Exelon Generation®

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U.S. Nuclear Regulatory Commission
Washington, DC 20555-0001

Nine Mile Point Nuclear Station, Unit 1
Renewed Facility Operating License No. DPR-63
Docket No. 50-220

Subject: License Amendment Request Pursuant to 10 CFR 50.90: Adoption of NFPA 805, Performance-Based Standard for Fire Protection for Light Water Reactor Electric Generating Plants (2001 Edition) – Supplemental Information Regarding Fire PRA Model (TAC No. ME8899)

References: (1) Letter from K. Langdon (NMPNS) to Document Control Desk (NRC), dated June 11, 2012, License Amendment Request Pursuant to 10 CFR 50.90: Adoption of NFPA 805, Performance-Based Standard for Fire Protection for Light Water Reactor Electric Generating Plants (2001 Edition)

Nine Mile Point Nuclear Station, LLC (NMPNS) hereby transmits supplemental information in support of a previously submitted request for an amendment to Nine Mile Point Unit 1 (NMP1) Renewed Operating License DPR-63. The initial request, dated June 11, 2012 (Reference 1), proposed the adoption of a new risk-informed performance-based (RI-PB) fire protection licensing basis which complies with the requirements in 10 CFR 50.48(a) and 10 CFR 50.48(c); the guidance in Regulatory Guide (RG) 1.205, "Risk-Informed Performance-Based Fire Protection for Existing Light-Water Nuclear Power Plants," Revision 1; and National Fire Protection Association (NFPA) 805, "Performance-Based Standard for Fire Protection for Light Water Reactor Electric Generating Plants," 2001 Edition.

The supplemental information, provided in Attachment 1 to this letter, describes an error identified in the logic of the fire PRA and the actions taken by the station to correct the error. The attachment also contains a description of the extent of condition review and revised risk values. In an email from B. Varga (NMPNS) to B. Vaidya (NRC), NMPNS stated its intention to submit a letter with this information to the NRC staff by May 30th, 2014.

The supplemental information contained in this letter does not affect the No Significant Hazards Consideration Determination analysis provided by NMPNS in Reference (1). Pursuant to 10 CFR 50.91(b)(1), NMPNS is also providing a copy of this supplemental information to the appropriate state representative.

There are no regulatory commitments contained in this letter.

Should you have any questions regarding the information in this submittal, please contact Everett (Chip) Perkins, Director-Licensing, at (315) 349-5219.

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I declare under penalty of perjury that the foregoing is true and correct. Executed on May 23, 2014.

Sincerely,

Christopher R Costanzo

CRC/BTV

Attachment: (1) Supplemental Information Regarding Fire PRA Model

cc: Regional Administrator, Region I, USNRC
Project Manager, USNRC
Resident Inspector, USNRC
A. L. Peterson, NYSERDA

ATTACHMENT (1)

SUPPLEMENTAL INFORMATION REGARDING FIRE PRA MODEL

Introduction

On May 8th, 2014, Nine Mile Point identified a postulated fire event that could result in a hot short with the potential to adversely impact safe shutdown equipment. The issue was identified on a reactor water cleanup supply isolation valve and represents an unanalyzed condition with respect to the Appendix R analysis. The PRA group was engaged to determine the impact of the condition on the fire PRA model submitted as part of the NFPA 805 License Amendment Request. On May 14, 2014, an error in the top logic of the fire PRA CAFTA model was identified while quantifying the model for determining risk trends associated with equipment failures. The error resulted in the CDF and LERF of some fire PRA scenarios to be under-estimated. The condition was entered into the Nine Mile Point corrective action program as CR-2014-004858. This attachment describes the identified error, its impact in the fire PRA, and the activities performed to correct it. The following actions were immediately initiated in response to the condition:

- A review of the extent of condition of the error
- An evaluation of the impact of the error in the quantification results for CDF, LERF, delta CDF, and delta LERF.
- Implementation of error corrections in the Fire PRA
- Implementation of risk reduction activities to compensate for risk increases resulting from error corrections, and
- Review of the model changes implemented for error correction and risk reduction

The extent of condition review indicated that the error was localized to the top logic of the fire PRA model. Specifically, the logic was preventing propagation of a specific set of fire scenarios to the top of the fault tree. A series of cut set reviews were conducted to support this conclusion regarding the extent of condition. The error was corrected as follows:

- Added gates BOC-049 and BOC-050 under gate IE-BOC to fix the missing link for these sequences to the SBO model (CAFTA fault tree file top-sbo.caf).
- Added gate IS-SYS to gate LERF in Level 2 model (CAFTA fault tree file RB.caf) to capture containment isolation failure mode in the BOC model. This failure mode was missing from the "LOCA Outside Containment" failure modes.
- Added gate IE-HELBRB to top branch in "Location" node of BOC event tree (CAFTA event tree file et-boc.eta) to address a fire issue where sequences were biasing to IE-HELBTBM when conditions also satisfied a break in the reactor building (IE-HELBRB). Re-exported et-boc.eta to fault tree (et-boc.caf). Similarly, removed IE-BOC from et-TR.eta and re-exported et-TR.eta to fault tree (et-TR.caf).

The evaluation of the error impact in the quantification results indicated an increase in the plant baseline CDF, LERF, delta CDF, and delta LERF. Once the error was corrected, the plant CDF, LERF, and delta LERF values were still under the Reg. Guide 1.174 acceptable regulatory limits. However, the delta CDF values slightly exceeded the acceptable limit. Consequently, risk reduction activities as described below were performed in order to lower the delta CDF values under the acceptable limit.

A multidisciplinary team performed reviews of the error-correcting and risk-reducing model changes. The reviews included independent reviews by individuals who were not involved in performing the work and multidisciplinary cut set reviews.

Risk Reduction Activities

Three risk reduction activities were performed to reduce the delta CDF values. The risk reduction activities, as well as the extent of their impact in the Fire PRA model are described below.

1. Revised Circuit Failure Mode Probabilities

The NMP1 FPRA circuit failure probability estimates were originally based on Section 10 of NUREG/CR-6850, as modified by Supplement 1 of NUREG/CR-6850 and generic RAIs published by the NEI. A supplemental interim technical guidance letter issued by the NRC on February 12, 2014 (ML14017A084) provides updated recommended circuit failure guidance pending issuance of NUREG/CR-7150 Volume 2 for fire-induced circuit failure mode likelihood analysis. The guidance provides the latest information developed by the expert panel concerning all conditional probability estimates for hot short-induced spurious operation occurrence and spurious operation duration for control circuits. At the time of the interim guidance release, NMP1 prepared and documented a sensitivity study to assess the impact of the new circuit failure mode probabilities in the fire PRA. Although the results of the sensitivity analysis indicated a risk reduction, the baseline model was not updated. However, as part of the risk reduction activities described in this attachment, the revised circuit failure mode probabilities were incorporated into the baseline model as described next.

The interim guidance provides a method with corresponding data that is intended eventually to replace the current Option 1 method and data in NUREG/CR-6850. In addition to revised circuit failure probabilities, the interim technical guidance also provides estimated probabilities that hot shorts fail to clear as a function of duration of spurious operation due to fire-induced hot shorts for AC and DC control circuits. Some highlights of the guidance are provided below. The hot-short duration probabilities depend on how long a hot-short can be tolerated without ill effect. The greater the tolerable duration, the lower the probability of occurrence, up to a point. The following guidance is provided and was used as one of the risk reduction activities:

- For AC control circuits, the lowest probability recommended by the guidance (ML14017A135, Table 8) is 7.1E-03 after 9 or more minutes (which is a reduction from previous guidance of 1.0E-2 after 15 minutes or more).

- For DC control circuits, the lowest probability recommended by the guidance (ML14017A135, Table 8) is 2.2E-02 after 7 or more minutes (which is a newly available conditional probability).

2. Fault Tree Update

Once the error described earlier in this attachment was corrected, the full model was quantified and cut set reviews were conducted for identifying conservatism that could be removed to reduce the risk. The following changes were made to the model as a result of the cut set reviews:

- Added gate RWCU-MAN under gate IE-HELB-FIRE-SUCT in IE-BOC.caf to credit manual isolation of RWCU break. This had been credited in MLOCA (Gate IE-MLOCA-RWCU in TOP-LOCA.caf) and this action is similarly applicable in RWCU over-pressurization logic. This was a noted conservatism.
- The model has two HEPs to address Loss of RPS Buses. ZRP02 involves operators accessing the East-West instrument room to use mechanical level instruments or simply invoking RPV Flooding via EOPs. ZRP01 involves operators using the GEMAC

instruments when other instruments are failed. The model needs to "select" which of these two HEPs applies based on the scenario and the previous model was conservative. ZRP01 was included under the gate logic for ZRP02 so that it would satisfy the AND gate logic used for these events (Top-TR.caf). The better way to address this modeling is to explicitly include the ZRP02 failure probability in the ZRP01 basic event as a conditional event. Therefore, deleted the ZRP01 basic event under the ZRP02 logic and revised the ZRP01 basic event to include the ZRP02 failure probability dependency. Also, the fault tree logic included with this action was assumed failed if the emergency condensers (ECs) fail. This was done to credit additional time for operator response but it is not necessary to assume failure of the operators if the ECs fail. Operators can determine RPV level from the East and West Instruments rooms and EOPs require RPV flooding if RPV level is unknown. The ZRP01 and ZRP02 actions are calculated based on the boildown time if ECs are failed. Thus, deleted Gate "RPS-BUS-EQUIP" from under Gate "RPS-BUS-RESPONSE" in top-tr.caf.

- It was noted that some cutsets had EC failure due to operator depressurization along with separate failure-to-depressurize actions. Because these actions are mutually exclusive, including them simultaneously is unnecessarily conservative. Simultaneous occurrence was prevented in the model by introducing new flags and corresponding changes to the mutually exclusive (MEX) file. Added a flag (ZZZBLOW=1.0) under ZEC01_ANN gate to tag the situations where ECs are failed by procedurally required RPV depressurization. Added another flag (ZZZNOBLOW) under the ZOD01-11 gates to tag situations where operators fail to depressurize. Revised MEX file to eliminate these combinations in the same cutset.

3. Fire Scenario Frequency Update

The fire scenario frequency update consisted in reducing the frequency of the full zone damage scenario for Fire Zone T3A. Fire Zone T3A is a relatively large fire zone covering over one half of turbine building elevation 261. It should be noted that this elevation has large openings to upper elevations (including an "atrium" type opening to multiple higher elevations) in the turbine building, which prevents smoke from accumulating in the Fire Zone and allows smoke to migrate throughout the building. The frequency for this scenario was conservative as it included the contribution of a number of pumps that would not generate a hot gas layer in such a large/open fire zone and manual suppression credit assumed a relatively short time available for controlling the fire. Specifically, the frequency of this scenario was reduced by:

- Crediting the CFAST model results that were already documented in Appendix W of the NMP1 Fire Modeling Notebook N1-FSS-F001. The CFAST results show that a hot gas layer could be formed by a relatively large fire in approximately 25 minutes. It should be noted that the associated CFAST run conservatively does not credit any of the openings to upper elevations of the Turbine Building. Therefore, using a 25-minute time to hot gas layer is conservative.
- Ensuring that the hot gas layer scenario is only developed by relatively large oil fires generated by the main feed water pumps. This is achieved by crediting the severity factors for very large main feed water pump fires listed in Chapter 9 of Supplement 1 of NUREG/CR-6850.

The practical implication of the changes discussed above is a reduction in the frequency of fire scenario T3A-CMPT-9, which was among the top contributors to delta CDF and delta LERF.

While revising the frequency for scenario T3A-CMPT-9 (i.e., the full zone damage for Fire Zone T3A) as described above, it was noted that the severity factor for pump oil fires had not been updated to the latest guidance documented in the NRC letter "RECENT FIRE PRA METHODS REVIEW PANEL DECISIONS AND EPRI 1022993, "EVALUATION OF PEAK HEAT RELEASE RATES IN ELECTRICAL CABINET FIRES", dated June 21, 2012. Because the NFPA 805 LAR was submitted before the letter was issued, the model still had the severity factors that were developed for pump oil fires and are part of the original guidance in NUREG/CR-6850. The value was updated to the latest guidance resulting in a risk increase for pump scenarios throughout the model. However, because the pump scenarios were not among the top contributors, the risk increase in these scenarios did not affect compliance with regulatory risk limits. It should be noted that this severity factor update has no direct relationship to the error correction discussed in this attachment, but needed to be implemented in order to be consistent with the latest guidance available.

Updated PRA Results

The following table lists and compares the previously submitted risk values to the updated risk values resulting from the error correction and risk reduction activities described in this attachment. The influences of error correction and risk reduction resulted in only minor changes to the risk measures.

Table 1: Comparison of Updated and Previously submitted PRA values

	Updated PRA Values (1/Rx-yr)	Previously Submitted PRA Values (1/Rx-yr)
CDF	3.40E-05	2.68E-05
Delta CDF	9.65E-06	9.24E-06
LERF	2.97E-06	3.03E-06
Delta LERF	9.09E-07	7.23E-07

As indicated in the following table the total plant CDF and LERF are significantly less than 1E-04/rx-yr (for CDF) and 1E-05/rx-yr (for LERF), which are the upper CDF and LERF limit of Region II in Figures 4 and 5 of Regulatory Guide 1.174 Rev 2. The estimates of the total plant CDF and LERF, and the estimates of the plant delta CDF and delta LERF, also shown in the table below, maintain the plant within the acceptance guidelines given in Figure 4 and 5 of Regulatory Guide 1.174.

Table 2: Updated Plant Level Risk Contributor Summary and Fire-Induced Delta Risk

Event Type	CDF (/rx-yr)	LERF (/rx-yr)	Comment
Fire	3.40E-05	2.97E-06	Table 1
Internal Events (including internal flood)	2.59E-06	2.55E-07	
Seismic	1.07E-06	1.05E-06	
High Winds/Tornado	1.60E-06	7.60E-07	Source: NMP1 Report SAS-TR-96-001
Transportation	ε	ε	Source: NMP1 Report SAS-TR-96-001
Nearby Industrial Facilities	ε	ε	Source: NMP1 Report SAS-TR-96-001
Low Power and Shutdown States	Not Available	Not Available	—
Total	3.93E-05	5.04E-06	—
Delta Risk	9.65E-06	9.09E-07	Delta risk solely based on the scope of fire initiating events.

NOTE: The ε symbol used in the table designates risks that are insignificant.

Impact on NMP-1 NFPA 805 LAR

NMPNS believes that the error correction and risk reduction activities documented in this attachment have a minimal impact on the NMP-1 NFPA 805 LAR based on the following considerations:

1. Extent of Condition:
    a. The identified error is limited to the top logic of the Fire PRA model, and consequently, does not impact the deterministic (e.g., NSCA, Fire Protection, etc.) elements of the transition process.
    b. A third party independent review of the event trees in the model was conducted to ensure the extent of condition was limited to the top logic. As part of the review process, sensitivity analyses were conducted to verify impact of selected model changes resulting from the review process. The results of the sensitivity analyses verified the extent of condition by ensuring no changes in the risk values were produced by the corrected model.
    c. The model changes identified earlier do not change the risk profile and key risk insights for NMP1, which are documented in the latest Attachment W of the NFPA-805 LAR submitted to the US NRC. Once the error was corrected, but before implementing risk reduction activities, only the delta CDF slightly exceeded the regulatory limits (delta CDF of 1.03E-5). The baseline CDF, LERF and the delta LERF values were still under the regulatory thresholds. Consequently, although the risk values associated with the scenarios listed in the latest NFPA 805 LAR Attachment W may be different, risk insights and conclusions have not changed.
    d. Because NMP1 has considerable margin in the total plant CDF and LERF values, risk reduction activities were not required to reduce baseline CDF and LERF.

2. Risk Reduction Activities:

    a. No new methodology or analyses have been implemented as a risk reduction strategy. The model revisions are limited to the ones described in this attachment. These changes were identified based on the frequencies and cut sets associated with the top scenarios contributing to delta CDF and delta LERF. This is consistent with the process followed through the development of the Fire PRA at NMP1.

    b. The revised circuit failure mode probabilities were applied to existing basic events in the model. No new logic or basic events were introduced to incorporate the probabilities. That is, the original circuit failure mode probabilities were replaced with the corresponding new ones from the interim staff guidance.

    c. The CFAST analysis used for supporting the frequency reduction for scenario T3A-CMPT-9 was already documented and subjected to verification and validation analysis. That is, no new CFAST runs were developed as part of the risk reduction activities documented in this attachment. Given the need for risk reduction among the top delta CDF scenarios, this specific scenario was the best candidate to remove conservatisms from the fire frequency.

Summary

NMP identified an error in the top logic of the CAFTA model on May 14, 2014. Following the discovery, NMP performed an extent of condition review, corrected the error, and re-performed the risk quantification. After the error was corrected, the quantification process resulted in increased risk values from which the delta CDF slightly exceeded the regulatory limits specified in Reg. Guide 1.174. A series of risk reduction activities were implemented to reduce the delta CDF value to acceptable limits. The updated quantification results provided in Table 1 show that the risk values of CDF, LERF, delta CDF, and delta LERF are within the acceptable regulatory limits.