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Portions of Enclosure 2 Contain ~~Security-Related Information~~
~~To Be Withheld Under 10 CFR 2.390~~

W3F1-2015-0025

May 14, 2015

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

SUBJECT: Responses to Request for Additional Information Regarding Adoption of National Fire Protection Association Standard NFPA 805 License Amendment Request (LAR) Waterford Steam Electric Station, Unit 3 (Waterford 3)
Docket No. 50-382
License No. NPF-38

REFERENCES:

1. Entergy letter W3F1-2011-0074 "License Amendment Request to Adopt NFPA 805 Performance-Based Standard for Fire Protection for Light Water Reactor Generating Plants (2001 Edition)", Waterford Steam Electric Station, Unit 3 dated November 17, 2011 [ML113220230]

2. Entergy letter W3F1-2012-0005 "Supplemental Information in Support of the NRC Acceptance Review of Waterford 3 License Amendment Request to Adopt NFPA 805, Waterford Steam Electric Station, Unit 3" dated January 26, 2012 [ML12027A049]

3. Entergy letter W3F1-2012-0064 "Response to Request for Additional Information Regarding Adoption of National Fire Protection Association Standard NFPA 805 License Amendment Request, Waterford Steam Electric Station, Unit 3" dated September 27, 2012 [ML12272A099]

4. Entergy letter W3F1-2012-0083 "90 Day Response to Request for Additional Information Regarding Adoption of National Fire Protection Association Standard NFPA 805 License Amendment Request, Waterford Steam Electric Station, Unit 3" dated October 16, 2012 [ML12290A216]

5. Entergy letter W3F1-2013-0022 "Response to 2nd Round Request for Additional Information Regarding Adoption of National Fire Protection Association Standard NFPA 805 License Amendment Request, Waterford Steam Electric Station, Unit 3" dated May 16, 2013 [ML13137A128]

When Attachment W of Enclosure 2 to this letter is removed this document is no longer ~~Security-Related~~.

6. Entergy letter W3F1-2013-0048 " Supplement to NFPA 805 License Amendment Request (LAR) Waterford Steam Electric Station, Unit 3" dated December 18, 2013 [ML13365A325]

7. NRC letter to Entergy dated February 6, 2015,"Request for Additional Information RE: License Amendment Request to Transition to National Fire Protection Association Standard 805 (TAC NO. ME7602) [ML15022A239]

Dear Sir or Madam:

By letter dated November 17, 2011, as supplemented by letters dated January 26, 2012, September 27, 2012, October 16, 2012, May 16, 2013, and December 18, 2013 (References 1 through 6 respectively), Entergy Operations, Inc. (Entergy), submitted a license amendment request (LAR) to transition its fire protection license basis at the Waterford Steam Electric Station, Unit 3, from paragraph 50.48(b) of Title 10 of the *Code of Federal Regulations* (10 CFR) to 10 CFR 50.48(c), "National Fire Protection Association Standard 805" (NFPA 805).

The LAR Supplement provided in Reference 6 represents changes to specified LAR Attachments and supporting calculations primarily as a result of performing extensive reanalysis utilizing only NRC-accepted methods. An NRC site audit was conducted the week of January 12, 2015 followed by Request for Additional Information (RAI) letter (Reference 7) received February 6, 2015. These RAIs were divided into 60, 90 and 120 day responses. Enclosure 1 contains responses to the 120 day RAIs.

Additionally, due to analysis and documentation changes resulting from RAI responses, and significant progress made on completing Attachment S implementation items, the following LAR Attachment changes are contained in Enclosure 2. The previous No Significant Hazards Evaluation is unchanged.

1. Attachment C, Table C-1 (RAB1 only) and Table C-2 (RAB23 only)
2. Attachment G
3. Attachment J
4. Attachment S, Tables S-1 and S-2 (both include completion status)
5. Attachment W

There are no new regulatory commitments contained in this submittal. If you require additional information, please contact the Regulatory Assurance Manager, John Jarrell at 504-739-6685.

I declare under penalty of perjury that the foregoing is true and correct. Executed on May 14, 2015.

Sincerely,

MCR/AJH

Enclosures: 1. 120 Day RAI Responses
2. LAR Attachment Changes

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Enclosure 1 to

W3F1-2015-0025

120 Day RAI Responses
Waterford 3 NFPA 805 License Amendment Request

FPE RAI S01

60 day response

FPE RAI S02

90 day response

FPE RAI S03

60 day response

FPE RAI S04

60 day response

FPE RAI S05

60 day response

SSA RAI S01

60 day response

SSA RAI S02

60 day response

SSA RAI S03

60 day response

SSA RAI S04

60 day response

SSA RAI S05

60 day response

SSA RAI S06

60 day response

FM RAI S01

NFPA 805, Section 2.4.3.3 states that the Probabilistic Risk Assessment (PRA) approach, methods, and data shall be acceptable to the NRC. The NRC staff noted that fire modeling comprised the following:

- The algebraic equations implemented in FDTs [Fire Dynamics Tools] were used to characterize flame radiation (heat flux), flame height, plume temperature, ceiling jet temperature, and hot gas layer (HGL) temperature, the latter of which is used in the multi-compartment analysis.

- The Consolidated Model of Fire Growth and Smoke Transport (CFAST) was used to assess main control room (MCR) habitability and to calculate HGL temperature in selected multi-compartment scenarios.

LAR Section 4.5.1.2, "Fire PRA" states, in part, that "[f]ire modeling was performed as part of the Fire PRA development (NFPA 805 Section 4.2.4.2)." Reference is made to LAR Attachment J, "Fire Modeling V&V [verification and validation]," for a discussion of the acceptability of the fire models that were used.

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

a. 60 day response

b. 90 day response

c. 90 day response

d. 60 day response

e. 90 day response

f. 60 day response

g. 90 day response

h. Specifically, regarding the use of CFAST in the MCR abandonment calculations:

    i. The licensee assumed that half of the electrical cabinet fire scenarios will involve single cable bundle fires and half will involve multiple cable bundle fires. The licensee stated that this assumption is conservative as all fires initiate as a single bundle cable fire, which need to propagate to become multiple bundle cable fires, and that most of the electrical cabinet fires will not involve multiple bundles as the MCR will be equipped with a rapid detection system.

    Provide justification for the assumed fraction of single cable bundle and multiple cable bundle electrical cabinet fires. Provide technical justification for the assumption that the growth rate and peak HRR recommended in NUREG/CR-6850, "EPRI [Electric Power Research Institute]/NRC-RES [Office of Nuclear Regulatory Research] Fire PRA Methodology for Nuclear Power Facilities, Volume 2: Detailed Methodology," dated September 2005 (ADAMS Accession No.

ML052580118), for electrical cabinet fires involving a single bundle fire can be applied to a fraction of electrical cabinets in the MCR with multiple cable bundles.

Describe the detection and suppression devices used in the electrical cabinets or main control boards in the control room and demonstrate their capability to suppress single cable bundle fires before they propagate to additional cable bundles

ii. During the audit walkdown of the MCR, the NRC staff noted several cabinets that do not appear to be separated by a double wall and an air gap. Provide the technical justification for not considering electrical cabinet fires that propagate to adjacent cabinets.

iii. 90 day response

iv. 60 day response

v. 60 day response

i. Specifically, regarding the use of CFAST in the RAB 7A, 7B, 7C and 7D calculations:

i. 90 day response

ii. The licensee indicated that most of the cables in RAB-7 are routed through covered cable trays and that the majority of the remaining cables are routed through conduits. Explain if there are any cables that are not enclosed in either covered cable trays or conduits, and describe how the fire propagation in these cables is accounted for in the CFAST analyses.

iii. 90 day response

iv. 60 day response

j. Specifically regarding the multi-compartment analysis (MCA):

i. 60 day response

ii. 60 day response

iii. 60 day response

Waterford 3 Response

h.i The assumption of half of the electrical cabinet fire scenarios will involve single cable bundle fires and half will involve multiple cable bundle fires has been removed from the main control room (MCR) abandonment analysis as documented in PRA-W3-05-028, Rev. 1 (“Fire PRA Main Control Room Analysis Notebook”). The analysis in PRA-W3-05-028, Rev. 2 now models all scenarios as multiple bundle fires.

No credit is taken for detection or suppression devices to limit fire growth to single bundle fires as all scenarios are treated as multiple bundle fires. Non suppression probability (NSP) factors used in the MCR scenarios credit prompt detection due to the presence of trained operators in the MCR and are taken from Supplement 1 of NUREG/CR-6850.

The response to PRA RAI S18 contains the effects of updating all MCR single bundle scenarios to multiple bundle fires.

h.ii Main control room (MCR) abandonment scenario CRA-CP-GRP-* (* represents different possible end states. See response to PRA RAI S04 for further explanation on multiple end states of an abandonment scenario), groups electrical cabinets in the equipment area of the MCR into one scenario. The individual impacts for each of the cabinets are included in the impact listing. Effectively this is a bounding scenario for electrical cabinet fires that propagate to adjacent cabinets.

There are 3 electrical cabinets in the operator area of the MCR that are not included in this grouping. Despite some minor differences in impacts, the results of these individual scenarios all lead to abandonment. Meaning that regardless of fire propagation between them the results would look the same.

Note that the partitions are solid, continuous, and noncombustible between each of the electrical cabinets, meaning that for the fire propagation to occur the fire would need to be very severe in nature. Such a severe fire would likely lead to abandonment of the MCR prior to propagation occurring.

i.ii There are a limited number of short-run exposed cables in RAB 7. Condition Report CR-WF3-2011-07289 describes the openings that exist. There are two areas of exposed cables approximately 2 feet by 3 feet and one approximately 2 ½ feet by 2 feet. They are located in the back of the relay room near Aux Panel 4. None of these three openings are vertically aligned or are over a fixed ignition source. This eliminates concerns of being a secondary ignition issue. The openings exist due to obstructions such that tray covers or Reg Guide 1.75 wrap cannot be re-installed back onto the cable tray.

As documented in EC-38344 ("Waterford 3 Thermoset/Thermoplastic Cable Report"), typical thermoset insulations are ethylene propylene rubber (EPR), crosslinked polyethylene (XLPE), chlorosulphonated polyethylene (Hypalon), and silicon rubber. Crosslinked polyethylene, chlorosulphonated polyethylene, and silicon rubber were matched with their corresponding cable type contained within NUREG 1805 ("Fire Dynamics Tool (FDT^s): Quantitative Fire Hazard Analysis Methods for the U.S. Nuclear Regulatory Commission Fire Protection Inspection Program") and have heat release rates (HRR) of 178 kW/m^2, 258 kW/m^2, and 182 kW/m^2, respectively. NUREG/CR-7010 ("Cable Heat Release, Ignition, and Spread in Tray Installations During Fire (CHRISTIFIRE) Phase 1: Horizontal Trays") provides a heat release rate of 150 kW/m^2 for typical thermoset cables. This value will be used as a surrogate for EPR as NUREG-1805 does not contain detailed information for EPR cables. Therefore the highest HRR from the common thermoset cables contained within Waterford 3 is 258 kW/m^2. Based on this information the 3 sections of exposed cables have approximate areas of 0.46 m^2, 0.56 m^2 and 0.56 m^2. These areas yield HRRs of 119 kW (0.46 m^2) and 144 kW (0.56 m^2).

Due to the limited number of exposed cables and minimal added effect, no attempt to model these cables for fire propagation was made in CFAST.

FM RAI S02

American Society of Mechanical Engineers/American Nuclear Society (ASME/ANS) Standard RA-Sa-2009, "Standard for Level 1/Large Early Release Frequency Probabilistic Risk Assessments for Nuclear Power Plant Applications," Part 4, requires damage thresholds be established to support the Fire PRA. Thermal impact(s) must be considered in determining the potential for thermal damage of structures, systems, and components and appropriate temperature and critical heat flux criteria must be used in the analysis.

In the updated response by letter dated June 11, 2014, to previous FM RAI 02.a, the licensee stated, in part, "[t]he design specifications for Waterford 3 cables required IEEE [Institute of Electrical and Electronics Engineers]-383 qualification. The materials of construction of the cables are consistent with thermoset performance which was the basis for the determination for the Fire PRA."

However, it appears that a damage threshold of 380 ºCentigrade (C) was used for thermoset cable, as opposed to 330 ºC, which is the NUREG/CR-6850-recommended bounding value for thermoset cable.

a. Describe how the installed cabling in the power block was characterized, specifically with regard to the critical damage/ignition threshold temperatures and critical heat fluxes for thermoset and thermoplastic cables as described in NUREG/CR-6850. Confirm that the ignition/damage criteria for raceways with a mixture of different types of cables were based on the cables with the lowest damage/ignition threshold in the target raceway, as recommended in Section H.1.4 of NUREG/CR-6850. If the characterization of cabling in the power block in terms of damage/ignition thresholds is not consistent with NRC guidance, then justify this deviation or replace this treatment with an acceptable approach in the integrated analysis provided in response to PRA RAI S18.

b. 60 day response

c. 60 day response

Waterford 3 Response

a. The damage threshold of 380 ºCentigrade (C) was used for thermoset cable, as opposed to 330 ºC, which is the NUREG/CR-6850 recommended bounding value for thermoset cable. The 380 ºC value was based on information taken from an averaging of thermoset cable failure criteria as found in Appendix H of NUREG/CR-6850 for installed cable types found at the Waterford 3 site, as documented in EC-38344 ("Waterford 3 Thermoset/Thermoplastic Cable Report"), which are most typically ethylene propylene rubber (EPR), cross-linked polyethylene (XLPE), chlorosulphonated polyethylene (Hypalon), and silicon rubber. However, in response to this RAI, the temperature-based damage threshold assignment for thermoset cables has been reduced to the NUREG/CR-6850 generic thermoset cable criterion of 330 ºC.

   For Waterford no selection of thermoplastic cable performance was found to be necessary based on plant information contained in EC-38344 and the Fire PRA walkdowns (PRA-W3-05-022). Although a very few thermoplastic non-PRA related data cables were noted to exist during the walkdowns, the overwhelming majority of cables are of thermoset material composition. All cables are treated as being thermoset with no credit for exposure duration or shielding taken during the various analyses.

The methodology for the updated temperature-based damage threshold assignment for thermoset cables is presented in PRA-W3-05-056 ("Waterford 3 Vertical Zone of Influence PAU Review") along with the additional target impacts. For many ignition sources, a damage threshold of 330 ºC was already used since target damage was determined by distance in 0.5 meter increments and the distance used would encompass both the 380 ºC damage threshold and the 330 ºC damage threshold.

The response to PRA RAI S18 contains the effects of updating any additional scenario impacts due to the change in the temperature-based damage threshold assignment for thermoset cables.

FM RAI S03

60 day response

FM RAI S04

NFPA 805, Section 2.7.3.3, states that acceptable engineering methods and numerical models shall only be used for applications to the extent these methods have been subject to V&V. These engineering methods shall only be applied within the scope, limitations, and assumptions prescribed for that method. The LAR, Section 4.7.3, states, in part, that "Engineering methods and numerical models used in support of compliance with 10 CFR 50.48(c) were applied appropriately as required by Section 2.7.3.3 of NFPA 805."

a. The NRC staff notes that algebraic models cannot be used outside the range of conditions covered by the experiments on which the model is based. NUREG-1805, includes a section on assumptions and limitations that provides guidance to the user in terms of proper and improper use for each FDT. Identify uses, if any, of the FDTs outside the limits of applicability of the model and for those cases explain how the use of the FDT was justified.

   Identify uses, if any, of the FDTs outside the limits of applicability of the model and for those cases explain how the use of the FDT was justified.

b. 90 day response

Waterford 3 Response

a. NUREG-1934 ("Nuclear Power Plant Fire Modeling Application Guide (NPP FIRE MAG) Final Report") contains a listing of parameters with the range for that parameter that was used in the NUREG/CR-1824 ("Verification and Validation of Selected Fire Models for Nuclear Power Plant Applications, Volumes 1 through 7") V&V study. A comparison of those parameters is presented for the various uses of the NUREG-1805 ("Fire Dynamics Tool (FDTs): Quantitative Fire Hazard Analysis Methods for the U.S. Nuclear Regulatory Commission Fire Protection Inspection Program") Fire Dynamics Tools (FDTs) spreadsheet tools in the Waterford 3 fire PRA as documented in PRA-W3-05-038 ("Documentation of Fire Modeling Tools Used for the Waterford Unit 3 FIRE PRA LAR Attachment J").

   Data for use in this analysis includes the heat release rate (HRR) of the various scenarios in the PRA-W3-05-038 study. Additionally, NUREG-1934 gives a correlation of $\rho_\infty T_\infty$=352 and a typical value of the heat capacity (C_p) of air at 298 K as 1.012 kJ/kg-°C. The acceleration of gravity is

9.81 m/s^2. The effective diameter (D) of the various fire sources is determined as shown below and is listed in PRA-W3-05-038 for the various fire sources. The various physical analysis unit (PAU) dimensions are listed in PRA-W3-05-038 for the various fire scenarios involving a hot gas layer (HGL) computation for comparison to the dimensionless V&V parameter for compartment aspect ratios. It should be noted that for many PAUs, the floor size is based on an equivalent square of the total surface area of the PAU floor.

The Waterford 3 fire PRA uses the FDT fire modeling tools in fixed fire source zones of influence (ZOIs), transient fire source ZOIs, oil fire source ZOIs, HGL temperature estimation for various fire sources, and secondary ignition ZOIs analyses.

The parameters from NUREG-1934 for use in a typical V&V comparison are given below along with their V&V ranges from NUREG/CR-1824. Any parameter(s) deemed not applicable to the Waterford 3 fire PRA are noted and discussion text for applicable parameters is given for the subsequent comparison of the FDTs uses in the Waterford 3 fire PRA, which is presented after the listing of the V&V parameters.

Fire Froude Number

Given by: $\dot{Q}^* = \frac{HRR \text{ or } \dot{Q}}{\rho_\infty c_p T_\infty D^2 \sqrt{gD}}$ with $\text{Effective D} = \sqrt{\frac{4A}{\pi}}$

Description: Ratio of characteristic velocities. A typical accidental fire has a Froude number of order 1. Momentum-driven fire plumes, like jet fires, have relatively high values. Buoyancy-driven fire plumes have relatively low values.

NUREG/CR-1824 V&V range: 0.4 – 2.4

Further discussion: Note that for wall and wall corner effects, a comparison to the V&V parameters is not applicable as discussed in PRA-W3-05-038 as the correlation used (the Alpert-Ward method, “Spreadsheet Templates for Fire Dynamics Calculations”) does not depend upon the fire area. Therefore, no presentation of wall or wall corner parameters is made in PRA-W3-05-038 or in this RAI. The actual fuel packages present at Waterford 3 are not expected to be outside the limits of the Alpert-Ward method for which the results are applied.

More details on the Alpert-Ward method is taken from RAI FM-S01 part “g”. This method is used to predict the rise in the temperature plume for a fire located along a wall or in a wall corner by means of an amplification factor of two (2) for wall locations and four (4) for corner locations. The amplification factors are the same based on information in Spreadsheet Templates for Fire Dynamics Calculations as well as Appendix L of NUREG/CR-6850 (“Fire PRA Methodology for Nuclear Power Facilities, Volumes 1 and 2 “). This correlation is used in lieu of a fire dynamics tool (FDT) calculation with the temperature plume correlation from NUREG-1805 and a similar amplification factor due to stated scenario conditions for the use of the temperature plume FDT correlation having the fire source in an open area where entrainment could occur to all sides of the fire source. Additionally, although a FDT calculation sheet does exist for wall and corner effects, it is limited to liquid hydrocarbon fuel fires and the estimation of flame height only, and is not applicable to a general fire of a predefined HRR such as the fixed ignition sources bins assessed for the prediction of plume temperature impacts.

Flame Length Ratio

Given by: $\frac{H_f + L_f}{H_c}$ with $\frac{L_f}{D} = 3.7\dot{Q}^{*\,2/5} - 1.02$

Description: A convenient parameter for expressing the "size" or the base height of the fire plus the length of the fire flame relative to the height of the enclosure. A value of 1 means that the flames reach the enclosure height. For this application, H_c is defined as the elevation of the upper boundary of the ZOI (i.e. potential target height) while H_f is zero as the intent is to compare the flame length ratio to the predicted ZOI distance.

Note that typically the flame length ratio parameter is used to identify scenarios where flame configuration changes such as when flame impingement on the compartment ceiling occurs. For a single analysis, this is a convenient and readily calculated comparison. However, for the FDT uses, the tracking of the numerous iterations of ignition source heights and compartment heights is burdensome and as such, the comparison of the ZOI distance to flame height is used as a surrogate to the compartment height. From PRA-W3-05-038 it is noted that the ignition source ZOIs are not directly applicable in situations where significant flame contact with the compartment ceiling is expected, such as an ignition source located very close to the compartment ceiling without further consideration for those effects.

NUREG/CR-1824 V&V range: 0.2 – 1.0

Further discussion: Note that similar to the Froude number, no comparison is made for wall or wall corner locations for the flame length ratio as the Alpert-Ward method does not depend upon the fire area.

Ceiling Jet Distance Ratio

Given by: $\frac{r_{cj}}{H_c - H_f}$

Description: Ceiling jet temperature and velocity correlations use this ratio of the horizontal distance within the ceiling jet from the fire centerline relative to the enclosure height minus the height of the fire flame to express the horizontal distance from a target to plume.

NUREG/CR-1824 V&V range: 1.2 – 1.7

FDT parameter value: Not applicable for any of the listed analyses.

Further discussion: From NUREG-1934, this parameter is used to validate the predicted time to detector and sprinkler activation and target failure when using a ceiling jet correlation. Detection and suppression activation is not analyzed in this model. No ceiling jet targets are analyzed in the various analyses; the temperature and velocity of the ceiling jet are not parameters of interest.

Equivalence Ratio

Given by: $\varphi = \frac{HRR\ or\ \dot{Q}}{\Delta H_{O_2} \dot{m}o_2}$

Description: The equivalence ratio relates the energy release rate (HRR) of the fire to the energy release that can be supported by the product of the heat of combustion, and mass flow rate of oxygen into the compartment. The fire is considered over- or under-ventilated based on whether φ is less than or greater than 1.0, respectively.

NUREG/CR-1824 V&V range: 0.04 – 0.6

FDT parameter value: Not applicable for any of the listed analyses.

Further discussion: The various analyses assume that all fires have sufficient ventilation and that the equivalence ratio is less than unity.

Compartment Aspect Ratio

Given by: $L/H_c \;\; or \;\; W/H_c$

Description: This parameter indicates the general shape of the compartment with ratios of the enclosure length to height or width to height.

NUREG/CR-1824 V&V range: 0.6 – 5.7

Radial Distance Ratio

Given by: $\frac{r}{D}$

Description: This ratio is the relative distance from a target to the center of the fire to the diameter of the fire source. It is important when calculating the radiative heat flux.

NUREG/CR-1824 V&V range: 2.2 – 5.7

Further discussion: Neither the correlations listed in Spreadsheet Templates for Fire Dynamics Calculations nor the FDTs model from NUREG-1805 address the specific situation of heat flux impacts for wall or wall corner ignition source locations. As discussed in RAI FM-S01 part “g”, with engineering judgment the FDT calculation sheet for heat flux impacts is applied for wall or wall corner ignition source locations by using the same amplifications factors of two (2) and four (4) increase in the ignition source HRR for wall or corner locations respectively, while maintaining the size of the ignition source at the same size as the open location ZOI calculations. Therefore, comparisons of the radial distance ratio are made for wall and wall corner applications in PRA-W3-05-038 and are presented in this RAI.

V&V Parameter Comparison

Each of the listed analyses is not directly comparable to all of the above V&V parameters as parameter aspects are related to selected fire scenario impacts such as vertical or horizontal impacts or HGLs. For ZOIs related to fire plume temperature, the Froude number and flame length ratio are selected for comparison. For radiant heat flux, the radial distance ratio is selected for comparison. For HGL impacts, the PAU aspect ratios are selected for comparison with the Froude number and flame length ratio, also applicable to HGL calculations, being presented in the ignition source’s ZOI discussion for the various HRRs. Each of the listed FDT analyses are compared to their selected V&V parameters.

Fixed Source ZOIs

Note that the fixed sources include 69 kW, 211 kW, and 702 kW, taken from the 98th percentile HRRs as found in NUREG/CR-6850. Fixed source scenarios have ambient temperatures of 77.0 °F (25.0 °C) and 105 °F (40.6 °C).

Fire Froude Number [V&V range of 0.4 – 2.4]

FDT parameter value: 69 kW – 0.1, 211 kW – 0.3, 702 kW – 1.1 for ambient temperatures of 77.0 °F (25.0 °C) and 105 °F (40.6 °C) and both target types of thermoset cables and sensitive electronics.

Further discussion: The FDTs for the 69 kW and the 211 kW fixed ignition sources produce Froude numbers that are below the V&V range. HRRs higher than approximately 300 kW are within the lower Froude number range. The highest fixed source HRR of 702 kW is within the V&V range with the Froude number value of 1.1. A Froude number that is slightly lower than the V&V range means that the fire area (plume) from the ignition source fire could be larger than the fire source evaluated in the V&V study. This situation would lead to a greater amount of

entrained air and a greater amount of combustion products released and generate a potentially higher gas temperature above the fire source as compared to a fire source with a smaller area and similar HRR that would fall within the V&V range. Also, having a lower Froude number indicates that the measured distances from the V&V study are greater than the ZOI distances which are nearer to the fire source. As a result, a somewhat lower Froude number is expected.

Flame Length Ratio [V&V range of 0.2 – 1.0]

FDT parameter value: 69 kW – N/A, 211 kW – 0.7, 702 kW – 0.7 for thermoset cables at ambient temperatures of 77.0 °F (25.0 °C) and 105 °F (40.6 °C). 69 kW – 0.1, 211 kW – 0.2, 702 kW – 0.2 for sensitive electronics at an ambient temperature of 77.0 °F (25.0 °C) and 69 kW – 0.1, 211 kW – 0.1, 702 kW – 0.2 for sensitive electronics at an ambient temperature of 105 °F (40.6 °C).

Further discussion: The single case which produces a “N/A” result is due to having a significantly low HRR to not produce a ZOI for particular target type and therefore no comparable ZOI dimension for the parameter calculations. The 69 kW case is lower than the V&V range due to having a relatively low HRR. The other values are within the V&V range for the ZOI distance comparison as discussed above.

Radial Distance Ratio [V&V range of 2.2 – 5.7]

FDT parameter value for open areas: 69 kW – N/A, 211 kW – N/A, 702 kW – 3.0 for thermoset cables at ambient temperatures of 77.0 °F (25.0 °C) and 105 °F (40.6 °C). 69 kW – N/A, 211 kW – 2.4, 702 kW – 4.3 for sensitive electronics at ambient temperatures of 77.0 °F (25.0 °C) and 105 °F (40.6 °C).

FDT parameter value for wall and wall corner areas: 69 kW – N/A, 211 kW – 2.4, 702 kW – 4.9 for thermoset cables at ambient temperatures of 77.0 °F (25.0 °C) and 105 °F (40.6 °C) for wall areas. 69 kW – 2.4, 211 kW – 3.6, 702 kW – 6.1 for sensitive electronics at ambient temperatures of 77.0 °F (25.0 °C) and 105 °F (40.6 °C) for wall areas. The fixed source ZOIs are not used for wall corner locations as no cases of fixed ignition sources in corner locations were noted, and therefore are not compared to the V&V parameters since the tool was not directly used in the fire PRA.

Further discussion: Cases which produce a “N/A” result are due to having a significantly low HRR to not produce a ZOI for particular target type and therefore no comparable ZOI dimension for the parameter calculations at the smallest distance increment used in the ignition source ZOI analysis as documented in PRA-W3-05-038. The single case of exceeding the V&V range is due to the large ZOI dimension for sensitive electronics which is due to their lower failure criteria. The main parameter of interest to the radial distance ratio is the heat flux ZOI and for farther separation distances is not expected to be as restrictive as the heat flux at those distances should be lower than at the ZOI. It is noted that validation results from Volume 3 of NUREG/CR-1824 indicate significant heat flux over predictions for the failure criteria levels used for ZOI calculations (i.e. between 3 and 11 kW/m^2 for sensitive electronics and thermoset cables respectively) that would result in longer (and therefore conservative) horizontal ZOI distances. The over prediction of the heat flux level is estimated in Section 4 of NUREG-1934 as having a bias factor of 1.44, or in other words being approximately 44 percent over estimated. Therefore the estimated heat flux level at the ZOI distance is likely conservative due to the calculation process of the FDTs. The other values are within the V&V range.

Transient Source ZOIs

Note that the transient source is 317 kW, taken from the 98th percentile HRRs as found in NUREG/CR-6850. Transient source scenarios have ambient temperatures of 77.0 °F (25.0 °C) and 105 °F (40.6 °C).

Fire Froude Number [V&V range of 0.4 – 2.4]

FDT parameter value: 317 kW – 0.5. This value is the same for ambient temperatures of 77.0 °F (25.0 °C) and 105 °F (40.6 °C) and both target types of thermoset cables and sensitive electronics.

Further discussion: Within the V&V range.

Flame Length Ratio [V&V range of 0.2 – 1.0]

FDT parameter value: 317 kW – 0.7 for thermoset cables, 0.2 for sensitive electronics. These values are the same for ambient temperatures of 77.0 °F (25.0 °C) and 105 °F (40.6 °C).

Further discussion: Within the V&V range.

Radial Distance Ratio [V&V range of 2.2 – 5.7]

FDT parameter value for open areas: 1.8 for thermoset cables, 3.6 for sensitive electronics. These values are the same for ambient temperatures of 77.0 °F (25.0 °C) and 105 °F (40.6 °C).

FDT parameter value for wall and wall corner areas: 317 kW – 3.0 for thermoset cables at ambient temperatures of 77.0 °F (25.0 °C) and 105 °F (40.6 °C) for wall areas. 317 kW – 4.3 for sensitive electronics at ambient temperatures of 77.0 °F (25.0 °C) and 105 °F (40.6 °C) for wall areas. 317 kW – 4.3 for thermoset cables at ambient temperatures of 77.0 °F (25.0 °C) and 105 °F (40.6 °C) for wall areas. 317 kW – 5.5 for sensitive electronics at ambient temperatures of 77.0 °F (25.0 °C) and 105 °F (40.6 °C) for wall corner areas.

Further discussion: The single case of a value lower than the V&V range suggests that the ZOI distance is close to the fire source (flames) compared to the V&V data results. More directly, if the ZOI distance was increased slightly, then the radial distance ratio would fall within the V&V range, however, the failure criteria for thermoset cables is high enough that the closer distances are appropriate for the FDT predictions. The ZOI distance is relatively short due to the fact that the fire source HRR is still relatively low, noting that from the discussion above, HRRs above approximately 300 kW were required to be within the Froude number V&V range. Additionally, as discussed previously the FDTs are noted to over predict flux levels in the range of the thermoset cable failure criteria by as much as 44 percent as noted in Section 4 of NUREG-1934. Therefore the estimated heat flux level at the ZOI distance is likely conservative due to the calculation process of the FDTs, the shorter distance of the thermoset cable ZOI just happens to not fall within the test range distances presented in the V&V comparison data. Other values are within in the V&V range for open areas. The values are within the V&V range for cases with wall and wall corner effects.

Oil Source ZOIs

Note that there are many oil source fire scenarios of similar HRRs evaluated in PRA-W3-05-038 and as such the ranges of each particular V&V parameter comparison are presented here with any notable incidents of a parameter being outside of the V&V range being discussed. Oil source scenarios have ambient temperatures of 77.0 °F (25.0 °C) and 105 °F (40.6 °C). Also note that the burning duration estimated by the FDT is not comparable to a dimensionless parameter from the V&V data, and therefore is not presented in this RAI.

<u>Fire Froude Number</u> [V&V range of 0.4 – 2.4]

FDT parameter value: All oil fire sources are within the V&V range. All cases' values range from 0.4 to 0.7 for an ambient temperature of 77.0 °F (25.0 °C) for both target types of thermoset cables and sensitive electronics. With an ambient temperature of 105 °F (40.6 °C) for both target types of thermoset cables and sensitive electronics, the value ranges from 0.4 to 0.5.

Further discussion: All values are within the V&V range.

<u>Flame Length Ratio</u> [V&V range of 0.2 – 1.0]

FDT parameter value: All oil fire sources are within the V&V range, with a single case producing a "N/A" result due to having a significantly low HRR to not produce a vertical ZOI for thermoset cable targets at the smallest distance increment used in the ignition source ZOI analysis as documented in PRA-W3-05-038. All other cases' values range from 0.2 to 0.7 for an ambient temperature of 77.0 °F (25.0 °C) for both target types of thermoset cables and sensitive electronics. With an ambient temperature of 105 °F (40.6 °C) the value is 0.7 for thermoset cable targets and the value ranges from 0.4 to 0.5 for sensitive electronic targets.

Further discussion: The single case which produces a "N/A" result is due to having a significantly low HRR to not produce a ZOI for particular target type and therefore no comparable ZOI dimension for the parameter calculations. All other values are within the V&V range for the ZOI distance comparison as discussed above.

<u>Radial Distance Ratio</u> [V&V range of 2.2 – 5.7]

FDT parameter value for open areas: Most of the oil fire sources are within the V&V range. The values range from 2.2 to 5.1 with most cases have a value of 2.2 to 3.4 for an ambient temperature of 77.0 °F (25.0 °C) for both target types of thermoset cables and sensitive electronics. A few cases are lower than the V&V range with values of 1.4 to 2.0. With an ambient temperature of 105 °F (40.6 °C) the value ranges from 1.5 to 1.8 for thermoset cable targets and the value ranges from 1.7 to 2.0 for sensitive electronic targets, which is lower than the V&V range.

FDT parameter value for wall and wall corner areas: The oil source ZOIs are not used for wall or wall corner locations as no cases of fixed oil ignition sources in wall or corner locations were noted, and therefore are not compared to the V&V parameters since the tool was not directly used in the fire PRA.

Further discussion: The cases of a value lower than the V&V range suggests that the ZOI distances are close to the fire source (flames) compared to the V&V data results and as discussed previously the FDTs are noted to over predict flux levels in the range of the sensitive electronics to thermoset cable failure criteria. As discussed previously, the estimated heat flux level at the ZOI distances are likely conservative due to the calculation process of the FDTs. The remainder of the values are within the V&V range.

<u>*Fixed, Transient, and Oil Source HGLs*</u>

Due to the numerous HRRs and PAU dimensions evaluated in PRA-W3-05-038 the ranges of each particular V&V parameter comparison are presented here with any notable incidents of a parameter being outside of the V&V range being discussed. All fixed and transient source scenarios have an ambient temperature of 77.0 °F (25.0 °C). Oil source scenarios have ambient temperatures of 77.0 °F (25.0 °C) and 105 °F (40.6 °C).

<u>Compartment Aspect Ratio</u> [V&V range of 0.6 – 5.7]

FDT parameter value: Fixed and transient sources with an ambient temperature of 77.0 °F (25.0 °C), the vast majority of scenarios are within the V&V range with values of 0.6 to 5.4. A few scenarios have values lower than the V&V range of 0.1 to 0.5. A few additional scenarios have

values higher than the V&V range of 6.6 to 10.5 and one case of 15.4. For oil sources, all scenarios with an ambient temperature of 77.0 °F (25.0 °C) are within the V&V range with values of 0.6 to 5.1 with the majority of cases being greater than a value of 1.0 to 3.7. The two oil source cases with an ambient temperature of 105 °F (40.6 °C) have a value of 0.4 which is slightly lower than the V&V range.

Further discussion: The compartment aspect ratios that fall outside the application range do so at both ends of the V&V range. This can be explained by the limited experiments selected for the validation study. As indicated in NUREG-1934, the selected experiments are representative of various types of spaces in commercial nuclear power plants, but do not encompass all possible geometries or applications. It is noted that both the MQH and Beyler room temperature models are reported to over predict room temperatures for most configurations in Volume 1 of NUREG/CR-1824. This over prediction throughout the evaluated scenarios suggests that the configurations outside of the validation range will also result in temperature over predictions. The areas with aspect ratios higher than the V&V range will have corridor-like flow characteristics, and could have locally more adverse conditions. The areas with aspect ratios lower than the V&V range will have shaft-like flow characteristics and would behave like a one zone environment; and treating them as a two zone environment should be conservative. None of the areas that have values higher than the V&V range are deemed to warrant additional considerations than their current ignition source analysis. The remaining values are within the V&V range.

Secondary Ignition ZOIs

Note that all secondary ignition ZOIs are used for scenarios with an ambient temperature of 77.0 °F (25.0 °C) only. The 105 °F (40.6 °C) ambient temperature is not used for secondary ignition ZOIs as there were no identified valid secondary ignitions within the reactor containment building (RCB) as noted in PRA-W3-05-038 and therefore the secondary ignition ZOIs are not compared to the V&V parameters since the tool was not directly used in the fire PRA. The various HRRs for the secondary ignitions are taken from PRA-W3-05-038.

Fire Froude Number [V&V range of 0.4 – 2.4]

FDT parameter value: 111 kW – 0.2, 634 kW – 1.0, 361.2 kW – 0.2, 797.5 kW – 1.8 for an ambient temperature of 77.0 °F (25.0 °C) and both target types of thermoset cables and sensitive electronics.

Further discussion: A Froude number that is slightly lower than the V&V range means that the fire area (plume) from the ignition source fire could be larger than the fire source evaluated in the V&V study. This situation would lead to a greater amount of entrained air and a greater amount of combustion products released and generate a potentially higher gas temperature above the fire source as compared to a fire source with a smaller area and similar HRR that would fall within the V&V range. Also, having a lower Froude number indicates that the measured distances from the V&V study are greater than the ZOI distances which are nearer to the fire source. As a result, a somewhat lower Froude number is expected. The remainder of the values are within the V&V range.

Flame Length Ratio [V&V range of 0.2 – 1.0]

FDT parameter value: 111 kW – 0.5, 634 kW – 0.7, 361.2 kW – 0.5, 797.5 kW – 0.7 for thermoset cables at an ambient temperature of 77.0 °F (25.0 °C) and 111 kW – 0.2, 634 kW – 0.2, 361.2 kW – 0.2, 797.5 kW – 0.3 for sensitive electronics at an ambient temperature of 77.0 °F (25.0 °C).

Further discussion: Within the V&V range.

Radial Distance Ratio [V&V range of 2.2 – 5.7]

FDT parameter value for open areas: 111 kW – N/A, 634 kW – 3.0, 361.2 kW – 1.2, 797.5 kW – 4.1 for thermoset cables at an ambient temperature of 77.0 °F (25.0 °C) and 111 kW – 2.5, 634 kW – 4.3, 361.2 kW – 2.7, 797.5 kW – 5.6 for sensitive electronics at an ambient temperature of 77.0 °F (25.0 °C).

FDT parameter value for wall and wall corner areas: The secondary ignition fire source ZOIs are not used for wall or wall corner locations as no cases of secondary ignition sources in corner locations were noted, and therefore are not compared to the V&V parameters since the tool was not directly used in the fire PRA.

Further discussion: The single case which produces a "N/A" result is due to having a significantly low HRR to not produce a ZOI for particular target type and therefore no comparable ZOI dimension for the parameter calculations. The case of a value lower than the V&V range suggests that the ZOI distance is close to the fire source (flames) compared to the V&V data results and as discussed previously the FDTs are noted to over predict flux levels in the range of the sensitive electronics to thermoset cable failure criteria and the estimated heat flux levels at the ZOI distances are likely conservative due to the calculation process of the FDTs. The remaining values are within the V&V range.

Conclusions

The comparison indicates that application of the FDTs as a tool to determine fire impacts within a physical analysis unit is reasonable and produces results largely within the V&V data ranges. Some exceptions are noted above that fall both above and below the V&V data ranges. The instances where the evaluation estimated FDTs' results are outside of the V&V data ranges are limited and based on their application on a PAU specific basis are not thought to influence the selection of fire impacts in a non-conservative manner. The use of FDTs typically produces conservative results as discussed above. A parameter comparison that falls slightly outside of the V&V test range does not mean that the results are non-conservative and can indicate a limitation of the available data for validation and not necessarily a limitation of the use of the FDT model for calculating ZOI impacts in the fire PRA applications.

FM RAI S05

90 day response

PRA RAI S01

90 day response

PRA RAI S02

60 day response

PRA RAI S03

By letter dated June 11, 2014, the response to PRA RAI 06 explains that a detailed sensitivity study was completed to examine the impact of using NUREG/CR-6850, Supplement 1 frequencies instead of those in Table 6-1 of NUREG/CR-6850 Volume 2. The response explains that a sensitivity study

was performed using the mean of the fire frequency bins contained in Table 6-1 of NUREG/CR-6850 for those bins with an alpha value less than or equal to one. The response, however, does not provide the sensitivity study results but does state that individual PAU core damage frequencies (CDFs) and large early release frequencies (LERFs) fall within Region II or III of the risk guidelines in RG 1.174, “An Approach for Using Probabilistic Risk Assessment in Risk-Informed Decisions on Plant-Specific Changes to the Licensing Basis,” Revision 2, dated May 2011 (ADAMS Accession No. ML100910006). Given that PRA RAI S18 asks for an integrated analysis using acceptable methods, the NRC staff notes that risk estimates may change.

Provide an indication of whether the acceptance guidelines of RG 1.174 may be exceeded if this sensitivity study would be applied to the integrated analysis requested in PRA RAI S18. If these guidelines may be exceeded, provide a description of fire protection, or related measures that can be taken to provide additional defense-in-depth as discussed in FAQ 08-0048, “Revised Fire Ignition Frequencies” (ADAMS Accession No. ML091590457).

Waterford 3 Response

A sensitivity study (PRA-W3-05-015 Rev 2, “FPRA Ignition Frequency Sensitivity Study”) was conducted on the aggregate analysis to understand the impact that fire ignition frequency could have on the results. NUREG/CR-6850 Supplement 1 (“Fire Probabilistic Risk Assessment Methods Enhancements”) data was updated to the data provided in NUREG/CR-6850 (“Fire PRA Methodology for Nuclear Power Facilities Volume 2: Detailed Methodology”). The resultant CDF and LERF increased by roughly 60 percent each; but still are acceptable, with overall totals at 2.84E-5 /yr and 1.51E-6 /yr respectively. These increases would not be applicable to compare to acceptance guidance in Reg. Guide 1.174 (“An Approach for Using PRA in Risk-Informed Decisions on Plant Specific Changes to the Licensing Basis, Revision 2”), as they are simply due to data change (not a plant change). As part of the sensitivity study, the delta risk portion of fire risk evaluations (FRE) was also updated to NUREG/CR-6850 data. The resultant ΔCDF and ΔLERF risk contributions remain very small (Region 3 of Reg. Guide 1.174) in all areas with the exception of two PAUs - RAB 7 and TGB.

The risk acceptance guidelines, according to Reg. Guide 1.174, state that a ΔCDF increase less than 1.00E-5 but greater than 1.00E-6 and a ΔLERF increase less than 1.00E-6 but greater than 1.00E-7 is considered a small change. Both RAB 7 and TGB fall within the small change region of acceptance in Reg. Guide 1.174. This is acceptable in accordance with Reg. Guide 1.174 since the total CDF is less than $10E^{-4}$ per reactor year and LERF is less than $10E^{-5}$ per reactor year. Since the total CDF and total LERF for the plant are well below these limits, the delta risk are acceptable provided some provision for cumulative impact tracking is addressed and maintained. Note that the plant total delta risk remains below Region 1 criterion from Reg. Guide 1.174.

To reduce the burden of cumulative impact tracking in these rooms, risk reduction methods could be explored in the future. Plant modifications such as installation of fire suppression equipment (pre-action sprinklers) in TGB switchgear area or dividing RAB 7 by trains may provide the relief needed to forego cumulative impact tracking. The increases were not due to a single source, but rather a cumulative effect of multiple scenarios within each zone. Furthermore, ranking of fire scenarios were relatively unchanged; providing no new insights on risk as a result.

Tables 1 and 2 provide CDF and LERF results.

Table 1 CDF Results

PAU ID	Supplement 1 data PAU CDF Total (/yr) (RSC-CALKNX-2013-0810)	Supplement 1 data for selected scenarios in the PAU CDF Total (/yr) (PRA-W3-05-015 R2 Table 2)	NUREG/CR-6850 data for selected scenarios in the PAU CDF Total (/yr) (PRA-W3-05-015 R2 Table 2)	Difference between selected scenarios (/yr)	NUREG/CR-6850 PAU CDF Total (/yr)	Percentage increase
CPBLDG	5.27E-9	3.42E-9	6.71E-9	3.29E-9	8.56E-9	62%
CTA	4.33E-9	1.82E-9	3.57E-9	1.75E-9	6.08E-9	40%
CTB	4.10E-9	1.69E-9	3.31E-9	1.62E-9	5.72E-9	40%
FHB	3.13E-9	9.76E-11	1.91E-10	9.36E-11	3.23E-9	3%
INTAKE	8.20E-9	2.18E-9	4.27E-9	2.09E-9	1.03E-8	25%
RAB1	2.65E-6	1.69E-6	3.53E-6	1.83E-6	4.48E-6	69%
RAB11	1.92E-9	5.25E-10	1.18E-9	6.55E-10	2.57E-9	34%
RAB12	1.47E-10	5.02E-11	1.09E-10	5.88E-11	2.06E-10	40%
RAB13	1.90E-9	5.20E-10	1.17E-9	6.50E-10	2.55E-9	34%
RAB15	4.01E-7	3.02E-8	5.74E-8	2.72E-8	4.28E-7	7%
RAB16	3.04E-7	2.06E-8	3.88E-8	1.83E-8	3.23E-7	6%
RAB2	1.21E-9	1.14E-10	2.23E-10	1.09E-10	1.32E-9	9%
RAB22	5.32E-10	8.81E-11	1.32E-10	4.39E-11	5.76E-10	8%
RAB27	7.16E-9	2.85E-9	5.61E-9	2.76E-9	9.93E-9	39%
RAB31	1.92E-7	4.87E-12	9.55E-12	4.68E-12	1.92E-7	0%
RAB7	4.33E-6	2.56E-6	5.01E-6	2.45E-6	6.78E-6	57%
RAB8	7.88E-6	5.40E-6	1.06E-5	5.19E-6	1.31E-5	66%
RCB	1.20E-7	3.92E-10	7.68E-10	3.76E-10	1.20E-7	0%
TGB	1.56E-6	1.19E-6	2.31E-6	1.11E-6	2.68E-6	71%
YARD	2.75E-7	5.19E-9	1.02E-8	4.99E-9	2.80E-7	2%
Total	1.78E-5	1.09E-5	2.16E-5	1.07E-5	2.84E-5	60%

Table 2 LERF Results

PAU ID	Supplement 1 data PAU CDF Total (/yr) (RSC-CALKNX-2013-0810)	Supplement 1 data selected for scenarios in the PAU LERF Total (/yr) (PRA-W3-05-015 R2 Table 2)	NUREG/CR-6850 data for selected scenarios in the PAU LERF Total (/yr) (PRA-W3-05-015 R2 Table 2)	Difference between selected scenarios (/yr)	NUREG/CR-6850 PAU LERF Total (/yr)	Percentage increase
CPBLDG	1.11E-10	7.25E-11	1.42E-10	6.97E-11	1.80E-10	63%
CTA	8.43E-11	3.47E-11	6.80E-11	3.33E-11	1.18E-10	40%
CTB	8.19E-11	3.36E-11	6.59E-11	3.23E-11	1.14E-10	39%
FHB	6.33E-11	1.97E-12	3.86E-12	1.89E-12	6.52E-11	3%
INTAKE	1.74E-10	4.63E-11	9.07E-11	4.44E-11	2.18E-10	26%
RAB1	1.87E-7	6.56E-8	1.33E-7	6.73E-8	2.54E-7	36%
RAB11	3.88E-11	1.06E-11	2.39E-11	1.33E-11	5.21E-11	34%
RAB12	2.97E-12	1.01E-12	2.19E-12	1.18E-12	4.15E-12	40%
RAB13	3.84E-11	1.05E-11	2.36E-11	1.31E-11	5.15E-11	34%
RAB15	5.97E-9	5.54E-10	1.05E-9	4.96E-10	6.47E-9	8%
RAB16	6.18E-9	4.05E-10	7.66E-10	3.60E-10	6.54E-9	6%
RAB2	2.19E-11	1.61E-12	3.16E-12	1.55E-12	2.34E-11	7%
RAB22	1.08E-11	1.78E-12	2.67E-12	8.90E-13	1.16E-11	8%
RAB27	1.51E-10	6.06E-11	1.19E-10	5.81E-11	2.09E-10	38%
RAB31	4.13E-9	9.85E-14	1.93E-13	9.46E-14	4.14E-9	0%
RAB7	5.67E-7	3.95E-7	7.74E-7	3.79E-7	9.46E-7	67%
RAB8	1.55E-7	1.17E-7	2.29E-7	1.12E-7	2.67E-7	72%
RCB	4.33E-9	8.21E-12	1.61E-11	7.90E-12	4.33E-9	0%
TGB	1.26E-8	6.96E-9	1.29E-8	5.97E-9	1.86E-8	47%
YARD	5.84E-9	1.10E-10	2.16E-10	1.06E-10	5.94E-9	2%
Total	9.49E-7	5.85E-7	1.15E-6	5.66E-7	1.51E-6	60%

Table 3 provides ΔCDF and ΔLERF results. Table 3 is Table 4 from PRA-W3-05-015 Rev 2.

Table 3 Delta Risk results

PAU ID	PAU ΔCDF Total Using Supp. 1 Fire Ignition Frequencies (/yr)	Calculated Difference (/yr) (PRA-W3-05-015 R2 Table 4)	PAU ΔCDF Total Using NUREG/CR-6850 Fire Ignition Frequencies (/yr)	PAU ΔLERF Total Using Supp. 1 Fire Ignition Frequencies (/yr)	Calculated Difference (/yr) (PRA-W3-05-015 R2 Table 4)	PAU ΔLERF Total Using NUREG/CR-6850 Fire Ignition Frequencies (/yr)
CPBLDG	N/A	N/A	N/A	N/A	N/A	N/A
CTA	N/A	N/A	N/A	N/A	N/A	N/A
CTB	N/A	N/A	N/A	N/A	N/A	N/A
FHB	N/A	N/A	N/A	N/A	N/A	N/A
INTAKE	N/A	N/A	N/A	N/A	N/A	N/A
RAB11	N/A	N/A	N/A	N/A	N/A	N/A
RAB12	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0
RAB13	N/A	N/A	N/A	N/A	N/A	N/A
RAB15	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0
RAB16	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0
RAB1	4.77E-7	4.94E-7	9.71E-7	1.81E-8	7.17E-9	2.53E-8
RAB2	2.70E-10	0.00E+0	2.70E-10	3.50E-12	0.00E+0	3.50E-12
RAB22	N/A	N/A	N/A	N/A	N/A	N/A
RAB27	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0
RAB31	1.90E-7	0.00E+0	1.90E-7	4.11E-9	0.00E+0	4.11E-9
RAB7	1.16E-7	4.88E-8	1.65E-7	8.12E-8	4.48E-8	1.26E-7
RAB8	8.18E-7	3.50E-8	8.53E-7	1.32E-8	6.31E-10	1.38E-8
RCB	6.44E-8	0.00E+0	6.44E-8	3.11E-9	0.00E+0	3.11E-9
TGB	7.35E-7	5.81E-7	1.32E-6	3.84E-9	3.06E-9	6.90E-9
YARD	N/A	N/A	N/A	N/A	N/A	N/A

PRA RAI S04

By letter dated June 11, 2014, the response to PRA RAI 07 explains that a screening value of 0.1 is no longer used as the conditional core damage probability (CCDP) for failure of alternate shutdown on loss of MCR habitability. The response explains that based on updated assessment including detailed Human Reliability Analysis (HRA), the original CCDP value of 0.1 was found not to be bounding. The assessment of MCR abandonment is not described in the response to PRA RAI 01, but the licensee's analysis appears to indicate that a single CCDP of 3.87E-1 was determined and used in all MCR abandonment scenarios. Table W-1 of the LAR supplement lists MCR abandonment scenarios for which the CCDP value is shown to be 1.0, which is not consistent with the licensee's analyses. It is not clear from the LAR and the licensee's analysis whether a single CCDP/CLERP (conditional large early release probability) value was determined for MCR abandonment, what the MCR abandonment CCDP/CLERP values are, and how single values can be representative of the CCDPs in MCR abandonment scenarios for which different fire-induced impacts are possible.

The response for PRA RAI 07 also states that "[a]ll [Fire PRA] abandonment scenarios are associated with [the Fire Area] RAB-1 which includes the control room proper as well as the cable vault." This statement appears to indicate that MCR abandonment may be credited for the cable vault, and therefore, MCR abandonment is credited for loss of control as well as loss of habitability in the MCR. The NRC staff notes that for MCR abandonment on loss of control, the cues to abandon the MCR, the timing associated with those cues, and the time allowed to complete required actions are different than for abandonment of the MCR on loss of habitability. It is not clear whether MCR abandonment is credited for loss of control, or how MCR abandonment was modeled for loss of habitability and if applicable for loss of control.

In light of the observations made above, please provide the following:

a. Describe how MCR abandonment was modeled for loss of habitability.

b. Identify in Table G-1 in Appendix G all operator actions required to bring the plant into a safe and stable state, including those that must be performed before and after leaving the MCR. Operator actions taken at a PCS should be identified as PCS actions.

c. Explain how the operator actions were modeled in the HRA and incorporated into the Fire PRA for both loss of habitability and loss of control.

d. Explain how the CCDPs/CLERPs are estimated for fires that lead to abandonment due to loss of habitability and how they address various possible fire-induced failures. Specifically include in this explanation, discussion of how the following scenarios are addressed:

    i. Scenarios where fire fails only a few functions aside from forcing MCR abandonment and successful alternate shutdown is straightforward;

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

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

e. If MCR abandonment is credited for loss of control (i.e., non-habitability cases), please:

    i. Describe when MCR abandonment on loss of control is credited and how it was modeled.

    ii. Discuss the bases for the timing assumed in the HRA performed for MCR abandonment scenarios on loss of control, including the results of thermal-hydraulics analyses. Include discussion of the cues to abandon the MCR, the timing associated with those cues, and the basis for time available to complete required actions. Include explanation of how fire-induced impacts, including spurious operations are accounted for in determining the timing associated with the cue to abandon and the time available to perform operator actions.

iii. If the timing of the cues to abandon the MCR and the available time for performing operator actions does not take into account fire-induced impacts, then justify the current approach or replace this approach with an acceptable approach in the integrated analysis provided in response to RAI S18.

f. Explain how the abandonment scenario frequencies due to loss of habitability and/or loss of control were determined. Include explanation of how the fire ignition frequencies contributing to this scenario and non-suppression probabilities were determined.

Waterford 3 Response

a. The human reliability analysis (HRA) portion of MCR abandonment is modeled identically for either loss of function or loss of habitability. Response to PRA RAI S04c describes how the operator actions were modeled.

Transient fires occurring in southern region and outer perimeter of RAB 1A (Figure 6 of PRA-W3-05-028, "Fire PRA Main Control Room Analysis Notebook") are considered for loss of habitability if they are not extinguished. These fires will generally impact non-control board electrical panels and are generally lacking PRA modeled equipment within. Also, the equipment lost would not impede reactor shutdown. Although some equipment would be lost and some systems possibly degraded, the operation of required equipment would continue. The transient frequency is partitioned using approximate floor areas.

Electrical panel fires located in southern region and outer perimeter of RAB 1A (Figure 6 of PRA-W3-05-028) lead to loss of habitability if the fire is not extinguished. Each panel was examined to determine the functions performed and the PRA-related components potentially damaged by the fire. This is documented in the fixed source notebook (PRA-W3-05-006F, "Fixed Ignition Source Zone of Influence Methods"). From this evaluation and considering the geometry of the panels a scenario for the majority of panels was developed, with some panels being separated into their own loss of habitability scenarios. Other panels (CP-31, CP-30 and CP-29) are close enough to CP-8 that damage could occur and result in a loss of control at CP-8 and abandonment due to control faults.

Main control board (MCB) fire scenarios are based on localized effects but all of them could potentially grow into a more severe fire and force abandonment due to loss of habitability.

Fire impacts of MCR abandonment loss of habitability scenarios were developed based on fire type and location; or in other words, based on a zone of influence (ZOI) from a postulated fire. They were then further assumed to lead to control room abandonment after a failure to extinguish the fire. The HRA then creates multiple end states for different actions that were potentially not completed during the abandonment process, as described in PRA RAI S04c response.

b. Attachment G, Table G-1 has been updated and is provided in Enclosure 2 to this submittal, replacing previously submitted versions. The necessary actions taken in the MCR prior to leaving, as well as actions to activate the Remote Shutdown Panel (LCP-43), are included. There are no additional actions necessary to be performed at the PCS to establish the safe and stable condition.

c. The approach to MCR abandonment HRA (PRA-W3-05-023 Rev 2, "Main Control Room Abandonment for Fire Initiating Events") is consistent with the best practices for performing human reliability analysis. The first step is to review the procedure and evaluate the steps necessary for maintaining the PRA functions modeled in the fire PRA.

Once the procedural steps for maintaining the PRA functions are identified, the next step is to define the potential end states with respect to fire impacts on equipment, and in some cases, the failure to perform certain actions. This requires detailed state modeling of the potential switch configurations to determine what will be available for the operators to safely shutdown the plant. This includes allowing the use of both trains of equipment as long as the fire effects do not result in a loss of the equipment or random fault does not occur. Another consideration is that any action taken from the control room that is modeled in the PRA cannot be successful once the control room is abandoned.

Off-Normal Procedure OP-901-502 ("Evacuation of Control Room and Subsequent Plant Shutdown") controls the immediate fire response, and if required, the transition to the remote shutdown panel (LCP-43). The majority of actions to accomplish this process require operator actions to provide the transfer and to establish control.

The procedure addresses immediate actions and actions necessary to transfer control to LCP-43, stabilize the plant and then either return to the control room or proceed to cold shutdown. For the MCR abandonment analysis, only those actions necessary to establish LCP-43 and place the plant control in a stable state are necessary. The MCR abandonment analysis models the transition to LCP-43 until the point that implementation items are completed. The model is integrated into the FPRA response model to ensure that the plant system status can be accurately accounted for within the model quantification.

d. The fire PRA model was quantified to give the CCDPs/CLERPs. The model has several different fire scenarios leading to loss of habitability abandonment (PRA-W3-05-028, "Fire PRA Main Control Room Analysis Notebook"). Primarily, these are scenarios where the fire fails only a few functions, which typically are non-PRA functions. Other scenarios were developed wherein the functions that are failed are slightly more damaging and are PRA related. However, these functions will not involve PRA related equipment pertaining to safe shutdown. If the fire-induced failures cause great difficulty for shutdown by failing multiple functions and/or complex spurious operations occurs, the fire would be considered as a loss of control abandonment as opposed to a loss of habitability abandonment. In any of these scenarios the fire impacted components are failed (degraded state or out of position), and thus cannot be credited in the shutdown from the remote shutdown panel unless they are specifically recovered. The fire PRA accounts for these failures through quantification.

After the fire impacts for the individual scenarios are discovered, they are paired with multiple potential HRA end states to adequately integrate the HRA into the fire model (PRA-W3-05-023 Rev 2, "Main Control Room Abandonment for Fire Initiating Events"). Each of these end states were then quantified.

e. i) The main control room abandonment assessment (PRA-W3-05-023 Rev 2) describes the selection of scenarios pertaining to loss of control. The selection process looked at the critical nature of the fire impact and was supported by a board-by-board question and answer session with an operations team supplemented by other Waterford 3 staff with plant operating experience. From this evaluation it was determined that a loss of one of four panels (CP-1, CP-2, CP-8 and CP-33; or fire scenarios for which these panels are targets) would be sufficient to require implementation of control room abandonment. The loss of these panels would impact ac power availability, RCS and reactor control, safety-related equipment or operation of DCT/WCT fans. Both direct failure due to a fire and secondary failure due to a transient fire in close proximity were considered to lead to the

need for abandonment due to an impaired control capacity. Panel fires were evaluated on a case-by-case basis to determine if sufficient equipment was lost to require abandonment. This again was limited to the four identified panels. Due to the uncertain nature as to the degree of failure possible, the general consensus was that a fire in RAB 1E (Cable Spreading Room) would lead to sufficient loss of control that abandonment would be expected. All fires in the Cable Spreading Room are assessed as requiring main control room abandonment.

e .ii) The main considerations with respect to maintain a safe-stable configuration are the local trip of the reactor coolant pumps (RCPs) and the ability to maintain secondary side cooling using the emergency feedwater system. A consequential loss of both the ability to trip the RCPs from the control room combined with a loss of component cooling water (CCW) to the RCPs can result in RCP seal failure and a need for makeup. Tripping the RCPs will preclude a seal failure as long as it is completed within 20 minutes after the loss of CCW (PSA-WF3-01 SC, “Waterford 3 PSA At-Power Level 1 Success Criteria Analysis”). Although there are several indications possible, the indication of a failure to trip is not required as this in an immediate action to implement local (at the switchgear) trip of power to the RCPs regardless of CCW state as a precautionary measure. Local actions conducted by the operator are described in the procedure, which is available locally. The other important action relates to maintaining EFW flow. PSA-WF3-01 SC indicates that the operators have 63 minutes to establish EFW flow to prevent core uncovery. For the main control room abandonment this time was shortened to 30 minutes to provide margin. Indication is provided by the level monitoring at LCP-43 and the control room abandonment procedure provides steps requiring the verification of control and operation.

The impacts from a fire within the MCR (RAB 1A) or the Cable Spreading Room (RAB 1E) can lead to potential spurious actions such as initiation of safety injection pumps, pressurizer heater actuation or valve status changes. The fire PRA modeling includes these potential events directly in the logic. Some are addressed by specific steps in the MCR abandonment procedure and those found to be important are subsequently covered by the transfer switches that redirects control from the control room to LCP-43. These potential outcomes were reviewed and found to be only of small importance to the risk once LCP-43 was established. No single fire impacts were identified that would significantly alter the course of the event within the 30 minute time window that were probabilistically significant. The most significant consideration was the potential for continued makeup after letdown isolation leading to a relief valve challenge. This takes several minutes to occur and there are steps in the procedure to terminate flow and isolate letdown as immediate actions. If a relief valve were challenged to relieve inventory, the relief valve would additionally have to fail to reclose and this is a relatively low probability event.

Overall, the new procedure structure and reduced operator burden increases the time flexibility when realistic timing criteria are applied for performance of key actions such as tripping the RCPs and ensuring continued EFW flow. The times selected include some margin when considering existing internal events PRA timing contained in PSA-WF3-01 SC.

e.iii) The timing cues do consider fire impacts. The decision to abandon on loss of control is directly related to the degree of fire damage present on specific boards. The timing is based on the assumption that the fire impacts could be sufficient to cause an immediate loss of CCW therefore requiring trip of the RCPs within 20 minutes and that the EFW

system may require manual control from LCP-43. The timing for this second action is based on the time required to prevent core uncovery (63 minutes, PSA-WF3-01 SC) and conservatively reduced to 30 minutes.

f. Loss of control and habitability fire frequency considerations are discussed below:

Electric Cabinet Fire loss of control – Each electric cabinet in the main control room (RAB 1A) was evaluated in PRA-W3-05-006F ("Fixed Ignition Source Zone of Influence Methods"). The failures associated with a particular cabinet are defined using a ZOI approach and are listed in the report. RSC-CALKNX-2013-0704 ("Documentation of WF3 Fixed Fire Ignition Source Frequencies Per Count") gives the ignition frequency per count. That ignition frequency is then multiplied by the number of bin counts the cabinet is; giving the cabinet's ignition frequency. If the damage caused by a cabinet is deemed severe (often when risk (CCDP or CLERP) is equal to 1), it is considered an abandonment scenario due to loss of control. If not, it was still retained as a non-abandonment scenario. Non-suppression probabilities (NSP) were applied using control room bin in Table 14-1 from Supplement 1 to NUREG/CR-6850.

Electric Cabinet Fire habitability – For loss of habitability, electrical cabinets were grouped by location and impacts. Using the ignition frequency per count and multiplying it by the total number of counts of all cabinets in a group, the group's ignition frequency is developed. Some cabinets were singled out due to the impacts from the potential cabinet fire; the ignition frequency per count multiplied by the cabinet's counts gives the ignition frequency for these scenarios. PRA-W3-05-026 ("Evaluation of the Unit 3 Control Room Abandonment Times at the Waterford Nuclear Station") gives timing for habitability criterion to be reached for a given fire type (fuel type), location, intensity (amount of heat coming from the fire), along with other criteria. This timing indicates when abandonment would likely begin. It also provides timing for NSP to be calculated for each heat release rate (HRR) bin. All HRR bins (SF*NSP) were summed together; and the correct SF*NSP was applied based on fire type and location in the MCR.

Main Control Board Fire loss of control – Scenarios on the main control board (MCB) were postulated in PRA-W3-05-028 ("Fire PRA Main Control Room Analysis Notebook") and the failures associated with each scenario are listed in that report. PRA-W3-05-001 ("Partitioning, Qualitative Screening, and Ignition Frequency Development Notebook") gives the ignition frequency. That ignition frequency is then multiplied by the $SF*P_{NS}$ developed from Appendix L of NUREG/CR-6850; giving the scenario's ignition frequency. If the damage caused by the scenario is deemed severe (often when risk (CCDP or CLERP) is equal to 1), it is considered an abandonment scenario due to loss of control. If not, it was still retained and a non-abandonment scenario.

Main Control Board Fire habitability - For loss of habitability, MCB panels were grouped by functions. The frequency for the MCB is based on the cabinet length. The ignition frequency for each section is summed together to get the groups ignition frequency; some segments of the MCB had abandonment scenarios individually. PRA-W3-05-026 gives timing for habitability criterion to be reached for a given fire type (fuel type), location, intensity (amount of heat coming from the fire), along with other criteria. This timing indicates when abandonment would likely begin. It also provides timing for NSP to be calculated for each heat release rate (HRR) bin. All HRR bins (SF*NSP) were summed together; and the correct SF*NSP was applied based on fire type and location in the MCR.

Transient Fire loss of control – Transient fires leading to abandonment due to loss of control typically originated in the Cable Spreading Room (RAB 1E). Ignition frequency for

these fires is based on the area. The room transient ignition frequency was given in PRA-W3-05-001. The room was divided into smaller sections called sub-PAUs; each sub-PAU has unique impact. A sub-PAUs ignition frequency is determined by the ratio of its floor area to the PAUs floor area. Non-Suppression Probability (NSP) were applied using transient fire bin in Table 14-1 from Supplement 1 to NUREG/CR-6850, along with taking credit for installed pre-action sprinkler system as prescribed in NUREG/CR-6850.

Transient Fire habitability - Transient fire scenarios leading to abandonment due to habitability were developed in the main control room (RAB 1A). A similar method of dividing the floor area into smaller areas (where similar impacts exist) was also used. The transient fire frequency is divided appropriately using the ratio of floor area in the small section compared to that of the room. PRA-W3-05-026 gives timing for habitability criterion to be reached for a given fire type (fuel type), location, intensity (amount of heat coming from the fire), along with other criteria. This timing indicates when abandonment would likely begin. It also provides timing for NSP to be calculated for each heat release rate (HRR) bin. All HRR bins (SF*NSP) were summed together; and the correct SF*NSP was applied based on fire type and location in the MCR.

PRA RAI S05

60 day response

PRA RAI S06

60 day response

PRA RAI S07

90 day response

PRA RAI S08

60 day response

PRA RAI S09

By letter dated June 11, 2014, the response to PRA RAI 22 explains that assessment of the MCR Main Control Board (MCB) was updated using the NUREG/CR-6850 Appendix L method but does not describe the new treatment. Based on the review of the licensee's updated analysis, the NRC staff makes the following observations.

The first observation is that the licensee's description of applying the Appendix L approach states that the MCB fire ignition frequency was "apportioned into different fire scenarios", and that the approach "allowed for approximately 88.3% of the of the MCB frequency to be discarded" as not significant. When applying the NUREG/CR-6850 Appendix L method, as per guidance in FAQ 14-0008, the frequency of a scenario involving specific target damage in the MCB should be determined by multiplying the probability of target damage, such as specified by Figure L-1 of NUREG/CR-6850, by the entire MCB frequency. Subdividing the MCB frequency is not intended by Appendix L guidance unless accompanied by recalculation of Appendix L, Figure L-1, target damage probabilities.

The second observation is that the analysis credited additional non-suppression probability for scenarios where fire propagates from one MCB panel to another based on the licensee's characterization of the MCB as "not an open construct," but rather "individual panels abutted together". The MCB configuration that justifies reducing the likelihood of fire propagation between MCB panels is not completely clear.

The third observation is that it appears from information presented in the licensee's analysis that there may be control functionality located on the rear side of the MCB. It is not clear from description of the licensee's analysis whether this functionality is included in the target sets addressed in the MCB fire evaluation. Note that guidance in FAQ 14-0008 provides discussion of MCB configurations in which the rear side of the MCB should also be considered an integral part of the MCB and analyzed as such.

Based on the observations above please provide the following:

a. Clarify how the MCB fire ignition was applied to MCB fire scenarios. If the entire MCB frequency is not multiplied by the target damage for each MCB fire scenario, per guidance in FAQ 14-0008, then justify the approach using NRC guidance on application of the Appendix L method, or remove this approach and replace it with an acceptable approach as part of the integrated analysis provided in response to PRA RAI S18.

b. Describe the MCB panel configuration that provides the basis for reducing the likelihood of fire propagation between MCB panels. Indicate whether there are partitions between the panels and if there are, whether there are any openings in the partitions. If the Waterford MCB panel configuration cannot justify reducing the likelihood of fire propagation between MCB panels using guidance in NUREG/CR-6850, then remove the additional non-suppression credit applied to fire scenarios between MCB panels as part of the integrated analysis provided in response to PRA RAI S18.

c. Clarify whether there is control functionality located on the rear side of the MCB and whether it included as part of the target sets addressed in application of the NUREG/CR-6850 Appendix L approach. If there is functionality on the rear side that must be considered an integral part of the MCB that was not assessed, then justify this exclusion or include consideration of fire damage to these functions as part of application of the NUREG/CR-6850 Appendix L approach in the integrated analysis provided in response to PRA RAI S18.

<u>Waterford 3 Response</u>

a. The frequency for each of the scenarios is calculated using the guidance found in Appendix L of NUREG/CR-6850, whereby the MCB bin frequency is multiplied by the severity factor and the non-suppression probability. Figure L-1 in NUREG/CR-6850, gives the severity factor multiplied by the non-suppression probability ($SF*P_{ns}$) in terms of the longest distance between targets in a given target set. No distinction was found regarding calculating scenario ignition frequency (MCB bin frequency* $SF*P_{ns}$) between Appendix L of NUREG/CR-6850 and resolution to FAQ 14-0008 ("Main Control Board Treatment") other than the inclusion of the rear side of the MCB in the analysis. The rear side of Waterford 3's MCB does not contain any control functionality; therefore no analysis is needed.

b. The main control board (MCB) for Waterford 3 consists of several individual panels abutted together in the form of an "L" shape. The partitions are solid, continuous, and noncombustible in between all control panels, with one exception between CP-1 and CP-4 where no partition exists. This was verified via a walkdown which included opening the MCB from the rear side. From FAQ 14-0008 Rev. 1("Main Control Board Treatment"), "partitions between panels/cabinets impact the progression of a fire and the characterization of damage sets across those partitions." It further suggests three methods for treatment of the partitions. Alternative number 2 was chosen for Waterford 3's MCB:

> *For the case where the values in Figure L-1 in NUREG/CR-6850 are not re-calculated, the MCB frequency should not be apportioned between different panel sections. The full MCB frequency should be assigned to all of the panels separate by the partitions. This is appropriate because the values in Figure L-1 represent the probability of a fire starting and growing anywhere in the length of a "typical" MCB regardless of the partitions. In this configuration, the partitions can be credited for preventing fire propagation provided that they are solid, continuous, and noncombustible. The practical implication of this approach results in conservatively applying the full MCB frequency to each panel (i.e., not apportioning the MCB frequency by panel sections) but limiting the fire propagation to each partitioned section.*

Previously, for Scenario MCB01Q, fire damage extended from CP-1 to CP-4 and inappropriately used an added non-suppression probability for added time to propagate to a new control panel. This was the only instance where an added non-suppression probability was used and has since been removed from the Fire PRA (PRA-W3-05-028, "Fire PRA Main Control Room Analysis Notebook"). The response to PRA RAI S18 contains the effects of removing this non-suppression probability.

c. There is no control functionality located on the rear side of Waterford's MCB and therefore, the rear side was not included as part of the target sets addressed in application of the NUREG/CR-6850 Appendix L approach.

PRA RAI S10

60 day response

PRA RAI S11

60 day response

PRA RAI S12

By letter dated June 11, 2014, the response to PRA RAI 32 explains that the MCR analysis has been revised by differentiating between single and multiple bundles of cables affecting abandonment times for MCR abandonment scenarios. Though the RAI response does not provide further description of the new approach, the NRC staff reviewed the description of the updated approach in the licensee's analysis. This description explains that 50 percent of fire scenarios are assumed to involve single cable bundles and 50 percent are assumed to involve multiple cable bundles. The licensee's analysis further explains that "this assumption is conservative because all fires initiate as a single bundle," and in the MCR "50% of the fires are likely to be single cable bundles prior to detection and suppression." The NRC staff notes that without supporting fire modeling or event data, it is not clear what the opportunity for suppression is before cables in multiple bundles are involved in a fire, and whether this assumption is conservative compared to, for example, specifically

identifying and modeling single and multiple cable bundles based on a walkdown. The NRC staff also notes that this assumption is a deviation from NUREG/CR-6850 guidance, which treats individual electrical panels as containing either a single cable bundle or multiple cable bundles.

Provide further justification that the assumption is conservative based on characterization of the actual cable bundle configurations in the MCR cabinets, or update risk results as part of the integrated analysis requested in PRA RAI S18.

Waterford 3 Response

The earlier MCR abandonment assessment (PRA-W3-05-028, "Waterford Steam Electric Station 3 Fire PRA Main Control Room Analysis Notebook, Rev. 1") was based on limited visual observations of the control room cabinets' internal configuration. From this assessment the analyst developed an assumption of an equal split between single and multiple cable bundle scenarios. There was an additional assumption related to the potential for multiple bundles being somewhat limited to single bundle scenarios and identified prior to full growth which was also used to support the single bundle split.

In addressing PRA RAI S09 Waterford 3 conducted additional confirmatory evaluations with regard to control room cabinet design, including cable arrangement observations. On the basis of this more complete assessment the cable bundles are determined to be multi-bundle constructs. The analysis has been updated to reflect multi bundle configurations for all MCR cabinets and throughout the MCB, with the exception of CP-53 which was verified to contain a single bundle. The impact on CDF and LERF will be presented in the sensitivity studies supporting PRA RAI S18.

PRA RAI S13

90 day response

PRA RAI S14

60 day response

PRA RAI S15

60 day response

PRA RAI S16

90 day response

PRA RAI S17

90 day response

PRA RAI S18

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

that result from proposed changes to the plant's licensing basis and describes a general framework to determine the acceptability of risk-informed changes. The NRC staff's review of the information in the LAR has identified several PRA methods that require additional review. The PRA methods currently under review include:

- PRA RAI S01 regarding treatment of secondary ignition
- PRA RAI S04 regarding modeling MCR abandonment
- PRA RAI S05 regarding modeling determination of additional risk of recovery actions
- PRA RAI S07 regarding the licensee's multiplier approach for developing fire HEPs
- PRA RAI S08 regarding treatment of sensitive electronics
- PRA RAI S09 regarding use of NUREG/CR-6850 Appendix L
- PRA RAI S12 regarding single versus multiple bundle cable fires
- PRA RAI S15 regarding the inclusion of SOKC for internal and fire event factors
- PRA RAI S17 regarding new spurious actuation guidance
- FM RAI S02.a regarding critical damage thresholds

Provide the following:

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

b. For each method (i.e., each bullet) above, explain how the issue will be addressed in 1) the final aggregate analysis results provided in support of the LAR, and 2) the PRA that will be used at the beginning of the self-approval of post-transition changes. In addition, provide confidence (e.g., with a proposed implementation item) that all changes will be made, that a focused-scope peer review will be performed on changes that are PRA upgrades as defined in the PRA standard, and that any findings will be resolved before self-approval of post-transition changes. Note that any use of unacceptable methods may prohibit the staff from completing its review for self-approval.

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

d. If any of the methods not accepted by the NRC staff will be retained in the PRA that will be used to estimate the change in risk of post-transition changes to support self-approval, explain how the quantification results for each future change will account for the use of these methods.

Waterford 3 Response

a. A simultaneous analysis for CDF and LERF was completed with results presented in Table 1 (below). (PRA-W3-05-049, "Comparison of Waterford 3 MOR and FRE CDF and LERF Results, Rev. 1")

b. Each bulleted method is discussed below:

- PRA RAI S01 regarding treatment of secondary ignition – Response to PRA RAI S01 shows that appropriate secondary ignition was accounted for, as prescribed by NUREG/CR-6850, throughout the analysis. No new impact to risk is seen from this RAI.

- PRA RAI S04 regarding modeling MCR abandonment - Extensive remodeling of the abandonment HRA has refined risk impacts and insights for RAB 1 risk (PRA-W3-05-023 R2, "Waterford 3 Main Control Room Abandonment HRA Analysis"). Scenarios involving control room abandonment due to habitability concerns were also redeveloped in order to better model potential fire impacts. Overall risk in the PAU has decreased by 4.34E-06/yr for CDF (62.9% decrease) and 2.08E-06 for LERF (93.3% decrease).

- PRA RAI S05 regarding modeling determination of additional risk of recovery actions – No additional recovery actions were added.

- PRA RAI S07 regarding the licensee's multiplier approach for developing fire HEPs – PRA RAI S07 found a single operator action from the Internal Events model (EHFMANTRNP) that involved both main control room (MCR) and ex-control room actions; however, this action was inappropriately binned to only MCR actions in the Fire PRA. EHFMANTRNP involves power restoration following a failure of the automatic bus transfer (ABT) device when transferring from onsite to offsite power. This action has been removed from the Fire PRA model. The removal of this action was not isolated for its impact on risk.

- PRA RAI S08 regarding treatment of sensitive electronics - FAQ 13-0004 was not utilized in the fire PRA. However, the work performed is consistent with or bounding of the methodology presented in FAQ 13-0004. Most panels (cabinets) installed at Waterford 3 are ventilated and as such could not make use of the enhanced failure criteria proposed in FAQ 13-0004. Instead these are subject to the lower NUREG/CR-6850 failure criteria which are employed in the current fire PRA analyses for sensitive electronics. No additional updates to the current methods, analysis, or results are necessary.

- PRA RAI S09 regarding use of NUREG/CR-6850 Appendix L – Removal of a 0.007 factor from one scenario (MCB01Q) resulted in an Increase in CDF of 1.99E-12 and 3.99E-14 for LERF. This will be removed during the next update. MCB01Q has no delta risk associated with it; therefore, Δrisk remains 0.

- PRA RAI S12 regarding single versus multiple bundle cable fires – As PRA RAI S04 alluded to, updates to the method in which control room abandonment loss of habitability scenarios impacts have been made. A walkdown was performed to determine which cabinets (including the main control board) contain single bundles and which have multi bundles. The result found that the vast majority of the cabinets contain multi bundled cables, with the exception of CP-53. The single versus multiple bundle cable fires methodology concern in PRA RAI S12 only applies to control room abandonment loss of habitability scenarios. The prior sum of CDF for scenarios affected is 1.76E-6/yr; the revised scenarios CDF sum is 1.08E-6 /yr. The prior sum of LERF for scenarios affected is 7.29E-7 /yr; the revised scenarios LERF sum is 2.40E-8 /yr. The expectation would be an increase from this change, however, the revision to the fire impacts of these fires has decreased the risk; overshadowing the expected increase.

- PRA RAI S15 regarding the inclusion of SOKC for internal and fire event factors – The results of PRA RAI S15, 1.1% increase for CDF and 9.7% increase for LERF, indicate that the calculated estimate for CDF and LERF are not sensitive to the SOKC. Based on the review, the basis for the low contribution is that, for the most part, the results are dominated by cut sets that do not represent combinations of component random failures. Fire induced failures of components are completely dependent within a scenario with no severity factor included such that there is not a SOKC adjustment required. For the LERF scenarios the result is controlled by cut set contributions that are devoid of any component failures not completely dependent on the presence of the fire. The 9.7% difference is associated with cut sets including circuit failure probabilities related to the CARS system. The impact is strongly associated with the assumption on variance associated with the hot short probability.

  The approved analysis method for calculating the impacts of hot shorts is NUREG/CR-7150, Vol. 2/EPRI 3002001989, "Joint Assessment of Cable Damage and Quantification of Effects from Fire (JACQUE-FIRE)", which provides updated estimates for the probability of hot short and also includes estimates for uncertainty. Considering information from this source indicates a variance level of 0.01 is more likely which would significantly reduce the impact of SOKC and would further support the conclusion that the SOKC considerations do not impact the results and conclusions derived from the fire PRA.

- PRA RAI S17 regarding new spurious actuation guidance – A value of 0.6 is used in the fire PRA. This value is bounding of the new spurious actuation guidance value of 0.56 that could be used. 0.56 will be utilized in the next revision of the fire PRA. This RAI has minimal effects on the results and will be addressed as implementation item S2-22 to incorporate the NUREG/CR-7150 Volume 2 guidance for spurious actuation.

- FM RAI S02.a regarding critical damage thresholds - Impacts were added to specific scenarios based on revising the damage threshold to 330 ºC from 380 ºC for thermoset cables, as discussed in response to FM RAI S02. This revision required fire impacts to be added to approximately 5 percent of the 1324 scenarios. The impacts of this are seen in the aggregate analysis.

  Results from the aggregate analysis are provided in Table 1.

Table 1 Results

	Previous fire PRA model (fire model associated with the LAR Supplemental (W3F1-2013-0048)	Revised fire PRA model (post RAI revisions)	Change in Risk
CDF	1.62E-5 /yr	1.80E-5 /yr	1.81E-6 /yr increase
RAB 1	6.90E-6 /yr	2.56E-6 /yr	4.34E-6 /yr decrease
Non-RAB 1	9.27E-6 /yr	1.54E-5 /yr	6.07E-6 /yr increase
LERF	2.89E-6 /yr	9.72E-7 /yr	1.92E-6 /yr decrease
RAB 1	2.23E-6 /yr	1.51E-7 /yr	2.08E-6 /yr decrease
Non-RAB 1	6.62E-7 /yr	8.21E-7 /yr	1.59E-7 /yr increase
Whole plant ΔCDF	2.31E-6 /yr	2.45E-6 /yr	1.40E-7 /yr increase
Whole plant ΔLERF	1.29E-7 /yr	1.24E-7 /yr	5.00E-9 /yr decrease

A significant increase in CDF is seen in non-RAB 1 and is mainly due to removing credit for EHFMANTRNP (PRA RAI S07) and changing the thermoset cable critical damage threshold from 380C to 330C (FM RAI S02). A significant decrease in CDF is seen in RAB 1 scenarios, despite increase from single vs. multi cable bundles (PRA RAI S12). This is attributed to remodeling of control room abandonment procedure. The significant decrease in LERF is also attributed to remodeling of control room abandonment procedure. All PAUs still meet Δrisk criteria for Region 3 of RG 1.174.
See updated Attachment W presented in Enclosure 2 of this submittal (W3F1-2015-0025).

c. RG 1.205 risk acceptance guidelines are satisfied for the aggregate analysis, as the delta risk values are within Region 3 criterion of Reg. Guide 1.174 for each PAU. Furthermore, the total plant delta risk falls below criterion limits of Region 1 of Reg. Guide 1.174.

No new modifications or operator actions are being credited to reduce delta risk.

d. All methods have been validated as currently aligned or have been realigned with accepted methodology.

PRA RAI S19

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

a) Summarize or list all modeling changes made to the Internal Events and Fire PRA since the December 18, 2013 submittal.

b) Indicate if any other methods were employed that deviate from the guidance in NUREG/CR-6850 or other acceptable guidance (e.g., FAQs or interim guidance documents). If so, describe and justify any proposed method that deviates from NRC guidance, or replace the proposed method with an accepted method. Also, include the proposed method as a method "currently under review" as part of the integrated analysis in the response to PRA RAI S18.

Waterford 3 Response

a) The changes made are described below:

   1. Added impacts to specific scenarios based on revising the damage threshold to 330ºC from 380 ºC for thermoset cables, as discussed in response to FM RAI S02. This revision required impacts to be added to approximately 5 percent of the scenarios.

   2. Main Control Room (MCR) Modeling

      i. Adjustments were made regarding mutli-bundle verses single-bundle cabinets and main control board (MCB) for habitability MCR abandonment cases. The Fire PRA model, in the December 18, 2013 submittal, assumed 50 / 50 allotments of single verses multi bundle. It was determined that the each of the MCR cabinets and MCB segments are heavily occupied with cables. Therefore, the analysis has been updated to reflect multi bundle for all MCR cabinets and throughout the MCB, with the exception of CP-53 which was verified to contain a single bundle.

      ii. During review of the amount of cabling in the MCBs, it was also determined that an assumed barrier separating CP-1 and CP-4 did not exist. Scenario MCB01Q had credited this non-existent barrier with an additional 0.007 non-suppression probability, which has been removed.

      iii. Loss of habitability abandonment scenarios were revisited to model them in further detail. The number of scenarios was expanded to better capture actual impacts from more specific sources.

      iv. Abandonment human reliability analysis (HRA) was revisited to integrate it into the model, opposed to being calculated outside of the FPRA quantification process. This process required the same fire scenario be applied to multiple HRA results (each scenario is duplicated with a different set of added failures due to incomplete operator actions).

3. During improvements to the MCR abandonment modeling it was discovered that 2 cables associated with reactor coolant system vent valves were missing from the FPRA and were subsequently included.
4. Miscellaneous erroneous impacts were corrected when discovered. In a very few instances, it was discovered that a cable was incorrectly tied to multiple train impacts (such as both the “A” and “B” safety buses). Control wire diagrams (CWD) and expert panels were consulted to verify the correct trains were associated with the cable. The corrections were then made to the FPRA.
5. During the PRA RAI S07 response development a single operator action from the Internal Events model (EHFMANTRNP) was identified that involved both MCR and ex-control room actions, but inappropriately binned to only MCR actions in the Fire PRA. This involved restoration following a failure of the automatic bus transfer (ABT) device when transferring from onsite to offsite power. This action has been removed from the Fire PRA model.

b) No known deviations from NUREG/CR-6850 or other approved methodologies exist.

Portions of Enclosure 2 Contain Security-Related Information
To Be Withheld Under 10 CFR 2.390

Enclosure 2 to

W3F1-2015-0025

Updated LAR Attachments
Waterford 3 NFPA 805 License Amendment Request

When Attachment W of Enclosure 2 to this letter is removed this document is no longer Security-Related.

Portions of Enclosure 2 Contain Security-Related Information To Be Withheld Under 10 CFR 2.390

Updated LAR Attachments
Waterford 3 NFPA 805 License Amendment Request

Table of Contents

When Attachment W of Enclosure 2 to this letter is removed this document is no longer Security-Related.

Attachment C, Table C-1 (RAB 1 only)

Performance Goal	Method of Accomplishment	Comments
1.5.1(a) Reactivity Control-HSB	Manual reactor trip from Control Room. CVCS Train B for boration control	
1.5.1(b) Inventory & Pressure Control	CVCS Train B SSD-ESWGR-32B (power supply for Pressurizer heaters)	
1.5.1(c) Decay Heat Removal HSB	EFW Train B Pump Main Steam to SG2	
1.5.1(d) Vital Auxiliaries (electrical)	Train B (EDG B)	
1.5.1(d) Vital Auxiliaries (HVAC)	HVC, HVR & SVS Train B equipment CCS Train B CHW & RFR Train B	
1.5.1(d) Vital Auxiliaries (mechanical)	CCW Train B Nitrogen gas system	
1.5.1(e) Process Monitoring	LCP-43 indication available with associated equipment	

References	Document ID
	EC-F13-001 Rev. 0 - Nuclear Safety Capability Assessment

Fire Suppression Activities Effect on Nuclear Safety Performance Criteria

Safe and stable conditions can be achieved and maintained in this fire area for all fire suppression activities. No automatic suppression is installed in this area except fire zone RAB 1E. Cable tray and conduit entrances into equipment are equipped with a water seal(s). Discharge of manual suppression water is controlled; therefore, any fire suppression activities will not adversely affect the ability to achieve the nuclear safety performance goal.

For fire zone RAB 1E, safe and stable conditions can be achieved and maintained in this fire area for all fire suppression activities. This area has a pre-action suppression system. Cable tray and conduit entrances into equipment are equipped with a water seal(s). Adequate drainage of water for fire extinguishment will be provided by gravity floor drains to the yard storm water system. Therefore, any fire suppression activities will not adversely affect the ability to achieve the nuclear safety performance goal.

Engineering Evaluation ID WF3-FP-11-00003, Attachment 6.2, Item 01 WF3 Review and Evaluation of Fire Protection Engineering Evaluations for NFPA 805 Transition

Inactive No
Functionally Equivalent No
Adequate for the Hazard Yes
Summary Purpose: The analysis evaluated the fire rating of the following fire doors: D024, D029, D046, D047, D075, D085, D128, D141, D161, D163, D167, D170, D179, AD192, D242 and D250.

Basis for Acceptability:
- The above fire rated doors were manufactured in accordance with UL procedures for an “A” label or UL procedures for a “B” label.
- Modifications made to the door or frame prevent the assemblies from having a UL label; however, these modifications have been evaluated and determined to not significantly adversely affect the hourly rating of the door.
- Fire doors evaluated were determined to be acceptable based on the fact that the fire severity in areas on either side of the door is significantly less than the evaluated rating of the fire door assembly.

Engineering Evaluation ID WF3-FP-11-00003, Attachment 6.2, Item 17 WF3 Review and Evaluation of Fire Protection Engineering Evaluations for NFPA 805 Transition

Inactive No
Functionally Equivalent No
Adequate for the Hazard Yes
Summary Purpose: This evaluation provides the technical justification for the existing fire seal configurations of block wall/ceiling interfaces known as “Gap Seals” located in the following Fire Areas: RAB 1 (Fire Zone 1E), 2, 3A, 5, 6, 7, 8, 15, 23, 23A, 25, 27 & 30.

Basis for Acceptability:
Gap Seals for fire barriers as described in Attachment 6.2, Item 17, Sections: 6.3; 6.6 - 6.11; 6.16 – 6.18; 6.21 - 6.25; 6.27; 6.32; 6.38 – 6.40 & 6.42:
- Extremely low fire severity.
- The Gap Seal configuration itself provides a level of protection based on the substantial construction and insulation qualities of the seal assembly.

Gap Seals as described in Attachment 6.2, Item 17, Sections: 6.12 - 6.15; 6.19 – 6.20 & 6.33 – 6.35:
- The Gap Seal configuration itself provides a level of protection based on the substantial construction and insulation qualities of the seal assembly.
- Automatic suppression system on a zone wide basis or in the areas where significant combustibles exist.
- Automatic detection system on a zone wide basis.

Engineering Evaluation ID WF3-FP-13-00006, Attachment 8.1 Barrier Evaluation Between Fire Areas RAB 1 and RAB 1B

Inactive No
Functionally Equivalent No
Adequate for the Hazard Yes

Summary

Purpose: Provide technical justification for the lack of rated fire dampers in HVAC ducts penetrating the 3-hour rated fire area boundary wall separating Fire Area RAB 1 (Control Room Complex) and Fire Area RAB 1B (Control Room H&V Room), located on +46' Elevation in the Reactor Auxiliary Building (RAB).

Basis for Acceptability:

- Limited Fire Severity.
- Automatic suppression in Fire Zone RAB 1E only.
- Manual suppression in Fire Areas RAB 1 & RAB 1B.
- Automatic detection in RAB 1 & 1B (except for the following portion of FZ RAB 1C: north/south & east/west corridor passageways and the operations office & vault located in the southeast corner of RAB 1C)
- Construction of the duct: Specifically, seismically supported HVAC ducts with no line of sight openings from one fire area to the other through the ductwork at the fire area interface.
- Administrative Controls for the control of transient combustibles and ignition sources.

Required FP System(s)/Feature(s)	Description	Required By	Comments
Detection	RAB 1A Detection	EEEE/LA	None
Detection	RAB 1A Detection	Risk Criteria	None
Detection	RAB 1C Detection	EEEE/LA	None
Detection	RAB 1C Detection	Risk Criteria	None
Detection	RAB 1D Detection	EEEE/LA	None
Detection	RAB 1D Detection	Risk Criteria	None
Detection	RAB 1E Detection	EEEE/LA	None
Detection	RAB 1E Detection	Risk Criteria	None
Water Suppression	RAB 1E Suppression	EEEE/LA	None
Water Suppression	RAB 1E Suppression	Risk Criteria	None
Passive	RAB 1A Combustible Control	EEEE/LA	None
Passive	RAB 1C Combustible Control	EEEE/LA	None
Passive	RAB 1D Combustible Control	EEEE/LA	None
Passive	RAB 1E Combustible Control	EEEE/LA	None
Passive	RAB 1E Combustible Control	DID Criteria	None
Passive	RAB 1E Hot Work Control	DID Criteria	None
Procedures / Guidance		Risk Criteria	Improvements to procedures necessary to incorporate recovery actions required to meet risk criteria.

Title	Fire Area RAB 1 - Control Room Envelope
Summary	A risk-informed, performance-based fire risk evaluation was performed for fire area RAB 1B to address the VFDRs of NFPA 805 Section 4.2.3. The acceptability of these VFDRs is based on: • The measured change in CDF and LERF and • The maintenance of defense-in-depth and safety margins The fire risk evaluation determined that with the implementation of the specified recovery actions, the installed fire detection and suppression systems, and enhancements to hot work and combustibles controls, the applicable risk, defense-in-depth, and safety margin criteria were satisfied.
Δ CDF	4.77E-7
Δ LERF	1.81E-8
DID Maintained	The VFDRs and the associated Fire Area risk (CDF) and scenario consequences (CCDP values) were evaluated to identify general DID echelon imbalances. Potential methods to balance the DID features were identified ensuring an adequate balance of DID features is maintained for the Fire Area. As a result of the review for this area, enhancements to hot work and combustible controls were identified as required for DID.
Safety Margin Maintained	All analyses and assessment have been performed utilizing accepted techniques and industry accepted standards. In addition, safety analysis acceptance criteria in the licensing basis (e.g., FSAR, supporting analyses) have been considered and provides sufficient margin to account for analysis and data uncertainty. As such, the Safety Margins are maintained.
Comments	

References	**Document ID**
	EC-F10-002 Rev. 003 - WF3 NFPA 805 Fire Risk Evaluation - Fire Area RAB 1

VFDR ID 1-001

VFDR ESSENTIAL CHILLED WATER PUMP P1 (3B-SB) CHW-MPMP-0001B

Fire damage to Essential Chilled Water Pump P1 (3B-SB) CHW-MPMP-0001B control cable may result in the following:

a.) Loss of Control-Control and Indication from CP-18

Loss of Essential Chilled Water Pump P1 (3B-SB) CHW-MPMP-0001B could challenge the Vital Auxiliaries (HVAC) Performance Criterion. This condition represents a variance from the deterministic requirements of Section 4.2.3 of NFPA 805. This is a separation issue and evaluation of the additional risk is required in accordance with Section 4.2.4 of NFPA 805.

Disposition This condition was evaluated for compliance using the performance-based approach of NFPA 805, Section 4.2.4. A fire risk evaluation determined that applicable risk, defense-in-depth, and safety margin criteria were satisfied without further action.

VFDR ID 1-002

VFDR VOLUME CONTROL TANK DISCHARGE VALVE CVC-183 (IN 92-18)

Fire damage to Volume Control Tank Discharge Valve CVC-183 Control cable may result in the following:

a.) Loss of Control-Control and Indication from CP-4.

The postulated fire damage to Volume Control Tank Discharge Valve CVC-183 has been identified for circuit failures as it is related to IN- 92-18 for fires originating from the Main Control Room.

Loss of Volume Control Tank Discharge Valve CVC-183 function could challenge the Inventory and Pressure Control Performance Criterion. This condition represents a variance from the deterministic requirements of Section 4.2.3 of NFPA 805. This is a separation issue and evaluation of the additional risk is required in accordance with Section 4.2.4 of NFPA 805.

Disposition This condition was evaluated for compliance using the performance-based approach of NFPA 805, Section 4.2.4. A fire risk evaluation determined that applicable risk, defense-in-depth, and safety margin criteria were satisfied without further action.

VFDR ID 1-005

VFDR DIESEL GENERATOR CONTROL PANEL DGB ENG CP

Fire damage to Diesel Generator Control Panel DGB ENG CP control cables could result in the following:

a.) Loss of Control-Control and Indication from CP-1
b.) Loss of Control-Control Signal from CP-1 to DGB Engine Control Panel

Loss of Diesel Generator Control Panel DGB ENG CP function could challenge the Vital Auxiliaries (electrical) Performance Criterion. This condition represents a variance from the deterministic requirements of Section 4.2.3 of NFPA 805. This is a separation issue and evaluation of the additional risk is required in accordance with Section 4.2.4 of NFPA 805.

Disposition This condition was evaluated for compliance using the performance-based approach of NFPA 805, Section 4.2.4. A fire risk evaluation determined that applicable risk, defense-in-depth, and safety margin criteria were satisfied without further action.

VFDR ID 1-006

VFDR DIESEL GENERATOR B CONTROL PANEL DGB GEN CP

Fire damage to Diesel Generator B Control Panel DGB GEN CP Control cables may result in the following:

a.) Loss of Control-Control from CP-1
b.) Loss of Control-Control from CP-1 to DGB Generator Control Panel
c.) Loss of Control-Control and Indication from CP-1

Loss of Diesel Generator B Control Panel DGB GEN CP function could challenge the Vital Auxiliaries (electrical) Performance Criterion. This condition represents a variance from the deterministic requirements of Section 4.2.3 of NFPA 805. This is a separation issue and evaluation of the additional risk is required in accordance with Section 4.2.4 of NFPA 805.

Disposition This condition was evaluated for compliance using the performance-based approach of NFPA 805, Section 4.2.4. A fire risk evaluation determined that applicable risk, defense-in-depth, and safety margin criteria were satisfied without further action.

VFDR ID 1-007

VFDR DIESEL GEN B SEQUENCER AND UV CIRCUIT EDG B SEQ/UV

Fire damage to Diesel Generator B Sequencer and Under-Voltage Circuit EDG B SEQ/UV Control cables (eight wires) could result in the following:

a.) Loss of Control-Control Signal from CP-1 to AUX PNL-2
b.) Loss of Control-Control Signal from ESFAS Cabinet B to AUX PNL-2
c.) Loss of Control Signal-Control from 4KV-ESWGR-3B to AUX PNL-2
d.) Loss of Control-Control and Indication from CP-1

Loss of Diesel Generator B Sequencer and Under-Voltage Circuit EDG B SEQ/UV function could challenge the Vital Auxiliaries (electrical) Performance Criterion. This condition represents a variance from the deterministic requirements of Section 4.2.3 of NFPA 805. This is a separation issue and evaluation of the additional risk is required in accordance with Section 4.2.4 of NFPA 805.

Note: VFDR 1-007 is also associated with VFDR 1-200.

Disposition This condition was evaluated for compliance using the performance-based approach of NFPA 805, Section 4.2.4. A fire risk evaluation determined that applicable risk, defense-in-depth, and safety margin criteria were satisfied without further action.

VFDR ID 1-008

VFDR DGB OUTPUT BREAKER EG-EBKR-3B-15

Fire damage to Diesel Generator B Output Breaker EG-EBKR-3B-15 Control cables may result in the following:

a.) Loss of Control-Control-Interlock Relays SA, SB, SC
b.) Loss of Control-Control-Signal from CP1 to AUX PNL 1
c.) Loss of Control-Control-Signal from DGB Generator Control Panel to CP1

Loss of Diesel Generator B Output Breaker EG-EBKR-3B-15 functions could challenge the Vital Auxiliaries (electrical) Performance Criterion. This condition represents a variance from the deterministic requirements of Section 4.2.3 of NFPA 805. This is a separation issue and evaluation of the additional risk is required in accordance with Section 4.2.4 of NFPA 805.

Disposition This condition was evaluated for compliance using the performance-based approach of NFPA 805, Section 4.2.4. A fire risk evaluation determined that applicable risk, defense-in-depth, and safety margin criteria were satisfied without further action.

VFDR ID 1-010

VFDR PZR AUX SPRAY VALVE B-CVC-216B

Fire damage to Pressurizer Auxiliary Spray Valve B-CVC-216B Control cable may result in the following:

a.) Loss of Control-Control from RTGB-CP-4

Loss of Pressurizer Auxiliary Spray Valve B CVC-216B function could challenge the Inventory and Pressure Control Performance Criterion. This condition represents a variance from the deterministic requirements of Section 4.2.3 of NFPA 805. This is a separation issue and evaluation of the additional risk is required in accordance with Section 4.2.4 of NFPA 805.

Disposition This condition was evaluated for compliance using the performance-based approach of NFPA 805, Section 4.2.4. A fire risk evaluation determined that applicable risk, defense-in-depth, and safety margin criteria were satisfied without further action.

VFDR ID 1-014

VFDR ESSENTIAL CHILLED WATER CHILLER WC-1(3B-SB) RFR-MCHL-0001B

Fire damage to Essential Chilled Water Chiller WC-1 (3B-SB) RFR-MCHL-0001B Control cable may result in the following:

a.) Loss of Control-Control and Indication from CP18

Loss of Essential Chilled Water Chiller WC-1 (3B-SB) RFR-MCHL-0001B could challenge the Vital Auxiliaries (mechanical) Performance Criterion. This condition represents a variance from the deterministic requirements of Section 4.2.3 of NFPA 805. This is a separation issue and evaluation of the additional risk is required in accordance with Section 4.2.4 of NFPA 805.

Disposition This condition was evaluated for compliance using the performance-based approach of NFPA 805, Section 4.2.4. A fire risk evaluation determined that applicable risk, defense-in-depth, and safety margin criteria were satisfied without further action.

VFDR ID 1-016

VFDR 480V SWITCHGEAR BUS 3B31-S SSD-ESWGR-31B

Fire damage to 480 VAC Switchgear Bus 3B31-S SSD-ESWGR-31B Control cables could result in the following:

a.) Loss of Control-Control-Signal from CP-31 to CP-4
b.) Loss of Control-Control-Signal from CP-4 to ISOL PNL
c.) Loss of Control-Control and Indication from CP-4
d.) Loss of Control-Indication from CP-4
e.) Loss of Control-Control-Breaker Control Signal for Non-SSD Instrument Air Compressor B
f.) Loss of Control-Breaker Close Control Signal for Non-SSD Instrument Air Compressor
g.) Loss of Control- Control-Breaker Control Signal for Non-SSD Instrument Air Compressor B
h.) Loss of Control-Control-Breaker Control Signal for Non-SSD CEDM Cooling Unit 3B
i.) Loss of Control-Control-SIAS TRIP Signal to AUX PNL 2 from ESFAS Cabinet B for Non-SSD CEDM Cooling Unit 3B
j.) Loss of Control-Control-Breaker Control Signal for Non-SSD CEDM Cooling Unit 3D
k.) Loss of Control-Control-SIAS TRIP Signal to AUX PNL 2 from ESFAS Cabinet B for Non-SSD CEDM Cooling Unit 3D
l.) Loss of Control-Control-Breaker Control for Non-SSD Shield Building Ventilation Fan
m.) Loss of Control-Control-Under-Voltage Coil Test Switch Signals from CP1 to AUX PNL-2
n.) Loss of Control-Control-Under-Voltage Test Signals to AUX PNL-2 from CP-1
o.) Loss of Control-Control and Indication from CP-1
p.) Loss of Control-Control-Breaker Position Signal to CP-1 from AUX PNL-2
q.) Loss of Control-Control-Non-SSD Breaker Control and indication to CP1 from AUX PNL 3

Loss of 480 VAC Switchgear Bus 3B31-S SSD-ESWGR-31B could challenge the Vital Auxiliaries (electrical) Performance Criterion. This condition represents a variance from the deterministic requirements of Section 4.2.3 of NFPA 805. This is a separation issue and evaluation of the additional risk is required in accordance with Section 4.2.4 of NFPA 805.

Note: VFDR 1-016 is also associated with VFDR 1-201.

Disposition This condition was evaluated for compliance using the performance-based approach of NFPA 805, Section 4.2.4. A fire risk evaluation determined that applicable risk, defense-in-depth, and safety margin criteria were satisfied without further action.

VFDR ID 1-017

VFDR AIR HANDLING AND COOLING UNIT AH-25B SVS-MAHU-0001B

Fire damage to Air Handling and Cooling Unit AH-25B SVS-MAHU-0001B Control cables could result in the following:

a.) Loss of Control-Control and Indication from CP-18
b.) Loss of Control-Control-Temperature Interlock from CP-44

Loss of Air Handling and Cooling Unit AH-25B SVS-MAHU-0001B could challenge the Vital Auxiliaries (HVAC) Performance Criterion. This condition represents a variance from the deterministic requirements of Section 4.2.3 of NFPA 805. This is a separation issue and evaluation of the additional risk is required in accordance with Section 4.2.4 of NFPA 805.

Disposition This condition has no corresponding PRA basic event and by definition has insignificant risk. A discussion concerning the exclusion of this component/basic event from the fire PRA model is found in PSA-WF3-03-01, Waterford 3 Methodology for Addressing VFDRs in the Fire PRA and NFPA 805.

VFDR ID 1-018

VFDR CCW PUMP ROOM B, AH-10B HVR-MAHU-0028B

Fire damage to CCW Pump Room B, AH-10B HVR-MAHU-0028B Control cable may result in the following:

a.) Loss of Control-Control-Indication at RTGB CP-18

Loss of CCW Pump Room B, AH-10B HVR-MAHU-0028B Control cables could challenge the Vital Auxiliaries (HVAC) Performance Criterion in support of HSB Operating mode. This condition represents a variance from the deterministic requirements of Section 4.2.3 of NFPA 805. This is a separation issue and evaluation of the additional risk is required in accordance with Section 4.2.4 of NFPA 805.

Disposition This condition has no corresponding PRA basic event and by definition has insignificant risk. A discussion concerning the exclusion of this component/basic event from the fire PRA model is found in PSA-WF3-03-01, Waterford 3 Methodology for Addressing VFDRs in the Fire PRA and NFPA-805.

VFDR ID 1-021

VFDR EFW PUMP ROOM B, AH-17B HVR-MAHU-0038B

Fire damage to EFW Pump Room B, AH-17B HVR-MAHU-0038B Control cable may result in the following:

a.) Loss of Control-Control - Indication RTGB CP-18

Loss of EFW Pump Room B, AH-17B HVR-MAHU-0038B Control cable could challenge the Vital Auxiliaries (HVAC) Performance Criterion. This condition represents a variance from the deterministic requirements of Section 4.2.3 of NFPA 805. This is a separation issue and evaluation of the additional risk is required in accordance with Section 4.2.4 of NFPA 805.

Disposition This condition has no corresponding PRA basic event and by definition has insignificant risk. A discussion concerning the exclusion of this component/basic event from the fire PRA model is found in PSA-WF3-03-01, Waterford 3 Methodology for Addressing VFDRs in the Fire PRA and NFPA-805.

VFDR ID 1-022

VFDR CHARGING PUMP ROOM B AH-18B HVR-MAHU-0040B

Fire damage to Charging Pump Room B AH-18B HVR-MAHU-0040B Control cable may result in the following:

a.) Loss of Control-Control - Indication from RTGB CP-18

Loss of CHARGING PUMP ROOM B, AH-18B HVR-MAHU-0040B Control cable could challenge the Vital Auxiliaries (HVAC) Performance Criterion in support of HSB Operating mode. This condition represents a variance from the deterministic requirements of Section 4.2.3 of NFPA 805. This is a separation issue and evaluation of the additional risk is required in accordance with Section 4.2.4 of NFPA 805.

Disposition This condition has no corresponding PRA basic event and by definition has insignificant risk. A discussion concerning the exclusion of this component/basic event from the fire PRA model is found in PSA-WF3-03-01, Waterford 3 Methodology for Addressing VFDRs in the Fire PRA and NFPA-805.

VFDR ID 1-024

VFDR BORIC ACID GRAVITY FEED VALVE TANK B BAM-113B

Fire damage to Boric Acid Gravity Feed Valve Tank B BAM-113B Control cable may result in the following:

a.) Loss of Control-Control and Indication from CP-4

Loss of Boric Acid Gravity Feed Valve Tank B BAM-113B Control cable could challenge the Inventory and Performance Criterion. This condition represents a variance from the deterministic requirements of Section 4.2.3 of NFPA 805. This is a separation issue and evaluation of the additional risk is required in accordance with Section 4.2.4 of NFPA 805.

Disposition This condition was evaluated for compliance using the performance-based approach of NFPA 805, Section 4.2.4. A fire risk evaluation determined that applicable risk, defense-in-depth, and safety margin criteria were satisfied without further action.

VFDR ID 1-025

VFDR MSIV UPSTREAM EMERGENCY DRAIN VALVE MS-119A (IN 92-18)

Fire damage to MSIV Upstream Emergency Drain Valve MS-119A Control cables could result in the following:

a.) Loss of Control-Control and Indication from CP-8
b.) Loss of Control-Control Signal from Main Steam Drip Pot Level Switch

The postulated fire damage MSIV Upstream Emergency Drain Valve MS-119A has been identified for circuit failures as it is related to IN 92-18 for fires originating from the main Control Room.

Loss of MSIV Upstream Emergency Drain Valve MS-119A could challenge the Decay Heat Removal Performance Criterion. This condition represents a variance from the deterministic requirements of Section 4.2.3 of NFPA 805. This is a separation issue and evaluation of the additional risk is required in accordance with Section 4.2.4 of NFPA 805.

Disposition This condition has no corresponding PRA basic event and by definition has insignificant risk. A discussion concerning the exclusion of this component/basic event from the fire PRA model is found in PSA-WF3-03-01, Waterford 3 Methodology for Addressing VFDRs in the Fire PRA and NFPA-805.

VFDR ID 1-026

VFDR MSIV UPSTREAM EMERGENCY DRAIN VALVE MS-119B (IN 92-18)

Fire damage to MSIV Upstream Emergency Drain Valve MS-119B Control cables could result in the following:

a.) Loss of Control-Control and Indication from CP-8
b.) Loss of Control-Control Signal from Main Steam Drip Pot Level Switch

The postulated fire damage to MSIV Upstream Emergency Drain Valve MS-119B has been identified for circuit failures as it is related to IN-92-18 for fires originating from the main Control Room.

Loss of MSIV Upstream Emergency Drain Valve MS-119B could challenge the Decay Heat Removal Performance Criterion. This condition represents a variance from the deterministic requirements of Section 4.2.3 of NFPA 805. This is a separation issue and evaluation of the additional risk is required in accordance with Section 4.2.4 of NFPA 805.

Disposition This condition has no corresponding PRA basic event and by definition has insignificant risk. A discussion concerning the exclusion of this component/basic event from the fire PRA model is found in PSA-WF3-03-01, Waterford 3 Methodology for Addressing VFDRs in the Fire PRA and NFPA-805.

VFDR ID 1-027

VFDR VARIBLE PITCH BLADE CONTROLLER FOR E-28B HVR-502B

Fire damage to Variable Pitch Blade Controller for E-28B HVR-502B Control cables could result in the following:

a.) Loss of Control-Control Signal from AUX PNL 2
b.) Loss of Control-Control Signal from CP-44

Loss of Variable Pitch Blade Controller for E-28B HVR-502B could challenge the Vital Auxiliaries (HVAC) Performance Criterion. This condition represents a variance from the deterministic requirements of Section 4.2.3 of NFPA 805. This is a separation issue and evaluation of the additional risk is required in accordance with Section 4.2.4 of NFPA 805.

Disposition The result of this condition has been measured and has insignificant risk. The component is not directly modeled in the PRA but is evaluated as though it is within the component boundary of a component that is in the PRA modeled. A discussion concerning the treatment and results is found in PSA-WF3-03-01, Waterford 3 Methodology for Addressing VFDRs in the Fire PRA and NFPA-805.

VFDR ID 1-028

VFDR S/G1 SAMPLE LINE ISOLATION VALVE SSL-8004A

Fire damage to Steam Generator 1 Sample Line Isolation Valve SSL-8004A Control cables could result in the following:

a.) Loss of Control- Valve Control to SSL-ISV-8004A from AUX PNL-2
b.) Loss of Control-Control Valve Indication / Control to CP-8 from AUX PNL-2

Loss of S/G1 Sample Line Isolation Valve SSL-8004A could challenge the Decay Heat Removal Performance Criterion. This condition represents a variance from the deterministic requirements of Section 4.2.3 of NFPA 805. This is a separation issue and evaluation of the additional risk is required in accordance with Section 4.2.4 of NFPA 805.

Disposition This condition was evaluated for compliance using the performance-based approach of NFPA 805, Section 4.2.4. A fire risk evaluation determined that applicable risk, defense-in-depth, and safety margin criteria were satisfied without further action.

VFDR ID 1-029

VFDR S/G2 SAMPLE LINE ISOLATION VALVE SSL-8004B

Fire damage to Steam Generator 2 Sample Line Isolation Valve SSL-8004B Control cables could result in the following:

a.) Loss of Control- Valve Control to SSL-ISV-8004B from AUX PNL-2
b.) Loss of Control-Control Valve Indication / Control to CP-8 from AUX PNL-2

Loss of S/G2 Sample Line Isolation Valve SSL-8004B could challenge the Decay Heat Removal Performance Criterion. This condition represents a variance from the deterministic requirements of Section 4.2.3 of NFPA 805. This is a separation issue and evaluation of the additional risk is required in accordance with Section 4.2.4 of NFPA 805.

Disposition This condition was evaluated for compliance using the performance-based approach of NFPA 805, Section 4.2.4. A fire risk evaluation determined that applicable risk, defense-in-depth, and safety margin criteria were satisfied without further action.

VFDR ID 1-030

VFDR AIR OPERATED DAMPER SVS-105B

Fire damage to Air Operated Damper SVS-105B Control cables could result in the following:

a.) Loss of Control-Control and Indication at CP-18

Loss of Air Operated Damper SVS-105B could challenge the Vital Auxiliaries (HVAC) Performance Criterion. This condition represents a variance from the deterministic requirements of Section 4.2.3 of NFPA 805. This is a separation issue and evaluation of the additional risk is required in accordance with Section 4.2.4 of NFPA 805.

Disposition This condition has no corresponding PRA basic event and by definition has insignificant risk. A discussion concerning the exclusion of this component/basic event from the fire PRA model is found in PSA-WF3-03-01, Waterford 3 Methodology for Addressing VFDRs in the Fire PRA and NFPA-805.

VFDR ID 1-031

VFDR AIR OPERATED DAMPER SVS-106B

Fire damage to Air Operated Damper SVS-106B Control cable could result in the following:

a.) Loss of Control-Control and Indication at CP-18

Loss of Air Operated Damper SVS-106B could challenge the Vital Auxiliaries (HVAC) Performance Criterion. This condition represents a variance from the deterministic requirements of Section 4.2.3 of NFPA 805. This is a separation issue and evaluation of the additional risk is required in accordance with Section 4.2.4 of NFPA 805.

Disposition This condition has no corresponding PRA basic event and by definition has insignificant risk. A discussion concerning the exclusion of this component/basic event from the fire PRA model is found in PSA-WF3-03-01, Waterford 3 Methodology for Addressing VFDRs in the Fire PRA and NFPA-805.

VFDR ID 1-037

VFDR CONTAINMENT SPRAY PUMP CS-MPMP-0001A

Fire damage to Containment Spray Pump CS-MPMP-0001A control cables may result in the following:

a.) Loss of Control-Control and Indication from CP-8
b.) Loss of Control-Control Signal from CP-1 to AUX PNL-1

Loss of Containment Spray Pump CS-MPMP-0001A could challenge the Inventory and Pressure Control Performance Criterion. This condition represents a variance from the deterministic requirements of Section 4.2.3 of NFPA 805. This is a separation issue and evaluation of the additional risk is required in accordance with Section 4.2.4 of NFPA 805.

Disposition This condition was evaluated for compliance using the performance-based approach of NFPA 805, Section 4.2.4. A fire risk evaluation determined that applicable risk, defense-in-depth, and safety margin criteria were satisfied without further action.

VFDR ID 1-038

VFDR CONTAINMENT SPRAY PUMP CS-MPMP-0001B

Fire damage to Containment Spray Pump CS-MPMP-0001B Control cables could result in the following:

a.) Loss of Control-Control and Indication from CP-8
b.) Loss of Control-Control Signal from ESFAS Cabinet B to AUX PNL-2
c.) Loss of Control-Control and Indication from CP-1

Loss of Containment Spray Pump CS-MPMP-0001B Control cables could challenge the Inventory and Pressure Control Performance Criterion. This condition represents a variance from the deterministic requirements of Section 4.2.3 of NFPA 805. This is a separation issue and evaluation of the additional risk is required in accordance with Section 4.2.4 of NFPA 805.

Disposition This condition was evaluated for compliance using the performance-based approach of NFPA 805, Section 4.2.4. A fire risk evaluation determined that applicable risk, defense-in-depth, and safety margin criteria were satisfied without further action.

VFDR ID 1-045

VFDR CCW TRAIN B ISOLATION VALVE (AOV, FC) CC-200B

Fire damage to Component Cooling Water Train B Isolation Valve (AOV, FC) CC-200B Control cables could result in the following:

a.) Loss of Control-Control - CP-8 to CC-200B
b.) Loss of Control-Control - CP-8 to AUX PNL 2

Loss of Component Cooling Water Train B Isolation Valve (AOV, FC) CC-200B could challenge the Vital Auxiliaries (mechanical) Performance Criterion. This condition represents a variance from the deterministic requirements of Section 4.2.3 of NFPA 805. This is a separation issue and evaluation of the additional risk is required in accordance with Section 4.2.4 of NFPA 805.

Disposition This condition was evaluated for compliance using the performance-based approach of NFPA 805, Section 4.2.4. A fire risk evaluation determined that applicable risk, defense-in-depth, and safety margin criteria were satisfied without further action.

VFDR ID 1-046

VFDR SG1 OUTLET STEAM PRESSURE TRANSMITTER MS-IPT-0303A

Fire damage to Steam Generator 1 Outlet Steam Pressure Transmitter MS-IPT-0303A Control and Power cables could result in the following:

a.) Loss of Control-Control 0-10 VDC Signal to MS-IPIC-0303A1 (CP-8) from CP-42
b.) Loss of Control-Control-Pressure Signal to CP-42 from MS-IPT-0303A
c.) Loss of Control-Control SG1 Outlet High Pressure Signal to Isolation Panel from CP-42
d) Loss of Power-Power-120 VAC to CP-42 from PAC-EBKR-IP-MC CKT 1

Loss of Steam Generator 1 Outlet Steam Pressure Transmitter MS-IPT-0303A could challenge the Decay Heat Removal Performance Criterion. This condition represents a variance from the deterministic requirements of Section 4.2.3 of NFPA 805. This is a separation issue and evaluation of the additional risk is required in accordance with Section 4.2.4 of NFPA 805.

Disposition This condition was evaluated for compliance using the performance-based approach of NFPA 805, Section 4.2.4. A fire risk evaluation determined that applicable risk, defense-in-depth, and safety margin criteria were satisfied without further action.

VFDR ID 1-047

VFDR SG2 OUTLET STEAM PRESSURE TRANSMITTER MS-IPT-0303B

Fire damage to Steam Generator 2 Outlet Steam Pressure Transmitter MS-IPT-0303B Control and Power cables could result in the following:

a.) Loss of Control- Control 0-10 VDC Signal to MS-IPIC-0303B1 (CP-8) from CP-45
b.) Loss of Control-Control-Pressure Signal to CP-45 from MS-IPT-0303B
c.) Loss of Control-Control SG2 Outlet High Pressure Signal to Isolation Panel from CP-45
d.) Loss of Power-Power-120 VAC from ID-EPDP-MD CKT 3 to CP-45

Loss of Steam Generator 2 Outlet Steam Pressure Transmitter MS-IPT-0303B could challenge the Decay Heat Removal Performance Criterion. This condition represents a variance from the deterministic requirements of Section 4.2.3 of NFPA 805. This is a separation issue and evaluation of the additional risk is required in accordance with Section 4.2.4 of NFPA 805.

Disposition This condition was evaluated for compliance using the performance-based approach of NFPA 805, Section 4.2.4. A fire risk evaluation determined that applicable risk, defense-in-depth, and safety margin criteria were satisfied without further action.

VFDR ID 1-048

VFDR CCW PUMP DISCHARGE XCONN ISOLATION VALVE CC-127B

Fire damage to Component Cooling Water Pump Discharge cross-connect Isolation Valve CC-127B Control and Power cables could result in the following:

a.) Loss of Control- Control Limit Switch Signal from CC-127A (B) to ISOL PNL
b.) Loss of Control-Control-Signal from CP-1 to AUX PNL 2 / Indication from AUX PANEL 2
c.) Loss of Control-Control Signal from Relay K412 (ESFAS Cabinet B) to EDG B Sequencer Relays (AUX PNL 2)
d.) Loss of Control-Control Signal from CCW Pump AB Assignment Switch (CP-8) to AXA and BXA Relays (ISOL PNL)
e.) Loss of Control-Control-Indication Signal from AUX PNL 3 to CP-8
f.) Loss of Control-Control-Low Level Signal from CC-ILS-7013B (CCW Surge Tank Channel B) to LSX Relay in AUX PNL-2
g.) Loss of Control-Control-Permissive from AX A/B Relay Isolation panel
h.) Loss of Control-Control and Indication at CP-8
i.) Loss of Control-Control Signal from 4KV-ESWGR-31B to AUX PNL 2
j.) Loss of Control-Control Signal from CP-1 to AUX PANEL 2 / Indication from AUX PANEL 2
k.) Loss of Power-Power – 125 VDC from DC-EPDP-AB-DC Circuit #42 to AXA and BXA Relays in ISOL PNL

Loss of Component Cooling Water Pump Discharge cross-connect Isolation Valve CC-127B could challenge the Vital Auxiliaries (mechanical) Performance Criterion. This condition represents a variance from the deterministic requirements of Section 4.2.3 of NFPA 805. This is a separation issue and evaluation of the additional risk is required in accordance with Section 4.2.4 of NFPA 805.

Disposition This condition was evaluated for compliance using the performance-based approach of NFPA 805, Section 4.2.4. A fire risk evaluation determined that applicable risk, defense-in-depth, and safety margin criteria were satisfied without further action.

VFDR ID 1-049

VFDR DCT B BYPASS VALVE CC-134B

Fire damage to Dry Cooling Tower B Bypass Valve CC-134B Control and Power cables could result in the following:

a.) Loss of Control- Control and Indication from CP-33 to AUX PNL-2
b.) Loss of Control-Control - Permissive Signal for CX Relay from CC-ILS-7013B (CCW SURGE TANK CHANNEL B)
c.) Loss of Power-Power-120 VAC Panel 391-SB Circuit #17 to AUX PNL 2

Loss of Dry Cooling Tower B Bypass Valve CC-134B could challenge the Vital Auxiliaries (mechanical) Performance Criterion. This condition represents a variance from the deterministic requirements of Section 4.2.3 of NFPA 805. This is a separation issue and evaluation of the additional risk is required in accordance with Section 4.2.4 of NFPA 805.

Disposition This condition was evaluated for compliance using the performance-based approach of NFPA 805, Section 4.2.4. A fire risk evaluation determined that applicable risk, defense-in-depth, and safety margin criteria were satisfied without further action.

VFDR ID 1-050

VFDR CCW HEADER B TO ESSENTIAL CHILLERS ISOLATION CC-301B

Fire damage to Component Cooling Water Header B to Essential Chillers Isolation CC-301B Control and Power cables could result in the following:

a.) Loss of Control- Control and Indication at CP-18
b.) Loss of Control-Control - Permissive Signal from CP-49 (CC-ITAC-7075B1)

Loss of Component Cooling Water Header B to Essential Chillers Isolation CC-301B could challenge the Vital Auxiliaries (mechanical) Performance Criterion. This condition represents a variance from the deterministic requirements of Section 4.2.3 of NFPA 805. This is a separation issue and evaluation of the additional risk is required in accordance with Section 4.2.4 of NFPA 805.

Disposition This condition was evaluated for compliance using the performance-based approach of NFPA 805, Section 4.2.4. A fire risk evaluation determined that applicable risk, defense-in-depth, and safety margin criteria were satisfied without further action.

VFDR ID 1-051

VFDR CCW HEADER B TO ESSENTIAL CHILLERS ISOLATION CC-322B

Fire damage to Component Cooling Water Header B to Essential Chillers Isolation CC-322B Control cables could result in the following:

a.) Loss of Control-Control and Indication at CP-18
b.) Loss of Control-Control-Permissive Signal from CP-49

Loss of Component Cooling Water Header B to Essential Chillers Isolation CC-322B could challenge the Vital Auxiliaries (mechanical) Performance Criterion. This condition represents a variance from the deterministic requirements of Section 4.2.3 of NFPA 805. This is a separation issue and evaluation of the additional risk is required in accordance with Section 4.2.4 of NFPA 805.

Disposition This condition was evaluated for compliance using the performance-based approach of NFPA 805, Section 4.2.4. A fire risk evaluation determined that applicable risk, defense-in-depth, and safety margin criteria were satisfied without further action.

VFDR ID 1-054

VFDR CHARGING PUMP B CVC-MPMP-0001B

Fire damage to Charging Pump B CVC-MPMP-0001B Control cables could result in the following:

a.) Loss of Control-Control Signal from CP-31 to CP-4
b.) Loss of Control-Control Signal from CP-4 to Isolation Panel
c.) Loss of Control-Control Signal from CP-4 to Relay B
d.) Loss of Control-Control and Indication from CP-4

Loss of Charging Pump B CVC-MPMP-0001B could challenge the Inventory and Pressure Control Performance Criterion. This condition represents a variance from the deterministic requirements of Section 4.2.3 of NFPA 805. This is a separation issue and evaluation of the additional risk is required in accordance with Section 4.2.4 of NFPA 805.

Disposition This condition was evaluated for compliance using the performance-based approach of NFPA 805, Section 4.2.4. A fire risk evaluation determined that applicable risk, defense-in-depth, and safety margin criteria were satisfied without further action.

VFDR ID 1-055

VFDR AH-25 CHW TEMPERATURE CONTROL VALVE CHW-900

Fire damage to AH-25 Chilled Water Temperature Control Valve CHW-900 Control and Power cables may result in the following:
a.) Loss of Control- Control Signal from CP-44 (PAC) to T1 and T2 Relays
b.) Loss of Control-Control-Temperature Control Signal from CP-44 (PAC)
c.) Loss of Control-Control and Indication from CP-18
d.) Loss of Power-Power – 120 VAC Feed from LVD-EPDP-61B Circuit #18

Loss of AH-25 Chilled Water Temperature Control Valve CHW-900 could challenge the Vital Auxiliaries (HVAC) Performance Criterion. This condition represents a variance from the deterministic requirements of Section 4.2.3 of NFPA 805. This is a separation issue and evaluation of the additional risk is required in accordance with Section 4.2.4 of NFPA 805.

Disposition This condition has no corresponding PRA basic event and by definition has insignificant risk. A discussion concerning the exclusion of this component/basic event from the fire PRA model is found in PSA-WF3-03-01, Waterford 3 Methodology for Addressing VFDRs in the Fire PRA and NFPA-805.

VFDR ID 1-062

VFDR PRESSURIZER HEATER BUS B SSD-ESWGR-32B

Fire damage to Pressurizer Heater Bus B SSD-ESWGR-32B Control and Power cables could result in the following:

a.) Loss of Control- Control – Under-Voltage Shed / Breaker Trip Signal for Non-SSD Pressurizer Back-Up Heater Banks 4 / 5 / 6
b.) Loss of Control-Control-Signal from CP-29 to ISOL Panel
c.) Loss of Control-Control Signal from CP-4 to ISOL Panel
d.) Loss of Control-Control and Indication from CP-1
e.) Loss of Power-Power – 120 VAC Non-Safety Vital ID-EPDP-014AB Circuit #13

Loss of Pressurizer Heater Bus B SSD-ESWGR-32B could challenge the Inventory and Pressure Control Performance Criterion. This condition represents a variance from the deterministic requirements of Section 4.2.3 of NFPA 805. This is a separation issue and evaluation of the additional risk is required in accordance with Section 4.2.4 of NFPA 805.

Disposition This condition has no corresponding PRA basic event and by definition has insignificant risk. A discussion concerning the exclusion of this component/basic event from the fire PRA model is found in PSA-WF3-03-01, Waterford 3 Methodology for Addressing VFDRs in the Fire PRA and NFPA-805.

VFDR ID 1-065

VFDR CHARGING PUMP DISCHARGE VALVE CVC-209

Fire damage to Charging Pump Discharge Valve CVC-209 Control cables may result in the following:

a.) Loss of Control-Control and Indication from CP-4 to AUX PNL 3
b.) Loss of Control-Control and Indication from AUX PNL 3 to CVC-ISV0209

Loss of Charging Pump Discharge Valve CVC-209 could challenge the Inventory and Pressure Control Performance Criterion. This condition represents a variance from the deterministic requirements of Section 4.2.3 of NFPA 805. This is a separation issue and evaluation of the additional risk is required in accordance with Section 4.2.4 of NFPA 805.

Disposition This condition was evaluated for compliance using the performance-based approach of NFPA 805, Section 4.2.4. A fire risk evaluation determined that applicable risk, defense-in-depth, and safety margin criteria were satisfied without further action.

VFDR ID 1-075

VFDR 480V MCC BUS 3B315B SSD-EMCC-315B

Fire damage to 480 VAC Motor Control Center Bus 3B315B SSD-EMCC-315B Control cable may result in the following:

a.) Loss of Control-Control and Indication from CP-1 to AUX PNL-2

Loss of 480 VAC Motor Control Center Bus 3B315B SSD-EMCC-315B could challenge the Vital Auxiliaries (electrical) Performance Criterion. This condition represents a variance from the deterministic requirements of Section 4.2.3 of NFPA 805. This is a separation issue and evaluation of the additional risk is required in accordance with Section 4.2.4 of NFPA 805.

Disposition This condition was evaluated for compliance using the performance-based approach of NFPA 805, Section 4.2.4. A fire risk evaluation determined that applicable risk, defense-in-depth, and safety margin criteria were satisfied without further action.

VFDR ID 1-076

VFDR STATION SERVICE TRANSFORMER 3B315-S SSD-EMT-315B

Fire damage to STATION SERVICE TRANSFORMER 3B315-S SSD-EMT-315B Control cable could result in the following:

a.) Loss of Control-Control and Indication from CP-1 to AUX PNL-2

Loss of STATION SERVICE TRANSFORMER 3B315-S SSD-EMT-315B could challenge the Vital Auxiliaries (electrical) Performance Criterion. This condition represents a variance from the deterministic requirements of Section 4.2.3 of NFPA 805. This is a separation issue and evaluation of the additional risk is required in accordance with Section 4.2.4 of NFPA 805.

Disposition This condition was evaluated for compliance using the performance-based approach of NFPA 805, Section 4.2.4. A fire risk evaluation determined that applicable risk, defense-in-depth, and safety margin criteria were satisfied without further action.

VFDR ID 1-077

VFDR H & V EQUIPMENT ROOM EXHAUST FAN HVR-MFAN-0024B

Fire damage to Heating and Ventilation Equipment Room Exhaust Fan HVR-MFAN-0024B Control cable could result in the following:

a.) Loss of Control-Control and Indication at RTGB CP-18

Loss of Heating and Ventilation Equipment Room Exhaust Fan HVR-MFAN-0024B could challenge the Vital Auxiliaries (HVAC) Performance Criterion. This condition represents a variance from the deterministic requirements of Section 4.2.3 of NFPA 805. This is a separation issue and evaluation of the additional risk is required in accordance with Section 4.2.4 of NFPA 805.

Disposition This condition has no corresponding PRA basic event and by definition has insignificant risk. A discussion concerning the exclusion of this component/basic event from the fire PRA model is found in PSA-WF3-03-01, Waterford 3 Methodology for Addressing VFDRs in the Fire PRA and NFPA-805.

VFDR ID 1-086

VFDR BORIC ACID MAKEUP TANK B LEVEL TRANSMITTER BAM-ILT-0208

Fire damage to Boric Acid Make-Up Tank B Level Transmitter BAM-ILT-0208 Control and Power cable could result in the following:

a.) Loss of Control-Control-Signal from BAM-ILT-0208 to CP29
b.) Loss of Control-Control-Signal from CP29 to CP50 (PAC)
c.) Loss of Control-Control Signal to LCP-43
d.) Loss of Control-Control-Indication from CP29 to CP4
e.) Loss of Power-Power – 120 VAC from Non-Safety Vital ID-EPDP-014AB Circuit 6

Loss of Boric Acid Make-Up Tank B Level Transmitter BAM-ILT-0208 could challenge the Process Monitoring Performance Criterion. This condition represents a variance from the deterministic requirements of Section 4.2.3 of NFPA 805. This is a separation issue and evaluation of the additional risk is required in accordance with Section 4.2.4 of NFPA 805.

Disposition This condition has no corresponding PRA basic event and by definition has insignificant risk. A discussion concerning the exclusion of this component/basic event from the fire PRA model is found in PSA-WF3-03-01, Waterford 3 Methodology for Addressing VFDRs in the Fire PRA and NFPA-805.

VFDR ID 1-087

VFDR RWSP TO CHRG PUMPS CVC-507

Fire damage to Refueling Water Storage Pool to Charging Pump CVC-507 Control cables could result in the following:

a.) Loss of Control- Control-Motor Contactor Control Signals to SSD-EMCC-312AB CMPT 3H from AUX PNL 4
b.) Loss of Control-Control-Remote Valve Control Signals to CP4 from AUX PNL4

Loss of Refueling Water Storage Pool to Charging Pump CVC-507 could challenge the Inventory and Pressure Control Performance Criterion. This condition represents a variance from the deterministic requirements of Section 4.2.3 of NFPA 805. This is a separation issue and evaluation of the additional risk is required in accordance with Section 4.2.4 of NFPA 805.

Disposition This condition was evaluated for compliance using the performance-based approach of NFPA 805, Section 4.2.4. A fire risk evaluation determined that applicable risk, defense-in-depth, and safety margin criteria were satisfied without further action.

VFDR ID 1-089

VFDR DCT B INLET ISOLATION VALVE CC-135B

Fire damage to Dry Cooling Tower B Inlet Isolation Valve CC-135B Control cables could result in the following:

a.) Loss of Control-Control and Indication from CP-33 to AUX PNL 2
b.) Loss of Control-Control-Permissive Signal for CX Relay from CC-ILS-7013B (CCW SURGE TANK CHANNEL B)

Loss of Dry Cooling Tower B Inlet Isolation Valve CC-135B could challenge the Vital Auxiliaries (mechanical) Performance Criterion. This condition represents a variance from the deterministic requirements of Section 4.2.3 of NFPA 805. This is a separation issue and evaluation of the additional risk is required in accordance with Section 4.2.4 of NFPA 805.

Disposition This condition was evaluated for compliance using the performance-based approach of NFPA 805, Section 4.2.4. A fire risk evaluation determined that applicable risk, defense-in-depth, and safety margin criteria were satisfied without further action.

VFDR ID 1-090

VFDR BATTERY ROOM EXHAUST FAN ROOM TEMPERATURE SVS-ITE-5038B

Fire damage to Battery Room Exhaust Fan Room Temperature SVS-ITE-5038B Control and Power cables may result in the following:

a.) Loss of Control-Control Signal from SVS-ITE-5038B to CP45
b.) Loss of Power-Power – 120 VAC from ID-EPDP-MD Circuit #3 to CP45

Loss of Battery Room Exhaust Fan Room Temperature SVS-ITE-5038B could challenge the Vital Auxiliaries (HVAC) Performance Criterion. This condition represents a variance from the deterministic requirements of Section 4.2.3 of NFPA 805. This is a separation issue and evaluation of the additional risk is required in accordance with Section 4.2.4 of NFPA 805.

Disposition This condition has no corresponding PRA basic event and by definition has insignificant risk. A discussion concerning the exclusion of this component/basic event from the fire PRA model is found in PSA-WF3-03-01, Waterford 3 Methodology for Addressing VFDRs in the Fire PRA and NFPA-805.

VFDR ID 1-091

VFDR BATTERY ROOM EXHAUST FANS SVS-MFAN-0004B, 0005B, 0006B, and 0007B

Fire damage to Battery Room Exhaust Fans, SVS-MFAN-0004B, 0005B, 0006B, and 0007B Control cable could result in the following:

a.) Loss of Control-Control and Indication from CP-18
b.) Loss of Control-Control and Indication from RTGB CP-18 to AUX PNL 2
c.) Loss of Control-Control and Indication from CP-18
d.) Loss of Control-Control-Interlock with Damper D-6 (B) Limit Switch
e.) Loss of Control-Control-Thermocouple Signal from CP-45
f.) Loss of Control-Control-Signal from TE-HV5038BS [SVS-ITE-5038B] to CP-45

Loss of Battery Room Exhaust Fans SVS-MFAN-0004B, 0005B, 0006B, and 0007B could challenge the Vital Auxiliaries (HVAC) Performance Criterion. This condition represents a variance from the deterministic requirements of Section 4.2.3 of NFPA 805. This is a separation issue and evaluation of the additional risk is required in accordance with Section 4.2.4 of NFPA 805.

Disposition This condition has no corresponding PRA basic event and by definition has insignificant risk. A discussion concerning the exclusion of this component/basic event from the fire PRA model is found in PSA-WF3-03-01, Waterford 3 Methodology for Addressing VFDRs in the Fire PRA and NFPA-805.

VFDR ID 1-092

VFDR RAB HVAC EQUIPMENT ROOM SUPPLY FAN AH-13B HVR-MAHU-0022B

Fire damage to RAB HVAC Equipment Room Supply Fan AH-13B HVR-MAHU-0022B Control cables could result in the following:

a.) Loss of Control-Control and Indication from CP18
b.) Loss of Control-Control Temperature Signal from CP44

Loss of RAB HVAC Equipment Room Supply Fan AH-13B HVR-MAHU-0022B could challenge the Vital Auxiliaries (HVAC) Performance Criterion. This condition represents a variance from the deterministic requirements of Section 4.2.3 of NFPA 805. This is a separation issue and evaluation of the additional risk is required in accordance with Section 4.2.4 of NFPA 805.

Disposition This condition has no corresponding PRA basic event and by definition has insignificant risk. A discussion concerning the exclusion of this component/basic event from the fire PRA model is found in PSA-WF3-03-01, Waterford 3 Methodology for Addressing VFDRs in the Fire PRA and NFPA-805.

VFDR ID 1-093

VFDR CCW HX ROOM, AH-24B HVR-MAHU-0026B

Fire damage to Component Cooling Water Heat Exchanger Room AH-24B HVR-MAHU-0026B Control and Power cables may result in the following:

a.) Loss of Control-Control Temperature Switch from CP44
b.) Loss of Control-Control-Signal from HVR-ITE-5009B to CP44
c.) Loss of Power-Power – 120 VAC from PAC-EBKR-IP-MD-2 Power Supply for CP44

Loss of Component Cooling Water Heat Exchanger Room AH-24B HVR-MAHU-0026B could challenge the Vital Auxiliaries (HVAC) Performance Criterion. This condition represents a variance from the deterministic requirements of Section 4.2.3 of NFPA 805. This is a separation issue and evaluation of the additional risk is required in accordance with Section 4.2.4 of NFPA 805.

Disposition This condition has no corresponding PRA basic event and by definition has insignificant risk. A discussion concerning the exclusion of this component/basic event from the fire PRA model is found in PSA-WF3-03-01, Waterford 3 Methodology for Addressing VFDRs in the Fire PRA and NFPA-805.

VFDR ID 1-100

VFDR NEUTRON FLUX LOG POWER CHANNEL D ENI-IJI-0001-D1

Fire damage to Neutron Flux LOG Power Channel D ENI-IJI-0001-D1 Control and Power cables may result in the following:

a.) Loss of Control-Control-Linear Signal 3 from B-31046-SMD to CP-10
b.) Loss of Control-Control-Wide Range High Voltage from CP-10 to B-3694
c.) Loss of Control-Control-Linear Signal 2 from B-3694 to CP-10
d.) Loss of Control-Control-Test Signal from CP-10 from B-3694
e.) Loss of Control-Control-LOG Signal from B-3694 to CP-10
f.) Loss of Control-Control-Signal from LOG Power Channel D to CP-28
g.) Loss of Control-Control EXCORE Linear Power Channel D Signal from CP-10 to CP-28
h.) Loss of Control-Control LOG Power Signal from CP-10 to CP-7
i.) Loss of Power-Power from CP-10 to Preamplifier in B-3694
j.) Loss of Power-Power-ID-EPDP-MD Circuit #5 to CP-28
k.) Loss of Power-Power – 120 VAC ID-EPDP-MD Circuit #1 to CP-10 Channel D
l.) Loss of Control-Control Linear Signal 1 from B-31046 SMD to CP-10
m.) Loss of Control-Control-Signal from CP-28 to CP-2
n.) Loss of Control-Control-Rate of Change Signal from CP-10 to CP-7
o.) Loss of Control- Control-Indication from CP-28 to LCP-43
p.) Loss of Power-POWER-ID-EPDP-MC CIRCUIT #11 TO CP-28

Loss of Neutron Flux LOG Power Channel D ENI-IJI-0001-D1 could challenge the Process Monitoring Performance Criterion. This condition represents a variance from the deterministic requirements of Section 4.2.3 of NFPA 805. This is a separation issue and evaluation of the additional risk is required in accordance with Section 4.2.4 of NFPA 805.

Disposition This condition has no corresponding PRA basic event and by definition has insignificant risk. A discussion concerning the exclusion of this component/basic event from the fire PRA model is found in PSA-WF3-03-01, Waterford 3 Methodology for Addressing VFDRs in the Fire PRA and NFPA-805.

VFDR ID 1-101

VFDR REACTOR COOLANT PUMP(s) RCP-MPMP-0001A/B and 0002A/B

Fire damage to Reactor Coolant Pump(s) RCP-MPMP-0001A/B and 0002A/B Control cables could result in the following:

a.) Loss of Control-Signal from AUX PNL-4 to 7KV-ESWGR-1A/B
b.) Loss of Control-Control and Indication from CP-2
c.) Loss of Control-Control Signal from RC-IPS-0114/124/134/144 and IFIS-5770A/B/C/D to AUX PNL-4
d.) Loss of Control-Control Signal from Accessory Connection Box #1 to AUX PNL-4
e.) Loss of Control-Control Signal from 7KV-ESWGR-1A/B to AUX PNL-4
f.) Loss of Control-Control and Indication from CP-2
g.) Loss of Control-Control Signal from CC-ISV-0660/0661/A/B to AUX PNL-4

Loss of Reactor Coolant Pump(s) RCP-MPMP-0001A/B and 0002A/B could challenge the Inventory and Pressure Control Performance Criterion. This condition represents a variance from the deterministic requirements of Section 4.2.3 of NFPA 805. This is a separation issue and evaluation of the additional risk is required in accordance with Section 4.2.4 of NFPA 805.

Disposition This condition was evaluated for compliance using the performance-based approach of NFPA 805, Section 4.2.4. A fire risk evaluation determined that applicable risk, defense-in-depth, and safety margin criteria were satisfied with a recovery action to locally trip the Reactor Coolant Pumps at Switchgear 1A and 1B.

VFDR ID 1-103

VFDR VCT LOW LEVEL TRANSMITTER CVC-ILT-227

Fire damage to VCT Low Level Transmitter CVC-ILT-227 Control and Power cables could result in the following:

a.) Loss of Control-Control Signal from CP-4 to Isolation Panel (RELAYS SX-1, SX-2)
b.) Loss of Power-Power-120 VAC Non-Safety Vital ID-EPDP-014AB Circuit #13
c.) Loss of Control-Control Letdown Regen Heat Exchanger Outlet Temperature High to ISOL PNL (CVC-EREL-300-D Relay) from CP-29
d.) Loss of Control-Control Signal from CVC-ILT-227 to CP-29
e.) Loss of Control-Control Signal from CP-29 to Isolation Panel (Relay LX-1, CVC-EREL-322-A)
f.) Loss of Control-Control-Signal from CP-29 to Isolation Panel (Relay LX-3, CVC-EREL-322-B)

Loss of VCT Low Level Transmitter CVC-ILT-227 could challenge the Inventory and Pressure Control Performance Criterion. This condition represents a variance from the deterministic requirements of Section 4.2.3 of NFPA 805. This is a separation issue and evaluation of the additional risk is required in accordance with Section 4.2.4 of NFPA 805.

Disposition This condition has no corresponding PRA basic event and by definition has insignificant risk. A discussion concerning the exclusion of this component/basic event from the fire PRA model is found in PSA-WF3-03-01, Waterford 3 Methodology for Addressing VFDRs in the Fire PRA and NFPA-805.

VFDR ID 1-107

VFDR CONTAINMENT FAN COOLERS CCS-MAHU-0001B

Fire damage to Containment Fan Coolers CCS-MAHU-0001B Control cable could result in the following:

a.) Loss of Control-Control and Indication from CP-18

Loss of Containment Fan Coolers CCS-MAHU-0001B could challenge the Vital Auxiliaries (Mechanical) Performance Criterion. This condition represents a variance from the deterministic requirements of Section 4.2.3 of NFPA 805. This is a separation issue and evaluation of the additional risk is required in accordance with Section 4.2.4 of NFPA 805.

Disposition This condition was evaluated for compliance using the performance-based approach of NFPA 805, Section 4.2.4. A fire risk evaluation determined that applicable risk, defense-in-depth, and safety margin criteria were satisfied without further action.

VFDR ID 1-112

VFDR MAIN STEAM ISOLATION VALVE MS-124A

Fire damage to Main Steam Isolation Valve MS-124A Control cables could result in the following:

a.) Loss of Control-Control Signal from Valve Limit Switch to Isolation Panel
b.) Loss of Control-Control Signal from Valve Limit Switches
c.) Loss of Power - Power – 125 VDC Feed from DC-EPDP-1B-DC Circuit #8
d.) Loss of Control-Control from ESFAS Cabinet B to Isolation Panel
e.) Loss of Control-Control Signal from K305 MSIS
f.) Loss of Control-Control and Indication from CP-8
g.) Loss of Control-Control-Signal to Close Coils MS-ISV-0124A1 and MS-ISV-0124A3

Loss of Main Steam Isolation Valve MS-124A could challenge the Decay Heat Removal Performance Criterion. This condition represents a variance from the deterministic requirements of Section 4.2.3 of NFPA 805. This is a separation issue and evaluation of the additional risk is required in accordance with Section 4.2.4 of NFPA 805.

Disposition This condition was evaluated for compliance using the performance-based approach of NFPA 805, Section 4.2.4. A fire risk evaluation determined that applicable risk, defense-in-depth, and safety margin criteria were satisfied without further action.

VFDR ID 1-113

VFDR MAIN STEAM ISOLATION VALVE MS-124B

Fire damage to Main Steam Isolation Valve MS-124B Control and Power cables could result in the following:

a.) Loss of Control-Control Signal from Valve Limit Switches
b.) Loss of Control-Control from ESFAS Cabinet B to Isolation Panel
c.) Loss of Control-Control Signal to Close Coils
d.) Loss of Control-Control Signal from LCP-83A to Isolation Panel
e.) Loss of Power-Power 125 VDC Feed from DC-EPDP-1A DC Circuit #10
f.) Loss of Control-Control and Indication from CP-8

Loss of Main Steam Isolation Valve MS-124B could challenge the Decay Heat Removal Performance Criterion. This condition represents a variance from the deterministic requirements of Section 4.2.3 of NFPA 805. This is a separation issue and evaluation of the additional risk is required in accordance with Section 4.2.4 of NFPA 805.

Disposition This condition was evaluated for compliance using the performance-based approach of NFPA 805, Section 4.2.4. A fire risk evaluation determined that applicable risk, defense-in-depth, and safety margin criteria were satisfied without further action.

VFDR ID 1-115

VFDR SG 1 BLOWDOWN ISOLATION VALVE BD-102A

Fire damage to Steam Generator 1 Blowdown Isolation Valve BD-102A Control cables could result in the following:

a.) Loss of Control-Control and Indication from CP-8
b.) Loss of Control-Control Signal from AUX PNL-2 to Operating Coil

Loss of Steam Generator 1 Blowdown Isolation Valve BD-102A could challenge the Decay Heat Removal Performance Criterion. This condition represents a variance from the deterministic requirements of Section 4.2.3 of NFPA 805. This is a separation issue and evaluation of the additional risk is required in accordance with Section 4.2.4 of NFPA 805.

Disposition This condition was evaluated for compliance using the performance-based approach of NFPA 805, Section 4.2.4. A fire risk evaluation determined that applicable risk, defense-in-depth, and safety margin criteria were satisfied without further action.

VFDR ID 1-116

VFDR SG 2 BLOWDOWN ISOLATION VALVE BD-102B

Fire damage to Steam Generator 2 Blowdown Isolation Valve BD-102B Control cables could result in the following:

a.) Loss of Control-Control and Indication from CP-8
b.) Loss of Control-Control Signal from AUX PNL-2 to Operating Coil

Loss of Steam Generator 2 Blowdown Isolation Valve BD-102B could challenge the Decay Heat Removal Performance Criterion. This condition represents a variance from the deterministic requirements of Section 4.2.3 of NFPA 805. This is a separation issue and evaluation of the additional risk is required in accordance with Section 4.2.4 of NFPA 805.

Disposition This condition was evaluated for compliance using the performance-based approach of NFPA 805, Section 4.2.4. A fire risk evaluation determined that applicable risk, defense-in-depth, and safety margin criteria were satisfied without further action.

VFDR ID 1-117

VFDR ACCW PUMP 3B DISCHARGE ISOLATION ACC-110B

Fire damage to ACCW Pump 3B Discharge Isolation ACC-110B Control cables could result in the following:

a.) Loss of Control-Control and Indication in CP-33 to AUX PNL 2

Loss of ACCW Pump 3B Discharge Isolation ACC-110B could challenge the Decay Heat Removal Performance Criterion. This condition represents a variance from the deterministic requirements of Section 4.2.3 of NFPA 805. This is a separation issue and evaluation of the additional risk is required in accordance with Section 4.2.4 of NFPA 805.

Disposition This condition was evaluated for compliance using the performance-based approach of NFPA 805, Section 4.2.4. A fire risk evaluation determined that applicable risk, defense-in-depth, and safety margin criteria were satisfied without further action.

VFDR ID 1-119

VFDR ACC HEADER B RETURN FROM ESSENTIAL CHILLERS ISOL ACC-139B

Fire damage to ACC Header B Return from Essential Chillers Isolation ACC-139B Control cables could result in the following:

a.) Loss of Control-Control Permissive Signal from CP-49 (CC-ITAC-7075B1)
b.) Loss of Control-Control and Indication at CP-18

Loss of ACC Header B Return from Essential Chillers Isolation ACC-139B could challenge the Vital Auxiliaries (mechanical) Performance Criterion. This condition represents a variance from the deterministic requirements of Section 4.2.3 of NFPA 805. This is a separation issue and evaluation of the additional risk is required in accordance with Section 4.2.4 of NFPA 805.

Disposition This condition was evaluated for compliance using the performance-based approach of NFPA 805, Section 4.2.4. A fire risk evaluation determined that applicable risk, defense-in-depth, and safety margin criteria were satisfied without further action.

VFDR ID 1-120

VFDR AUX FEEDWATER PUMP AFW-MPMP-0001

Fire damage to Auxiliary Feedwater Pump AFW-MPMP-0001 Control cables could result in the following:

a.) Loss of Control-Control from RTGB-CP1 to LCP-70

Loss of Auxiliary Feedwater Pump AFW-MPMP-0001 could challenge the Decay Heat Removal Performance Criterion. This condition represents a variance from the deterministic requirements of Section 4.2.3 of NFPA 805. This is a separation issue and evaluation of the additional risk is required in accordance with Section 4.2.4 of NFPA 805.

Disposition This condition was evaluated for compliance using the performance-based approach of NFPA 805, Section 4.2.4. A fire risk evaluation determined that applicable risk, defense-in-depth, and safety margin criteria were satisfied without further action.

VFDR ID 1-121

VFDR DRY COOLING TOWER B FAN 1-15, CC-EMTR-315-1F, 1M, 2F, 2M, 3F, 3M, 4F, 4M, 5F, 5M, 7F, 7M, 8F, 8M, 9F

Fire damage to Dry Cooling Tower B Fans 1-15, CC-EMTR-315-1F, 1M, 2F, 2M, 3F, 3M, 4F, 4M, 5F, 5M, 7F, 7M, 8F, 8M, 9F Control cables could result in the following:

a.) Loss of Control-Control-Control and Indication from CP-33 to AUX PNL 2
b.) Loss of Control-Control-Control from CP-49 to CP-33

Loss of Dry Cooling Tower B Fans 1-15, CC-EMTR-315-1F, 1M, 2F, 2M, 3F, 3M, 4F, 4M, 5F, 5M, 7F, 7M, 8F, 8M, 9F could challenge the Vital Auxiliaries (mechanical) Performance Criterion. This condition represents a variance from the deterministic requirements of Section 4.2.3 of NFPA 805. This is a separation issue and evaluation of the additional risk is required in accordance with Section 4.2.4 of NFPA 805.

Disposition This condition was evaluated for compliance using the performance-based approach of NFPA 805, Section 4.2.4. A fire risk evaluation determined that applicable risk, defense-in-depth, and safety margin criteria were satisfied without further action.

VFDR ID 1-122

VFDR AH-25 (3B-SB) COOL COIL TEMP, SVS-ITE-5014B, 5015B, 5018B, 5019B, 5020B, 5021B

Fire damage to AH-25 (3B-SB) Cooling Coil Temperature, SVS-ITE-5014B, 5015B, 5018B, 5019B, 5020B, 5021B Control and Power cables could result in the following:

a.) Loss of Control-Control-Signal from Thermocouple to CP-44
b.) Loss of Power-Power – 120 VAC Vital from ID-EPDP-MD to CP-44 (PAC)

Loss of AH-25 (3B-SB) Cooling Coil Temperature, SVS-ITE-5014B, 5015B, 5018B, 5019B, 5020B, 5021B could challenge the Vital Auxiliaries (HVAC) Performance Criterion. This condition represents a variance from the deterministic requirements of Section 4.2.3 of NFPA 805. This is a separation issue and evaluation of the additional risk is required in accordance with Section 4.2.4 of NFPA 805.

Disposition This condition has no corresponding PRA basic event and by definition has insignificant risk. A discussion concerning the exclusion of this component/basic event from the fire PRA model is found in PSA-WF3-03-01, Waterford 3 Methodology for Addressing VFDRs in the Fire PRA and NFPA-805.

VFDR ID 1-123

VFDR COMPONENT COOLING WATER PUMP B CC-MPMP-0001B

Fire damage to Component Cooling Water Pump B CC-MPMP-0001B Control cables could result in the following:

a.) Loss of Control-Control-Signal from CP8 to Relay AXA
b.) Loss of Control-Control-Control and Indication from CP-8

Loss of Component Cooling Water Pump B CC-MPMP-0001B could challenge the Vital Auxiliaries (mechanical) Performance Criterion. This condition represents a variance from the deterministic requirements of Section 4.2.3 of NFPA 805. This is a separation issue and evaluation of the additional risk is required in accordance with Section 4.2.4 of NFPA 805.

Disposition This condition was evaluated for compliance using the performance-based approach of NFPA 805, Section 4.2.4. A fire risk evaluation determined that applicable risk, defense-in-depth, and safety margin criteria were satisfied without further action.

VFDR ID 1-124

VFDR CCW MAKE-UP HDR B TO CCW HEADER B SUPPLY VALVE CMU-538B

Fire damage to Component Cooling Water (CCW) Make-Up Header B to CCW Header B Supply Valve CMU-538B Control cables could result in the following:

a.) Loss of Control-Control120 VAC for Control and Indication to CP8 from AUX PNL 2

Loss of Component Cooling Water (CCW) Make-Up Header B to CCW Header B Supply Valve CMU-538B could challenge the Vital Auxiliaries (mechanical) Performance Criterion. This condition represents a variance from the deterministic requirements of Section 4.2.3 of NFPA 805. This is a separation issue and evaluation of the additional risk is required in accordance with Section 4.2.4 of NFPA 805.

Disposition This condition was evaluated for compliance using the performance-based approach of NFPA 805, Section 4.2.4. A fire risk evaluation determined that applicable risk, defense-in-depth, and safety margin criteria were satisfied without further action.

VFDR ID 1-125

VFDR CCW MAKE-UP PUMP 3B CMU-MPMP-0004B

Fire damage to Component Cooling Water Make-Up Pump 3B CMU-MPMP-0004B Control cables could result in the following:

a.) Loss of Control-Control-Control and Indication from CP-8
b.) Loss of Control-Control-Signal from CCW Surge Tank

Loss of Component Cooling Water Make-Up Pump 3B CMU-MPMP-0004B could challenge the Vital Auxiliaries (mechanical) Performance Criterion. This condition represents a variance from the deterministic requirements of Section 4.2.3 of NFPA 805. This is a separation issue and evaluation of the additional risk is required in accordance with Section 4.2.4 of NFPA 805.

Disposition This condition was evaluated for compliance using the performance-based approach of NFPA 805, Section 4.2.4. A fire risk evaluation determined that applicable risk, defense-in-depth, and safety margin criteria were satisfied without further action.

VFDR ID 1-126

VFDR RWSP LEVEL TRANSMITTER SI-ILT-0305B

Fire damage to Refueling Water Storage Pool Level Transmitter SI-ILT-0305B Control cables could result in the following:

a.) Loss of Control-Control - 1-5 VDC RWSP Level Signal to ESFAS (CP-10) from CP-26
b.) Loss of Control-Control - 4-20 MADC Signal to CP-26 from SI-ILT-0305B
c.) Loss of Control-Control - 0-10 VDC Signal to SI-ILR-305B (CP-7) and SI-ILI-305B (CP-7) from CP-26
d.) Loss of Power-120 VAC to CP-26 from ID-EPDP-MB CKT 5
e.) Loss of Power-120 VAC to CP-26 from ID-EPDP-MA CKT 6

Loss of Refueling Water Storage Pool Level Transmitter SI-ILT-0305B could challenge the Process Monitoring Performance Criterion. This condition represents a variance from the deterministic requirements of Section 4.2.3 of NFPA 805. This is a separation issue and evaluation of the additional risk is required in accordance with Section 4.2.4 of NFPA 805.

Disposition This condition was evaluated for compliance using the performance-based approach of NFPA 805, Section 4.2.4. A fire risk evaluation determined that applicable risk, defense-in-depth, and safety margin criteria were satisfied without further action.

VFDR ID 1-127

VFDR CCW SURGE TANK LEVEL INDICATION CC-ILT-7010B

Fire damage to Component Cooling Water Surge Tank Level Indication CC-ILT-7010B Control and Power cables could result in the following:

a.) Loss of Control-Control-Tank Level Signal to CC-ILI-7010B (CP-8) from CP-44 (PAC)
b.) Loss of Control-Control-Level Signal to CP-44 from CC-ILT-7010B
c.) Loss of Power-Power – 120 VAC Vital Feed to CP44 from PAC EBKR-IP-MD-2 Circuit 2

This is the credited Train B CCW surge tank level instrument. Loss of Component Cooling Water Surge Tank Level Indication CC-ILT-7010B could challenge the Vital Auxiliaries (mechanical). This condition represents a variance from the deterministic requirements of Section 4.2.3 of NFPA 805. This is a separation issue and evaluation of the additional risk is required in accordance with Section 4.2.4 of NFPA 805.

Disposition This condition has no corresponding PRA basic event and by definition has insignificant risk. A discussion concerning the exclusion of this component/basic event from the fire PRA model is found in PSA-WF3-03-01, Waterford 3 Methodology for Addressing VFDRs in the Fire PRA and NFPA-805.

VFDR ID 1-128

VFDR EDG B ROOM TEMPERATURE TO HVR-502B, HVR-ITE-5013B

Fire damage to Emergency Diesel Generator B Room Temperature HVR-502B, HVR-ITE-5013B Control and Power cables could result in the following:

a.) Loss of Control-Control – Control Signal from HVR-ITE-5013B to CP-44
b.) Loss of Power-Power – 120 VAC from Circuit 2, ID-EPDP-MD

Loss of Emergency Diesel Generator B Room Temperature HVR-502B, HVR-ITE-5013B could challenge the Vital Auxiliaries (HVAC) Performance Criterion. This condition represents a variance from the deterministic requirements of Section 4.2.3 of NFPA 805. This is a separation issue and evaluation of the additional risk is required in accordance with Section 4.2.4 of NFPA 805.

Disposition This condition was evaluated for compliance using the performance-based approach of NFPA 805, Section 4.2.4. A fire risk evaluation determined that applicable risk, defense-in-depth, and safety margin criteria were satisfied without further action.

VFDR ID	1-129
VFDR	TEMPERATURE SWITCH, HVR-ITE-5100B Fire damage to Temperature Switch HVR-ITE-5100B Control and Power cables could result in the following: a.) Loss of Control-Control-Signal from HVR-ITE-5100B to CP-44 b.) Loss of Power-Power – 120 VAC from Circuit 2, ID-EPDP-MD Loss of Temperature Switch HVR-ITE-5100B could challenge the Vital Auxiliaries (HVAC) Performance Criterion. This condition represents a variance from the deterministic requirements of Section 4.2.3 of NFPA 805. This is a separation issue and evaluation of the additional risk is required in accordance with Section 4.2.4 of NFPA 805.
Disposition	This condition has no corresponding PRA basic event and by definition has insignificant risk. A discussion concerning the exclusion of this component/basic event from the fire PRA model is found in PSA-WF3-03-01, Waterford 3 Methodology for Addressing VFDRs in the Fire PRA and NFPA-805.

VFDR ID	1-130
VFDR	TEMPERATURE SWITCH HVR-ITE-5101B Fire damage to Temperature Switch HVR-ITE-5101B Control and Power cables could result in the following: a.) Loss of Control-Control-Signal from HVR-ITE-5101B to CP-44 b.) Loss of Power-Power-120 VAC from Circuit 2, ID-EPDP-MD Loss of Temperature Switch HVR-ITE-5101B could challenge the Vital Auxiliaries (HVAC) Performance Criterion. This condition represents a variance from the deterministic requirements of Section 4.2.3 of NFPA 805. This is a separation issue and evaluation of the additional risk is required in accordance with Section 4.2.4 of NFPA 805.
Disposition	This condition has no corresponding PRA basic event and by definition has insignificant risk. A discussion concerning the exclusion of this component/basic event from the fire PRA model is found in PSA-WF3-03-01, Waterford 3 Methodology for Addressing VFDRs in the Fire PRA and NFPA-805.

VFDR ID 1-131

VFDR TEMPERATURE SWITCH HVR-ITE-5102B

Fire damage to Temperature Switch HVR-ITE-5102B Control and Power cables could result in the following:

a.) Loss of Control-Control-Signal from HVR-ITE-5102B to CP-44
b.) Loss of Power-Power-120 VAC from Circuit 2, ID-EPDP-MD

Loss of Temperature Switch HVR-ITE-5102B could challenge the Vital Auxiliaries (HVAC) Performance Criterion. This condition represents a variance from the deterministic requirements of Section 4.2.3 of NFPA 805. This is a separation issue and evaluation of the additional risk is required in accordance with Section 4.2.4 of NFPA 805.

Disposition This condition has no corresponding PRA basic event and by definition has insignificant risk. A discussion concerning the exclusion of this component/basic event from the fire PRA model is found in PSA-WF3-03-01, Waterford 3 Methodology for Addressing VFDRs in the Fire PRA and NFPA-805.

VFDR ID 1-132

VFDR TEMPERATURE SWITCH HVR-ITE-5103B

Fire damage to Temperature Switch HVR-ITE-5103B Control and Power cables could result in the following:

a.) Loss of Control-Control-Signal from HVR-ITE-5103B to CP-44
b.) Loss of Power-Power -120 VAC from Circuit 2, ID-EPDP-MD

Loss of Temperature Switch HVR-ITE-5103B could challenge the Vital Auxiliaries (HVAC) Performance Criterion. This condition represents a variance from the deterministic requirements of Section 4.2.3 of NFPA 805. This is a separation issue and evaluation of the additional risk is required in accordance with Section 4.2.4 of NFPA 805.

Disposition This condition has no corresponding PRA basic event and by definition has insignificant risk. A discussion concerning the exclusion of this component/basic event from the fire PRA model is found in PSA-WF3-03-01, Waterford 3 Methodology for Addressing VFDRs in the Fire PRA and NFPA-805.

VFDR ID 1-133

VFDR ACC-MPMP-0001A AUXILIARY COMPONENT COOLING WATER PUMP A

Fire damage to Auxiliary Component Cooling Water Pump A ACC-MPMP-0001A Control cables could result in the following:

a.) Loss of Control-Control-Indication from CP-33 to AUX PNL-1
b.) Loss of Control-Control Signal from CP-48 to AUX PNL-1
c.) Loss of Control-Control-Signal from CP-42 to AUX PNL-1

Loss of Auxiliary Component Cooling Water Pump A ACC-MPMP-0001A could challenge the Decay Heat Removal Performance Criterion. This condition represents a variance from the deterministic requirements of Section 4.2.3 of NFPA 805. This is a separation issue and evaluation of the additional risk is required in accordance with Section 4.2.4 of NFPA 805.

Disposition This condition was evaluated for compliance using the performance-based approach of NFPA 805, Section 4.2.4. A fire risk evaluation determined that applicable risk, defense-in-depth, and safety margin criteria were satisfied without further action.

VFDR ID 1-134

VFDR ACC-MPMP-0001B AUXILIARY COMPONENT COOLING WATER PUMP B

Fire damage to Auxiliary Component Cooling Water Pump B ACC-MPMP-0001B Control cables could result in the following:

a.) Loss of Control-Control-Indication from CP-33
b.) Loss of Control-Control Signal from CP-49 PAC
c.) Loss of Control-Control-Signal from CP-45

Loss of Auxiliary Component Cooling Water Pump B ACC-MPMP-0001B could challenge the Decay Heat Removal Performance Criterion. This condition represents a variance from the deterministic requirements of Section 4.2.3 of NFPA 805. This is a separation issue and evaluation of the additional risk is required in accordance with Section 4.2.4 of NFPA 805.

Disposition This condition was evaluated for compliance using the performance-based approach of NFPA 805, Section 4.2.4. A fire risk evaluation determined that applicable risk, defense-in-depth, and safety margin criteria were satisfied without further action.

VFDR ID 1-135

VFDR ACC HEADER A RETURN FROM ESSENTIAL CHILLERS ISOL ACC-139A

Fire damage to ACC Header A Return from Essential Chillers Isolation Valve ACC-139A Control cables could result in the following:

a.) Loss of Control-Control-Permissive from CP-48
b.) Loss of Control-Control and Indication at CP-18

Loss of ACC Header A Return from Essential Chillers Isolation Valve ACC-139A could challenge the Vital Auxiliaries (mechanical) Performance Criterion. This condition represents a variance from the deterministic requirements of Section 4.2.3 of NFPA 805. This is a separation issue and evaluation of the additional risk is required in accordance with Section 4.2.4 of NFPA 805.

Disposition This condition was evaluated for compliance using the performance-based approach of NFPA 805, Section 4.2.4. A fire risk evaluation determined that applicable risk, defense-in-depth, and safety margin criteria were satisfied without further action.

VFDR ID 1-200

VFDR DIESEL GEN. B SEQUENCER AND UV CIRCUIT

Fire damage to Diesel Generator B Sequencer and Under-Voltage Circuit Control cables could result in the following:

a) Loss of Control-Control Signal from CP1 to Auxiliary Panel-2
b) Loss of Control-Control Signal from ESFAS Cabinet B to Auxiliary Panel-2
c) Loss of Control-Control Signal from 4KV-ESWGR-3B to Auxiliary Panel-2
d) Loss of Control-Control and Indication from CP1
e) Loss of Control-Indication from CP1

Loss of Diesel Generator B Sequencer and Under-Voltage Circuit could challenge the Vital Auxiliaries (electrical) Performance Criterion. This condition represents a variance from the deterministic requirements of Section 4.2.3 of NFPA 805. This is a separation issue and evaluation of the additional risk is required in accordance with Section 4.2.4 of NFPA 805.

Note: VFDR 1-200 is also associated with VFDR 1-007.

Disposition This condition was evaluated for compliance using the performance-based approach of NFPA 805, Section 4.2.4. A fire risk evaluation determined that applicable risk, defense-in-depth, and safety margin criteria were satisfied without further action.

VFDR ID 1-201

VFDR 480V SWITCHGEAR BUS 3B31-S SSD-ESWGR-31B

Fire damage to 480 VAC Switchgear Bus 3B31-S SSD-ESWGR-31B Control cables could result in the following:

a.) Loss of Control-Control-Under-Voltage Coil Test Switch Signals from CP1 to AUX PNL-2
b.) Loss of Control-Control-Under-Voltage Test Signals to AUX PNL-2 from CP-1

Disposition This condition was evaluated for compliance using the performance-based approach of NFPA 805, Section 4.2.4. A fire risk evaluation determined that applicable risk, defense-in-depth, and safety margin criteria were satisfied without further action. (Note: VFDR 1-201 is also associated with VFDR 1-016.)

VFDR ID 1-202

VFDR CONTAINMENT PRESSURE TRANSMITTER CB-IPT-6701SMA THROUGH CB-IPT-6701SMD

Fire damage to Containment Pressure Transmitter CB-IPT-6701SMA through CB-IPT-6701SMD Power and Control cables could result in the following:

a) Loss of Power-Power – 120 VAC to CP-25 from ID-EPDP-MA Circuit 5
b) Loss of Power-Power – 120 VAC to CP-25 from ID-EPDP-MB Circuit 6
c) Loss of Control-Control - 1-5 VDC CB-IP6701SMA Containment High Pressure and 1-5 VDC CB-IP6702SMA Containment High-High Pressure Signal to ESFAS (CP-10) from CP-25
d) Loss of Control-Control - 4-20 MADC CB-IPT-6701SMA Pressure Signal to CP-25 from Containment Penetration 121
e) Loss of Power-Power – 120 VAC to CP-26 from ID-EPDP-MB Circuit 5
f) Loss of Power-Power – 120 VAC to CP-26 from ID-EPDP-MA Circuit 6
g) Loss of Control-Control - 1-5 VDC CB-IP6701SMB Containment High Pressure and 1-5 VDC CB-IP6702SMB Containment High-High Pressure Signal to ESFAS (CP-10) from CP-26
h) Loss of Control-Control - 4-20 MADC CB-IPT-6701SMB Pressure Signal to CP-26 from Containment Penetration 123
i) Loss of Power-Power – 120 VAC to CP-27 from ID-EPDP-MC Circuit 5
j) Loss of Power-Power – 120 VAC to CP-27 from ID-EPDP-MD Circuit 11
k) Loss of Control-Control - 1-5 VDC CB-IP6701SMC Containment High Pressure and 1-5 VDC CB-IP6702SMC Containment High-High Pressure Signal to ESFAS (CP-10) from CP-27
l) Loss of Control-Control - 4-20 MADC CB-IPT-6701SMC Pressure Signal to CP-27 from Containment Penetration 124
m) Loss of Power-Power – 120 VAC to CP-28 from ID-EPDP-MD Circuit 5
n) Loss of Power-Power – 120 VAC to CP-28 from ID-EPDP-MC Circuit 11
o) Loss of Control-Control - 1-5 VDC CB-IP6701SMD Containment High Pressure and 1-5VDC CB-IP6702SMD Containment High-High Pressure Signal to ESFAS (CP-10) from CP-28
p) Loss of Control-Control - 4-20 MADC CB-IPT-6701SMD Pressure Signal to CP-28 from Containment Penetration 122

Loss of Containment Pressure Transmitter CB-IPT-6701SMA through CB-IPT-6701SMD could challenge the Inventory and Pressure Control Performance Criterion. This condition represents a variance from the deterministic requirements of Section 4.2.3 of NFPA 805. This is a separation issue and evaluation of the additional risk is required in accordance with Section 4.2.4 of NFPA 805.

Disposition This condition was evaluated for compliance using the performance-based approach of NFPA 805, Section 4.2.4. A fire risk evaluation determined that applicable risk, defense-in-depth, and safety margin criteria were satisfied without further action.

VFDR ID 1-203

VFDR REACTOR HEAD VENT VALVES RC-1014, RC-1015, RC-1017 AND RC-3186 AND PRESSURIZER HEAD VENT VALVES RC-3183 AND RC-3184

Fire damage to Reactor Head Vent Valves RC-1014, RC-1015, RC-1017 and RC-3186 and Pressurizer Head Vent Valves RC-3183 and RC-3184 Power cables could result in the following:

a) Loss of Power-Power - Operating Coil, CP-8 to Penetration 142
b) Loss of Power-Power - Operating Coil, CP-8 to Penetration 141

Loss of Reactor Head Vent Valves RC-1014, RC-1015, RC-1017 and RC-3186 and Pressurizer Head Vent Valves RC-3183 and RC-3184 could challenge the Inventory and Pressure Control Performance Criterion. This condition represents a variance from the deterministic requirements of Section 4.2.3 of NFPA 805. This is a separation issue and evaluation of the additional risk is required in accordance with Section 4.2.4 of NFPA 805.

Disposition This condition was evaluated for compliance using the performance-based approach of NFPA 805, Section 4.2.4. A fire risk evaluation determined that applicable risk, defense-in-depth, and safety margin criteria were satisfied without further action.

VFDR ID 1-204

VFDR 4KV BUS 3B3 TIE TO BUS 3B2

Fire damage to 4KV Bus 3B3 Tie to Bus 3B2 4KV-EBKR-3B-11 Control cable could result in the following:

a) Loss of Control-Control - Signal from CP1 to Auxiliary Panel-2

Loss of 4KV Bus 3B3 Tie to Bus 3B2 4KV-EBKR-3B-11 could challenge the Vital Auxiliaries (electrical) Performance Criterion. This condition represents a variance from the deterministic requirements of Section 4.2.3 of NFPA 805. This is a separation issue and evaluation of the additional risk is required in accordance with Section 4.2.4 of NFPA 805.

Disposition This condition was evaluated for compliance using the performance-based approach of NFPA 805, Section 4.2.4. A fire risk evaluation determined that applicable risk, defense-in-depth, and safety margin criteria were satisfied without further action.

VFDR ID	1-205
VFDR	4.16 KV AUXILIARY BUS 3B3-S 4KV-ESWGR-3B Fire damage to 4.16 KV Auxiliary Bus 3B3-S 4KV-ESWGR-3B Control cables could result in the following: a) Loss of Control-Control - Signal from ESFAS Cabinet B to Auxiliary Panel-2 b) Loss of Control-Control and Indication from CP1 Loss of 4.16 KV Auxiliary Bus 3B3-S 4KV-ESWGR-3B could challenge the Vital Auxiliaries (electrical) Performance Criterion. This condition represents a variance from the deterministic requirements of Section 4.2.3 of NFPA 805. This is a separation issue and evaluation of the additional risk is required in accordance with Section 4.2.4 of NFPA 805.
Disposition	This condition was evaluated for compliance using the performance-based approach of NFPA 805, Section 4.2.4. A fire risk evaluation determined that applicable risk, defense-in-depth, and safety margin criteria were satisfied without further action.

VFDR ID 1-206

VFDR 480V PRESS. HEATER DISTRIBUTION PANEL 373B RC-EPDP-73B

Fire damage to 480 VAC Pressurizer Heater Distribution Panel 373B RC-EPDP-73B Power and Control cables could result in the following:

a) Loss of Control-Control - 0-10 VDC Pressurizer / Level Signals from / to CP-31 to / from CP-30
b) Loss of Power-Power – 120 VAC Non-Safety Vital Feed Normal to CP-31 from ID-EPDP-014AB Circuit 11
c) Loss of Power-Power – 120 VAC Non-Safety Vital Feed Normal to CP-30 from ID-EPDP-014AB Circuit 7
d) Loss of Control-Control - 0-10 VDC Pressurizer Pressure / Level Signals from CP-31 to RC-ILI-0103 /Recorders (CP-2)
e) Loss of Control-Control - 0-10 VDC Pressurizer Pressure Signal from CP-30 to HS-100 / HS-110/Recorders (CP-2)
f) Loss of Control-Control - 0-10 VDC Pressurizer Pressure Signal from CP-31 to HS-100 / HS-110/Recorders (CP-2)
g) Loss of Power-Power – 120 VAC Non-Safety Vital Feed to CP-31 from CP-2
h) Loss of Power-Power – 120 VAC Non-Safety Vital Feed to CP-30 from CP-2
i) Loss of Power-Power – 120 VAC Non-Safety Vital Feed to CP-2 from Auxiliary Panel-4
j) Loss of Control-Control - 0-10 VDC Pressurizer Pressure Signal from CP-31 to CP-12A
k) Loss of Control-Control - 0-10 VDC Pressurizer Pressure Signal from CP-30 to CP-12B
l) Loss of Control-Control - 4-20 MADC Proportional Heater Demand Signal from CP-31 to Auxiliary Panel-4
m) Loss of Control-Control - 4-20 MADC Proportional Heater Demand Signal to RC-ECTR-32A-5C from Auxiliary Panel-4
n) Loss of Control-Control - 4-20 MADC Proportional Heater Demand Signal to RC-ECTR-32B-5C from Auxiliary Panel-4
o) Loss of Control-Control - 0-10 VDC Pressurizer Level Signal LY-110X to CP-31 from CP-25
p) Loss of Control-Control - 0-10 VDC Pressurizer Level Signal LY-110Y to CP-30 from CP-26
q) Loss of Power-Power – 120 VAC Non-Safety Vital Feed to CP-31 from CP-4
r) Loss of Power-Power – 120 VAC Non-Safety Vital Feed to CP-4 from Isolation Panel
s) Loss of Control-Control - Pressurizer Pressure Setpoint Signal from Transfer Switch 43-1 (Auxiliary Panel-4A) to CP-31
t) Loss of Control-Control - Pressurizer Pressure Setpoint Signal from RC-IPIC-0100 (CP-2) to Transfer Switch 43-1 (Auxiliary Panel-4A)
u) Loss of Control-Control - Pressurizer Level Setpoint Signal from Transfer Switch 43-2 (Auxiliary Panel-4A) to CP-31
v) Loss of Control-Control - Pressurizer Level Setpoint Signal from LIC-110 (CP-2) to Transfer Switch 43-2 (Aux Panel 4A)
w) Loss of Control-Control - Remote Breaker Control / Indication to CP-2 from Auxiliary Panel-4

Loss of 480 VAC Pressurizer Heater Distribution Panel 373B RC-EPDP-73B could challenge the Inventory and Pressure Control Performance Criterion. This condition represents a variance from the deterministic requirements of Section 4.2.3 of NFPA 805. This is a separation issue and evaluation of the additional risk is required in accordance with Section 4.2.4 of NFPA 805.

Disposition This condition was evaluated for compliance using the performance-based approach of NFPA 805, Section 4.2.4. A fire risk evaluation determined that applicable risk, defense-in-depth, and safety margin criteria were satisfied without further action.

VFDR ID 1-207

VFDR MSIS CHANNEL A ACTUATION LOGIC MSIS-A-AUTO AND MSIS CHANNEL B ACTUATION LOGIC MSIS-B-AUTO

Fire damage to MSIS Channel A Actuation Logic MSIS-A-AUTO and MSIS Channel B Actuation Logic MSIS-B-AUTO Power and Control cables could result in the following:

a) Loss of Control-Control - Test Module Signal from CP-33 to ESFAS Cabinet A Bay 5
b) Loss of Control-Control – MSIS Manual Actuation from CP-8 to CP-10 Cabinet A
c) Loss of Control-Control - MSIS Manual Actuation from CP-8 to CP-10 Cabinet B
d) Loss of Control-Control - MSIS Manual Actuation from CP-7 to CP-10 Cabinet C
e) Loss of Control-Control - MSIS Manual Actuation from CP-7 to CP-10 Cabinet D
f) Loss of Power-Power – 120 VAC to CP-10 Cabinet A from ID-EPDP-MA Circuit 1
g) Loss of Power-Power – 120 VAC to CP-10 Cabinet B from ID-EPDP-MB Circuit 1
h) Loss of Power-Power – 120 VAC to CP-10 Cabinet C from ID-EPDP-MC Circuit 1
i) Loss of Power-Power – 120 VAC to CP-10 Cabinet D from ID-EPDP-MD Circuit 1
j) Loss of Control-Control – CSAS / RAS / MSIS / EFAS1 / EFAS2 1A Signals to ESFAS Cabinet A from CP-10 Cabinet A
k) Loss of Control-Control – CSAS / RAS / MSIS / EFAS1 / EFAS2 2A Signals to ESFAS Cabinet A from CP-10 Cabinet B
l) Loss of Control-Control – CSAS / RAS / MSIS / EFAS1 / EFAS2 3A Signals to ESFAS Cabinet A from CP-10 Cabinet C
m) Loss of Control-Control – CSAS / RAS / MSIS / EFAS1 / EFAS2 4A Signals to ESFAS Cabinet A from CP-10 Cabinet D
n) Loss of Control-Control - Test Module Signal from CP- 33 to ESFAS Cabinet B Bay 5
o) Loss of Control-Control – CSAS / RAS / MSIS / EFAS1 / EFAS2 1B Signals to ESFAS Cabinet B from CP-10 Cabinet A
p) Loss of Control-Control – CSAS / RAS / MSIS / EFAS1 / EFAS2 2B Signals to ESFAS Cabinet B from CP-10 Cabinet B
q) Loss of Control-Control – CSAS / RAS / MSIS / EFAS1 / EFAS2 3B Signals to ESFAS Cabinet B from CP-10 Cabinet C
r) Loss of Control-Control – CSAS / RAS / MSIS / EFAS1 / EFAS2 4B Signals to ESFAS Cabinet B from CP-10 Cabinet D

Loss of MSIS Channel A Actuation Logic MSIS-A-AUTO and MSIS Channel B Actuation Logic MSIS-B-AUTO could challenge the Decay Heat Removal Control Performance Criterion. This condition represents a variance from the deterministic requirements of Section 4.2.3 of NFPA 805. This is a separation issue and evaluation of the additional risk is required in accordance with Section 4.2.4 of NFPA 805.

Disposition This condition was evaluated for compliance using the performance-based approach of NFPA 805, Section 4.2.4. A fire risk evaluation determined that applicable risk, defense-in-depth, and safety margin criteria were satisfied without further action.

VFDR ID 1-208

VFDR SG1 PRESSURE TRANSMITTER SG-IPT-1013A THROUGH 1013D, SG2 PRESSURE TRANSMITTER SG-IPT-1023A THROUGH 1023D, EFW FLOW SG1 BACKUP EFW-223A, EFW FLOW SG2 BACKUP EFW-223B, EFW FLOW SG1 PRIMARY EFW-224A, EFW FLOW SG2 PRIMARY EFW-224B, EFW PRIMARY ISOLATION VALVE EFW-228B AND EFW PRIMARY ISOLATION VALVE EFW-229A

Fire damage to Steam Generator 1 (SG1) Pressure Transmitter SG-IPT-1013A through 1013D, Steam Generator 2 (SG2) Pressure Transmitter SG-IPT-1023A through 1023D, Emergency Feedwater (EFW) Flow SG1 Backup EFW-223A, EFW Flow SG2 Backup EFW-223B, EFW Flow SG1 Primary EFW-224A, EFW Flow SG2 Primary EFW-224B, EFW Primary Isolation Valve EFW-228B and EFW Primary Isolation Valve EFW-229A Power and control cables could result in the following:

a) Loss of Power-Power – 120 VAC to CP-25 from ID-EPDP-MA Circuit 5
b) Loss of Power- Power – 120 VAC to CP-25 from ID-EPDP-MB Circuit 6
c) Loss of Control-Control - 4-20 MADC SG-IPT-1013A Signal to CP-25 from Containment Penetration 121
d) Loss of Control- Control - 1-5 VDC SG1 Low Pressure Signal to CP-10 from CP-25
e) Loss of Power- Power – 120 VAC to CP-26 from ID-EPDP-MB Circuit 5
f) Loss of Power- Power – 120 VAC to CP-26 from ID-EPDP-MA Circuit 6
g) Loss of Control- Control - 0-10 VDC Signal to SG-IPI-1013B (CP-8) from CP-26
h) Loss of Control- Control - 4-20 MADC SG-IPT-1013B Signal to CP-26 from Containment Penetration 123
i) Loss of Control- Control - 1-5 VDC SG2 Low Pressure Signal to CP-10 from CP-26
j) Loss of Control- Control - 0-10 VDC Signal to SG-IPI-1023B (CP-8) from CP-26
k) Loss of Control- Control - 4-20 MADC SG-IPT-1023B Signal to CP-26 from Containment Penetration 123
l) Loss of Control- Control - 1-5 VDC SG2 Low Pressure Signal to CP-10 from CP-26
m) Loss of Power- Power – 120 VAC to CP-28 from ID-EPDP-MD Circuit 5
n) Loss of Power- Power – 120 VAC to CP-28 from ID-EPDP-MC Circuit 11
o) Loss of Control- Control - 0-10 VDC Signal to SG-IPI-1013D (CP-8) from CP-28
p) Loss of Control- Control - 4-20 MADC SG-IPT-1013D Signal to CP-28 from Containment Penetration 122
q) Loss of Control- Control - 1-5 VDC SG1 Low Pressure Signal to CP-10 from CP-28
r) Loss of Control- Control - 0-10 VDC Signal to SG-IPI-1023D (CP-8) from CP-28
s) Loss of Control- Control - 4-20 MADC SG-IPT-1023D Signal to CP-28 from Containment Penetration 122
t) Loss of Control- Control - 1-5 VDC SG2 Low Pressure Signal to CP-10 from CP-28
u) Loss of Power- Power – 120 VAC to CP-27 from ID-EPDP-MC Circuit 5
v) Loss of Power- Power – 120 VAC to CP-27 from ID-EPDP-MD Circuit 11
w) Loss of Control- Control - 4-20 MADC SG-IPT-1013C Signal to CP-27 from Containment Penetration 124
x) Loss of Control- Control - 1-5 VDC SG1 Low Pressure Signal to CP-10 from CP-27
y) Loss of Control- Control - 4-20 MADC SG-IPT-1023A Signal to CP-25 from Containment Penetration 121
z) Loss of Control- Control - 1-5 VDC SG2 Low Pressure Signal to CP-10 from CP-25
aa) Loss of Control-Control – 4-20 MADC SG-IPT-1023C Signal to CP-27 from Containment Penetration 124

bb) Loss of Control- Control – 1-5 VDC SG2 Low Pressure Signal to CP-10 from CP-27
cc) Loss of Control- Control - Signal to CP-8 HIC-FW8331A1S (EFWIHIC8331 A1)
dd) Loss of Control- Control - Signal to CP-8 HIC-FW8331B2S (EFWIHIC8331 B2)
ee) Loss of Control- Control - Signal to CP-8 HIC-FW8331B1S (EFWIHIC8331 B1)
ff) Loss of Control- Control - Signal to CP-8 HIC-FW8331A2S (EFWIHIC8331 A2)
gg) Loss of Control- Control and Indication from CP-8

Loss of SG1 Pressure Transmitter SG-IPT-1013A through 1013D, SG2 Pressure Transmitter SG-IPT-1023A through 1023D, EFW Flow SG1 Backup EFW-223A, EFW Flow SG2 Backup EFW-223B, EFW Flow SG1 Primary EFW-224A, EFW Flow SG2 Primary EFW-224B, EFW Primary Isolation Valve EFW-228B and EFW Primary Isolation Valve EFW-229A could challenge the Decay Heat Removal Control Performance Criterion. This condition represents a variance from the deterministic requirements of Section 4.2.3 of NFPA 805. This is a separation issue and evaluation of the additional risk is required in accordance with Section 4.2.4 of NFPA 805.

Disposition

This condition was evaluated for compliance using the performance-based approach of NFPA 805, Section 4.2.4. A fire risk evaluation determined that applicable risk, defense-in-depth, and safety margin criteria were satisfied without further action.

VFDR ID 1-209

VFDR DGB ROOM EXHAUST FAN HVR-MFAN-0025B

Fire damage to Diesel Generator B Room Exhaust Fan HVR-MFAN-0025B Control cable could result in the following:

a) Loss of Control-Control and Indication at RGB CP-18

Loss of Diesel Generator B Room Exhaust Fan HVR-MFAN-0025B could challenge the Vital Auxiliaries (HVAC) Performance Criterion. This condition represents a variance from the deterministic requirements of Section 4.2.3 of NFPA 805. This is a separation issue and evaluation of the additional risk is required in accordance with Section 4.2.4 of NFPA 805.

Disposition

This condition was evaluated for compliance using the performance-based approach of NFPA 805, Section 4.2.4. A fire risk evaluation determined that applicable risk, defense-in-depth, and safety margin criteria were satisfied without further action.

VFDR ID 1-210

VFDR CCW TRAIN A ISOLATION VALVE (AOV, FC) CC-200A

Fire damage to Component Cooling Water Train A Isolation Valve (AOV, FC) CC-200A Control cables could result in the following:

a) Loss of Control-Control - CP-8 to CC-200A
b) Loss of Control-Control - CP-8 to Auxiliary Panel 1

Loss of Component Cooling Water Train A Isolation Valve (AOV, FC) CC-200A could challenge the Vital Auxiliaries (mechanical) Performance Criterion. This condition represents a variance from the deterministic requirements of Section 4.2.3 of NFPA 805. This is a separation issue and evaluation of the additional risk is required in accordance with Section 4.2.4 of NFPA 805.

Disposition This condition was evaluated for compliance using the performance-based approach of NFPA 805, Section 4.2.4. A fire risk evaluation determined that applicable risk, defense-in-depth, and safety margin criteria were satisfied without further action.

VFDR ID 1-220

VFDR EFW MOTOR DRIVEN PUMP B

Fire damage to Emergency Feedwater Motor Driven Pump B Control cables could result in the following:

a) Loss of Control-Control and Indication from CP8
b) Loss of Control-Control – Signal from CP-1 to Auxiliary Panel-2 / Indication from Auxiliary Panel-2 to CP-1
c) Loss of Control-Control - Signal from Relay K412 (ESFAS Cabinet B) to EDG B Sequencer Relays (Aux Panel-2)
d) Loss of Control-Control - Signal from 4KV-ESWGR-31B to Panel 2
e) Loss of Control-Control Indication from CP1

Loss of Emergency Feedwater Motor Driven Pump B could challenge the Decay Heat Removal Performance Criterion. This condition represents a variance from the deterministic requirements of Section 4.2.3 of NFPA 805. This is a separation issue and evaluation of the additional risk is required in accordance with Section 4.2.4 of NFPA 805.

Disposition This condition was evaluated for compliance using the performance-based approach of NFPA 805, Section 4.2.4. A fire risk evaluation determined that applicable risk, defense-in-depth, and safety margin criteria were satisfied without further action.

VFDR ID 1-221

VFDR SG1 ATMOSHPERIC DUMP VALVE MS-116A

Fire damage to Steam Generator 1 Atmospheric Dump Valve MS-116A Power and Control cables could result in the following:

a) Loss of Control-Control - 0-10 VDC Signal to MS-IPIC-0303A1 (CP-8) from CP-42
b) Loss of Control-Control - 0-10 VDC Signal to MS-IPIC-0303A1 (LCP-43) from CP-42
c) Loss of Control-Control - Remote Shutdown Switch Signal to CP-42 from Auxiliary Panel 1
d) Loss of Control-Control - 0-20 MADC Signal to SG1 Main Steam Atmospheric Dump Valve Controller from CP-42
e) Loss of Power-Power – 120 VAC to CP-42 from PAC-EBKR-IP-MC Circuit 1

Loss of Steam Generator 1 Atmospheric Dump Valve MS-116A could challenge the Decay Heat Removal Performance Criterion. This condition represents a variance from the deterministic requirements of Section 4.2.3 of NFPA 805. This is a separation issue and evaluation of the additional risk is required in accordance with Section 4.2.4 of NFPA 805.

Disposition This condition was evaluated for compliance using the performance-based approach of NFPA 805, Section 4.2.4. A fire risk evaluation determined that applicable risk, defense-in-depth, and safety margin criteria were satisfied without further action.

VFDR ID 1-222

VFDR SG2 ATMOSHPERIC DUMP VALVE MS-116B

Fire damage to Steam Generator 2 Atmospheric Dump Valve MS-116B Power and Control cables could result in the following:

a) Loss of Control-Control - 0-10 VDC Signal to MS-IPIC-0303B1 (CP-8) from CP-45
b) Loss of Control-Control - 0-10 VDC Signal to MS-IPIC-0303B1 (LCP-43) from CP-45
c) Loss of Control-Control - 0-10 VDC Remote Shutdown Switch Signal to CP-45 from Auxiliary Panel 2
d) Loss of Control-Control - 4-20 MADC Signal to SG2 Main Steam Atmospheric Dump Valve Controller from CP-45
e) Loss of Power-Power to 120 VAC - ID-EPDP-MD Circuit #3 to CP-45

Loss of Steam Generator 2 Atmospheric Dump Valve MS-116B could challenge the Decay Heat Removal Performance Criterion. This condition represents a variance from the deterministic requirements of Section 4.2.3 of NFPA 805. This is a separation issue and evaluation of the additional risk is required in accordance with Section 4.2.4 of NFPA 805.

Disposition This condition was evaluated for compliance using the performance-based approach of NFPA 805, Section 4.2.4. A fire risk evaluation determined that applicable risk, defense-in-depth, and safety margin criteria were satisfied without further action.

Attachment C, Table C-2 (RAB 23 Only)

Required FP Systems/Features

Revised Fire Zone RAB 23

Attachment C, Table C-2 (RAB 23 Only)

Fire Area ID: RAB 23 – Corridor/Common Passageway
Compliance Basis: NFPA 805 4.2.4.2 Performance Based

Fire Zone ID	Description	Required Suppression System	Required Detection System	Required Fire Protection Feature	Required Fire Protection Feature and System Detail
RAB 23	Corridor/Common Passageway	L,E,R	L,E,R	E	Detection, Suppression

Attachment G. Recovery Actions Transition

Overview of Process

In accordance with the guidance provided in NEI 04-02, FAQ 07-0030, Revision 5, and RG 1.205, the following methodology was used to determine recovery actions required for compliance (i.e., determining the population of post-transition recovery actions). The methodology consisted of the following steps:

- Step 1: Define the primary control station and determine which pre-transition OMAs are taken at primary control station (Activities that occur in the Main Control Room are not considered pre-transition OMAs). Activities that take place at the PCS or in the Main Control Room are not recovery actions, by definition.
- Step 2: Determine the population of recovery actions that are required to resolve VFDRs (to meet the risk acceptance criteria or maintain a sufficient level of defense-in-depth).
- Step 3: Evaluate the additional risk presented by the use of recovery actions required to demonstrate the availability of a success path
- Step 4: Evaluate the feasibility of the recovery actions
- Step 5: Evaluate the reliability of the recovery actions

An overview of these steps and the results of their implementation are provided below.

Step 1: Clearly define the PCS and determine which pre-transition OMAs are taken at PCS (Activities that occur in the Main Control Room are not considered pre-transition OMAs). Activities that take place at PCS or in the Main Control Room are not recovery actions, by definition.

Results of Step 1:

For a fire in the Control Room, the PCS is defined as follows:

- Remote Shutdown Panel Room, LCP-43 (located in Fire Area RAB 9). This is the Remote Shutdown Panel and Fire Area located on the +21.00 elevation adjacent to the switchgear and battery rooms.
- Actions necessary to activate, turn on, power up, prevent spurious operation, transfer control or indication or otherwise enable the PCS (LCP-43) and make it capable of fulfilling its intended function following a fire include:
    - Operation of transfer switches

The actions taken in the process of abandoning a control room and transferring to a PCS do not meet the definition of a recovery action subject to the conditions above since they are also considered as taking place at the PCS. These actions are part of the PCS so the additional risk of their use does not need to be evaluated to demonstrate compliance with NFPA 805 Section 4.2.4. Activities at the PCS, including transition activities, are also compliant with NFPA 805 Section 4.2.3.1.

Table G-1, “Recovery Actions and Activities Occurring at the Primary Control Station,” identifies the recovery actions being transitioned and activities necessary to enable the PCS and to maintain the plant in a hot standby (safe and stable) condition. These actions are labeled as RA and PCS in the RA/PCS column.

Step 2: Determine the population of recovery actions that are required to resolve VFDRs (to meet the risk acceptance criteria or maintain a sufficient level of defense-in-depth).

Results of Step 2:

The Waterford 3 recovery actions to be transitioned for NFPA 805 are provided in Table G-1. The results in Table G-1 identify four recovery actions (based on fire risk evaluation results from Fire Areas RAB 1, RAB 7, RAB 8 and TGB) necessary to meet the risk acceptance criteria. No actions are being transitioned solely for defense-in-depth.

Step 3: Evaluate the additional risk presented by the use of recovery actions required to demonstrate the availability of a success path.

Results of Step 3:

The set of recovery actions that are necessary to demonstrate the availability of a success path for the nuclear safety performance criteria (See Table G-1) were evaluated for additional risk using the process described in NEI 04-02, FAQ 07-0030, and RG 1.205 and compared against the guidelines of RG 1.174 and RG 1.205. The additional risk is provided in Attachment W.

All of the operator manual actions and recovery actions were reviewed for adverse impact. None of the actions were found to have an adverse impact on the Fire PRA.

Step 4: Evaluate the feasibility of the recovery actions

Results of Step 4:

The Operator Manual Actions, which have been transitioned to Recovery Actions as listed in Table G-1, were assessed for feasibility utilizing Recovery Action Feasibility and Reliability Review, WF3-FP-13-00003, Revision 0 .

The feasibility approach taken in WF3-FP-13-00003 is consistent with that provided in FAQ 07-0030, Revision 5. However, training processes will be updated to include the use of drills associated with recovery actions. (See Attachment S)

Step 5: Evaluate the reliability of Recovery Actions

Results of Step 5:

The reliability of recovery actions that were modeled specifically in the Fire PRA were addressed using Fire PRA methods.

The potential risk of the recovery action is bounded by the delta risk of the FRE. For the bounding reliability treatment see results in Attachment W.

Table G-1 Recovery Actions and Activities Occurring at the Primary Control Station

Fire Area	Equipment ID	Equipment Description	Action	VFDR	RA/ PCS
RAB 1	Main Control Room	Main Control Boards	• Depress the Reactor Trip pushbuttons to trip the reactor • Close Main Steam Isolation Valves – MS-401A & B • Close Letdown Stop Valve – CVC-101 • Close Letdown Inside Containment Isolation – CVC103 • Place Charging Pumps A, B & AB control switches to OFF		PCS
RAB 1	Transfer Switch	Fire Transfer Switches	Operate all transfer switches at Auxiliary Panel 2 in RAB 7B, Auxiliary Panel 3 in RAB 7D, and Auxiliary Panels 4 and 1 in RAB 7A. (Place switches in the AUX CR (transfer) position. Operate all transfer switches and push to activate controls at LCP-43 in RAB 9.		PCS
RAB 1	RC-MPMP-0001A RC-MPMP-0001B RC-MPMP-0002A RC-MPMP-0002B	Reactor Coolant Pumps	To secure the reactor coolant pumps to prevent potential RCP seal LOCA, de-energize RC-MPMP-0001A, RC-MPMP-0001B, RC-MPMP-0002A, and RC-MPMP-0002B at local breakers in Fire Area TGB to terminate flow.	1-101	RA
RAB 7	RC-MPMP-0001A RC-MPMP-0001B RC-MPMP-0002A RC-MPMP-0002B	Reactor Coolant Pumps	To secure the reactor coolant pumps to prevent potential RCP seal LOCA, de-energize RC-MPMP-0001A, RC-MPMP-0001B, RC-MPMP-0002A, and RC-MPMP-0002B at local breakers in Fire Area TGB to terminate flow.	7-070 7-071 7-072 7-073	RA
RAB 8	RC-MPMP-0001B RC-MPMP-0002B	Reactor Coolant Pumps	To secure the reactor coolant pumps to prevent potential RCP seal LOCA, de-energize RC-MPMP-0001A, RC-MPMP-0001B, RC-MPMP-0002A, and RC-MPMP-0002B at local breakers in Fire Area TGB to terminate flow.	8-093 8-094	RA
TGB(1)	RC-MPMP-0001A RC-MPMP-0001B RC-MPMP-0002A RC-MPMP-0002B	Reactor Coolant Pumps	To secure the reactor coolant pumps to prevent potential RCP seal LOCA, de-energize RC-MPMP-0001A, RC-MPMP-0001B, RC-MPMP-0002A, and RC-MPMP-0002B at local breakers in Fire Area TGB to terminate flow. .	TGB-01	RA

(1) Recovery Action in TGB for fires in TGB is only credited in scenarios where the action is not impacted by the location of the fire.

Table G-1 includes all risk required Recovery Actions and the actions necessary to establish control at LCP-43 (which is the alternate shutdown panel and PCS). Not listed in G-1 are specific actions taken at the PCS to operate the plant and control the plant shutdown (i.e. actions such as to maintain secondary cooling, maintain steam generator level/pressure, and maintain pressurizer level).

Once control of the plant has been established at the PCS, operators will use available controls as dictated by operations procedures to maintain the plant in a safe and stable condition. The location of the fire and impact on specific equipment will determine which equipment and actions will be available to the operators. Site Emergency Response organizations will be aligned to support evaluation, planning, and performance of ongoing operating activities needed to maintain the plant in a safe and stable condition. Operation under these conditions presents a low-risk environment for maintaining safe and stable conditions as activities have shifted from immediate, time critical response actions to an evaluated and planned state of operation.

Attachment J – Fire Modeling V&V

Fire Modeling V&V

Plant specific fire modeling at WF3 in support of the Fire PRA consists of the following:

- The MCR abandonment calculation,
- Multi-compartment scenarios,
- Generic fire modeling treatments used as applicable to develop ZOIs, and
- Plant-specific detailed fire modeling of various scenarios.

Each area of fire modeling is briefly described below.

Main Control Room Abandonment

The goal of the MCR abandonment report is to compute the time operators would abandon the MCR using the NUREG/CR-6850 abandonment criteria. All calculations are performed using the two zone Consolidated Model of Fire Growth and Smoke Transport (CFAST) tool.

Generic Fire Modeling Treatments

Generic fire modeling treatments are used to establish ZOIs for specific classes of ignition sources and primarily serve as a screening calculation under NUREG/CR-6850, Sections 8 and 11. The generic fire modeling treatments are based on a collection of empirical and algebraic models and correlations performed using the first-order calculational methods of the Fire Dynamics Tools (FDTs) fire modeling tools.

Plant-Specific Fire Modeling Treatments

Plant-specific detailed fire modeling treatments are used to refine ZOI impacts for specific classes of ignition sources as well as to define the ZOI impacts for select PAUs in the fire PRA. This work also comes from NUREG/CR-6850, Section 11. The detailed fire modeling treatments are based on a collection of empirical and algebraic models and correlations performed using the first-order calculational methods of the FDTs fire modeling tools. Note that in addition to the tools and methods listed in the plant-specific fire modeling treatments discussed in Table J-3, the generic fire modeling treatments listed in Table J-2 are also applicable to the plant-specific fire modeling treatments. The generic treatments are not repeated in the plant-specific treatments.

Multi-Compartment Scenarios

The goal of the multi-compartment scenario report is to determine potential effects in adjacent plant locations to the various postulated fire sources. For retained multi-compartment scenarios, the ZOI of the ignition source is taken from the generic fire modeling or plant specific fire modeling as appropriate, with hot gas layer impacts being determined for the specific multi-compartment scenario. All hot gas layer temperature calculations are performed using the first-order calculational methods of the FDTs fire modeling tools or the CFAST tool.

See Tables J-1 through J-4 for more details of each fire modeling activity’s V&V basis.

Main Control Room Abandonment

Table J-1 V & V Basis for Fire Models / Model Correlations Used

Calculation	Application	V & V Basis	Discussion
Smoke Concentration or Visibility And Smoke Layer Height	Calculates the smoke concentration to estimate visibility criteria for MCR abandonment.	• NIST Special Publication 1041 • NIST Special Publication 1026 • NUREG-1824, Volume 5 • NUREG/CR-6850, Section 11	The V&V of CFAST specifically for Nuclear Power Plant applications has been documented in NUREG-1824. It was concluded that CFAST models the smoke concentration and layer height in an appropriate manner, and tends to over-predict the smoke concentration level, which is conservative. Abandonment criterion from NUREG/CR-6850 is used, which is considered realistic to slightly conservative. V&V of Version 6 of CFAST is also discussed in NIST Special Publication 1026.
Gas Temperature	Calculates the temperature at a specified elevation to estimate temperature criteria for MCR abandonment.	• NIST Special Publication 1041 • NIST Special Publication 1026 • NUREG-1824, Volume 5 • NUREG/CR-6850, Section 11	The V&V of CFAST specifically for Nuclear Power Plant applications has been documented in NUREG-1824. It was concluded that CFAST models the gas temperature in an appropriate manner. NUREG/CR-6850 abandonment criterion is used, which is considered realistic to slightly conservative. V&V of Version 6 of CFAST is also discussed in NIST Special Publication 1026.

Generic Fire Modeling Treatments

Table J-2 V & V Basis for Fire Models / Model Correlations Used

Calculation	Application	V & V Basis	Discussion
Plume Centerline Temperature (Method of Heskestad)	Calculates the vertical separation distance to a target in order to determine the vertical extent of the ZOI based on temperature.	• NUREG-1805, Chapter 9 • NUREG-1824, Volume 3 • SFPE Handbook, 4th Edition, Chapter 2 • NUREG/CR-6850, Appendix H	The correlation is used in the NUREG-1805 fire model, for which V&V was documented in NUREG-1824. The correlation is documented in an authoritative publication of the SFPE Handbook of Fire Protection Engineering. NUREG/CR-6850 generic screening damage criteria are used, which is considered conservative. The correlation is used within the limits of its range of applicability for most ignition sources. A few very low heat release rate (HRR) ignition sources lead to a Froude number that is slightly lower than the V&V range which means that the fire area (plume) from the ignition source fire could be larger than the fire source evaluated in the V&V study. This situation would lead to a greater amount of entrained air and a greater amount of combustion products released and generate a potentially higher gas temperature above the fire source as compared to a fire source with a smaller area and similar HRR that would fall within the V&V range. Also, having a lower Froude number indicates that the measured distances from the V&V study are greater than the ZOI distances which are nearer to the fire source.
Radiant Heat Flux (Point Source and Solid Flame 1 Methods)	Calculates the horizontal or radial separation distance to a target in order to determine the horizontal extent of the ZOI based on heat flux. These methods are used only to generate a comparison plot in the ZOI documentation, not for ignition source ZOI estimations.	• NUREG-1805, Chapter 5 • NUREG-1824, Volume 3 • SFPE Handbook, 4th Edition, Chapter 3 • NUREG/CR-6850, Appendix H	The correlation is used in the NUREG-1805 fire model, for which V&V was documented in NUREG-1824. The correlation is documented in an authoritative publication of the SFPE Handbook of Fire Protection Engineering. NUREG/CR-6850 generic screening damage criteria are used, which is considered conservative. The correlation is used only for a comparison plot in the ZOI documentation and therefore its use in the fire PRA as compared to its range of applicability is not required.

Table J-2 V & V Basis for Fire Models / Model Correlations Used

Calculation	Application	V & V Basis	Discussion
Radiant Heat Flux (Solid Flame 2 or Radiant Flame Method)	Calculates the horizontal or radial separation distance to a target in order to determine the horizontal extent of the ZOI based on heat flux.	• NUREG-1805, Chapter 5 • NUREG-1824, Volume 3 • SFPE Handbook, 4th Edition, Chapter 3 • NUREG/CR-6850, Appendix H	The correlation is used in the NUREG-1805 fire model, for which V&V was documented in NUREG-1824. The correlation is documented in an authoritative publication of the SFPE Handbook of Fire Protection Engineering. NUREG/CR-6850 generic screening damage criteria are used, which is considered conservative. The correlation is used within the limits of its range of applicability for most ignition sources. A few cases have a significantly low HRR to not produce a ZOI for particular target type and therefore no comparable ZOI dimension for the parameter calculations. A single case of exceeding the V&V range is due to the large ZOI dimension for sensitive electronics which is due to their lower failure criteria. A few cases that produce a value lower than the V&V range suggests that the ZOI distance is closer to the fire source (flames) compared to the V&V data results. More directly, if the ZOI distance was increased slightly, then the radial distance ratio would fall within the V&V range, however, the failure criteria for thermoset cables is high enough that the closer distances are appropriate for the FDT predictions. The estimated heat flux level at the ZOI distances are likely conservative due to the calculation process of the FDTs as noted in NUREG/CR-1824 and NUREG-1934.

Table J-2 V & V Basis for Fire Models / Model Correlations Used

Calculation	Application	V & V Basis	Discussion
Hot Gas Layer (Method of Beyler)	Calculates the hot gas layer temperature for a closed compartment with no ventilation for various ignition sources. Note that Revision 1 of this FDT spreadsheet is used, as is appropriate.	• NUREG-1805, Chapter 2 • NUREG-1824, Volume 3 • SFPE Handbook, 4th Edition, Chapter 3	The correlation is used in the NUREG-1805 fire model, for which V&V was documented in NUREG-1824. The correlation is documented in an authoritative publication of the SFPE Handbook of Fire Protection Engineering. The correlation is used within the limits of its range of applicability for the vast majority of scenarios. The WF3 fire PRA has compartment aspect ratios that fall outside the application range at both ends of the V&V range. This can be explained by the limited experiments selected for the validation study. As indicated in NUREG-1934, the selected experiments are representative of various types of spaces in commercial nuclear power plants, but do not encompass all possible geometries or applications. It is noted that both the MQH and Beyler room temperature models are reported to over predict room temperatures for most configurations in NUREG/CR-1824. This over prediction throughout the evaluated scenarios suggests that the configurations outside of the validation range will also result in temperature over predictions.

Table J-2 V & V Basis for Fire Models / Model Correlations Used

Calculation	Application	V & V Basis	Discussion
Plume Centerline Temperature for Wall or Corner Locations (Alpert-Ward Method)	Calculates the vertical separation distance to a target in order to determine the vertical extent of the ZOI based on temperature. Used for fire source locations adjacent to a wall or wall corner using HRR location factors of 2 for ignition sources located along a wall and a factor of 4 for ignition sources located in a wall corner.	• Evaluation of Unsprinklered Fire Hazards, Fire Safety Journal, Volume 7 • NUREG/CR-6850, Appendix L	The Alpert-Ward correlation as expressed and used in the WF3 fire PRA study uses a coefficient of 22 whereas the expression of Alpert's correlation for plume temperature in Appendix L of NUREG/CR-6850 uses a coefficient of 16.9, with all other portions of the calculation being equivalent between the two sources, thus the use of Alpert's correlation in this study is conservative when compared to the correlation as presented in NUREG/CR-6850. NUREG/CR-6850 also discusses the use of location factors of 1 for open areas and 2 for wall locations, consistent with the methodology used in this study with a factor of 2 for wall locations and a factor of 4 for corner locations. NUREG/CR-6850 generic screening damage criteria are used, which is considered conservative. The use of wall adjacent fire source location or wall corner fire source location results are used with engineering judgment should an ignition source be located directly adjacent to a wall or in a wall corner.

Table J-2 V & V Basis for Fire Models / Model Correlations Used

Calculation	Application	V & V Basis	Discussion
Radiant Heat Flux for Wall or Corner Locations (Solid Flame 2 or Radiant Flame Method)	Calculates the horizontal or radial separation distance to a target in order to determine the horizontal extent of the ZOI based on heat flux. Used for fire source locations adjacent to a wall or wall corner using HRR location factors of 2 for ignition sources located along a wall and a factor of 4 for ignition sources located in a wall corner.	• NUREG-1805, Chapter 5 • NUREG-1824, Volume 3 • SFPE Handbook, 4th Edition, Chapter 3 • NUREG/CR-6850, Appendix H	The correlation is used in the NUREG-1805 fire model, for which V&V was documented in NUREG-1824. The correlation is documented in an authoritative publication of the SFPE Handbook of Fire Protection Engineering. The correlation is used with an increase in the postulated HRR of 2x or 4x for a wall or wall corner location respectively which serves to conservatively assume all heat flux is radiated back into the fire location compartment from the wall or wall corner. NUREG/CR-6850 generic screening damage criteria are used, which is considered conservative. The use of wall adjacent fire source location or wall corner fire source location results are used with engineering judgment should an ignition source be located directly adjacent to a wall or in a wall corner. The oil source ZOIs are not used for wall or wall corner locations and therefore are not compared to the V&V parameters since the tool was not directly used in the fire PRA. The fixed source ZOIs are not used for wall corner locations as no cases of fixed ignition sources in corner locations were noted, and therefore are not compared to the V&V parameters since the tool was not directly used in the fire PRA. For fixed sources in wall locations, the correlation is used within the limits of its range of applicability for most ignition sources. A few cases have a significantly low HRR to not produce a ZOI for particular target type and therefore no comparable ZOI dimension for the parameter calculations. For transient sources the correlation is used within the limits of its range of applicability.

Plant-Specific Detailed Fire Modeling Treatments

Table J-3 V & V Basis for Fire Models / Model Correlations Used

Calculation	Application	V & V Basis	Discussion
Pool Fire Heat Release Rate (Method of Babrauskas)	Calculates the heat release rate of a liquid hydrocarbon fuel pool fire.	• NUREG-1805, Chapter 3 • NUREG-1824, Volume 3 • SFPE Handbook, 4th Edition, Chapter 3	The correlation is used in the NUREG-1805 fire model. The correlation is documented in an authoritative publication of the SFPE Handbook of Fire Protection Engineering. The correlation is not directly comparable to a dimensionless parameter but is used as inputs to the oil source ZOIs and HGLs which are compared to dimensionless parameters.
Pool Fire Burning Duration (Method of Babrauskas)	Calculates the burning duration of a liquid hydrocarbon fuel pool fire.	• NUREG-1805, Chapter 3 • NUREG-1824, Volume 3 • SFPE Handbook, 4th Edition, Chapter 3	The correlation is used in the NUREG-1805 fire model. The correlation is documented in an authoritative publication of the SFPE Handbook of Fire Protection Engineering. The correlation is not directly comparable to a dimensionless parameter but is used as inputs to the oil source ZOIs and HGLs which are compared to dimensionless parameters.
Pool Fire Flame Height (Method of Heskestad)	Calculates the flame height of a liquid hydrocarbon fuel pool fire.	• NUREG-1805, Chapter 3 • NUREG-1824, Volume 3 • SFPE Handbook, 4th Edition, Chapters 2 and 3	The correlation is used in the NUREG-1805 fire model, for which V&V was documented in NUREG-1824. The correlation is documented in an authoritative publication of the SFPE Handbook of Fire Protection Engineering. The correlation is used within the limits of its range of applicability.

Table J-3 V & V Basis for Fire Models / Model Correlations Used

Calculation	Application	V & V Basis	Discussion
Pool Fire Flame Height (Method of Thomas)	Calculates the flame height of a liquid hydrocarbon fuel pool fire.	• NUREG-1805, Chapter 3 • NUREG-1824, Volume 3 • SFPE Handbook, 4th Edition, Chapter 3	The correlation is used in the NUREG-1805 fire model, for which V&V was documented in NUREG-1824. The correlation is documented in an authoritative publication of the SFPE Handbook of Fire Protection Engineering. The correlation is used within the limits of its range of applicability.
Wall Flame Height (Method of Delichatsios)	Calculates the flame height of a liquid hydrocarbon fuel pool fire when the fuel pool is located against a wall. Used for one comparison case for fixed oil source flame height estimations.	• NUREG-1805, Chapter 4 • NUREG-1824, Volume 3 • SFPE Handbook, 4th Edition, Chapter 3	The correlation is used in the NUREG-1805 fire model. The correlation is documented in an authoritative publication of the SFPE Handbook of Fire Protection Engineering. The correlation is used within the limits of its range of applicability. The correlation is used only for a comparison height in the ZOI documentation and therefore its use in the fire PRA as compared to its range of applicability is not required.
Corner Flame Height (Method of Hesemi and Tokunaga)	Calculates the flame height of a liquid hydrocarbon fuel pool fire when the fuel pool is located in a wall corner. Used for one comparison case for fixed oil source flame height estimations.	• NUREG-1805, Chapter 4 • NUREG-1824, Volume 3 • Combustion Science and Technology, Volume 40	The correlation is used in the NUREG-1805 fire model. The correlation is documented in a publication of the ASME and Combustion Science and Technology as documented in NUREG-1805. The correlation is used within the limits of its range of applicability. The correlation is used only for a comparison height in the ZOI documentation and therefore its use in the fire PRA as compared to its range of applicability is not required.
Correlation for Heat Release Rates and Ignition Timing of Cable Fires (Method of Lee)	Used to correlate benchscale data to heat release rates from cable tray fires and estimate the ignition time of cable tray fires or secondary ignition of cable tray(s).	• NUREG/CR-6850, Appendix R • SFPE Handbook, 4th Edition, Chapter 3	The correlation is recommended by NUREG/CR-6850. The correlation is documented in an authoritative publication of the SFPE Handbook of Fire Protection Engineering. The correlation is used as instructed in NUREG/CR-6850 which is taken as being within its range of applicability.

Multi-Compartment Scenarios

Table J-4 V & V Basis for Fire Models / Model Correlations Used

Calculation	Application	V & V Basis	Discussion
Hot Gas Layer (Method of Beyler)	Calculates the hot gas layer temperature for a closed compartment with no ventilation for various ignition sources. Note that Revision 1 of this FDT spreadsheet is used, as is appropriate.	• NUREG-1805, Chapter 2 • NUREG-1824, Volume 3 • SFPE Handbook, 4th Edition, Chapter 3	The correlation is used in the NUREG-1805 fire model, for which V&V was documented in NUREG-1824. The correlation is documented in an authoritative publication of the SFPE Handbook of Fire Protection Engineering. The correlation is used within the limits of its range of applicability for the vast majority of scenarios. The WF3 fire PRA has compartment aspect ratios that fall outside the application range at both ends of the V&V range. This can be explained by the limited experiments selected for the validation study. As indicated in NUREG-1934, the selected experiments are representative of various types of spaces in commercial nuclear power plants, but do not encompass all possible geometries or applications. It is noted that both the MQH and Beyler room temperature models are reported to over predict room temperatures for most configurations in NUREG/CR-1824. This over prediction throughout the evaluated scenarios suggests that the configurations outside of the validation range will also result in temperature over predictions.
Hot Gas Layer Height (Using CFAST)	Calculates the height of the hot gas layer for use in assessing potential damage to equipment or cables.	• NIST Special Publication 1041 • NIST Special Publication 1026 • NUREG-1824, Volume 5 • NUREG/CR-6850, Section 11	The V&V of CFAST specifically for Nuclear Power Plant applications has been documented in NUREG-1824. It was concluded that CFAST models the smoke concentration and layer height in an appropriate manner. V&V of Version 6 of CFAST is also discussed in NIST Special Publication 1026.

Table J-4 V & V Basis for Fire Models / Model Correlations Used

Calculation	Application	V & V Basis	Discussion
Gas Temperature (Using CFAST)	Calculates the temperature of the hot gas layer for use in assessing potential damage to equipment or cables.	• NIST Special Publication 1041 • NIST Special Publication 1026 • NUREG-1824, Volume 5 • NUREG/CR-6850, Section 11	The V&V of CFAST specifically for Nuclear Power Plant applications has been documented in NUREG-1824. It was concluded that CFAST models the gas temperature in an appropriate manner. NUREG/CR-6850 generic screening damage criteria are used, which is considered conservative. Other plant-specific damage criteria are also used, as appropriate, and are documented in the WF3 fire PRA. V&V of Version 6 of CFAST is also discussed in NIST Special Publication 1026.

References

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3. Peacock, R., et al, CFAST-Consolidated Model of Fire Growth and Smoke Transport (Version 6) Technical Reference Guide, NIST Special Publication 1026, October 2011.
4. EPRI/NRC-RES Fire PRA Methodology for Nuclear Power Facilities, Volumes 1 and 2, Electric Power Research Institute (EPRI) and United States Nuclear Regulatory Commission (USNRC), EPRI 1008239 & NUREG/CR-6850, October 2004.
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7. Hasemi Y., and T.Tokunaga, *Some Experimental Aspects of Turbulent Diffusion Flames and Buoyant Plumes from Fire Sources Against a Wall and in Corner of Walls*, Combustion Science and Technology, Volume 40, 1984.
8. Alpert, R. and Ward, E., *Evaluation of Unsprinklered Fire Hazards*, Fire Safety Journal, Volume 7, 1984.
9. Mowrer, F., Spreadsheet Templates for Fire Dynamics Calculations, September 2003.

Attachment S – Plant Modifications and Implementation Items (with Completion Status)

Table S-1 identifies plant modifications to be completed and includes a description of the modifications along with the following information:

- A problem statement
- Risk ranking of the modification
- An indication if the modification is currently included in the Fire PRA
- Compensatory Measure in place, and
- A risk-informed characterization of the modification and compensatory measure

The following Legend should be used when reviewing the table:

- High = Modification would have an appreciable impact on reducing overall fire CDF.
- Med = Modification would have a measurable impact on reducing overall fire CDF.
- Low = Modification would have either an insignificant or no impact on reducing overall fire CDF.

Table S-1 Plant Modifications

Item	Rank	Problem Statement	Proposed Modification	In Fire PRA	Comp Measure	Risk Informed Characterization
S1-1		Deleted (Engineering Report WF3-FP-13-00001 Rev 2)				
S1-2		Deleted (LAR Supplement W3F1-2013-0048)				
S1-3		Deleted (LAR Supplement W3F1-2013-0048)				
S1-4		Deleted (LAR Supplement W3F1-2013-0048)				
S1-5	Low	In Fire Area RAB 6, PRA credits a qualified 1-hour fire resistance rating ERFBS fire wrap barrier from fire damage. <u>LAR Source</u>: Attachment A & C (NEI-04-02 Table B-1 VFDR 3.11.5 <u>STATUS</u>: ERFBS installed in RAB 6 via Work Orders 155876, 155870 & 155866.	Waterford 3 will install an ERFBS (3M barrier material) in Fire Area RAB 6 EC 10818 is currently in progress. This ERFBS modification will provide a qualified 1- hour fire resistance rating.	Yes	Yes	This modification is not a result of fire risk evaluations, but is assumed in the fire PRA model for Fire Area RAB 6. In accordance with station directives, compensatory measures per FP-001-015 have been established as appropriate.
S1-6		Deleted (LAR Supplement W3F1-2013-0048)				
S1-7		Deleted (RAI PRA 43f).				

Table S-1 Plant Modifications

Item	Rank	Problem Statement	Proposed Modification	In Fire PRA	Comp Measure	Risk Informed Characterization
S1-8	Med	NFPA 72E section 3-4.3 code non-compliance identified heat detectors in fire areas listed below have incorrect (lower temperature) factory set point trip range settings for the normal and accident design temperatures for the applicable fire areas. The following six fire areas and systems are identified below: 1) Diesel Generator A RM (Fire Area RAB 16; Room No. 221) 2) Diesel Generator B RM (Fire Area RAB 15; Room No. 222) 3) Turbine Lube Oil Tank (TGB Elevation +15). 4) Hydrogen Seal Oil Unit (TGB Elevation +40) 5) S/G Feed Water Pump A (TGB Elevation +15). 6) S/G Feed Water Pump B (TGB Elevation +15). <u>LAR Source:</u> Attachment A (NEI-04-02 Table B-1) VFDR 3.8.2-1 <u>STATUS</u>: Implemented via Engineering Change EC 36048. 1) Diesel Generator A RM (WO 386162 – installed and functionally tested) 2) Diesel Generator B RM (WO 386162 – installation in progress) 3) Turbine Lube Oil Tank (WO 386140 – installed and ready for testing) 4) Hydrogen Seal Oil Tank (WO 386140 – installed and ready for testing) 5) S/G Feed Water Pump A (WO 386140 – installed and ready for testing) 6) S/G Feed Water Pump B (WO 386140 – installed and ready for testing)	Waterford 3 will install a modification to remove existing fire detection heat detectors and add new (UL listed) heat detectors with factory set point trip settings as described below: DG-A & B Fire Areas RAB 15 & RAB 16 heat detectors (120 degrees F trip set point) will be replaced with new heat detectors with intermediate temperature class (175 to 249 degree F) in the two DG rooms. Two TGB fire areas heat detectors (135 degree F trip set point) will be replaced with heat detectors with intermediate temperature class (175 to 249 degree F) in the four TGB fire areas; Turbine Lube Oil Tank, Hydrogen Seal Oil Unit, S/G Feed Water Pump A, S/G Feed Water Pump B systems.	Yes	No	This modification is not a result of fire risk evaluations, but is assumed in the fire PRA model for the appropriate Fire Area detection systems. This modification will be completed to meet NFPA 805 Code requirements.

Table S-1 Plant Modifications

Item	Rank	Problem Statement	Proposed Modification	In Fire PRA	Comp Measure	Risk Informed Characterization
S1-9	Low	Trouble and ground fault signals from the following automatic sprinkler systems transmit dual signals which do not identify the correct sprinkler systems at the main control room fire alarm panel. These areas are listed below: 1) Unit Auxiliary Transformer 3A & Main Transformer 3A (Transformer Yard). 2) Unit Auxiliary Transformer 3B & Main Transformer 3B (Transformer Yard). 3) Turbine Lube Oil Tank (TGB Elevation +15; Sprinkler System FPM-5). 4) Hydrogen Seal Oil Unit (TGB Elevation +40, Sprinkler System FPM-6). 5) S/G Feed Water Pump B (TGB Elevation +15; Sprinkler System FPM-8). 6) Under Mezzanine Floor (TGB Elevation +15, Wet Pipe Sprinkler System FPM-10A). 7) Under Mezzanine Floor (TGB Elevation +15, Wet Pipe Sprinkler System FPM-10B). LAR Source: Attachment A (NEI-04-02 Table B-1) VFDR 3.8.1-1 STATUS: Implemented via Engineering Change EC 36048. All installed and ready for testing. WO 386167 for 1) and 2), and WO 386140; for 3) through 7).	Waterford 3 will install a modification to upgrade the fire alarm detection system to correct identified deficiencies. This modification affects the fire detection panel Cerberus/Pyrotronics (UL listed) transmitters.	No	No	The fire alarm signaling system is not credited in the Fire PRA. This modification will be completed to meet NFPA 805 Code requirements.

Table S-1 Plant Modifications

Item	Rank	Problem Statement	Proposed Modification	In Fire PRA	Comp Measure	Risk Informed Characterization
S1-10	Low	NFPA 20 section 626.f code non-compliance was identified for the Fire Pump Diesel Engine A & B start batteries. The batteries are installed on the floor in each diesel pump room which is subject to flooding via a water pipe rupture or water leak in one of the diesel pump rooms. <u>LAR Source</u>: Attachment A (NEI-04-02 Table B-1) VFDR 3.5.3-2 <u>STATUS</u>: Complete EC 36049 implemented via WO 386172	Waterford 3 will install a modification for a steel battery rack in accordance with site requirements that will elevate the batteries to protect them from potential flooding.	No	No	The subject flood protection of diesel fire pump battery bank is not credited in the Fire PRA. This modification will be completed to meet NFPA 805 Code requirements.
S1-11	Low	NFPA 20 section 514.e.2 code non-compliance was identified for the electrical fire pump motor. One phase of the three phase motor starter does not have the remote supervisory or monitor function to detect a cable fault, however locally in the fire pump house at the pump controller all three motor phases are locally supervised. <u>LAR Source</u>: Attachment A (NEI-04-02 Table B-1) VFDR 3.5.3-2 <u>STATUS</u>: Complete EC 36049 implemented via WO 386172	Waterford 3 will install or modify as necessary alarm supervisory relays and associated circuits for the 480VAC three phase electrical fire pump motor to provide the remote supervisory or monitor function to detect a cable fault.	No	No	The subject electrical fire pump motor remote supervisory circuit is not credited in the Fire PRA. This modification will be completed to meet NFPA 805 Code requirements.

Table S-1 Plant Modifications

Item	Rank	Problem Statement	Proposed Modification	In Fire PRA	Comp Measure	Risk Informed Characterization
S1-12	Low	NFPA 50A section 6-61.613 code non-compliance was identified in outdoor bulk hydrogen storage area. Electrical equipment, components, and installation methods are not in accordance with Article 501 of the National Electrical Code for Class I, Division 2. <u>LAR Source</u>: Attachment A (NEI-04-02 Table B-1) VFDR 3.3.7.1-1 <u>STATUS</u>: Complete EC 36047 implemented via WO 386032	Waterford 3 will install a modification to upgrade the electrical installation at the bulk hydrogen storage area to comply will Article 501 of the National Electrical Code for Class I, Division 2.	No	No	The subject outdoor bulk hydrogen storage area is not credited in the Fire PRA. This modification will be completed to meet NFPA 805 Code requirements.
S1-13	Low	NFPA 50A sections 4-42.423 and 8-82 code non-compliances were identified in outdoor bulk hydrogen storage areas. Ten plastic caps are installed on the top of each (hydrogen safety relief device ten total) vent pipe to prevent water and moisture from collecting and freezing in the winter that will interfere with proper operation of the device. Code section 4-42.423 requires the vent piping to be designed to prevent moisture from collecting and causing freezing of the safety relief devices; however code section 8-82 requires no combustible material within 15 feet of containers which includes the plastic caps. <u>LAR Source</u>: Attachment A (NEI-04-02 Table B-1) VFDR 3.3.7.1-1 <u>STATUS</u>: Complete EC 36047 implemented via WO 386032-02	Waterford 3 will install a modification to identify and replace the vent pipe caps with the correct material.	No	No	The subject outdoors bulk hydrogen storage area is not credited by the PRA. This modification will be completed to meet NFPA 805 Code requirements.

Table S-1 Plant Modifications

Item	Rank	Problem Statement	Proposed Modification	In Fire PRA	Comp Measure	Risk Informed Characterization
S1-14	High	The Waterford PRA analysis consider that the personnel offices and other combustible materials presently in Fire Area RAB 27 (RAB+7) needed to be removed to address the impact of potential fire scenarios. STATUS: Complete EC 50625 implemented under WO 383445	To offset a potential fire risk, the office contents and occupants will be moved or transferred to alternate locations and the area will be returned to an acceptable configuration, absent combustibles.	Yes	No	This configuration change is credited in the fire PRA model. The modification provides a decrease from the threat of the effects of a fire originating from a fire in RAB 27.
SI-15		Deleted (Engineering Report WF3-FP-13-00001 Rev 2)				

Table S-2, Items provided below are those items (procedure changes, process updates, and training to affected plant personnel) that will be completed prior to the implementation of new NFPA 805 fire protection program.

Table S-2 Implementation Items

Item	Description	LAR Section / Source
S2-1	Replace Fire Brigade Personal Alert Safety System devices with units that meet Fire Code NFPA 600 - 2000 Edition and NFPA 1982. STATUS: Complete (LRLAR-2011-00182-CA 31)	Attachment A (NEI-04-02 B-1 Table) VFDR 3.4.1(a)(1)-1
S2-2	Revise plant documents to include clear guidance that conduits used for electrical raceways shall be metal and thin walled metallic tubing shall not be used in accordance with the requirements of this section. Appropriate station electrical specifications will be updated to specify only metal tray and metal conduits shall be used for electrical raceways. Thin wall metallic tubing shall not be used for power, instrumentation, or control cables. STATUS: Plant document revisions specified in this table item are assigned and tracked by Waterford 3 LRLAR-2011-182 CA 9.	Attachment A (NEI-04-02 B-1 Table) VFDR 3.3.5.2
S2-3	Revise Bulk Hydrogen System vendor/plant documentation and perform periodic inspections and preventive maintenance in accordance with NFPA 50A. STATUS: Complete (CR-WF3-2011-06349 CA 3)	Attachment A (NEI-04-02 B-1 Table) VFDR 3.3.7.1-1
S2-4	Provide appropriate means to alert personnel for NFPA 50A Bulk Hydrogen System for all personnel on hazards of hydrogen flames. STATUS: Complete (CR-WF3-2011-06349 CA 5)	Attachment A (NEI-04-02 B-1 Table) VFDR 3.3.7.1-3
S2-5	Update Pre-Fire Strategies and necessary plant documents to: 1) Include a description of areas for flooding. 2) Identify areas containing redundant safe shutdown equipment susceptible to water damage from fire brigade fire suppression activities. 3) Revise fire brigade training plans to address judicious use of fire hose streams to limit water damage to redundant safe shutdown equipment. STATUS: Complete (LRLAR-2011-0182 CA 4 & WLP-FPFB-IFB01 Slide 161)	Attachment A (NEI-04-02 B-1 Table) VFDR 3.4.2.1 RAI FPE 15
S2-6	Revise plant test procedures to perform air flow tests on deluge sprinkler systems where it is not practical to perform full flow tests and document trip time for deluge system actuation. STATUS: Complete (CR-WF3-2011-06349 CA 28 & 42)	Attachment A (NEI-04-02 B-1 Table) VFDR 3.9.1(2)-2

Table S-2 Implementation Items

Item	Description	LAR Section / Source
S2-7	Revise plant documents to address concerns associated with equipment being taken out of service during NPO modes. This procedure revision will provide guidelines for actions to be taken in specific fire areas when components or system trains are taken out of service. For those fire areas where the credited KSF system or equipment has been taken out of service the following guidelines will be included in plant procedures. • Prohibition or limitation of hot work. • Prohibition or limitation of combustible materials, and/or • Establishment of additional fire watches as appropriate. Utilizing the above outlined approaches to alleviate the identified "pinch points," the credited KSFs can be maintained. STATUS: In Progress (LRLAR-2012-255 CA 46 & 49)	Attachment D
S2-8	Revise Entergy Procedure EN-DC-127, Control of Hot Work and Ignition Sources, and EN-DC-161, Control of Combustibles, to provide controls to limit the likelihood of a cable fire or a transient fire identified in the Defense in Depth Report WF3-FP-13-00004. STATUS: In Progress (CR-WF3-2014-0640 CA 14)	Attachment C
S2-9	Deleted (LAR Supplement W3F1-2013-0048)	
S2-10	Develop and implement the NFPA 805 monitoring program per NFPA 805 Section 2.6. STATUS: In Progress	LAR Section 4.6
S2-11	Develop Fire Protection Design Basis Document as described in NFPA 805, Section 2.7.1.2 and necessary supporting documentation as described in NFPA 805, Section 2.7.1.3. This is part of transition to 10 CFR 50.48(c) to ensure program implementation. A cross-reference to supporting documents will also be established. STATUS : Complete (LRLAR-2012-0255 CA 50)	LAR Section 4.7.1
S2-12	Revise the Configuration Control Procedures to reflect NFPA 805 licensing basis requirements. STATUS: Complete (LRLAR-2011-0182 CA 17)	LAR Section 4.7.2

Table S-2 Implementation Items

Item	Description	LAR Section / Source
S2-13	Several NFPA 805 document types such as: NSCA Supporting Information, Non-Power Mode NSCA Treatment, etc., generally require new control procedures and processes to be developed since they are new documents and databases created as a result of the transition to NFPA 805. The new procedures will be modeled after the existing processes for similar types of documents and databases. System level design basis documents will be revised to reflect the NFPA 805 role that the system components now play. This includes update of the Safe Shutdown Analysis. STATUS: In Progress WF3 CR 2014-0640 CA 14, LRLAR 2011-182 CA 36, LRLAR 2012-255 CA 48, , LRLAR 2012-255 CA 49	LAR Section 4.7.2 RAI SS 01.01
S2-14	Revise Entergy EN-DC-330, Fire Protection Program Procedures to reflect the applicable Quality Assurance requirements of NFPA 805, section 2.7.3[a1]. STATUS: In Progress (CR-WF3-2014-2029 CA 4)	LAR Section 4.7.3
S2-15	Post-transition, for personnel performing fire modeling or Fire PRA development and evaluation, Waterford 3 will develop and maintain qualification requirements for individuals assigned various tasks. Position Specific Guides will be developed to identify and document required training and mentoring to ensure individuals are appropriately qualified per the requirements of NFPA 805 Section 2.7.3.4 to perform assigned work. STATUS: Complete (FTK-ESPP-G00060 R5[DPO2])	LAR Section 4.7.3
S2-16	Revise plant administrative procedures/documents to require periodic inspection of transformer oil collection basins and drain paths to ensure that they are free of debris and capable of performing their design function. STATUS: In Progress (LRLAR-2011-0182 CA 32)	Attachment A (NEI-04-02 B-1 Table) VFDR 3.3.9-1
S2-17	Update the recovery action feasibility process against the criteria of FAQ 07-0030 including the incorporate of drills into the fire protection program to ensure all feasibility criteria in FAQ 07-0030 are addressed for NSCA and NPO recovery actions STATUS: In Progress (LRLAR-2011-0182 CA 36)	Attachment G, Step 4 Results RAIs SS 08.01, SS 12
S2-18	Develop or revise necessary plant procedures/documents to address requirements of NFPA 241, Section 5.1 for Thermit Welding and revise Engineering Report WF3-FP-10-00021 "WF3 Code Compliance Report for NFPA 51B" to include compliance with NFPA 241 "Safeguarding Construction, Alteration, and Demolition Operations" - 2000 Edition[a3]. STATUS: Complete (LRLAR-2011-0182 CA 22)	Attachment A (NEI-04-02 B-1 Table) VFDR 3.3.1.3.1
S2-19	Update the NSCA, engineering and PRA documentation to address transition to additional criteria in NEI 00-01, Revision 2. STATUS: Complete (LRLAR-2012-0255 CA 22 & 31)	RAI SS 02.01

Table S-2 Implementation Items

Item	Description	LAR Section / Source
S2-20	Following completion of updated FREs, evaluate revised list of Recovery Actions for feasibility using the criteria of FAQ-07-0030 and revise Attachments C, G, S and W. STATUS: Complete (W3F1-2013-0048)	RAIs SS 08.01, SS 13
S2-21	The FPRA has a mission time of 24-hours. Update plant procedures to satisfy the FPRA mission times for N_2 accumulators III, IV, V, VI, VII and VIII. STATUS: In Progress (LRLAR-2012-0255 CA 48)	LAR section 4.7.1
S2-22	Verify the validity of the reported change in risk subsequent to completion of all PRA-credited modifications, procedures updates, and implementation items confirms that the as-built, as-operated change-in-risk meets the risk acceptance guidelines using guidance in NUREG/CR-7150 Volume 2. STATUS: In Progress (LRLAR-2012-0255 CA 26 & 27)	4.8.2, RAI PRA S17