.00E+00	CIS-AVOB-VLVS-CR-FR	OP FT CLOSE CONTAINMENT ISOLATION VALVES (CR) (HEP)
		6.30E-03	CVC-PMOA-P55-TRP-FR	OP FT STOP CHARGING PUMP OPERATION (CR) (HEP)
		1.00E+00	HPI-AVOA-NPSH-MB-FR	OP FT ALGN HPSI SUBCLG FOR MB/SBLOCA (CR) (HEP)

Compliant Plant – FA-02 (Cable Spreading Room) – Scenario 02_FBC-1 – Top Five Cutsets - CDF				
#	Cutset Prob	Event Prob	Event	Description
		1.00E+00	LOC-FLG-CNSEQ-ETREES	IF "1" - EVENT ADDED TO CNSQ LOCA ETREES/PREVNT SUBSUMING (Flag Event)
		7.62E-02	PZR-RVMB-RV-1041-DEV	PZR SAFETY VALVE RV-1041 FTC (ON SUBSEQUENT DEMANDS) (Dev Event)
		1.00E+00	TR-MCND-AV-27-27_LBL	Sequence Label
297	1.83E-08	6.27E-05	02_FBC-1	EY-01 Instrument AC Panel - No propagation to overhead trays.
		1.00E+00	CIS-AVOB-VLVS-CR-FR	OP FT CLOSE CONTAINMENT ISOLATION VALVES (CR) (HEP)
		6.30E-03	CVC-PMOA-P55-TRP-FR	OP FT STOP CHARGING PUMP OPERATION (CR) (HEP)
		1.00E+00	HPI-AVOA-NPSH-MB-FR	OP FT ALGN HPSI SUBCLG FOR MB/SBLOCA (CR) (HEP)
		1.00E+00	LOC-FLG-CNSEQ-ETREES	IF "1" - EVENT ADDED TO CNSQ LOCA ETREES/PREVNT SUBSUMING (Flag Event)
		4.63E-02	PZR-RVMB-RV-1041	PZR (T-72) SAFETY VALVE RV-1041 FTC (AFTER INITIAL DEMAND)
		1.00E+00	TR-MCND-AV-27-27_LBL	Sequence Label
986	5.25E-09	6.27E-05	02_FBC-1	EY-01 Instrument AC Panel - No propagation to overhead trays.
		6.30E-03	CVC-PMOA-P55-TRP-FR	OP FT STOP CHARGING PUMP OPERATION (CR) (HEP)
		1.00E+00	LOC-FLG-CNSEQ-ETREES	IF "1" - EVENT ADDED TO CNSQ LOCA ETREES/PREVNT SUBSUMING (Flag Event)
		1.33E-02	PZR-RVCC-1039-40-41MB	MULT PZR SAFTY VALVES FTC CC (ON 10 SUBSEQUENT DEMANDS) (Dev Event)
		1.00E+00	TR-MCND-AV-24-4_LBL	Sequence Label

Post-Transition Plant – FA-23 (Turbine Building) – Scenario 23_FBF00-B – Top Five Cutsets - LERF				
#	Cutset Prob	Event Prob	Event	Description
1	2.38E-10	1.02E-03	23_FBF00-B	EA-13 - 2400V Switchgear (non HEAF) Scenario. Fire is not suppressed prior to pr
		9.20E-03	AFW-PMOT-P-8D_M-FR	OP FT ALGN & OPERATE P-8D GIVEN NON-SBO EVENTS (LOC) (HEP)
		1.00E+00	EDG-DGOA-LDSHD_M-FR	OP FT ALGN EDG'S-LD SHD FAILS FOR NON-SIS EVNTS (LOC) (HEP)
		2.90E-02	EDG-DGOA-LOADSHD-FR	OP FT ALGN EDG'S-LD SHD FAILS FOR NON-SIS EVNTS (LOC) (HEP)
		1.00E+00	EDG-DGOA-LOCMAN-FR	OP FT ESTABLISH LOCAL MANUAL CONTROL OF EDG 1-1 (LOC) (HEP)
		1.00E-02	-PHE-AVOB-ISO-SG-FR	OPERATOR ACTION TO ISOLATE SG ADVS
		0.00E+00	-PHE-PPMC-LOOPSEAL-CLEAR	LOOP SEAL AND CORE BARREL CLEARED
		1.16E-02	PHE-TBMJ-HI-HI	TI-SGTR | HI PRES & INTACT LOOP SEAL / HI PRES & INTACT LOOP SEAL
		7.62E-02	PZR-RVMB-RV-1041-DEV	PZR SAFETY VALVE RV-1041 FTC (ON SUBSEQUENT DEMANDS) (Dev Event)
		1.00E+00	TR-MCND-AV-21-32_LBL	Sequence Label
7	1.63E-10	1.02E-03	23_FBF00-B	EA-13 - 2400V Switchgear (non HEAF) Scenario. Fire is not suppressed prior to pr
		6.30E-03	CVC-PMOA-P55-TRP-FR	OP FT STOP CHARGING PUMP OPERATION (CR) (HEP)
		1.00E+00	EDG-DGOA-LDSHD_M-FR	OP FT ALGN EDG'S-LD SHD FAILS FOR NON-SIS EVNTS (LOC) (HEP)
		2.90E-02	EDG-DGOA-LOADSHD-FR	OP FT ALGN EDG'S-LD SHD FAILS FOR NON-SIS EVNTS (LOC) (HEP)
		1.00E+00	EDG-DGOA-LOCMAN-FR	OP FT ESTABLISH LOCAL MANUAL CONTROL OF EDG 1-1 (LOC) (HEP)
		1.00E+00	LOC-FLG-CNSEQ-ETREES	IF "1" - EVENT ADDED TO CNSQ LOCA ETREES/PREVNT SUBSUMING (Flag Event)

Post-Transition Plant – FA-23 (Turbine Building) – Scenario 23_FBF00-B – Top Five Cutsets - LERF				
#	Cutset Prob	Event Prob	Event	Description
		1.00E-02	-PHE-AVOB-ISO-SG-FR	OPERATOR ACTION TO ISOLATE SG ADVS
		0.00E+00	-PHE-PPMC-LOOPSEAL-CLEAR	LOOP SEAL AND CORE BARREL CLEARED
		1.16E-02	PHE-TBMJ-HI-HI	TI-SGTR | HI PRES & INTACT LOOP SEAL / HI PRES & INTACT LOOP SEAL
		7.62E-02	PZR-RVMB-RV-1041-DEV	PZR SAFETY VALVE RV-1041 FTC (ON SUBSEQUENT DEMANDS) (Dev Event)
		1.00E+00	TR-MCND-AV-27-32_LBL	Sequence Label
8	1.51E-10	1.02E-03	23_FBF00-B	EA-13 - 2400V Switchgear (non HEAF) Scenario. Fire is not suppressed prior to pr
		8.75E-06	EDC-BYCC-ED-0102-MB	CC EVENT: ED-01 ED-02
		1.00E+00	EDC-C1OA-72-0102-FR	OP FTO SHNT TRIPS (72-01 & 72-02) TO SHED DC LOADS (LOC) (HEP)
		1.00E+00	EDG-DGOA-K-15-FR	OP FT ALIGN B.5.B K-15 GENERATOR TO POWER EC-150 (LOC) (HEP)
		1.00E+00	LOC-FLG-CNSEQ-ETREES	IF "1" - EVENT ADDED TO CNSQ LOCA ETREES/PREVNT SUBSUMING (Flag Event)
		1.00E-02	-PHE-AVOB-ISO-SG-FR	OPERATOR ACTION TO ISOLATE SG ADVS
		0.00E+00	-PHE-PPMC-LOOPSEAL-CLEAR	LOOP SEAL AND CORE BARREL CLEARED
		2.39E-01	PHE-TBMJ-LI-LI	TI-SGTR | LO PRES & INTACT LOOP SEAL / LO PRES & INTACT LOOP SEAL
		5.99E-02	-PHE-TBMJ-PI-2D	PRESSURE-INDUCED STEAM GENERATOR TUBE RUPTURE GIVEN 2 DEPRESS SGS
		7.62E-02	PZR-RVMB-RV-1041-DEV	PZR SAFETY VALVE RV-1041 FTC (ON SUBSEQUENT DEMANDS) (Dev Event)
		1.00E+00	TR-MCND-AV-27-32_LBL	Sequence Label
9	1.45E-10	1.02E-03	23_FBF00-B	EA-13 - 2400V Switchgear (non HEAF) Scenario. Fire is not suppressed prior to pr
		9.20E-03	AFW-PMOT-P-8D_M-FR	OP FT ALGN & OPERATE P-8D GIVEN NON-SBO EVENTS (LOC) (HEP)
		1.00E+00	EDG-DGOA-LDSHD_M-FR	OP FT ALGN EDG'S-LD SHD FAILS FOR NON-SIS EVNTS (LOC) (HEP)
		2.90E-02	EDG-DGOA-LOADSHD-FR	OP FT ALGN EDG'S-LD SHD FAILS FOR NON-SIS EVNTS (LOC) (HEP)
		1.00E+00	EDG-DGOA-LOCMAN-FR	OP FT ESTABLISH LOCAL MANUAL CONTROL OF EDG 1-1 (LOC) (HEP)
		1.00E-02	-PHE-AVOB-ISO-SG-FR	OPERATOR ACTION TO ISOLATE SG ADVS
		0.00E+00	-PHE-PPMC-LOOPSEAL-CLEAR	LOOP SEAL AND CORE BARREL CLEARED
		1.16E-02	PHE-TBMJ-HI-HI	TI-SGTR | HI PRES & INTACT LOOP SEAL / HI PRES & INTACT LOOP SEAL
		4.63E-02	PZR-RVMB-RV-1041	PZR (T-72) SAFETY VALVE RV-1041 FTC (AFTER INITIAL DEMAND)
		1.00E+00	TR-MCND-AV-21-32_LBL	Sequence Label
13	1.26E-10	1.02E-03	23_FBF00-B	EA-13 - 2400V Switchgear (non HEAF) Scenario. Fire is not suppressed prior to pr
		4.20E-03	AFW-PMOT-P-8D_L-FR	OP FT ALGN & OPERATE P-8D GIVEN FPIE NON-SBO EVENTS (HEP)
		2.55E-03	EDG-C1MA-S-965	DISCONNECT AT P-965 FAILS TO OPEN
		1.00E+00	EDG-DGOA-LDSHD_M-FR	OP FT ALGN EDG'S-LD SHD FAILS FOR NON-SIS EVNTS (LOC) (HEP)
		1.00E-02	-PHE-AVOB-ISO-SG-FR	OPERATOR ACTION TO ISOLATE SG ADVS
		0.00E+00	-PHE-PPMC-LOOPSEAL-CLEAR	LOOP SEAL AND CORE BARREL CLEARED
		1.16E-02	PHE-TBMJ-HI-HI	TI-SGTR | HI PRES & INTACT LOOP SEAL / HI PRES & INTACT LOOP SEAL
		1.00E+00	TR-MCND-AV-14_LBL	Sequence Label

Compliant Plant – FA-23 (Turbine Building) – Scenario 23_FBF00-B – Top Five Cutsets - LERF				
#	Cutset Prob	Event Prob	Event	Description
7	2.62E-08	1.02E-03	23_FBF00-B	EA-13 - 2400V Switchgear (non HEAF) Scenario. Fire is not suppressed prior to pr
		1.00E-03	CIS-GKOL-HATCH	PRE-INIT: EQUIPMENT HATCH DOOR/SEAL LEFT OPENED (HEP)
		2.57E-02	EDG-DGMG-K-6B	DIESEL GENERATOR 1-2 FAILS TO RUN
		1.00E+00	HPI-AVOB-CV-300X-FR	OP FT CLOSE 1 OF 2 OPEN SPRAY VALVES - CSS NPSH(CR) (HEP)
		1.00E+00	TR-MCND-AV-18_LBL	Sequence Label
8	2.62E-08	1.02E-03	23_FBF00-B	EA-13 - 2400V Switchgear (non HEAF) Scenario. Fire is not suppressed prior to pr
		1.00E-03	CIS-GKOL-MZ-18	PRE-INIT: FUEL TRANSFER TUBE 36 (MZ-18) LEFT OPEN (HEP)
		2.57E-02	EDG-DGMG-K-6B	DIESEL GENERATOR 1-2 FAILS TO RUN
		1.00E+00	HPI-AVOB-CV-300X-FR	OP FT CLOSE 1 OF 2 OPEN SPRAY VALVES - CSS NPSH(CR) (HEP)
		1.00E+00	TR-MCND-AV-18_LBL	Sequence Label
9	2.59E-08	1.02E-03	23_FBF00-B	EA-13 - 2400V Switchgear (non HEAF) Scenario. Fire is not suppressed prior to pr
		1.00E+00	EDG-DGOA-LDSHD_M-FR	OP FT ALGN EDG'S-LD SHD FAILS FOR NON-SIS EVNTS (LOC) (HEP)
		2.90E-02	EDG-DGOA-LOADSHD-FR	OP FT ALGN EDG'S-LD SHD FAILS FOR NON-SIS EVNTS (LOC) (HEP)
		1.00E+00	EDG-DGOA-LOCMAN-FR	OP FT ESTABLISH LOCAL MANUAL CONTROL OF EDG 1-1 (LOC) (HEP)
		1.00E-02	-PHE-AVOB-ISO-SG-FR	OPERATOR ACTION TO ISOLATE SG ADVS
		0.00E+00	-PHE-PPMC-LOOPSEAL-CLEAR	LOOP SEAL AND CORE BARREL CLEARED
		1.16E-02	PHE-TBMJ-HI-HI	TI-SGTR | HI PRES & INTACT LOOP SEAL / HI PRES & INTACT LOOP SEAL
		7.62E-02	PZR-RVMB-RV-1041-DEV	PZR SAFETY VALVE RV-1041 FTC (ON SUBSEQUENT DEMANDS) (Dev Event)
		1.00E+00	TR-MCND-AV-21-32_LBL	Sequence Label
10	1.94E-08	1.02E-03	23_FBF00-B	EA-13 - 2400V Switchgear (non HEAF) Scenario. Fire is not suppressed prior to pr
		7.41E-04	CIS-TKMJ-CNMT-LINER	CIS PRE-EXISTING FAILURE DUE TO ERRORS CRACKS TEARS (WCAP-16341)
		2.57E-02	EDG-DGMG-K-6B	DIESEL GENERATOR 1-2 FAILS TO RUN
		1.00E+00	HPI-AVOB-CV-300X-FR	OP FT CLOSE 1 OF 2 OPEN SPRAY VALVES - CSS NPSH(CR) (HEP)
		1.00E+00	TR-MCND-AV-18_LBL	Sequence Label
11	1.89E-08	1.02E-03	23_FBF00-B	EA-13 - 2400V Switchgear (non HEAF) Scenario. Fire is not suppressed prior to pr
		7.20E-04	CIS-GKMJ-HATCH	EQUIPMENT HATCH SEAL RUPTURES
		2.57E-02	EDG-DGMG-K-6B	DIESEL GENERATOR 1-2 FAILS TO RUN
		1.00E+00	HPI-AVOB-CV-300X-FR	OP FT CLOSE 1 OF 2 OPEN SPRAY VALVES - CSS NPSH(CR) (HEP)
		1.00E+00	TR-MCND-AV-18_LBL	Sequence Label

Post-Transition Plant – FA-23 (Turbine Building) – Scenario 23_FAO00-B – Top Five Cutsets - LERF				
#	Cutset Prob	Event Prob	Event	Description
5	1.67E-10	7.16E-04	23_FAO00-B	EA-21 4160 V (non HEAF) Scenario. Fire is not suppressed prior to propagation t
		9.20E-03	AFW-PMOT-P-8D_M-FR	OP FT ALGN & OPERATE P-8D GIVEN NON-SBO EVENTS (LOC) (HEP)

Post-Transition Plant – FA-23 (Turbine Building) – Scenario 23_FAO00-B – Top Five Cutsets - LERF				
#	Cutset Prob	Event Prob	Event	Description
		1.00E+00	EDG-DGOA-LDSHD_M-FR	OP FT ALGN EDG'S-LD SHD FAILS FOR NON-SIS EVNTS (LOC) (HEP)
		2.90E-02	EDG-DGOA-LOADSHD-FR	OP FT ALGN EDG'S-LD SHD FAILS FOR NON-SIS EVNTS (LOC) (HEP)
		1.00E+00	EDG-DGOA-LOCMAN-FR	OP FT ESTABLISH LOCAL MANUAL CONTROL OF EDG 1-1 (LOC) (HEP)
		1.00E-02	-PHE-AVOB-ISO-SG-FR	OPERATOR ACTION TO ISOLATE SG ADVS
		0.00E+00	-PHE-PPMC-LOOPSEAL-CLEAR	LOOP SEAL AND CORE BARREL CLEARED
		1.16E-02	PHE-TBMJ-HI-HI	TI-SGTR | HI PRES & INTACT LOOP SEAL / HI PRES & INTACT LOOP SEAL
		7.62E-02	PZR-RVMB-RV-1041-DEV	PZR SAFETY VALVE RV-1041 FTC (ON SUBSEQUENT DEMANDS) (Dev Event)
		1.00E+00	TR-MCND-AV-21-32_LBL	Sequence Label
15	1.15E-10	7.16E-04	23_FAO00-B	EA-21 4160 V (non HEAF) Scenario. Fire is not suppressed prior to propagation t
		6.30E-03	CVC-PMOA-P55-TRP-FR	OP FT STOP CHARGING PUMP OPERATION (CR) (HEP)
		1.00E+00	EDG-DGOA-LDSHD_M-FR	OP FT ALGN EDG'S-LD SHD FAILS FOR NON-SIS EVNTS (LOC) (HEP)
		2.90E-02	EDG-DGOA-LOADSHD-FR	OP FT ALGN EDG'S-LD SHD FAILS FOR NON-SIS EVNTS (LOC) (HEP)
		1.00E+00	EDG-DGOA-LOCMAN-FR	OP FT ESTABLISH LOCAL MANUAL CONTROL OF EDG 1-1 (LOC) (HEP)
		1.00E+00	LOC-FLG-CNSEQ-ETREES	IF "1" - EVENT ADDED TO CNSQ LOCA ETREES/PREVNT SUBSUMING (Flag Event)
		1.00E-02	-PHE-AVOB-ISO-SG-FR	OPERATOR ACTION TO ISOLATE SG ADVS
		0.00E+00	-PHE-PPMC-LOOPSEAL-CLEAR	LOOP SEAL AND CORE BARREL CLEARED
		1.16E-02	PHE-TBMJ-HI-HI	TI-SGTR | HI PRES & INTACT LOOP SEAL / HI PRES & INTACT LOOP SEAL
		7.62E-02	PZR-RVMB-RV-1041-DEV	PZR SAFETY VALVE RV-1041 FTC (ON SUBSEQUENT DEMANDS) (Dev Event)
		1.00E+00	TR-MCND-AV-27-32_LBL	Sequence Label
18	1.06E-10	7.16E-04	23_FAO00-B	EA-21 4160 V (non HEAF) Scenario. Fire is not suppressed prior to propagation t
		8.75E-06	EDC-BYCC-ED-0102-MB	CC EVENT: ED-01 ED-02
		1.00E+00	EDC-C1OA-72-0102-FR	OP FTO SHNT TRIPS (72-01 & 72-02) TO SHED DC LOADS (LOC) (HEP)
		1.00E+00	EDG-DGOA-K-15-FR	OP FT ALIGN B.5.B K-15 GENERATOR TO POWER EC-150 (LOC) (HEP)
		1.00E+00	LOC-FLG-CNSEQ-ETREES	IF "1" - EVENT ADDED TO CNSQ LOCA ETREES/PREVNT SUBSUMING (Flag Event)
		1.00E-02	-PHE-AVOB-ISO-SG-FR	OPERATOR ACTION TO ISOLATE SG ADVS
		0.00E+00	-PHE-PPMC-LOOPSEAL-CLEAR	LOOP SEAL AND CORE BARREL CLEARED
		2.39E-01	PHE-TBMJ-LI-LI	TI-SGTR | LO PRES & INTACT LOOP SEAL / LO PRES & INTACT LOOP SEAL
		5.99E-02	-PHE-TBMJ-PI-2D	PRESSURE-INDUCED STEAM GENERATOR TUBE RUPTURE GIVEN 2 DEPRESS SGS
		7.62E-02	PZR-RVMB-RV-1041-DEV	PZR SAFETY VALVE RV-1041 FTC (ON SUBSEQUENT DEMANDS) (Dev Event)
		1.00E+00	TR-MCND-AV-27-32_LBL	Sequence Label
19	1.02E-10	7.16E-04	23_FAO00-B	EA-21 4160 V (non HEAF) Scenario. Fire is not suppressed prior to propagation t
		9.20E-03	AFW-PMOT-P-8D_M-FR	OP FT ALGN & OPERATE P-8D GIVEN NON-SBO EVENTS (LOC) (HEP)
		1.00E+00	EDG-DGOA-LDSHD_M-FR	OP FT ALGN EDG'S-LD SHD FAILS FOR NON-SIS EVNTS (LOC) (HEP)
		2.90E-02	EDG-DGOA-LOADSHD-FR	OP FT ALGN EDG'S-LD SHD FAILS FOR NON-SIS EVNTS (LOC) (HEP)
		1.00E+00	EDG-DGOA-LOCMAN-FR	OP FT ESTABLISH LOCAL MANUAL CONTROL OF EDG 1-1 (LOC) (HEP)

Post-Transition Plant – FA-23 (Turbine Building) – Scenario 23_FAO00-B – Top Five Cutsets - LERF				
#	Cutset Prob	Event Prob	Event	Description
		1.00E-02	-PHE-AVOB-ISO-SG-FR	OPERATOR ACTION TO ISOLATE SG ADVS
		0.00E+00	-PHE-PPMC-LOOPSEAL-CLEAR	LOOP SEAL AND CORE BARREL CLEARED
		1.16E-02	PHE-TBMJ-HI-HI	TI-SGTR | HI PRES & INTACT LOOP SEAL / HI PRES & INTACT LOOP SEAL
		4.63E-02	PZR-RVMB-RV-1041	PZR (T-72) SAFETY VALVE RV-1041 FTC (AFTER INITIAL DEMAND)
		1.00E+00	TR-MCND-AV-21-32_LBL	Sequence Label
27	8.81E-11	7.16E-04	23_FAO00-B	EA-21 4160 V (non HEAF) Scenario. Fire is not suppressed prior to propagation t
		4.20E-03	AFW-PMOT-P-8D_L-FR	OP FT ALGN & OPERATE P-8D GIVEN FPIE NON-SBO EVENTS (HEP)
		2.55E-03	EDG-C1MA-S-965	DISCONNECT AT P-965 FAILS TO OPEN
		1.00E+00	EDG-DGOA-LDSHD_M-FR	OP FT ALGN EDG'S-LD SHD FAILS FOR NON-SIS EVNTS (LOC) (HEP)
		1.00E-02	-PHE-AVOB-ISO-SG-FR	OPERATOR ACTION TO ISOLATE SG ADVS
		0.00E+00	-PHE-PPMC-LOOPSEAL-CLEAR	LOOP SEAL AND CORE BARREL CLEARED
		1.16E-02	PHE-TBMJ-HI-HI	TI-SGTR | HI PRES & INTACT LOOP SEAL / HI PRES & INTACT LOOP SEAL
		1.00E+00	TR-MCND-AV-14_LBL	Sequence Label

Compliant Plant – FA-23 (Turbine Building) – Scenario 23_FAO00-B – Top Five Cutsets - LERF				
#	Cutset Prob	Event Prob	Event	Description
15	1.84E-08	7.16E-04	23_FAO00-B	EA-21 4160 V (non HEAF) Scenario. Fire is not suppressed prior to propagation t
		1.00E-03	CIS-GKOL-HATCH	PRE-INIT: EQUIPMENT HATCH DOOR/SEAL LEFT OPENED (HEP)
		2.57E-02	EDG-DGMG-K-6B	DIESEL GENERATOR 1-2 FAILS TO RUN
		1.00E+00	HPI-AVOB-CV-300X-FR	OP FT CLOSE 1 OF 2 OPEN SPRAY VALVES - CSS NPSH(CR) (HEP)
		1.00E+00	TR-MCND-AV-18_LBL	Sequence Label
16	1.84E-08	7.16E-04	23_FAO00-B	EA-21 4160 V (non HEAF) Scenario. Fire is not suppressed prior to propagation t
		1.00E-03	CIS-GKOL-MZ-18	PRE-INIT: FUEL TRANSFER TUBE 36 (MZ-18) LEFT OPEN (HEP)
		2.57E-02	EDG-DGMG-K-6B	DIESEL GENERATOR 1-2 FAILS TO RUN
		1.00E+00	HPI-AVOB-CV-300X-FR	OP FT CLOSE 1 OF 2 OPEN SPRAY VALVES - CSS NPSH(CR) (HEP)
		1.00E+00	TR-MCND-AV-18_LBL	Sequence Label
17	1.82E-08	7.16E-04	23_FAO00-B	EA-21 4160 V (non HEAF) Scenario. Fire is not suppressed prior to propagation t
		1.00E+00	EDG-DGOA-LDSHD_M-FR	OP FT ALGN EDG'S-LD SHD FAILS FOR NON-SIS EVNTS (LOC) (HEP)
		2.90E-02	EDG-DGOA-LOADSHD-FR	OP FT ALGN EDG'S-LD SHD FAILS FOR NON-SIS EVNTS (LOC) (HEP)
		1.00E+00	EDG-DGOA-LOCMAN-FR	OP FT ESTABLISH LOCAL MANUAL CONTROL OF EDG 1-1 (LOC) (HEP)
		1.00E-02	-PHE-AVOB-ISO-SG-FR	OPERATOR ACTION TO ISOLATE SG ADVS
		0.00E+00	-PHE-PPMC-LOOPSEAL-CLEAR	LOOP SEAL AND CORE BARREL CLEARED
		1.16E-02	PHE-TBMJ-HI-HI	TI-SGTR | HI PRES & INTACT LOOP SEAL / HI PRES & INTACT LOOP SEAL
		7.62E-02	PZR-RVMB-RV-1041-DEV	PZR SAFETY VALVE RV-1041 FTC (ON SUBSEQUENT DEMANDS) (Dev Event)

Compliant Plant – FA-23 (Turbine Building) – Scenario 23_FAO00-B – Top Five Cutsets - LERF				
#	Cutset Prob	Event Prob	Event	Description
		1.00E+00	TR-MCND-AV-21-32_LBL	Sequence Label
26	1.36E-08	7.16E-04	23_FAO00-B	EA-21 4160 V (non HEAF) Scenario. Fire is not suppressed prior to propagation t
		7.41E-04	CIS-TKMJ-CNMT-LINER	CIS PRE-EXISTING FAILURE DUE TO ERRORS CRACKS TEARS (WCAP-16341)
		2.57E-02	EDG-DGMG-K-6B	DIESEL GENERATOR 1-2 FAILS TO RUN
		1.00E+00	HPI-AVOB-CV-300X-FR	OP FT CLOSE 1 OF 2 OPEN SPRAY VALVES - CSS NPSH(CR) (HEP)
		1.00E+00	TR-MCND-AV-18_LBL	Sequence Label
29	1.32E-08	7.16E-04	23_FAO00-B	EA-21 4160 V (non HEAF) Scenario. Fire is not suppressed prior to propagation t
		7.20E-04	CIS-GKMJ-HATCH	EQUIPMENT HATCH SEAL RUPTURES
		2.57E-02	EDG-DGMG-K-6B	DIESEL GENERATOR 1-2 FAILS TO RUN
		1.00E+00	HPI-AVOB-CV-300X-FR	OP FT CLOSE 1 OF 2 OPEN SPRAY VALVES - CSS NPSH(CR) (HEP)
		1.00E+00	TR-MCND-AV-18_LBL	Sequence Label

Post-Transition Plant – FA-02 (Cable Spreading Room) – Scenario 02_FAQ-2B – Top Five Cutsets - LERF				
#	Cutset Prob	Event Prob	Event	Description
1	4.42E-07	3.01E-04	02_FAQ-2B	EB-12 480V Load Center - Fire is not suppressed prior to damage of first target
		1.00E+00	EDC-C1OA-72-0102-FR	OP FTO SHNT TRIPS (72-01 & 72-02) TO SHED DC LOADS (LOC) (HEP)
		1.00E+00	EDG-DGOA-K-15-FR	OP FT ALIGN B.5.B K-15 GENERATOR TO POWER EC-150 (LOC) (HEP)
		1.00E+00	LOC-FLG-CNSEQ-ETREES	IF "1" - EVENT ADDED TO CNSQ LOCA ETREES/PREVNT SUBSUMING (Flag Event)
		6.60E-03	PCP-PMOF-P-50X-FR	OP FT TRIP PCP'S GIVEN LOSS OF CCW SEAL CLNG (CR) (HEP)
		1.00E-02	-PHE-AVOB-ISO-SG-FR	OPERATOR ACTION TO ISOLATE SG ADVS
		0.00E+00	-PHE-PPMC-LOOPSEAL-CLEAR	LOOP SEAL AND CORE BARREL CLEARED
		2.39E-01	PHE-TBMJ-LI-LI	TI-SGTR | LO PRES & INTACT LOOP SEAL / LO PRES & INTACT LOOP SEAL
		5.99E-02	-PHE-TBMJ-PI-2D	PRESSURE-INDUCED STEAM GENERATOR TUBE RUPTURE GIVEN 2 DEPRESS SGS
		1.00E+00	TR-MCND-AV-25-17_LBL	Sequence Label
2	1.18E-07	3.01E-04	02_FAQ-2B	EB-12 480V Load Center - Fire is not suppressed prior to damage of first target
		1.00E+00	EDC-C1OA-72-0102-FR	OP FTO SHNT TRIPS (72-01 & 72-02) TO SHED DC LOADS (LOC) (HEP)
		1.00E+00	EDG-DGOA-K-15-FR	OP FT ALIGN B.5.B K-15 GENERATOR TO POWER EC-150 (LOC) (HEP)
		1.00E+00	LOC-FLG-CNSEQ-ETREES	IF "1" - EVENT ADDED TO CNSQ LOCA ETREES/PREVNT SUBSUMING (Flag Event)
		6.60E-03	PCP-PMOF-P-50X-FR	OP FT TRIP PCP'S GIVEN LOSS OF CCW SEAL CLNG (CR) (HEP)
		1.00E-02	-PHE-AVOB-ISO-SG-FR	OPERATOR ACTION TO ISOLATE SG ADVS
		5.99E-02	PHE-TBMJ-PI-2D	PRESSURE-INDUCED STEAM GENERATOR TUBE RUPTURE GIVEN 2 DEPRESS SGS
		1.00E+00	TR-MCND-AV-25-17_LBL	Sequence Label
3	6.96E-08	3.01E-04	02_FAQ-2B	EB-12 480V Load Center - Fire is not suppressed prior to damage of first target
		1.00E+00	EDC-C1OA-72-0102-FR	OP FTO SHNT TRIPS (72-01 & 72-02) TO SHED DC LOADS (LOC) (HEP)

Post-Transition Plant – FA-02 (Cable Spreading Room) – Scenario 02_FAQ-2B – Top Five Cutsets - LERF				
#	Cutset Prob	Event Prob	Event	Description
		1.00E+00	EDG-DGOA-K-15-FR	OP FT ALIGN B.5.B K-15 GENERATOR TO POWER EC-150 (LOC) (HEP)
		1.00E+00	LOC-FLG-CNSEQ-ETREES	IF "1" - EVENT ADDED TO CNSQ LOCA ETREES/PREVNT SUBSUMING (Flag Event)
		1.04E-03	PCP-PMMT-CCW-M-1	MULTIPLE SEAL FAILRE DURING A LOSS OF CCW W CBO ISOLA (Dev Event)
		1.00E-02	-PHE-AVOB-ISO-SG-FR	OPERATOR ACTION TO ISOLATE SG ADVS
		0.00E+00	-PHE-PPMC-LOOPSEAL-CLEAR	LOOP SEAL AND CORE BARREL CLEARED
		2.39E-01	PHE-TBMJ-LI-LI	TI-SGTR | LO PRES & INTACT LOOP SEAL / LO PRES & INTACT LOOP SEAL
		5.99E-02	-PHE-TBMJ-PI-2D	PRESSURE-INDUCED STEAM GENERATOR TUBE RUPTURE GIVEN 2 DEPRESS SGS
		1.00E+00	TR-MCND-AV-25-17_LBL	Sequence Label
4	6.69E-08	3.01E-04	02_FAQ-2B	EB-12 480V Load Center - Fire is not suppressed prior to damage of first target
		9.99E-04	CVC-AVMB-CV-2003	LETDOWN ORIFICE STOP VALVE CV-2003 FTC
		1.00E+00	EDC-C1OA-72-0102-FR	OP FTO SHNT TRIPS (72-01 & 72-02) TO SHED DC LOADS (LOC) (HEP)
		1.00E+00	EDG-DGOA-K-15-FR	OP FT ALIGN B.5.B K-15 GENERATOR TO POWER EC-150 (LOC) (HEP)
		1.00E+00	LOC-FLG-CNSEQ-ETREES	IF "1" - EVENT ADDED TO CNSQ LOCA ETREES/PREVNT SUBSUMING (Flag Event)
		1.00E-02	-PHE-AVOB-ISO-SG-FR	OPERATOR ACTION TO ISOLATE SG ADVS
		0.00E+00	-PHE-PPMC-LOOPSEAL-CLEAR	LOOP SEAL AND CORE BARREL CLEARED
		2.39E-01	PHE-TBMJ-LI-LI	TI-SGTR | LO PRES & INTACT LOOP SEAL / LO PRES & INTACT LOOP SEAL
		5.99E-02	-PHE-TBMJ-PI-2D	PRESSURE-INDUCED STEAM GENERATOR TUBE RUPTURE GIVEN 2 DEPRESS SGS
		1.00E+00	TR-MCND-AV-22-18-32_LBL	Sequence Label
5	6.39E-08	3.01E-04	02_FAQ-2B	EB-12 480V Load Center - Fire is not suppressed prior to damage of first target
		9.54E-04	CVC-KVMA-SV-2003	LETDOWN ORIFICE ISOL SV-2003 FAILS TO DEENERGIZE
		1.00E+00	EDC-C1OA-72-0102-FR	OP FTO SHNT TRIPS (72-01 & 72-02) TO SHED DC LOADS (LOC) (HEP)
		1.00E+00	EDG-DGOA-K-15-FR	OP FT ALIGN B.5.B K-15 GENERATOR TO POWER EC-150 (LOC) (HEP)
		1.00E+00	LOC-FLG-CNSEQ-ETREES	IF "1" - EVENT ADDED TO CNSQ LOCA ETREES/PREVNT SUBSUMING (Flag Event)
		1.00E-02	-PHE-AVOB-ISO-SG-FR	OPERATOR ACTION TO ISOLATE SG ADVS
		0.00E+00	-PHE-PPMC-LOOPSEAL-CLEAR	LOOP SEAL AND CORE BARREL CLEARED
		2.39E-01	PHE-TBMJ-LI-LI	TI-SGTR | LO PRES & INTACT LOOP SEAL / LO PRES & INTACT LOOP SEAL
		5.99E-02	-PHE-TBMJ-PI-2D	PRESSURE-INDUCED STEAM GENERATOR TUBE RUPTURE GIVEN 2 DEPRESS SGS
		1.00E+00	TR-MCND-AV-22-18-32_LBL	Sequence Label

Compliant Plant – FA-02 (Cable Spreading Room) – Scenario 02_FAQ-2B – Top Five Cutsets - LERF				
#	Cutset Prob	Event Prob	Event	Description
1	4.42E-07	3.01E-04	02_FAQ-2B	EB-12 480V Load Center - Fire is not suppressed prior to damage of first target
		1.00E+00	EDC-C1OA-72-0102-FR	OP FTO SHNT TRIPS (72-01 & 72-02) TO SHED DC LOADS (LOC) (HEP)
		1.00E+00	EDG-DGOA-K-15-FR	OP FT ALIGN B.5.B K-15 GENERATOR TO POWER EC-150 (LOC) (HEP)

Compliant Plant – FA-02 (Cable Spreading Room) – Scenario 02_FAQ-2B – Top Five Cutsets - LERF				
#	Cutset Prob	Event Prob	Event	Description
		1.00E+00	EDG-DGOA-LDSHD_M-FR	OP FT ALGN EDG'S-LD SHD FAILS FOR NON-SIS EVNTS (LOC) (HEP)
		1.00E+00	LOC-FLG-CNSEQ-ETREES	IF "1" - EVENT ADDED TO CNSQ LOCA ETREES/PREVNT SUBSUMING (Flag Event)
		6.60E-03	PCP-PMOF-P-50X-FR	OP FT TRIP PCP'S GIVEN LOSS OF CCW SEAL CLNG (CR) (HEP)
		1.00E-02	-PHE-AVOB-ISO-SG-FR	OPERATOR ACTION TO ISOLATE SG ADVS
		0.00E+00	-PHE-PPMC-LOOPSEAL-CLEAR	LOOP SEAL AND CORE BARREL CLEARED
		2.39E-01	PHE-TBMJ-LI-LI	TI-SGTR | LO PRES & INTACT LOOP SEAL / LO PRES & INTACT LOOP SEAL
		5.99E-02	-PHE-TBMJ-PI-2D	PRESSURE-INDUCED STEAM GENERATOR TUBE RUPTURE GIVEN 2 DEPRESS SGS
		1.00E+00	TR-MCND-AV-25-17_LBL	Sequence Label
2	1.58E-07	3.01E-04	02_FAQ-2B	EB-12 480V Load Center - Fire is not suppressed prior to damage of first target
		3.10E-02	ADV-XVOB-MAN_M-FR	OP FT CLOSE MANUAL VALVES TO ISOLATE ADV (LOC) (HEP)
		1.00E+00	EDC-C1OA-72-0102-FR	OP FTO SHNT TRIPS (72-01 & 72-02) TO SHED DC LOADS (LOC) (HEP)
		1.00E+00	EDG-DGOA-K-15-FR	OP FT ALIGN B.5.B K-15 GENERATOR TO POWER EC-150 (LOC) (HEP)
		1.00E+00	ESD-FLG-2SG-BLDN-B	SET TO "1" - ESDE W/2 SG BLWDWN W/AFW FEEDING 50B (Flag Event)
		1.00E+00	ESD-FLG-SGA-BLDN	SET TO "1" - ESDE ON SG E-50A (Flag Event)
		1.00E-02	-PHE-AVOB-ISO-SG-FR	OPERATOR ACTION TO ISOLATE SG ADVS
		0.00E+00	-PHE-PPMC-LOOPSEAL-CLEAR	LOOP SEAL AND CORE BARREL CLEARED
		2.39E-01	PHE-TBMJ-LI-LI	TI-SGTR | LO PRES & INTACT LOOP SEAL / LO PRES & INTACT LOOP SEAL
		5.99E-02	-PHE-TBMJ-PI-2D	PRESSURE-INDUCED STEAM GENERATOR TUBE RUPTURE GIVEN 2 DEPRESS SGS
		7.62E-02	PZR-RVMB-RV-1041-DEV	PZR SAFETY VALVE RV-1041 FTC (ON SUBSEQUENT DEMANDS) (Dev Event)
		1.00E+00	TR-MCND-AV-21-32_LBL	Sequence Label
3	1.25E-07	3.01E-04	02_FAQ-2B	EB-12 480V Load Center - Fire is not suppressed prior to damage of first target
		3.10E-02	ADV-XVOB-MAN_L-FR	OP FT CLOSE MANUAL VALVES TO ISOLATE ADV (LOC) (HEP)
		6.00E-02	AFW-PMOE-EC150_L-FR	OP FT XFR AFW PP START TO C-150 PNL (SCRNING VAL) (LOC) (HEP)
		1.00E+00	E50-FLG-LVL-INSTR-AV	IF "1" - PLACEHOLDER EC-150 INSTR CREDIT (Flag Event)
		1.00E+00	EDC-C1OA-72-0102-FR	OP FTO SHNT TRIPS (72-01 & 72-02) TO SHED DC LOADS (LOC) (HEP)
		1.00E+00	EDG-DGOA-K-15-FR	OP FT ALIGN B.5.B K-15 GENERATOR TO POWER EC-150 (LOC) (HEP)
		1.00E+00	EDG-DGOA-LDSHD_M-FR	OP FT ALGN EDG'S-LD SHD FAILS FOR NON-SIS EVNTS (LOC) (HEP)
		1.00E+00	ESD-FLG-SGA-BLDN	SET TO "1" - ESDE ON SG E-50A (Flag Event)
		1.00E-02	-PHE-AVOB-ISO-SG-FR	OPERATOR ACTION TO ISOLATE SG ADVS
		0.00E+00	-PHE-PPMC-LOOPSEAL-CLEAR	LOOP SEAL AND CORE BARREL CLEARED
		2.39E-01	PHE-TBMJ-LI-LI	TI-SGTR | LO PRES & INTACT LOOP SEAL / LO PRES & INTACT LOOP SEAL
		5.99E-02	-PHE-TBMJ-PI-2D	PRESSURE-INDUCED STEAM GENERATOR TUBE RUPTURE GIVEN 2 DEPRESS SGS
		1.00E+00	TR-MCND-AV-14_LBL	Sequence Label
4	1.23E-07	3.01E-04	02_FAQ-2B	EB-12 480V Load Center - Fire is not suppressed prior to damage of first target
		3.10E-02	ADV-XVOB-MAN_L-FR	OP FT CLOSE MANUAL VALVES TO ISOLATE ADV (LOC) (HEP)

Compliant Plant – FA-02 (Cable Spreading Room) – Scenario 02_FAQ-2B – Top Five Cutsets - LERF				
#	Cutset Prob	Event Prob	Event	Description
		5.90E-02	AFW-PMOE-P-990_L-FR	OP FT ALGN THE B.5.b PUMP FOR S/G MAKEUP (LOC) (HEP)
		1.00E+00	EDC-C1OA-72-0102-FR	OP FTO SHNT TRIPS (72-01 & 72-02) TO SHED DC LOADS (LOC) (HEP)
		1.00E+00	EDG-DGOA-K-15-FR	OP FT ALIGN B.5.B K-15 GENERATOR TO POWER EC-150 (LOC) (HEP)
		1.00E+00	EDG-DGOA-LDSHD_M-FR	OP FT ALGN EDG'S-LD SHD FAILS FOR NON-SIS EVNTS (LOC) (HEP)
		1.00E+00	ESD-FLG-SGA-BLDN	SET TO "1" - ESDE ON SG E-50A (Flag Event)
		1.00E-02	-PHE-AVOB-ISO-SG-FR	OPERATOR ACTION TO ISOLATE SG ADVS
		0.00E+00	-PHE-PPMC-LOOPSEAL-CLEAR	LOOP SEAL AND CORE BARREL CLEARED
		2.39E-01	PHE-TBMJ-LI-LI	TI-SGTR | LO PRES & INTACT LOOP SEAL / LO PRES & INTACT LOOP SEAL
		5.99E-02	-PHE-TBMJ-PI-2D	PRESSURE-INDUCED STEAM GENERATOR TUBE RUPTURE GIVEN 2 DEPRESS SGS
		1.00E+00	TR-MCND-AV-14_LBL	Sequence Label
5	1.18E-07	3.01E-04	02_FAQ-2B	EB-12 480V Load Center - Fire is not suppressed prior to damage of first target
		1.00E+00	EDC-C1OA-72-0102-FR	OP FTO SHNT TRIPS (72-01 & 72-02) TO SHED DC LOADS (LOC) (HEP)
		1.00E+00	EDG-DGOA-K-15-FR	OP FT ALIGN B.5.B K-15 GENERATOR TO POWER EC-150 (LOC) (HEP)
		1.00E+00	EDG-DGOA-LDSHD_M-FR	OP FT ALGN EDG'S-LD SHD FAILS FOR NON-SIS EVNTS (LOC) (HEP)
		1.00E+00	LOC-FLG-CNSEQ-ETREES	IF "1" - EVENT ADDED TO CNSQ LOCA ETREES/PREVNT SUBSUMING (Flag Event)
		6.60E-03	PCP-PMOF-P-50X-FR	OP FT TRIP PCP'S GIVEN LOSS OF CCW SEAL CLNG (CR) (HEP)
		1.00E-02	-PHE-AVOB-ISO-SG-FR	OPERATOR ACTION TO ISOLATE SG ADVS
		5.99E-02	PHE-TBMJ-PI-2D	PRESSURE-INDUCED STEAM GENERATOR TUBE RUPTURE GIVEN 2 DEPRESS SGS
		1.00E+00	TR-MCND-AV-25-17_LBL	Sequence Label

Post-Transition Plant – FA-02 (Cable Spreading Room) – Scenario 02_FBC-1 – Top Five Cutsets - LERF				
#	Cutset Prob	Event Prob	Event	Description
468	6.27E-10	6.27E-05	02_FBC-1	EY-01 Instrument AC Panel - No propagation to overhead trays.
		1.00E-03	CIS-GKOL-HATCH	PRE-INIT: EQUIPMENT HATCH DOOR/SEAL LEFT OPENED (HEP)
		1.00E+00	CVC-AVOB-CV-2001-FR	OP FT CLOSE CV-2001 ON HI TEMP AT LETDWN HX E-58 (CR) (HEP)
		1.00E-02	CVC-AVOB-CV-2009-FR	OP FAILS TO CLOSE CV-2009 (CR) (HEP)
		1.00E+00	CVC-PMOE-P-55ABC-FR	OP FT INITIATE CHARGING FLOW (CR) (HEP)
		1.00E+00	CVC-PMOE-P-55B-FR	OP FT ALGN CHARGING FOR SGTR (CR) (HEP)
		1.00E+00	HPI-PMOE-HPSI-FR	OP FAILS TO INITIATE HPSI AFTER AUTO START FAILURE (CR) (HEP)
		1.00E+00	LOC-FLG-CNSEQ-ETREES	IF "1" - EVENT ADDED TO CNSQ LOCA ETREES/PREVNT SUBSUMING (Flag Event)
		1.00E+00	TR-MCND-AV-22-02-19_LBL	Sequence Label
469	6.27E-10	6.27E-05	02_FBC-1	EY-01 Instrument AC Panel - No propagation to overhead trays.
		1.00E-03	CIS-GKOL-MZ-18	PRE-INIT: FUEL TRANSFER TUBE 36 (MZ-18) LEFT OPEN (HEP)
		1.00E+00	CVC-AVOB-CV-2001-FR	OP FT CLOSE CV-2001 ON HI TEMP AT LETDWN HX E-58 (CR) (HEP)

Post-Transition Plant – FA-02 (Cable Spreading Room) – Scenario 02_FBC-1 – Top Five Cutsets - LERF				
#	Cutset Prob	Event Prob	Event	Description
		1.00E-02	CVC-AVOB-CV-2009-FR	OP FAILS TO CLOSE CV-2009 (CR) (HEP)
		1.00E+00	CVC-PMOE-P-55ABC-FR	OP FT INITIATE CHARGING FLOW (CR) (HEP)
		1.00E+00	CVC-PMOE-P-55B-FR	OP FT ALGN CHARGING FOR SGTR (CR) (HEP)
		1.00E+00	HPI-PMOE-HPSI-FR	OP FAILS TO INITIATE HPSI AFTER AUTO START FAILURE (CR) (HEP)
		1.00E+00	LOC-FLG-CNSEQ-ETREES	IF "1" - EVENT ADDED TO CNSQ LOCA ETREES/PREVNT SUBSUMING (Flag Event)
		1.00E+00	TR-MCND-AV-22-02-19_LBL	Sequence Label
582	4.65E-10	6.27E-05	02_FBC-1	EY-01 Instrument AC Panel - No propagation to overhead trays.
		7.41E-04	CIS-TKMJ-CNMT-LINER	CIS PRE-EXISTING FAILURE DUE TO ERRORS CRACKS TEARS (WCAP-16341)
		1.00E+00	CVC-AVOB-CV-2001-FR	OP FT CLOSE CV-2001 ON HI TEMP AT LETDWN HX E-58 (CR) (HEP)
		1.00E-02	CVC-AVOB-CV-2009-FR	OP FAILS TO CLOSE CV-2009 (CR) (HEP)
		1.00E+00	CVC-PMOE-P-55ABC-FR	OP FT INITIATE CHARGING FLOW (CR) (HEP)
		1.00E+00	CVC-PMOE-P-55B-FR	OP FT ALGN CHARGING FOR SGTR (CR) (HEP)
		1.00E+00	HPI-PMOE-HPSI-FR	OP FAILS TO INITIATE HPSI AFTER AUTO START FAILURE (CR) (HEP)
		1.00E+00	LOC-FLG-CNSEQ-ETREES	IF "1" - EVENT ADDED TO CNSQ LOCA ETREES/PREVNT SUBSUMING (Flag Event)
		1.00E+00	TR-MCND-AV-22-02-19_LBL	Sequence Label
600	4.51E-10	6.27E-05	02_FBC-1	EY-01 Instrument AC Panel - No propagation to overhead trays.
		7.20E-04	CIS-GKMJ-HATCH	EQUIPMENT HATCH SEAL RUPTURES
		1.00E+00	CVC-AVOB-CV-2001-FR	OP FT CLOSE CV-2001 ON HI TEMP AT LETDWN HX E-58 (CR) (HEP)
		1.00E-02	CVC-AVOB-CV-2009-FR	OP FAILS TO CLOSE CV-2009 (CR) (HEP)
		1.00E+00	CVC-PMOE-P-55ABC-FR	OP FT INITIATE CHARGING FLOW (CR) (HEP)
		1.00E+00	CVC-PMOE-P-55B-FR	OP FT ALGN CHARGING FOR SGTR (CR) (HEP)
		1.00E+00	HPI-PMOE-HPSI-FR	OP FAILS TO INITIATE HPSI AFTER AUTO START FAILURE (CR) (HEP)
		1.00E+00	LOC-FLG-CNSEQ-ETREES	IF "1" - EVENT ADDED TO CNSQ LOCA ETREES/PREVNT SUBSUMING (Flag Event)
		1.00E+00	TR-MCND-AV-22-02-19_LBL	Sequence Label
601	4.51E-10	6.27E-05	02_FBC-1	EY-01 Instrument AC Panel - No propagation to overhead trays.
		7.20E-04	CIS-GKMJ-MZ-18	FUEL TRANSFER TUBE 36
		1.00E+00	CVC-AVOB-CV-2001-FR	OP FT CLOSE CV-2001 ON HI TEMP AT LETDWN HX E-58 (CR) (HEP)
		1.00E-02	CVC-AVOB-CV-2009-FR	OP FAILS TO CLOSE CV-2009 (CR) (HEP)
		1.00E+00	CVC-PMOE-P-55ABC-FR	OP FT INITIATE CHARGING FLOW (CR) (HEP)
		1.00E+00	CVC-PMOE-P-55B-FR	OP FT ALGN CHARGING FOR SGTR (CR) (HEP)
		1.00E+00	HPI-PMOE-HPSI-FR	OP FAILS TO INITIATE HPSI AFTER AUTO START FAILURE (CR) (HEP)
		1.00E+00	LOC-FLG-CNSEQ-ETREES	IF "1" - EVENT ADDED TO CNSQ LOCA ETREES/PREVNT SUBSUMING (Flag Event)
		1.00E+00	TR-MCND-AV-22-02-19_LBL	Sequence Label

Compliant Plant – FA-02 (Cable Spreading Room) – Scenario 02_FBC-1 – Top Five Cutsets - LERF				
#	Cutset Prob	Event Prob	Event	Description
2045	6.27E-10	6.27E-05	02_FBC-1	EY-01 Instrument AC Panel - No propagation to overhead trays.
		1.00E-03	CIS-GKOL-HATCH	PRE-INIT: EQUIPMENT HATCH DOOR/SEAL LEFT OPENED (HEP)
		1.00E+00	CVC-AVOB-CV-2001-FR	OP FT CLOSE CV-2001 ON HI TEMP AT LETDWN HX E-58 (CR) (HEP)
		1.00E-02	CVC-AVOB-CV-2009-FR	OP FAILS TO CLOSE CV-2009 (CR) (HEP)
		1.00E+00	CVC-PMOE-P-55ABC-FR	OP FT INITIATE CHARGING FLOW (CR) (HEP)
		1.00E+00	CVC-PMOE-P-55B-FR	OP FT ALGN CHARGING FOR SGTR (CR) (HEP)
		1.00E+00	HPI-PMOE-HPSI-FR	OP FAILS TO INITIATE HPSI AFTER AUTO START FAILURE (CR) (HEP)
		1.00E+00	LOC-FLG-CNSEQ-ETREES	IF "1" - EVENT ADDED TO CNSQ LOCA ETREES/PREVNT SUBSUMING (Flag Event)
		1.00E+00	TR-MCND-AV-22-02-19_LBL	Sequence Label
2046	6.27E-10	6.27E-05	02_FBC-1	EY-01 Instrument AC Panel - No propagation to overhead trays.
		1.00E-03	CIS-GKOL-MZ-18	PRE-INIT: FUEL TRANSFER TUBE 36 (MZ-18) LEFT OPEN (HEP)
		1.00E+00	CVC-AVOB-CV-2001-FR	OP FT CLOSE CV-2001 ON HI TEMP AT LETDWN HX E-58 (CR) (HEP)
		1.00E-02	CVC-AVOB-CV-2009-FR	OP FAILS TO CLOSE CV-2009 (CR) (HEP)
		1.00E+00	CVC-PMOE-P-55ABC-FR	OP FT INITIATE CHARGING FLOW (CR) (HEP)
		1.00E+00	CVC-PMOE-P-55B-FR	OP FT ALGN CHARGING FOR SGTR (CR) (HEP)
		1.00E+00	HPI-PMOE-HPSI-FR	OP FAILS TO INITIATE HPSI AFTER AUTO START FAILURE (CR) (HEP)
		1.00E+00	LOC-FLG-CNSEQ-ETREES	IF "1" - EVENT ADDED TO CNSQ LOCA ETREES/PREVNT SUBSUMING (Flag Event)
		1.00E+00	TR-MCND-AV-22-02-19_LBL	Sequence Label
2657	4.65E-10	6.27E-05	02_FBC-1	EY-01 Instrument AC Panel - No propagation to overhead trays.
		7.41E-04	CIS-TKMJ-CNMT-LINER	CIS PRE-EXISTING FAILURE DUE TO ERRORS CRACKS TEARS (WCAP-16341)
		1.00E+00	CVC-AVOB-CV-2001-FR	OP FT CLOSE CV-2001 ON HI TEMP AT LETDWN HX E-58 (CR) (HEP)
		1.00E-02	CVC-AVOB-CV-2009-FR	OP FAILS TO CLOSE CV-2009 (CR) (HEP)
		1.00E+00	CVC-PMOE-P-55ABC-FR	OP FT INITIATE CHARGING FLOW (CR) (HEP)
		1.00E+00	CVC-PMOE-P-55B-FR	OP FT ALGN CHARGING FOR SGTR (CR) (HEP)
		1.00E+00	HPI-PMOE-HPSI-FR	OP FAILS TO INITIATE HPSI AFTER AUTO START FAILURE (CR) (HEP)
		1.00E+00	LOC-FLG-CNSEQ-ETREES	IF "1" - EVENT ADDED TO CNSQ LOCA ETREES/PREVNT SUBSUMING (Flag Event)
		1.00E+00	TR-MCND-AV-22-02-19_LBL	Sequence Label
2714	4.51E-10	6.27E-05	02_FBC-1	EY-01 Instrument AC Panel - No propagation to overhead trays.
		7.20E-04	CIS-GKMJ-HATCH	EQUIPMENT HATCH SEAL RUPTURES
		1.00E+00	CVC-AVOB-CV-2001-FR	OP FT CLOSE CV-2001 ON HI TEMP AT LETDWN HX E-58 (CR) (HEP)
		1.00E-02	CVC-AVOB-CV-2009-FR	OP FAILS TO CLOSE CV-2009 (CR) (HEP)
		1.00E+00	CVC-PMOE-P-55ABC-FR	OP FT INITIATE CHARGING FLOW (CR) (HEP)
		1.00E+00	CVC-PMOE-P-55B-FR	OP FT ALGN CHARGING FOR SGTR (CR) (HEP)
		1.00E+00	HPI-PMOE-HPSI-FR	OP FAILS TO INITIATE HPSI AFTER AUTO START FAILURE (CR) (HEP)

Compliant Plant – FA-02 (Cable Spreading Room) – Scenario 02_FBC-1 – Top Five Cutsets - LERF				
#	Cutset Prob	Event Prob	Event	Description
		1.00E+00	LOC-FLG-CNSEQ-ETREES	IF "1" - EVENT ADDED TO CNSQ LOCA ETREES/PREVNT SUBSUMING (Flag Event)
		1.00E+00	TR-MCND-AV-22-02-19_LBL	Sequence Label
2715	4.51E-10	6.27E-05	02_FBC-1	EY-01 Instrument AC Panel - No propagation to overhead trays.
		7.20E-04	CIS-GKMJ-MZ-18	FUEL TRANSFER TUBE 36
		1.00E+00	CVC-AVOB-CV-2001-FR	OP FT CLOSE CV-2001 ON HI TEMP AT LETDWN HX E-58 (CR) (HEP)
		1.00E-02	CVC-AVOB-CV-2009-FR	OP FAILS TO CLOSE CV-2009 (CR) (HEP)
		1.00E+00	CVC-PMOE-P-55ABC-FR	OP FT INITIATE CHARGING FLOW (CR) (HEP)
		1.00E+00	CVC-PMOE-P-55B-FR	OP FT ALGN CHARGING FOR SGTR (CR) (HEP)
		1.00E+00	HPI-PMOE-HPSI-FR	OP FAILS TO INITIATE HPSI AFTER AUTO START FAILURE (CR) (HEP)
		1.00E+00	LOC-FLG-CNSEQ-ETREES	IF "1" - EVENT ADDED TO CNSQ LOCA ETREES/PREVNT SUBSUMING (Flag Event)
		1.00E+00	TR-MCND-AV-22-02-19_LBL	Sequence Label

NRC REQUEST

PRA RAI 23.c.01

The response to PRA RAI 23c, in the letter dated December 2, 2013, ADAMS Accession No. ML13336A649, indicates that additional exceptions to those modeling mechanisms discussed in the response to PRA RAI 23b were employed (e.g., those cases for which the PRA model lacks sufficient resolution to model the VFDR or those that utilize surrogate basic events or HFEs to estimate/bound the change in risk in lieu of manipulating components or actions directly associated with the VFDR); however, the discussion of these exceptions is limited to a reference provided in the licensee's analysis.

Provide a discussion of these exceptions and how the delta risk is determined for each.

ENO RESPONSE

Exceptions to the normal modeling mechanisms were used to calculate reported changes in risk and the additional risk of RAs (recovery actions). PNP did not employ exceptions that utilize surrogate basic events or HFEs to estimate/bound the change in risk in lieu of manipulating components or actions directly associated with the VFDRs. PNP did employ exceptions for cases in which the PRA model lacks sufficient resolution to model the VFDR. These are discussed below.

The exceptions for cases in which the PRA model lacks sufficient resolution to model the VFDR fall into two categories: (1) treatment of systems and components not modeled in the fire PRA, and (2) systems and components that are modeled in the fire PRA but where the function and applicable fault consequences are not aligned with the deterministic requirements.

For exceptions involving systems and components not modeled in the fire PRA, delta risks are determined through an evaluation of the basis for not modeling the systems and/or components in the fire PRA. When the basis for exclusion is determined to remain valid in the context of the fire PRA, delta risks are taken to be epsilon. For this class of exceptions, all bases for exclusion were determined to remain valid and the delta risk set to epsilon.

For exceptions involving systems and components modeled in the fire PRA but where the function and applicable fault consequences are not aligned with the deterministic requirements, delta risks are determined via the normal modeling mechanisms, that is, by protecting the cables and components that resulted in the VFDR from fire damage in the calculation. Subsequently, an evaluation of the basis for modeling the systems and/or components in the fire PRA differently than deterministically required is performed. When the basis is determined to be valid in the context of the fire PRA, the delta risks are taken as the delta risks associated with the systems and components as modeled in the fire PRA determined via the normal modeling mechanisms. Finally, an

evaluation of the approach is performed to ensure associated delta risks are representative.

The list of exceptions treated in these ways is discussed below.

EDG 1-1 room ventilation

VFDRs involving loss of the normal power supply for EDG 1-1 room cooling fans V-24A and V-24B via fire damage to EB-25 occur in fire areas 1, 2, 3 and 13. Loss of EDG room cooling results in excessive diesel room heatup during diesel operation and failure of sensitive EDG electrical components (e.g., EC-22, voltage regulator, etc.) for electrical vital auxiliaries.

The fire PRA results for these VFDR reflect protecting from fire damage all PRA functions of EB-25. The delta risks of the VFDRs represent protection of the alternate power supply for the EDG 1-1 room cooling fans. This has no risk benefit in the PRA model. Other functions in the PRA not directly associated with the deterministic variance (e.g. PORV block valve MO-1042A) that do have risk benefit are also protected.

Battery room ventilation

VFDRs involving failure to protect room ventilation systems for the battery rooms exist in fire areas 1, 2, 3, 4, 5, 6, 11, 12, 13, 21, 23 and 32. Battery room ventilation is not required for equipment operation in the PRA. Therefore, the ventilation system functions and corresponding components are not modeled in the fire PRA and by definition the associated delta risks are epsilon.

Cable spreading room ventilation

VFDRs involving failure to protect room ventilation systems for the cable spreading room exist in fire areas 1, 2, 3, 4, 5, 6, 9, 10, 11, 13, 15, 16, 17, 18, 21, 22, 23, 24, 25, 27, 28, 30 and 31. Cable spreading room ventilation is not required for equipment operation in the PRA. Therefore, the ventilation system functions and corresponding components are not modeled in the fire PRA and by definition the associated delta risks are epsilon.

Switchgear room ventilation

VFDRs involving failure to protect room ventilation systems for the switchgear rooms exist in fire areas 1, 2, 3, 4, 5, 6, 9, 10, 11, 13, 15, 16, 17, 18, 21, 22, 23, 24, 25, 27, 28, 30 and 31. Switchgear room ventilation is not required for equipment operation in the PRA. Therefore, the ventilation system functions and corresponding components are not modeled in the fire PRA and by definition the associated delta risks are epsilon.

Condensate and heater drain pump trips

VFDRs involving loss of the ability to trip condensate pumps and heater drain pumps exist in fire areas 1, 2, 4 and 23. Condensate and heater drain pump trip functions are not modeled in the PRA. The pumps are not credibly capable of steam generator overfill at pressure due to pump head capacity and suction source limitations.

The fire PRA results for these VFDRs reflect the PRA functions of the condensate pumps. These are (1) to support main feedwater, (2) to provide low pressure feed for secondary side decay heat removal, and (3) to function to preclude drain down of the condensate storage tank. The delta risks of the VFDRs represent protection of the trip function. This has no risk benefit in the PRA model. Other functions in the PRA not directly associated with the deterministic variance (e.g. support for low pressure feed) that do have risk benefit may also be protected.

Service water train

VFDRs involving the loss of a service water train to support one emergency diesel generator and one train of control room HVAC exist in fire areas 1, 2, 4, 9, 13, 16, 21, 23 and 34. Control room ventilation is not modeled to support equipment operation or control room habitability for the mission time of the PRA. Control room HVAC is included in the PRA model to determine its availability as an input to the calculation of non-suppression probabilities in control room fire scenarios.

The fire PRA results for these VFDRs reflect protecting from fire damage one service water pump and valves required to maintain one train of service water from the control room. The delta risks of these VFDRs include other functions in the PRA not directly associated with the deterministic variance. For example, PCP seal cooling to prevent PCP seal LOCAs, engineered safeguards system (ESS) pump cooling to mitigate larger LOCAs and provide redundant mitigation of very small LOCAs.

Note that several of these VFDRs also involve loss of the ability to monitor service water pump flow (header pressure) from the control room. These VFDRs indicated service water pressure indicator PI-1321 requires protection. PI-1321 is not modeled in the fire PRA by definition the associated delta risks for this specific component are epsilon.

Steam generator blowdown valves

VFDRs involving spurious opening of steam generator blowdown valves exist in fire areas 1, 2, 3 and 16. Steam generator blowdown valve closure is not required for successful secondary side decay heat removal in the PRA. Therefore, steam generator blowdown valves are not modeled in the fire PRA and by definition the associated delta risks are epsilon.

Primary coolant system (PCS) sample line isolation

A VFDR involving a failure to isolate a primary coolant system sample lines exists in fire area 13. Sample line isolation is not required for successful PCS isolation for the mission time of the PRA. Therefore, the PCS sample line isolation function and corresponding components are not modeled in the fire PRA and by definition the associated delta risks are epsilon.

Primary coolant system (PCS) dilution path isolation

VFDRs involving a failure to isolate a primary coolant system dilution path exist in fire areas 1, 2, 4 and 13. Dilution path isolation is not required for successful reactivity control for the mission time of the PRA. Therefore, the PCS dilution isolation function and corresponding components are not modeled in the fire PRA and by definition the associated delta risks are epsilon.

Control room ventilation

VFDRs involving a failure to protect one train of control room ventilation exist in fire areas 3, 4, 5, 6, 9, 10, 11, 13, 15, 16, 17, 18, 21, 22, 23, 24, 25, 27, 28, 30 and 31. Control room ventilation is not required to support equipment operation or control room habitability (except for control room abandonment scenarios) for the mission time of the PRA. Therefore, control room ventilation system functions and corresponding components are not modeled in the fire PRA and by definition the associated delta risks are epsilon.

HPSI pump flow path

A VFDR involving loss of HPSI injection to PCS via cross-tie to charging piping due to fire damage to HPSI pump control, suction valves, injection pathway valves and valves required for pump cooling exists in fire area 13. The PRA model only considers the PCS makeup paths of HPSI injection via ESS loop injection valves and charging pump injection via the CVCS injection valves. Makeup to PCS via the HPSI-CVCS cross-tie is not credited.

The fire PRA results for this VFDR reflect failing and protecting from fire damage the component required to preserve this function from the control room, except MO-3072. The delta risks of this VFDR include other functions in the PRA not directly associated with the deterministic variance. MO-3072 is not modeled in the fire PRA and does not impact fire PRA success criteria. Therefore, by definition the associated delta risks for this specific component are epsilon.

Engineered safeguards room ventilation

A VFDR involving failure to protect room ventilation systems for the engineered safeguards rooms exists in fire area 13. Engineered safeguards room ventilation is not required for equipment operation in the PRA. Therefore, the ventilation system functions

and corresponding components are not modeled in the fire PRA and by definition the associated delta risks are epsilon.

NRC REQUEST

PRA RAI 28.a.01

The response to PRA RAI 28a, in the letter dated December 2, 2013, ADAMS Accession No. ML13336A649, states that "the aggregate impact of employing scoping values for the HFEs as provided in NUREG-1792, "Good Practices for Implementing Human Reliability Analysis (HRA)" that are not risk significant is an increase in (internal events) CDF by a factor of 1.8;" however, the response does not address the impact on the fire PRA.

a. *Provide the impact of employing NUREG-1792 scoping values on the fire risk estimates demonstrating that they are insignificant for both the transition and the self-approval change in risk guidelines values;*

b. *Otherwise, provide updated risk results as part of the composite change-in-risk analysis requested in PRA RAI 30, using scoping values consistent with the guidance in NUREG-1792, and indicate what values will be used in post-transition fire risk evaluations.*

ENO RESPONSE

The results of the comparison of the change in core damage frequency (CDF) for the RAI Response Fire PRA Model demonstrates that the increase in core damage frequency is lower than the impact calculated for the full power internal events and therefore considered insignificant. For the RAI Response Fire PRA Model, the use of NUREG-1792 scoping values results in a factor increase of 1.07 in CDF. This factor increase is also insignificant with respect to the impact on the aggregate risk used in evaluating RG 1.174 risk acceptance guidelines as reported in response to PRA RAI 20.01. Therefore the conditions of PRA RAI 28.a.01 a) are met and response to PRA RAI 28.a.01 b) is not required.

NRC REQUEST

PRA RAI 30

Section 2.4.3.3 of the NFPA 805 standard incorporated by reference into 50.48(c) states that the probabilistic safety assessment (PSA) (PSA is also referred to as PRA) approach, methods, and data shall be acceptable to the authority having jurisdiction (AHJ), which is the NRC. RG 1.205, "Risk-Informed, Performance-Based Fire Protection for Existing Light-Water Nuclear Power Plants," identifies NUREG/CR-6850, NEI 04-02, Revision 2, "Guidance for Implementing a Risk-Informed, Performance-

Based Fire Protection Program Under 10 CFR 50.48(c)," and the ongoing FAQ process as documenting acceptable to the staff for adopting a fire protection program consistent with NFPA 805.

The NRC staff identified several methods and weaknesses that were used in the fire PRA. RAIs were provided about these methods and weaknesses and the responses have been reviewed. The staff notes that the justification does not seem to be complete (e.g., credit for control power transformers is not supported by experiments). Also, in some instances, aspects of the Fire PRA model may have been incomplete at the time of the LAR submittal, but subsequently completed in response to an RAI. All these methods are included in the list below:

- *PRA RAIs 01.a and 03 (i.e., F&O CS-A9-01) regarding integration of the completed supplemental cable analysis into the fire PRA model*
- *PRA RAIs 01.c and 03 (i.e., F&O CS-C1-01) regarding integration of the cable routing data verification results into the fire PRA model*
- *PRA RAI 01.d regarding integration of the completed analysis into the fire PRA model*
- *PRA RAIs 01.h and 03 (i.e., F&Os FQ-C1-01 and HRA-D2-01) regarding updating the dependency analysis*
- *PRA RAI 01.h (as clarified by PRA RAI 01h.02) regarding minimum ("floor") values for the joint probability of multiple HFEs*
- *PRA RAI 01.j (as clarified by PRA RAI 01j.01) regarding treatment of fire propagation in cabinets*
- *PRA RAIs 01.o and 11 regarding the treatment of sensitive electronics*
- *PRA RAIs 01.m and 11 regarding treatment of junction boxes*
- *PRA RAI 01.q (as clarified by PRA RAI 01q.01) regarding the target damage time model*
- *PRA RAI 01.s regarding transient fire location*
- *PRA RAI 01.t regarding unavailability estimates for credited detection and suppression systems*
- *PRA RAI 01.w regarding the frequency and suppression of catastrophic turbine-generator fires*

- *PRA RAIs 01.y (as clarified by PRA RAI 01y.01) regarding barrier failure probabilities*
- *PRA RAI 01.z regarding active barrier failure probabilities*
- *PRA RAI 01.aa regarding hydrogen frequency apportioning and target set development*
- *PRA RAI 01.bb regarding talk-throughs with plant operations and training personnel*
- *PRA RAI 01.cc regarding accounting for scenario context in the definition of HFEs*
- *PRA RAI 01.dd regarding use of guidance in NUREG-1921 for screening, scoping and detailed human error probabilities*
- *PRA RAI 01.ee regarding the modeling of significant accident sequences*
- *PRA RAI 01.ff regarding accounting for relevant fire effects in the HRA*
- *PRA RAIs 01.nn and 03 (i.e., F&O FSS-E3-01) regarding providing mean values (i.e., CDF, LERF, ΔCDF and ΔLERF) reflecting propagation of parametric uncertainty, accounting for the state of knowledge correlation*
- *PRA RAI 06 regarding the omission of transient scenarios at pinch points*
- *PRA RAI 07 regarding the treatment of transient and fixed ignition sources in the cable spreading room*
- *PRA RAIs 08 and 11 regarding the development of scenarios for self-ignited cable fires and cable fires due to hot work*
- *PRA RAI 13 regarding identified inconsistencies in the generic frequencies assigned to Bins 24 and 26*
- *PRA RAI 17.a regarding the treatment of the complete back panel of sub-enclosure 1 as electrical cabinets*
- *PRA RAI 17.b (as clarified by PRA RAI 17b.01) regarding apportionment of the MCB frequency to MCB sections*
- *PRA RAI 17.d regarding treatment of fire propagation for MCB and electrical panels in the MCR, addressing both adjacent and non-adjacent panels as well as considering the impact on time-to-abandonment calculations*

- *PRA RAI 17.e regarding MCR transient fire placement*
- *PRA RAIs 17.h and 28.h regarding treatment of MCR HVAC*
- *PRA RAI 18 regarding HEAF-related fire scenarios*
- *PRA RAI 19 regarding the impact of suppression activities on components in the fire PRA*
- *PRA RAI 25 regarding removal of the surrogate approach for calculating ΔCDF and ΔLERF*
- *PRA RAI 28a.01 regarding pre-initiator scoping values for HFEs*

<u>Changes that may impact fire-affected components</u>

The responses to the following Fire Modeling (FM) RAIs appear to have caused changes that may impact the fire-affected components for a variety of fires. The aggregate change-in-risk evaluation should include the potential impact of changes in:

- *FM RAI 01.b regarding transient fire growth times*
- *FM RAI 01.c regarding wall and corner effects of transient fires on MCR abandonment times and implementation of NUREG/CR-6850 abandonment criteria*
- *FM RAI 01.e regarding thermal plume and hot gas layer effects on ZOI determination*
- *FM RAI 01.f regarding impact of secondary and intervening combustibles on ZOI determination*
- *FM RAI 01.g regarding the flame spread, fire propagation and HRR estimates associated with cable trays*
- *FM RAI 01.k regarding non-cable secondary combustibles*
- *FM RAI 01.l regarding horizontal and vertical cable tray propagation*
- *FM RAI 04 regarding fire models used outside their limitations*

<u>PRA Methods and weaknesses still under review:</u>

The following methods and weaknesses have been identified, but the NRC Staff review is continuing with additional RAIs and further supporting information has been requested. Alternatively, any of these methods and weaknesses may be replaced with a method or model previously accepted by the NRC by modifying the Fire PRA model.

- *PRA RAI 01.e.01 regarding PCP seal model*

- *PRA RAI 01.f.01 regarding instrumentation (including associated cable tracing) for HFEs credited in the fire PRA*
- *PRA 01.h.01 regarding treatment of location in the dependency analysis*
- *PRAs 01.k.01 regarding treatment of MCR abandonment due to loss of control*
- *PRA RAI 01.l.01 regarding the HRA approach utilized for pre- and post-abandonment actions*
- *PRA RAI 01.r.01 regarding smoke detector response time*
- *PRA RAI 20.01 regarding NUREG/CR-6850 fire ignition frequencies sensitivity analysis*

<u>FM Methods and weaknesses still under review:</u>

The following methods and weaknesses have been identified for which the NRC Staff review is continuing with additional FM RAIs that may cause changes that impact the fire-affected components for a variety of fires:

- *FM RAI 01.01 regarding structural steel analysis*
- *FM RAI 07 regarding time of fire propagation to adjacent cabinets*
- *FM RAI 09 regarding high energy arcing fault (HEAF) initiated fires*

a. *For each method (i.e., each bullet) above, explain how the issue will be addressed in 1) the final composite analysis results provided in support of the LAR, and 2) the PRA that will be used at the beginning of the self-approval of post-transition changes. (This includes all items listed above including changes that may impact fire affect components; PRA methods and weaknesses still under review, and FM methods and weaknesses still under review)*

b. *Provide the results of a composite analysis that shows the integrated impact on the fire risk (CDF, LERF, ΔCDF, ΔLERF) after the methods and weaknesses have been replaced. As the review process is concluded, additional changes to replace any method or weakness still under review may be required. In this composite analysis, for those cases where the individual issues have a synergistic impact on the results, a simultaneous analysis must be performed. For those cases where no synergy exists, a one-at-a-time analysis may be done. If the impact on the change in risk from transition is negligible, a quantitative evaluation is unnecessary.*

c. *As committed in the responses to PRA RAIs 23 and 26, respectively, provide updated Attachments W (including all tables, e.g., CDF and LERF insights), and Attachment S to the LAR.*

ENO RESPONSE

*Note: The terms "LAR Model" and "RAI Response Fire PRA Model," used in the ENO responses below, refer to the fire PRA model issued to support the original PNP LAR submittal in December 2012 and to the updated model quantified to provide the results presented here, respectively.

NRC REQUEST

- *PRA RAIs 01.a and 03 (i.e., F&O CS-A9-01) regarding integration of the completed supplemental cable analysis into the fire PRA model.*

ENO RESPONSE

The supplemental cable analysis has been completed and integrated into the RAI Response Fire PRA Model. See the revised Table W-2 provided in Attachment 4.

NRC REQUEST

- *PRA RAIs 01.c and 03 (i.e., F&O CS-C1-01) regarding integration of the cable routing data verification results into the fire PRA model.*

ENO RESPONSE

The cable routing data verification results have been integrated into the RAI Response Fire PRA Model. See the revised Table W-2 provided in Attachment 4.

NRC REQUEST

- *PRA RAI 01.d regarding integration of the completed analysis into the fire PRA model*

ENO RESPONSE

The evaluation of instrumentation is complete. The associated circuit analysis has been completed. Integration of instrumentation that could potentially affect accident mitigating equipment or operator response was incorporated into the RAI Response Fire PRA Model. See the revised Table W-2 provided in Attachment 4.

NRC REQUEST

- *PRA RAIs 01.h and 03 (i.e., F&Os FQ-C1-01 and HRA-D2-01) regarding updating the dependency analysis*

ENO RESPONSE

PNP screening HEPs, which were the subject of PRA RAIs 01.h and 03, have been superseded as a result of using NUREG-1921 scoping values and additional detailed HEPs as discussed in response to PRA RAI 01.I, RAI 12 and 12.01. Upon NFPA-805 implementation the dependency analysis will be updated to include the new fire recovery actions, new procedures, and plant modifications (See Attachment S, Table S-3, Item 3).

NRC REQUEST

- *PRA RAI 01.h (as clarified by PRA RAI 01h.02) regarding minimum ("floor") values for the joint probability of multiple HFEs*

ENO RESPONSE

The guidance of NUREG-1921 was implemented and a floor value of 1E-5 was used for all conditional joint HEPs whose calculated value was less than 1E-5. The impact of these changes was negligible.

NRC REQUEST

- *PRA RAI 01.j (as clarified by PRA RAI 01j.01) regarding treatment of fire propagation in cabinets*

ENO RESPONSE

All cabinets previously treated as "closed, sealed and robust" were judged to meet the criteria established in FAQ 08-0042, thus risk estimates treating these cabinets as open is not required. Therefore, scenarios modeling fire propagation from these electrical panels are not included in the quantification update.

NRC REQUEST

- *PRA RAIs 01.o and 11 regarding the treatment of sensitive electronics*

ENO RESPONSE

The treatment of sensitive electronics in the RAI Response Fire PRA Model was updated to be consistent with NUREG/CR-6850 Appendix S guidance. The impact of these changes is reflected in the updated risk numbers. See the revised Table W-2 provided in Attachment 4.

NRC REQUEST

- *PRA RAIs 01.m and 11 regarding treatment of junction boxes*

ENO RESPONSE

The treatment of junction boxes in the RAI Response Fire PRA Model has been updated to be consistent with that described in FAQ 13-0006. The impact of these changes is reflected in the updated risk numbers. See the revised Table W-2 provided in Attachment 4.

NRC REQUEST

- *PRA RAI 01.q (as clarified by PRA RAI 01.q.01) regarding the target damage time model*

ENO RESPONSE

The RAI Response Fire PRA Model was modified to use the 'damage accrual' method using elements of the Arrhenius methodology. The impact of these changes is reflected in the updated risk numbers. See the revised Table W-2 provided in Attachment 4.

NRC REQUEST

- *PRA RAI 01.s regarding transient fire location*

ENO RESPONSE

The assumed transient location was modified for specific plant locations which included larger transient combustible containers. Transient scenarios developed in these areas using the revised criterion have been integrated into the RAI Response Fire PRA Model. The impact of these changes is reflected in the updated risk numbers. See the revised Table W-2 provided in Attachment 4.

NRC REQUEST

- *PRA RAI 01.t regarding unavailability estimates for credited detection and suppression systems*

ENO RESPONSE

Generic detection and suppression system failure rates from NUREG/CR-6850 were used in the RAI Response Fire PRA Model because a review of plant records identified minimal unavailability of the credited detection or suppression systems. Therefore, the RAI Response Fire PRA Model was not updated.

NRC REQUEST

- *PRA RAI 01.w regarding the frequency and suppression of catastrophic turbine-generator fires*

ENO RESPONSE

The calculation for the T/G catastrophic fire was updated to be consistent with the NUREG/CR-6850 guidance. The updated results for the T/G catastrophic fire scenario are included in the RAI Response Fire PRA Model. See the revised Table W-2 provided in Attachment 4.

NRC REQUEST

- *PRA RAIs 01.y (as clarified by PRA RAI 01y.01) regarding barrier failure probabilities*

ENO RESPONSE

The multi-compartment barrier failure probability was updated to sum the barrier failure probabilities for each type of barrier present per NUREG/CR-6850. The risk impact of these changes are included in the RAI Response Fire PRA Model. See the revised Table W-2 provided in Attachment 4.

NRC REQUEST

- *PRA RAI 01.z regarding active barrier failure probabilities*

ENO RESPONSE

The active barrier failure probabilities were updated to be consistent with the guidance in NUREG/CR-6850. The numerical impact of these changes are incorporated into the RAI Response Fire PRA Model. See the revised Table W-2 provided in Attachment 4.

NRC REQUEST

- *PRA RAI 01.aa regarding hydrogen frequency apportioning and target set development*

ENO RESPONSE

The frequency apportionment of hydrogen fires was updated as indicated in PRA RAI 01.aa. The numerical effect of these changes is reflected in the RAI Response Fire PRA Model. See the revised Table W-2 provided in Attachment 4.

NRC REQUEST

- *PRA RAI 01.bb regarding talk-throughs with plant operations and training personnel*

ENO RESPONSE

The HRA analysis was updated to follow the guidance in NUREG-1921 for screening, scoping and detailed human error probabilities. The indicated reviews for credited HEPs have been completed. The numerical effect is reflected in the RAI Response Fire PRA Model. See the revised Table W-2 provided in Attachment 4.

NRC REQUEST

- *PRA RAI 01.cc regarding accounting for scenario context in the definition of HFEs*

ENO RESPONSE

Per the response to PRA 01.cc, changes to the development of human error probabilities are reflected in the RAI Response Fire PRA Model. See the revised Table W-2 provided in Attachment 4..

NRC REQUEST

- *PRA RAI 01.dd regarding use of guidance in NUREG-1921 for screening, scoping and detailed human error probabilities*

ENO RESPONSE

The HRA analysis was updated to follow the guidance in NUREG-1921 for screening, scoping and detailed human error probabilities. The numerical effects of these changes are reflected in the RAI Response Fire PRA Model. See the revised Table W-2 provided in Attachment 4.

NRC REQUEST

- *PRA RAI 01.ee regarding the modeling of significant accident sequences*

ENO RESPONSE

The HRA analysis was updated to follow the guidance in NUREG-1921 regarding the modeling of significant accident sequences for screening, scoping and detailed human error probabilities. The numerical effect of changes to account for recovery actions are reflected in the RAI Response Fire PRA Model. See the revised Table W-2 provided in Attachment 4.

NRC REQUEST

- *PRA RAI 01.ff regarding accounting for relevant fire effects in the HRA*

ENO RESPONSE

Changes made in support of the resolution of PRA RAI 01.ff have been incorporated in the RAI Response Fire PRA Model for both fire response actions and actions that were carried over from the FPIE PRA. The impacts of these changes are reflected in the RAI Response Fire PRA Model. See the revised Table W-2 provided in Attachment 4.

NRC REQUEST

- *PRA RAIs 01.nn and 03 (i.e., F&O FSS-E3-01) regarding providing mean values (i.e., CDF, LERF, ΔCDF and ΔLERF) reflecting propagation of parametric uncertainty, accounting for the state of knowledge correlation.*

ENO RESPONSE

Based on the level of detail and fidelity of the RAI Response Fire PRA model, it is expected that the change in uncertainty, due to the application of the state of knowledge correlation to the requested parameters, is negligible.

NRC REQUEST

- *PRA RAI 06 regarding the omission of transient scenarios at pinch points*

ENO RESPONSE

Transient fire scenarios were developed for these locations to demonstrate no pinch points were omitted and are included in the results of the RAI Response Fire PRA Model. The impacts of these new scenarios are reflected in the updated risk numbers. See the revised Table W-2 provided in Attachment 4.

NRC REQUEST

- *PRA RAI 07 regarding the treatment of transient and fixed ignition sources in the cable spreading room*

ENO RESPONSE

The method used to model transient and fixed ignition sources in the Cable Spreading Room (CSR) was updated in the RAI Response Fire PRA Model to more appropriately bound the fire risk in this PAU as described in the previous response to PRA RAI 07. These updated scenarios are included in the RAI Response Fire PRA Model. See the revised Table W-2 provided in Attachment 4.

NRC REQUEST

- *PRA RAIs 08 and 11 regarding the development of scenarios for self-ignited cable fires and cable fires due to hot work*

ENO RESPONSE

The development of scenarios for self-ignited cable fires and cable fires due to hot work in the PNP fire PRA has been re-performed in accordance with FAQ 13-0005. The new scenarios have been integrated into the RAI Response Fire PRA Model. See the revised Table W-2 provided in Attachment 4.

NRC REQUEST

- *PRA RAI 13 regarding identified inconsistencies in the generic frequencies assigned to Bins 24 and 26*

ENO RESPONSE

The generic frequencies for bins 24 and 26 have been updated accordingly. The numerical effects of these updates are reflected in the RAI Response Fire PRA Model. See the revised Table W-2 provided in Attachment 4.

NRC REQUEST

- *PRA RAI 17.a regarding the treatment of the complete back panel of sub-enclosure 1 as electrical cabinets*

ENO RESPONSE

Based on the wording in FAQ 14-0008, the back panel of sub-enclosure 1 meets the definition of a main control board (MCB). Since utilization of this approach is consistent with the latest guidance in FAQ 14-0008, treatment of the back panels remains unchanged. See the revised Table W-2 provided in Attachment 4.

NRC REQUEST

- *PRA RAI 17.b (as clarified by PRA RAI 17b.01) regarding apportionment of the MCB frequency to MCB sections*

ENO RESPONSE

The plant-wide MCB frequency apportioned to each of three MCB sections was updated in accordance with the response to PRA RAI 17.b.01. The impact of these changes to the MCB frequency apportionment is reflected in the RAI Response Fire PRA Model. See the revised Table W-2 provided in Attachment 4.

NRC REQUEST

- *PRA RAI 17.d regarding treatment of fire propagation for MCB and electrical panels in the MCR, addressing both adjacent and non-adjacent panels as well as considering the impact on time-to-abandonment calculations*

ENO RESPONSE

Per the PRA RAI 17.d revised response, provided as part of PRA RAI 17.b.01, the

model was updated. The numerical effect of these changes is reflected in the RAI Response Fire PRA Model. See the revised Table W-2 provided in Attachment 4.

NRC REQUEST

- *PRA RAI 17.e regarding MCR transient fire placement*

ENO RESPONSE

The placement of transient fires in the control room was modified as indicated in the resolution of PRA RAI 17.e. The impact of these changes to the MCB frequency apportionment is reflected in the RAI Response Fire PRA Model. See the revised Table W-2 provided in Attachment 4.

NRC REQUEST

- *PRA RAIs 17.h and 28.h regarding treatment of MCR HVAC*

ENO RESPONSE

As indicated in the response to PRA RAI 17.h, the treatment of control room HVAC was updated to consider both random and fire induced failures when calculating the likelihood of control room abandonment. The indirect numerical impact of these changes is reflected in the RAI Response Fire PRA Model. See the revised Table W-2 provided in Attachment 4.

As noted in the response to PRA RAI 28.h, the MCR HVAC system is not included in the RAI Response Fire PRA Model as a mitigation system or support system necessary to prevent core damage. Consequently, there is no direct numerical impact to the quantification of the RAI Response Fire PRA Model.

NRC REQUEST

- *PRA RAI 18 regarding HEAF-related fire scenarios*

ENO RESPONSE

The fire scenarios postulated for HEAF events in 1D and 1C switchgear rooms have updated using calculations performed using detailed fire modeling with FDS. These updated scenarios are included in the RAI Response Fire PRA Model. See the revised Table W-2 provided in Attachment 4.

NRC REQUEST

- *PRA RAI 19 regarding the impact of suppression activities on components in the fire PRA*

ENO RESPONSE

The Fire Suppression Activities Effect on Nuclear Safety Performance Criteria report was reviewed to identify the impacts of suppression activities on components in the fire PRA. Applicable fire PRA scenarios were updated in the RAI Response Fire PRA Model to include component failures consistent with NUREG/CR-6850 guidance. The impact of these changes is reflected in the RAI Response Fire PRA Model. See the revised Table W-2 provided in Attachment 4.

NRC REQUEST

- *PRA RAI 25 regarding removal of the surrogate approach for calculating ΔCDF and ΔLERF*

ENO RESPONSE

The calculations generated in support of the resolution of this RAI do not use the surrogate approach described in PRA RAI 25. The numerical effect is reflected in the base quantification of the RAI Response Fire PRA Model, which includes ΔCDF and ΔLERF for each fire area that removes credit for beyond compliance modifications directly for the compliant plant. See the revised Table W-2 provided in Attachment 4.

NRC REQUEST

- *PRA RAI 28a.01 regarding pre-initiator scoping values for HFEs*

ENO RESPONSE

Per the response in PRA RAI 28.a.01, there is no numerical impact as a result of the resolution.

Changes that may impact fire-affected components

NRC REQUEST

The responses to the following Fire Modeling (FM) RAIs appear to have caused changes that may impact the fire-affected components for a variety of fires. The aggregate change-in-risk evaluation should include the potential impact of changes in:

- *FM RAI 01.b regarding transient fire growth times*

ENO RESPONSE

Control room abandonment scenarios were modified based on the resolution of FM RAI 01.b. The impact of these changes is reflected in the RAI Response Fire PRA Model. See the revised Table W-2 provided in Attachment 4.

NRC REQUEST

- *FM RAI 01.c regarding wall and corner effects of transient fires on MCR abandonment times and implementation of NUREG/CR-6850 abandonment criteria*

ENO RESPONSE

Control room abandonment scenarios were modified based on the resolution of FM RAI 01.c. The impact of these changes is reflected in the RAI Response Fire PRA Model. See the revised Table W-2 provided in Attachment 4.

NRC REQUEST

- *FM RAI 01.e regarding thermal plume and hot gas layer effects on ZOI determination*

ENO RESPONSE

Fire scenarios were modified based on the resolution of FM RAI 01.e. The impact of these changes is reflected in the RAI Response Fire PRA Model. See the revised Table W-2 provided in Attachment 4.

NRC REQUEST

- *FM RAI 01.f regarding impact of secondary and intervening combustibles on ZOI determination*

ENO RESPONSE

Fire scenarios were modified based on the resolution of FM RAI 01.f. The impact of these changes is reflected the RAI Response Fire PRA Model. See the revised Table W-2 provided in Attachment 4.

NRC REQUEST

- *FM RAI 01.g regarding the flame spread, fire propagation and HRR estimates associated with cable trays*

ENO RESPONSE

Fire scenarios were modified based on the resolution of FM RAI 01.g. The impact of these changes is reflected in the RAI Response Fire PRA Model. See the revised Table W-2 provided in Attachment 4.

NRC REQUEST

- *FM RAI 01.k regarding non-cable secondary combustibles*

ENO RESPONSE

No model changes were required by the resolution of FM RAI 01.k. Consequently, there is no impact to the quantification of the RAI Response Fire PRA Model.

NRC REQUEST

- *FM RAI 01.l regarding horizontal and vertical cable tray propagation*

ENO RESPONSE

FM RAI 01.l was resolved via fire scenario modification. The impact of these changes is reflected in the RAI Response Fire PRA Model. See the revised Table W-2 provided in Attachment 4.

NRC REQUEST

- *FM RAI 04 regarding fire models used outside their limitations*

ENO RESPONSE

No model changes were required by the resolution of FM RAI 04. Consequently, there is no impact to the quantification of the RAI Response Fire PRA Model.

NRC REQUEST

PRA Methods and weaknesses still under review:

The following methods and weaknesses have been identified, but the NRC Staff review is continuing with additional RAIs and further supporting information has been requested. Alternatively, any of these methods and weaknesses may be replaced with a method or model previously accepted by the NRC by modifying the Fire PRA Model.

- *PRA RAI 01.e.01 regarding PCP seal model*

ENO RESPONSE

The response to PRA RAI 01.e.01 demonstrates that the PCP seal model is consistent with the consensus model as endorsed by the NRC as documented in WCAP-16175-P-A. Consequently, there is no impact to the quantification of the RAI Response Fire PRA Model.

NRC REQUEST

- *PRA RAI 01.f.01 regarding instrumentation (including associated cable tracing) for HFEs credited in the fire PRA*

ENO RESPONSE

Instrumentation for HFE's credited in the fire PRA were treated as per the response to PRA 01.f.01. The impact of these changes is reflected the RAI Response Fire PRA Model. See the revised Table W-2 provided in Attachment 4.

NRC REQUEST

- *PRA 01.h.01 regarding treatment of location in the dependency analysis*

ENO RESPONSE

Upon NFPA-805 implementation, the dependency analysis will be updated to include the new fire recovery actions, new procedures, plant modifications, and application of NUREG-1921 location dependencies. (See Attachment S, Table S-3, Item 3).

NRC REQUEST

- *PRAs 01.k.01 regarding treatment of MCR abandonment due to loss of control*

ENO RESPONSE

The response to PRA RAI 01.k.01 indicates that abandonment due to loss of control is not considered. Therefore, there is no numerical impact to the quantification of the RAI Response Fire PRA Model.

NRC REQUEST

- *PRA RAI 01.l.01 regarding the HRA approach utilized for pre- and post-abandonment actions*

ENO RESPONSE

Pre- and post-abandonment actions have been treated as described in PRA RAI 01.l.01. The impact of these changes is reflected in the RAI Response Fire PRA Model. See the revised Table W-2 provided in Attachment 4.

NRC REQUEST

- *PRA RAI 01.r.01 regarding smoke detector response time*

ENO RESPONSE

As indicated in the response to PRA RAI 01.r and 01.r.01, the fire PRA model was updated to include the failure probability of automatic detection systems credited in the calculation of manual non-suppression probabilities (NSPs) and the updated smoke detector response times. The numerical impact of these changes is reflected in the RAI Response Fire PRA Model. See the revised Table W-2 provided in Attachment 4.

NRC REQUEST

- *PRA RAI 20.01 regarding NUREG/CR-6850 fire ignition frequencies sensitivity analysis*

ENO RESPONSE

The sensitivity analysis regarding NUREG/CR-6850 fire ignition frequencies has been completed. RG 1.174 limits are satisfied. See PRA RAI 20.01 response.

NRC REQUEST

FM Methods and weaknesses still under review:

The following methods and weaknesses have been identified for which the NRC Staff review is continuing with additional FM RAIs that may cause changes that impact the fire-affected components for a variety of fires:

- *FM RAI 01.01 regarding structural steel analysis*
- *FM RAI 07 regarding time of fire propagation to adjacent cabinets*
- *FM RAI 09 regarding high energy arcing fault (HEAF) initiated fires*

NRC REQUEST

- *FM RAI 01.01 regarding structural steel analysis*

ENO RESPONSE

The Fire PRA model has been updated to assume structural collapse of the compartment given the failure of one structural steel column for the applicable fire scenarios. The updated fire scenarios have been incorporated and are reflected in the RAI Response Fire PRA Model. See the revised Table W-2 provided in Attachment 4.

NRC REQUEST

- *FM RAI 07 regarding time of fire propagation to adjacent cabinets*

ENO RESPONSE

Hughes Associates Report 0021-0019-000-001 has been updated to reflect a 10 minute propagation time between adjacent panels in the Main Control Room (MCR). Additional technical justification for assuming 15 minutes for fire propagation is not required. The updated fire scenarios have been incorporated and are reflected in the RAI Response Fire PRA Model. See the revised Table W-2 provided in Attachment 4.

NRC REQUEST

- *FM RAI 09 regarding high energy arcing fault (HEAF) initiated fires*

ENO RESPONSE

Per the response to FM RAI 09, the RAI Response Fire PRA Model was updated. See the revised Table W-2 provided in Attachment 4.

NRC REQUEST

a. *For each method (i.e., each bullet) above, explain how the issue will be addressed in 1) the final composite analysis results provided in support of the LAR, and 2) the PRA that will be used at the beginning of the self-approval of post-transition changes. (This includes all items listed above including changes that may impact fire affect components; PRA methods and weaknesses still under review, and FM methods and weaknesses still under review)*

ENO RESPONSE

a. For each method (i.e. each bullet) above, PNP describes the impact to the RAI Response Fire PRA Model. The final composite analysis results are reflected in the revised Table W-1 and W-2 provided in Attachment 4.

   The PRA model used at the beginning of the self-approval of post-transition changes would be the RAI Response Fire PRA Model with each issue addressed as described above. This model would exclude modifications not implemented at the time.

NRC REQUEST

b. *Provide the results of a composite analysis that shows the integrated impact on the fire risk (CDF, LERF, ΔCDF, ΔLERF) after the methods and weaknesses have been replaced. As the review process is concluded, additional changes to replace any method or weakness still under review may be required. In this composite analysis, for those cases where the individual issues have a synergistic impact on the results, a simultaneous analysis must be performed. For those cases where no synergy exists, a one-at-a-time analysis may be done. If the impact on the change in risk from transition is negligible, a quantitative evaluation is unnecessary.*

ENO RESPONSE

b. The composite analysis is reflected in the RAI Response Fire PRA Model and includes synergistic effects. See the revised Table W-2 provided in Attachment 4.

NRC REQUEST

c. *As committed in the responses to PRA RAIs 23 and 26, respectively, provide updated Attachments W (including all tables, e.g., CDF and LERF insights), and Attachment S to the LAR.*

ENO RESPONSE

c. The updated Attachment W Tables, Table W-1 and W-2, are provided in Attachment 4. These tables supersede the Attachment W Tables, Table W-1 and W-2, submitted with the NFPA 805 LAR on December 12, 2012.

   The updated Attachment S has been provided in Attachment 3. This update supersedes the Attachment S submitted with the NFPA 805 LAR on December 12, 2012.

ENO FOLLOW UP RESPONSE TO PRA RAI 12 REGARDING FOCUSED-SCOPE PEER REVIEW ON THE USE OF NUREG-1921:

A focused-scope peer review on the changes to the fire HRA methodology due to development and use of scoping HEPs per NUREG -1921 was completed. The peer review concluded PNP has appropriately implemented the scoping approach in the fire PRA. Six (6) findings were identified associated with the scoping approach. The findings involved verification of feasibility during implementation and confirmation that scoping HFEs were applied to only non-significant HFEs. These findings do not impact the conclusions of the fire PRA and will be addressed as part of LAR Table S-3, Item 3.

ATTACHMENT 2
LICENSEE IDENTIFIED ISSUES

The following licensee identified issues were discovered as a result of responding to RAIs:

1. Table 4-3
2. Table B-1
3. Table B-3
4. Attachment S

LICENSEE IDENTIFIED ISSUE #1: Table 4-3

LAR Table 4-3 has been revised to incorporate additional credited fire protection detection and suppression as a result of responding to fire modeling and probabilistic risk assessment RAI's. One other minor correction was made to correct a previous oversight.

As a result of responding to PRA RAI 01.r.01, regarding the modeling of the automatic detection system failure probability, scenarios within Fire Areas 2, 3, 4, 15, and 21 are now also crediting manual detection. Table 4-3 has been revised to reflect manual detection being credited in Fire Areas 2, 3, 4, 15, and 21. Detection was already a required system "R" in Table 4-3 for Fire Areas 2, 3, 4, 15, and 21, therefore the only change was to add "Manual Detection" to the required fire protection feature and system details column.

As a result of responding to PRA RAI 01.x and FM RAI 01.f, regarding the treatment of sub-volumes in the multi-compartment analysis and the impact of secondary combustibles on zone of influence determinations, credit for manual suppression is now applied to a subset of fire scenarios within Fire Area 23. As part of the change to include credit for manual suppression in Fire Area 23 to resolve PRA RAI 01.x and FM RAI 01.f, manual detection is also being credited within Fire Area 23. Table 4-3 has been revised to reflect manual detection and manual suppression being credited in Fire Area 23. Suppression was already being changed to a required system "R" in Table 4-3 for Fire Area 23 as discussed below therefore "Manual Suppression" was added to the required fire protection feature and system details column. Detection was not a required system in Table 4-3 for Fire Area 23, therefore the required detection system column was changed from "None" to "R^{5}" with a new footnote 5 stating "Manual Detection Only" and "Manual Detection" was added to the required fire protection feature and system details column.

Additionally, manual detection was previously credited in Fire Area 13 however this was not identified in Table 4-3. Table 4-3 has been revised to reflect manual detection being credited in Fire Area 13.

ATTACHMENT 2
LICENSEE IDENTIFIED ISSUES

As a result of responding to FM RAI 01.q and FM RAI 01.01 regarding the number of structural steel member failures that would challenge the Turbine Building integrity, a revision to credit the automatic suppression system around the Main Feedwater Pumps was necessary. Additionally, in resolving PRA RAI 01.w, regarding the modeling of the Turbine Generator Oil and Hydrogen scenarios, the credit for automatic suppression was made more consistent with the guidance in NUREG/CR-6850 Appendix O and this includes credit for the automatic suppression systems in the Turbine Building. Table 4-3 has been revised to reflect the Fire Area 23 automatic suppression system as being a required "R" system in the required suppression system column. Previously the Turbine Building suppression system was only identified as "E" indicating it was credited in support of Existing Engineering Equivalency Evaluation (EEEE) criteria.

Table 4-3 has been revised internally to reflect the changes described above. This response supersedes the previously submitted Table 4-3 entries with the above information and documents the Table 4-3 changes from the December 12, 2012 NFPA 805 LAR.

LICENSEE IDENTIFIED ISSUE #2: Table B-1

Based on review of the NFPA 805 LAR, the following licensee identified revisions are being submitted for Attachment A, Table B-1:

Licensee Identified Change to Table B-1 Section 3.3.4:

The compliance statement of Section 3.3.4 is being changed from "Complies" to "Complies with Clarification".

The compliance basis of Section 3.3.4 is being replaced with the following:
"FPIP-1, Attachment 3, Section D.1.(d) states, "Thermal insulation materials, radiation shielding materials, ventilation duct materials, and soundproofing materials are noncombustible or limited combustible." This defines the general standard that PNP applies to materials used for these purposes. It is not always practical, however, to reasonably obtain materials that meet the definition of noncombustible or limited combustible. For example, there are unique or specific commercially available materials that do not meet the BTU content limit of the limited combustible definition (<3500 BTU/lb) even while meeting the flame spread rating limit (<25). When such materials are used, the materials are evaluated as transient or permanent combustibles and considered in the overall combustible loading of the fire area, as appropriate.

ENO Procedures EN-DC-115, EN-DC-128, and EN-DC-161 are written to ensure that the specified materials are in compliance with the requirement or evaluated appropriately."

Additionally, reference to procedure EN-DC-161, revision Rev. 10, "Control of Combustibles" should be included in the list of references for Section 3.3.4.

Licensee Identified Change to Table B-1 Section 3.11.3:

The Compliance Basis for Section 3.11.3 under the heading WILL COMPLY WITH THE USE OF COMMITMENT currently states that "(1): A modification will be performed to repair Door-44, which is not in conformance with the requirements of NFPA 80. See Attachment S, (S-2, "Plant Modifications Committed")." The nonconformance of Door-44 has been evaluated in an Existing Engineering Equivalency Evaluation and the modification is no longer being pursued. This statement from the compliance basis should be deleted.

The compliance basis of Door-44 will fall under the COMPLIES WITH USE OF EEEE similar to other fire doors which have been justified in EA-APR-98-004. EA-APR-98-004 is already included as part of the Section 3.11.3 response.

The above Table B-1 revisions supersede the previously submitted PNP LAR Attachment A, Table B-1, Section 3.3.4 and Section 3.11.3 responses in the original LAR.

LICENSEE IDENTIFIED ISSUE #3: Table B-3

Subsequent to the PNP NFPA 805 LAR, several new VFDRs were identified that are in addition to those contained in the PNP LAR Attachment C; Table B-3. Also included are VFDRs that were revised due to a change in the VFDRs scope of credited equipment failures for a given fire area. The new VFDR information is in addition to the VFDRs contained in the PNP LAR Attachment C, Table B-3. The revised and deleted VFDRs supersede the information contained in the PNP LAR Attachment C, Table B-3. These revisions are the result of the addition of equipment and supporting cable analysis; NSCA evaluation revision, combined with the identification of the potential failures found after the development of Table B-3. These VFDRs represent failure of equipment functions that have been previously evaluated in similar VFDRs that occur in other fire areas. There are no new or unique equipment functional failures contained in the VFDR information being provided from those previously discussed the PNP LAR Attachment C, Table B-3.

ATTACHMENT 2
LICENSEE IDENTIFIED ISSUES

Performance Criteria

The new/revised VFDRs identify additional challenges to ensuring the performance criteria stated in NFPA 805 Section 1.5.1 will be met. Ability to establish and maintain safe and stable conditions is assured through defined actions and modifications that provide resolution and control should the postulated VFDR events occur. Performance criteria challenges are:

- Inventory and pressure control criterion is assured through the ability to provide charging flow to the primary coolant system; ensuring a source of borated water is available and ensuring removal of primary coolant pumps from service thereby avoiding the potential for a primary coolant pump seal LOCA. The disposition of these VFDRs ensures the ability to meet the criterion for Inventory and Pressure control is maintained.

- Decay Heat Removal criterion is maintained though the ability to close and control atmospheric steam dump valves and by ensuring a controlled source of auxiliary feedwater is available thereby reducing the risk associated with the inability to provide decay heat removal capability.

- Vital Auxiliary criterion is maintained through the ability to re-align 480 VAC power to the 125 VDC bus battery charger when cross connected and through evaluations demonstrating that the loss of cable spreading, switchgear or battery room ventilation does not create a concern for room access or equipment performance. The Vital Auxiliary Criterion is also maintained through the ability to control and maintain service water cooling to safe shutdown loads in areas where cooling may be required.

MSO/IN-92-18

All new VFDRs discussed below are associated with established multiple spurious operation (MSO) events. MSO events include:

- Loss of vital power supplies
- Primary coolant pump seal failure events
- Excess steam demand events
- Excess auxiliary feedwater flow/over cooling events
- Excess charging to the primary coolant system
- Loss of SIRW tank contents to the containment sump

- Loss of important ventilation and service water cooling systems

Given the similarity of these MSO events to those occurring in other fire areas the recovery actions and proposed modifications to address resolution may be the same as previously outlined for the similar VFDRs in other fire areas.

The new VFDRs are not associated with any motor operated valves therefore there are no new IN-92-18 motor operated valve failures being presented.

Where new recovery actions may be required, they will be noted in the individual VFDR disposition statement. These new VFDRs do not require additional Defense-In-Depth (DID) actions.

Modifications

These new/revised VFDRs will benefit from or will be resolved by modifications representing the future plant configuration as described in the PNP NFPA 805 LAR, - Attachment - S, Table S-2. These modifications include:

- Modification S2-26 will add the ability to align the 125 VDC Battery charger's 480 VAC power supply to the same train power when the battery chargers are cross connected. VFDR number ENP-1475 will be addressed by this modification.

- Modification S2-5 will install an alternate and diverse primary coolant pump trip capability in the control room. VFDR numbers ENP-1477 and ENP-1478 will be addressed by this modification.

- Modification S2-11 will install a separate charging pump trip capability in the control room. VFDR numbers ENP-1151, ENP-1268, ENP-1484, ENP-1488 and ENP-1491, ENP-1492, will be addressed by this modification.

- Modification S2-12 will install a separate control capability for the atmospheric steam dump valves. Risk is reduced for VFDR number ENP-1480 through installation of alternate controls for the atmospheric steam dump valves outside the Control Room.

Given the nature of the failures listed in the VFDRs these planned modifications will support resolution through risk reduction or elimination of the VFDR issue.

ATTACHMENT 2
LICENSEE IDENTIFIED ISSUES

New/Revised/Deleted VFDR Statements

The new VFDRs are in addition to the information in PNP NFPA 805 LAR Attachment C, Table B-3. The revised and deleted VFDRs supersede the information in Table B-3. The VFDR changes below are presented in order of the fire area where the condition exists.

Fire Area 4, 1-C Switchgear Room

New VFDR No.: ENP-1475 ED-20, 125 VDC Bus No. 2 - MSO

The function of ED-20L and ED-20R, 125 Volt DC Bus No. 2 - Left/Right is to provide power for equipment operation, control and indication. Fire could cause damage to the power supply to this 125 volt DC bus when ED-20 is cross connected to battery charger ED-18. Bus ED-20 is used to provide power to credited components required to achieve and maintain primary coolant system inventory, pressure control and decay heat removal. This could challenge the criterion for Vital Auxiliaries. This is a separation issue.

Disposition

This VFDR has been evaluated and it has been determined that the risk, safety margin, and defense-in-depth meet the acceptance criteria of NFPA 805 section 4.2.4 with no recovery or defense-in-depth actions required. Modification S2-26 installs controls to switch 125 VDC Battery charger's 480 VAC power supply to maintain train separation when alternate chargers are in service.

Fire Area 5, 1-1 Diesel Generator Room

New VFDR No.: ENP-1477 P-50A, P-50C, 252-103, 252-104, Primary Coolant Pumps and Breakers - MSO

The function of the primary coolant pumps is to provide motive force for circulation of primary coolant through the primary coolant system. A fire in FA-5, 1-1 Diesel Generator Room, could cause cable damage and the loss of DC bus ED-10 resulting in the loss of the 125 volt DC power to the individual 4,160 volt AC breakers failing them in their closed position. Continued primary coolant pump operation should seal cooling be lost may result in pump seal failure. This could challenge the criterion for Inventory and Pressure Control.

Disposition

This VFDR has been evaluated and it has been determined that the risk, safety margin, and defense-in-depth meet the acceptance criteria of NFPA 805 section 4.2.4 with no

recovery actions or defense-in-depth actions required. Modification S2-5 installs an alternate and diverse primary coolant pump trip capability in the Control Room.

Fire Area 6, 1-2 Diesel Generator Room

Revised VFDR: ENP-1151	P-55A, P-55B, P-55C, Charging Pump Operation - MSO

NOTE: ENP-1151 is revised to include spurious operation of all charging pumps by adding P-55C to the title, VFDR discussion and equipment evaluated by the Fire PRA. The VFDR now states:

The charging pump's function is to provide motive force for transferring water from the volume control tank or safety injection refueling water tank (in addition to other water sources) to the primary coolant system for purification and inventory control. Fire could cause cable damage resulting in spurious operation or the loss of control of all charging pumps from the Control Room. This could affect make up flow to the primary coolant system. Spurious isolation of the suction supply could also damage the pumps. This could challenge the criterion for Inventory and Pressure Control. This is a separation issue.

Disposition

This VFDR has been evaluated and it has been determined that the risk, safety margin, and defense-in-depth meet the acceptance criteria of NFPA 805 section 4.2.4 with no recovery actions or defense-in-depth actions required. Modification S2-11 installs an alternate and diverse charging pump trip capability in the Control Room.

Fire Area 11, Battery Room # 2

New VFDR No.: ENP-1479	P-50B, P-50D, 252-203, 252-204, Primary Coolant Pumps and Breakers - MSO

The function of the primary coolant pumps is to provide motive force for circulation of primary coolant through the primary coolant system. A fire in FA-11, Battery Room No. 2, could cause cable damage and the loss of DC bus ED-20 resulting in the loss of the 125 volt DC power to the individual 4,160 volt AC breakers failing them in their closed position. Continued primary coolant pump operation should seal cooling be lost may result in pump seal failure. This could challenge the criterion for Inventory and Pressure Control.

Disposition

This VFDR has been evaluated and it has been determined that the risk, safety margin, and defense-in-depth meet the acceptance criteria of NFPA 805 section 4.2.4 with no

recovery actions or defense-in-depth actions required. Action may be required to gain positive control of these pumps at their local breakers and to remove the pumps from service.

Fire Area 12, Battery Room # 1

New VFDR No.: ENP-1478 P-50A, P-50C, 252-103, 252-104, Primary Coolant Pumps and Breakers - MSO

The function of the primary coolant pumps is to provide motive force for circulation of primary coolant through the primary coolant system. A fire in FA-12, Battery Room No. 1 could cause cable damage and the loss of DC bus ED-10 resulting in the loss of the 125 volt DC power to the individual 4,160 volt AC breakers failing them in their closed position. Continued primary coolant pump operation should seal cooling be lost may result in pump seal failure. This could challenge the criterion for Inventory and Pressure Control.

Disposition

This VFDR has been evaluated and it has been determined that the risk, safety margin, and defense-in-depth meet the acceptance criteria of NFPA 805 section 4.2.4 with no recovery actions or defense-in-depth actions required. Modification S2-5 installs an alternate and diverse primary coolant pump trip capability in the Control Room.

Fire Area 12, Battery Room # 1

New VFDR No.: ENP-1493 V-43, Cable Spreading and Switchgear Room Ventilation

The function of the cable spreading room and switchgear room ventilation components is to maintain room environment for personnel access and for removal of waste heat supporting equipment life. Action may be required to provide temporary cooling to the cable spreading and switchgear rooms following loss of ventilation to this area. Fire could cause cable damage that results a loss of power or the inability to cool the cable spreading room and switchgear rooms. This may challenge the criterion for Vital Auxiliaries. This is a separation issue.

Disposition

This VFDR has been evaluated and it has been determined that the risk, safety margin, and defense-in-depth meet the acceptance criteria of NFPA 805 section 4.2.4 with no modifications, recovery actions or defense-in-depth actions required.

ATTACHMENT 2
LICENSEE IDENTIFIED ISSUES

Fire Area 14, Reactor Containment Building

New VFDR No.: ENP-1480 CV-0779, CV-0780, CV-0781, CV-0782, Atmospheric Steam Dump Valves - MSO

The atmospheric steam dump valves function is to allow controlled venting of steam from the associated steam generator allowing removal of heat from the primary coolant system. Rapid opening of these valves also reduces pressure transients during loss of load events thereby limiting the challenge to the code safety relief valves. Fire could cause cable damage resulting in a failed closed condition or a spurious opening of any or all of these normally closed steam generator atmospheric steam dump valves, with the inability to operate the affected valve from the control room. This could affect the ability to control steam flow from either or both steam generators at a flow rate necessary to control decay heat removal. This could challenge the criterion for Decay Heat Removal. This is a separation issue.

Disposition

This VFDR has been evaluated and it has been determined that the risk, safety margin, and defense-in-depth meet the acceptance criteria of NFPA 805 section 4.2.4 with no defense-in-depth actions required. Action is required to close all four atmospheric steam dump valves by removing power to their individual air supply solenoid valves. Modification S2-12 installs a separate control capability for the atmospheric steam dump valves outside the Control Room requiring action to manually operate the valves for decay heat removal.

Fire Area 14, Reactor Containment Building

New VFDR No.: ENP-1484 P-55A, P-55B, P-55C, Charging Pumps – MSO

The function of the charging pumps is to provide motive force for transferring water from the volume control tank or safety injection refueling water tank (in addition to other water sources) to the primary coolant system for purification and inventory control. Fire induced cable failure may result in spurious starting of any or all of the three charging pumps. Excess charging flow may challenge the criterion for Pressure and Inventory Control. This is a separation issue.

Disposition

This VFDR has been evaluated and it has been determined that the risk, safety margin, and defense-in-depth meet the acceptance criteria of NFPA 805 section 4.2.4 with no recovery actions or defense-in-depth actions required. Modification S2-11 installs an alternate and diverse charging pump trip capability in the Control Room.

ATTACHMENT 2
LICENSEE IDENTIFIED ISSUES

Fire Area 16, Component Cooling Pump Room

Deleted VFDR: ENP-973	CV-2191, Primary Coolant Pump Controlled Bleedoff Stop – MSO

NOTE: Revised NSCA shows ENP-0973 is not a VFDR since control of the valve remains in the Control Room. VFDR is no longer required.

The function of valve CV-2191, Primary Coolant Pump Controlled Bleedoff Stop, is to isolate the primary coolant pump controlled bleedoff line from the primary coolant pumps to T-74, Primary System Drain Tank. Fire could cause cable damage resulting in a spurious closure or failed open condition of this normally open valve. The inability to close the valve from the control room to reduce the diversion of primary coolant system inventory to the primary coolant drain tank from the primary coolant pump seals' controlled bleedoff could challenge the criterion for Inventory and Pressure Control. This is a separation issue.

Disposition

This VFDR has been evaluated and it has been determined that the risk, safety margin, and defense-in-depth meet the acceptance criteria of NFPA 805 section 4.2.4 with no modifications or defense-in-depth actions required. Action is required to fail CV-2191 closed.

Fire Area 16, Component Cooling Pump Room

Revised VFDR: ENP-0974	P-54A, P-54B, P-54C, P-67A, P-67B, CV-3001, CV-3002, SIRW Diversion to Containment Sump – MSO

NOTE: ENP-0974 is revised to include spurious operation of all containment spray pumps by adding P-54A and by addition of the low pressure safety injection pumps P-67A and P-67B to the title and discussion text. The VFDR now states:

The function of the containment spray pumps is to provide motive force for transferring water from the T-58, Safety Injection Refueling Water Tank, or the containment sump to the containment spray headers in support of containment cooling during postulated accidents. Low pressure safety injection pumps provide water flow to the primary coolant system during postulated accidents and circulate primary system water during shutdown cooling and refueling operation for decay heat removal. Fire induced cable failure may result in spurious starting of the containment spray and low pressure safety injection pumps combined with opening of the containment spray header isolation valves. Operation of a containment spray pump or low pressure safety injection pump combined with a spurious valve operation and opening a containment spray valve would transfer T-58, Safety Injection Refueling Water Tank, contents to the containment sump.

Loss of the T-58, Safety Injection Refueling Water Tank, contents may challenge the criterion for Pressure and Inventory Control. This is a separation issue.

Disposition

This VFDR has been evaluated and it has been determined that the risk, safety margin, and defense-in-depth meet the acceptance criteria of NFPA 805 section 4.2.4 with no modifications or defense-in-depth actions required. Action may be required to gain positive control of all three containment spray pumps and both low pressure safety injection pumps.

Fire Area 16, Component Cooling Pump Room

Revised VFDR: ENP-975	P-55A, P-55B, P-55C, Charging Pump Operation – MSO

NOTE: ENP-0974 is revised to include spurious operation of all charging pumps by adding P-55A and P-55B to the VFDR description and disposition. The VFDR now states:

The function of the charging pump is to provide motive force for transferring water from the volume control tank or safety injection refueling water tank (in addition to other water sources) to the primary coolant system for purification and inventory control. Fire could cause cable damage resulting in spurious operation of all charging pumps and the loss of control of the pumps from the Control Room. This could affect makeup flow to the primary coolant system. Excess flow may also challenge primary system relief valve setpoints. This could challenge the criterion for Inventory or Pressure Control. This is a separation issue.

Disposition

This VFDR has been evaluated and it has been determined that the risk, safety margin, and defense-in-depth meet the acceptance criteria of NFPA 805 section 4.2.4 with no modifications or defense-in-depth actions required. Action is required to establish positive control of charging pumps P-55A, P-55B and P-55C.

Fire Area 21, Electrical Equipment Room

New VFDR No.: ENP-1485	P-7A, P-7B, P-7C, Service Water Pumps – MSO

The function of the service water system is to support removal of waste and decay heat from the plant. Cable exposure may result in spurious actuation of all three service water pumps and spurious closure of service water header valves resulting in the loss of

a flow path for all service water pumps. This may challenge the criterion for Vital Auxiliaries. This is a separation issue.

Disposition

This VFDR has been evaluated and it has been determined that the risk, safety margin, and defense-in-depth meet the acceptance criteria of NFPA 805 section 4.2.4 with no modifications or defense-in-depth actions required. Action may be required to gain positive control of the service water pumps.

Fire Area 21, Electrical Equipment Room

New VFDR No.: ENP-1486	P-54A, P-54B, P-54C, P-67A, P-67B, CV-3055, CV-3025, CV-3002, CV-3001, Containment Spray and LPSI System Components - MSO

The function of the containment spray pumps is to provide motive force for transferring water from the T-58, Safety Injection Refueling Water Tank, or the containment sump to the containment spray headers in support of containment cooling during postulated accidents. The function of the low pressure safety injection pumps is to provide borated water inventory to the primary coolant system during postulated events and to provide cooling water flow for decay heat removal during refueling operation. Fire induced cable failure may result in spurious starting of any or all of the three containment spray pumps and any or all low pressure safety injection pumps combined with the containment spray header isolation valves opening. Operation of the pumps combined with a spurious opening of isolation and containment spray valve would transfer T-58, Safety Injection Refueling Water Tank, contents to the containment sump. Loss of the T-58, Safety Injection Refueling Water Tank contents may challenge the criterion for Pressure and Inventory Control. This is a separation issue.

Disposition

This VFDR has been evaluated and it has been determined that the risk, safety margin, and defense-in-depth meet the acceptance criteria of NFPA 805 section 4.2.4 with no modifications or defense-in-depth actions required. Action may be required to gain positive control of all three containment spray pumps and both low pressure safety injection pumps.

ATTACHMENT 2
LICENSEE IDENTIFIED ISSUES

Fire Area 21, Electrical Equipment Room

New VFDR No.: ENP-1487 P-8A, P-8B, P-8C, CV-0727, CV-0749, CV-0736A, CV-0737A, Auxiliary Feedwater System Pump and Control Valves – MSO

The function of the auxiliary feedwater system is to supply water to the steam generators for decay heat. Action may be required to gain positive control of P-8A, P-8B and P-8C following spurious actuation of one or more non-credited auxiliary feedwater pumps and failure of the downstream flow control valves in the open position. Fire induced cable damage may result in the loss of control power or spurious operation of these auxiliary feedwater pumps and associated downstream flow control valves. This may challenge the criterion for Decay Heat Removal. This is a separation issue.

Disposition

This VFDR has been evaluated and it has been determined that the risk, safety margin, and defense-in-depth meet the acceptance criteria of NFPA 805 section 4.2.4 with no modifications or defense-in-depth actions required. Action may be required to gain positive control of all three auxiliary feedwater pumps or the flow control valves.

Fire Area 26, Southwest Cable Penetration Room

New VFDR No.: ENP-1488 P-55A, P-55B, P-55C, Charging Pumps – MSO

The function of the charging pumps is to provide motive force for transferring water from the volume control tank or safety injection refueling water tank (in addition to other water sources) to the primary coolant system for purification and inventory control. Fire induced cable failure may result in spurious starting of any or all of the three charging pumps. Excess charging flow may challenge the criterion for Pressure and Inventory Control. This is a separation issue.

Disposition

This VFDR has been evaluated and it has been determined that the risk, safety margin, and defense-in-depth meet the acceptance criteria of NFPA 805 section 4.2.4 with no recovery actions or defense-in-depth actions required. Modification S2-11 installs an alternate and diverse charging pump trip capability in the Control Room.

ATTACHMENT 2
LICENSEE IDENTIFIED ISSUES

Fire Area 27, Radwaste Addition - VRS

New VFDR No.: ENP-1235 PO-3033A, PO-3033C, Portable Fans for Cable Spreading and Switchgear Room Cooling – MSO

Cable Spreading Room ventilation components maintain the room at acceptable levels for personnel access and equipment life. Action may be required to set up temporary cooling fans for cooling of the Cable Spreading Room. Fire could cause damage to the primary air supply tubing resulting in a closure of these ventilation exhaust dampers and a loss of cooling to the credited equipment in the Cable Spreading Room. This could challenge the criterion for Vital Auxiliaries.

Disposition

This VFDR has been evaluated and it has been determined that the risk, safety margin, and defense-in-depth meet the acceptance criteria of NFPA 805 section 4.2.4 with no modifications, recovery actions or defense-in-depth actions required.

Fire Area 32, SIRW Tank / CCW Roof Area

New VFDR No.: ENP-1476 V-15B, Battery Room Fan – MSO

Battery room ventilation components maintain the room environment at acceptable levels for personnel access and equipment life. In addition, the equipment ensures that unacceptable levels of hydrogen from battery operation do not accumulate in the room. Cable exposure to a fire in this fire area may result in the failure of power supply to V-15B, Battery Room Ventilation Fan. This is a separation issue.

Disposition

This VFDR has been evaluated and it has been determined that the risk, safety margin, and defense-in-depth meet the acceptance criteria of NFPA 805 section 4.2.4 with no modifications, recovery actions or defense-in-depth actions required.

Fire Area 32, SIRW Tank / CCW Roof Area

New VFDR No.: ENP-1490 P-54A, P-54B, P-54C, P-67A, P-67B, CV-3055, CV-3025, CV-3002, CV-3001, Containment Spray and LPSI System Components – MSO

The function of the containment spray pumps is to provide motive force for transferring water from the T-58, Safety Injection Refueling Water Tank, or the containment sump to the containment spray headers in support of containment cooling during postulated accidents. The function of the low pressure safety injection pumps is to provide borated

water inventory to the primary coolant system during postulated events and to provide cooling water flow for decay heat removal during refueling operation. Fire induced cable failure may result in spurious starting of any or all of the three containment spray pumps and any or all low pressure safety injection pumps combined with the containment spray header isolation valves opening. Operation of a pumps combined with a spurious opening of a containment spray valve would transfer T-58, Safety Injection Refueling Water Tank, contents to the containment sump. Loss of the T-58, Safety Injection Refueling Water Tank contents may challenge the criterion for Pressure and Inventory Control. This is a separation issue.

Disposition

This VFDR has been evaluated and it has been determined that the risk, safety margin, and defense-in-depth meet the acceptance criteria of NFPA 805 section 4.2.4 with no modifications or defense-in-depth actions required. Action may be required to gain positive control of all three containment spray pumps and to isolate low pressure safety injection flow from the control room.

Fire Area 32, SIRW Tank / CCW Roof Area

New VFDR No.: ENP-1491 P-55A, P-55B, P-55C, Charging Pumps - MSO

The function of the charging pumps is to provide motive force for transferring water from the volume control tank or safety injection refueling water tank (in addition to other water sources) to the primary coolant system for purification and inventory control. Fire induced cable failure may result in spurious starting of any or all of the three charging pumps. Excess charging flow may challenge the criterion for Pressure and Inventory Control. This is a separation issue.

Disposition

This VFDR has been evaluated and it has been determined that the risk, safety margin, and defense-in-depth meet the acceptance criteria of NFPA 805 section 4.2.4 with no recovery actions or defense-in-depth actions required. Modification S2-11 installs an alternate and diverse charging pump trip capability in the Control Room

Fire Area 34, Manhole #1

New VFDR No.: ENP-1492 P-55A, P-55B, P-55C, Charging Pumps – MSO

The function of the charging pumps is to provide motive force for transferring water from the volume control tank or safety injection refueling water tank (in addition to other water sources) to the primary coolant system for purification and inventory control. Fire induced cable failure may result in spurious starting of any or all of the three charging

pumps. Excess charging flow may challenge the criterion for Pressure and Inventory Control. This is a separation issue.

Disposition

This VFDR has been evaluated and it has been determined that the risk, safety margin, and defense-in-depth meet the acceptance criteria of NFPA 805 section 4.2.4 with no recovery actions or defense-in-depth actions required. Modification S2-11 installs an alternate and diverse charging pump trip capability in the Control Room.

Fire Area Description Revisions

PNP's NFPA 805 LAR Attachment C, Table B-3, submitted to the NRC on December 12, 2012, is being revised as a result of changes made to the Nuclear Safety Capability Assessment (NSCA) model and changes made to PNP's Fire PRA model. Fire PRA Model changes and resulting impact to the revised output evaluations affect Table B-3 fire area descriptions and disposition statements for VFDRs where recovery actions are required.

PNP's LAR Attachment C, Table B-3, Fire Area Risk Summary section provides a statement addressing CDF and LERF values for each fire area. Updated values for CDF and LERF are available in the response to PRA RAI 30.

FSEA Description Change

PNP NFPA 805 LAR Attachment C, Table B-3, Page C-156, Fire Area 13, section titled, "Fire Suppression Effects on Nuclear Safety Performance Criteria", contains incorrect information related to the Auxiliary Building 590' main corridor floor drains and contains an incorrect equipment name for tank T-60. The drains are in Fire Area 13, Auxiliary Building – Miscellaneous. (Formally Auxiliary Building 590 ft. Corridor). Current statements indicate that floor drains flow to the safeguards sumps and are then pumped to the Dirty Water Drain Tank (T60). The correct wording should state that the floor drains on the 590 ft. corridor elevation in the Auxiliary Building drain to the Dirty Waste Drain Tank East/West (T-60).

Report PLP-RPT-12-00100, "Fire Suppression Activities Effect on Nuclear Safety Performance Criteria. (FSEA)" was revised to reflect the correct information stated above. Review of the changes concluded the revised wording did not alter the conclusion reached in the FSEA for this fire area stating in part *that fire suppression activities and inadvertent fire protection system operation will not adversely affect achievement of the Nuclear Safety Performance Criteria.*

ATTACHMENT 2
LICENSEE IDENTIFIED ISSUES

LICENSEE IDENTIFIED ISSUE #4: Attachment S

Attachment S has been revised to clarify selected items and to reflect recent revisions to the Fire PRA. The following table provides an itemized list of the changes and the reason for each change. Attachment 3 provides the complete revised Attachment S, which supersedes the Attachment S provided in the original NFPA 805 LAR.

Item	Attachment S Revision	Reason for Change
1	In S1-3, In FPRA entry is changed from 'No' to 'Yes', and the Risk Informed Characterization is revised accordingly.	The completed modification removed the potential for this failure mode. PRA accounts for this modification by not failing the affected circuits. This minor change is made to correct the record
2	New item S1-4 is added and item S2-16 is deleted.	Modification S2-16 was completed following submittal of the LAR. Therefore, this item is moved from Table S-2 to Table S-1, new item S1-4. Minor changes have been made to indicate item is complete.
3	S2-1 modification, under 'Proposed Modification', the description is changed to remove "hardened" from structure description.	The original plan was to install the new AFW pump in a structure that was "hardened" to protect from damage by tornado missiles, earthquakes and flooding. This protection is not required for NFPA 805; therefore the term "hardened" was removed from the modification description.
4	S2-2 modification was determined to provide no risk benefit and, therefore, the modification is no longer being pursued.	Modification was determined by PRA to be of no risk benefit.
5	S2-3 modification was determined to provide no risk benefit and, therefore, the modification is no longer being pursued.	Modification was determined by PRA to be of no risk benefit.
6	S2-7 modification, under 'Proposed Modification', the description is changed from an electrical modification to a mechanical modification by providing the ability to operate the Engineered Safeguards (ESS) Pumps seal cooling supply and return valves using backup nitrogen.	Modification details were refined after LAR submittal. The presence of a Safety Injection Actuation Signal (SIAS) prevents closure of the ESS Pumps seal cooling supply and return valves from the Control Room. The presence of an SIAS coincident with a loss of CCW both fails ESS pump seal cooling and creates the need for multiple local actions to align Service Water as a backup source of seal cooling water. The original modification would have provided means to override the SIAS from the Control Room in order to permit reclosure of the ESS Pumps seal cooling CCW supply and return valves, but the modification still required the availability of the normal air supply. The revised modification adds the capability to close the ESS Pump Seal Cooling CCW supply and return valves using backup nitrogen and eliminates the need to override the SIAS. This provides a more reliable method to

ATTACHMENT 2
LICENSEE IDENTIFIED ISSUES

Item	Attachment S Revision	Reason for Change
		accomplish the intent of the modification by facilitating restoration of ESS pump seal cooling using Service Water following a loss of CCW.
7	S2-9 modification was determined to provide no risk benefit and, therefore, the modification is no longer being pursued.	Modification was determined by PRA to be of no risk benefit.
8	S2-13 modification Problem Statement and Proposed Modification entries are changed to clarify the issue and the method by which the modification will be accomplished	Modification details were refined following submittal of the LAR. In the current design, a Safety Injection Signal causes the CCW Heat Exchanger Service Water outlet valves to open and the temperature control valves to close. A spurious Recirculation Actuation Signal (RAS) coincident with spurious closure or failure to open of a Service Water outlet valve would result in a loss of cooling to the ESS Pump and Primary Coolant Pump Seals. The original modification proposed to revise electrical circuitry to provide a means to override a spurious RAS to permit reopening the temperature control valves. The revised approach will accomplish the same intent by changing the configurations of the temperature control valve operators to open on RAS and fail open on loss of air. This ensures that Service Water flow is maintained to the CCW Heat Exchangers in spite of a spurious RAS signal or spurious valve operations. This approach reduces the risk from spurious valve closure from loss of control due to fire induced faults.
9	S2-26 modification In FPRA entry is changed from 'No' to 'Yes' and Risk Informed Characterization is clarified.	The FPRA now reflects the modified state, so the In FPRA entry should be Yes. In the current plant design, each battery has two chargers. One charger for each battery is powered from the opposite electrical division, so when these chargers are in service, the electrical divisions are cross-connected. The modification would add the ability to power that second charger from either the same or opposite electrical division. The proposed modification eliminates the design issue related to cross-connecting electrical divisions while retaining operational flexibility, enhancing equipment reliability and improving human factors associated with fire mitigation. The reworded Risk Informed Characterization more accurately describes the impact of the modification.
10	S2-33 modification was determined to provide no risk benefit and, therefore, the modification is no longer being pursued.	Modification was determined by PRA to be of no risk benefit.
11	S2-38 modification Proposed Modification description is changed to correct a	Entry is changed to cite correct fan designation, V-

ATTACHMENT 2
LICENSEE IDENTIFIED ISSUES

Item	Attachment S Revision	Reason for Change
	typographic error in original LAR.	78.
12	S2-39 modification Problem Statement is changed to correct a typographic error in original LAR.	Entry is changed to cite correct fan designation, V-21D.