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

Peach Bottom Atomic Power Station, Units 2 and 3
Subsequent Renewed Facility Operating License Nos. DPR-44 and DPR-56
NRC Docket Nos. 50-277 and 50-278

Subject: Response to Request for Additional Information
License Amendment Request to Revise Technical Specifications to Adopt Risk Informed Completion Times TSTF-505, Revision 2, "Provide Risk-Informed Extended Completion Times - RITSTF Initiative 4b."

References:

1. Letter from David P. Helker, Exelon Generation Company, LLC, to the U.S. Nuclear Regulatory Commission, "License Amendment Request to Revise Technical Specifications to Adopt Risk Informed Completion Times TSTF-505, Revision 2, 'Provide Risk-Informed Extended Completion Times - RITSTF Initiative 4b,'" dated May 29, 2020 (ADAMS Accession No. ML20150A007).

2. Email from Jennifer Tobin, U.S. Nuclear Regulatory Commission, to David Helker, Exelon Generation Company, LLC, "Peach Bottom Units 2 and 3 - Request for Additional Information - TSTF-505 (EPID L-2019-LLA-0120)," dated January 12, 2021 (ADAMS Accession No. ML21012A130).

By letter dated May 29, 2020 (Reference 1), Exelon Generation Company, LLC (Exelon) requested approval for proposed changes to the Technical Specifications (TS), Appendix A of Subsequent Renewed Facility Operating License Nos. DPR-44 and DPR-56 for Peach Bottom Atomic Power Station (PBAPS), Units 2 and 3, respectively.

The proposed amendments would modify TS requirements to permit the use of Risk Informed Completion Times (RICT) in accordance with TSTF-505, Revision 2, "Provide Risk-Informed Extended Completion Times - RITSTF Initiative 4b," (ADAMS Accession No. ML18183A493).

By email dated January 12, 2021 (Reference 2), the NRC notified Exelon that additional information is needed to complete its review of the Reference 1 submittal. The attachment to this letter provides a response to the request for additional information contained in the Reference 2 email.

Exelon has reviewed the information supporting a finding of no significant hazards consideration, and the environmental consideration, that were previously provided to the NRC in the Reference 1 letter. Exelon has concluded that the information provided in this response does not affect the bases for concluding that the proposed license amendments do not involve a significant hazards consideration under the standards set forth in 10 CFR 50.92. In addition, Exelon has concluded that the information in this response does not affect the bases for concluding that neither an environmental impact statement nor an environmental assessment needs to be prepared in connection with the proposed amendments.

There are no regulatory commitments contained in this response.

In accordance with 10 CFR 50.91, "Notice for public comment; State consultation," paragraph (b), Exelon is notifying the Commonwealth of Pennsylvania of this response to a request for additional information by transmitting a copy of this letter and its attachment to the designated State Official.

Should you have any questions concerning this submittal, please contact Glenn Stewart at (610) 765-5529.

I declare under penalty of perjury that the foregoing is true and correct. Executed on the 4th day of February 2021.

Respectfully,

David P. Helker
Sr. Manager, Licensing and Regulatory Affairs
Exelon Generation Company, LLC

Attachment:
Response to NRC Request for Additional Information

cc:	USNRC Region I, Regional Administrator	w/ attachment
	USNRC Project Manager, PBAPS	"
	USNRC Senior Resident Inspector, PBAPS	"
	Director, Bureau of Radiation Protection - Pennsylvania Department of Environmental Protection	"
	S. Seaman - State of Maryland	"

ATTACHMENT

License Amendment Request

Peach Bottom Atomic Power Station, Units 2 and 3
Docket Nos. 50-277 and 50-278

Revise Technical Specifications to Adopt Risk Informed Completion Times TSTF-505, Revision 2, "Provide Risk-Informed Extended Completion Times - RITSTF Initiative 4b."

Response to NRC Request for Additional Information

References:

1. Letter from David P. Helker, Exelon Generation Company, LLC, to the U.S. Nuclear Regulatory Commission, "License Amendment Request to Revise Technical Specifications to Adopt Risk Informed Completion Times TSTF-505, Revision 2, 'Provide Risk-Informed Extended Completion Times - RITSTF Initiative 4b,'" dated May 29, 2020 (ADAMS Accession No. ML20150A007).

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By email dated January 12, 2021 (Reference 2), the NRC notified Exelon that additional information is needed to complete its review of the Reference 1 submittal. This attachment provides a response to the request for additional information (RAI) contained in the Reference 2 email. NOTE: The NRC staff’s questions are in italics throughout this attachment to distinguish from the Exelon responses.

RAI #1

The Nuclear Energy Institute (NEI) Topical Report NEI 06-09, Revision 0-A, "Risk-Informed Technical Specifications Initiative 4b, Risk-Managed Technical Specifications (RMTS) Guidelines, Industry Guidance Document," dated November 2006 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML122860402) (hereafter NEI 06-09-A), and the U.S. Nuclear Regulatory Commission (NRC) Final Safety Evaluation for NEI 06-09-A, dated May 17, 2007 (ADAMS Accession No. ML071200238), specify that the license amendment request (LAR) should identify key assumptions and sources of uncertainty and should assess/disposition each as to its impact on the RMTS application.

Section 2.3.4 of NEI 06-09-A states that sensitivity studies should be performed on the base probabilistic risk assessment (PRA) model prior to initial implementation of the RMTS program on uncertainties that could potentially impact the results of an risk-informed completion time (RICT) calculation. NEI 06-09-A also states that the insights from the sensitivity studies should be used to develop appropriate risk management actions (RMAs), including highlighting risk-significant operator actions, confirming availability and operability of important standby equipment, and assessing the presence of severe or unusual environmental conditions. Uncertainty exists in the PRA modeling of Flexible Mitigation Strategies (FLEX) related to the equipment failure probabilities for FLEX equipment used in the model, the corresponding operator actions, and pre-initiator failure probabilities. Therefore, FLEX modeling *assumptions can be key assumptions and sources of uncertainty for the RICTs proposed in this application.*

In response to a question raised during the regulatory audit held on November 9, 2020 (APLA audit Question 05), the licensee provided in the LAR supplement dated December 2, 2020, (ADAMS Accession No. ML20337A301) sensitivity study results in Table 5.b.ii-2 that estimated the RICTs for increased FLEX equipment failure rates and individual and combined FLEX human error probabilities (HEPs). In this sensitivity study, the licensee used the 95th percentile values for the individual and combined FLEX HEPs to provide bounding realistic estimates, which seems appropriate. The licensee concluded in the response that the RICT is not sensitive to the uncertainties associated with FLEX equipment failure rates and FLEX HEPs, and based on the results of the sensitivity study, no specific global RMAs were identified related to FLEX operator actions. However, the NRC staff notes that the sensitivity study results in Table 5.b.ii-2 show significant decreases in RICT times of 43 and 20 percent for Technical Specifications (TS) limiting conditions for operation (LCOs) 3.8.1.D (inoperability of two or more offsite AC power circuits) and 3.8.1.E (inoperability of one offsite AC power circuit and one emergency diesel generator), respectively. Therefore, the basis for the licensee's conclusion regarding this sensitivity study is unclear. Given the significant impact on RICTs regarding TS LCOs 3.8.1.D and 3.8.1.E, it is unclear to the NRC staff how the source of uncertainty associated with FLEX HEPs will be addressed in the RMTS program for these LCOs. The NRC staff notes that the sensitivity study does not address the other proposed RICT TS LCOs and plant configurations with multiple LCO entries; therefore, it is unclear what the impact of this uncertainty is on the remaining proposed RICT TS LCOs and how this uncertainty will be addressed in the RMTS program for these LCOs.

Furthermore, part (b)(ii)(1) of the response to APLA audit Question 05 states that methods provided in Electric Power Research Institute (EPRI) Report 3002013018, "Human Reliability Analysis (HRA) for Diverse and Flexible Mitigation Strategies (FLEX) and Use of Portable Equipment: Examples and Guidance," dated November 2018, were used to analyze the transportation of portable equipment, installation of equipment, and routing of hoses and cables. It is noted that this EPRI report is not approved by the NRC staff. Also, the response identifies for two FLEX human failure events that multiple executable operator actions were analyzed as a single surrogate value instead of explicitly analyzing each action, which is not in accordance with accepted HRA methods. Therefore, the use of these methods appears to introduce additional uncertainty related to the credit for FLEX operator actions. In light of the above observations, provide the following information.

a) Discuss whether the RICTs for other TS LCOs (i.e., those in scope of the RMTS program but not evaluated in Table 5.b.ii-2 of the LAR supplement) and for plant configurations involving more than one LCO entry are significantly impacted by FLEX HEP uncertainties. For those TS LCOs that are significantly impacted by this source of uncertainty, identify the LCOs and how this source of uncertainty impacts the RICT (e.g., describe and provide the results of a sensitivity study). Also, discuss the basis for the chosen plant configurations involving more than one LCO entry.

b) For TS LCOs 3.8.1.D and 3.8.1.E, and other TS LCOs determined in part (a), above, to be significantly impacted by FLEX HEP uncertainties, address either (i) or (ii) below:

i. Describe how sources of uncertainty associated with FLEX HEPs will be addressed in the RMTS program. For those TS LCOs in LAR Enclosure 12 ("Risk Management Action Examples") and in the response to EEEB audit Question 05 ("RMA Examples") of the LAR supplement that are significantly impacted by FLEX HEP uncertainties (e.g., TS LCO 3.8.1.D in Section 4.1.3 of LAR Enclosure 12), provide updated RMAs that may be considered during a RICT Program entry to minimize any potential adverse impact from FLEX HEP uncertainties, and explain how these RMAs are expected to reduce the risk associated with this source of uncertainty.

OR

ii. Provide a detailed justification that the sensitivities of the computed RICTs to FLEX HEP uncertainties do not need to be addressed in the RMTS program as required by Section 2.3.4 of NEI 06-09-A.

Response

Item a)

The Peach Bottom RICT LAR Submittal [1] and Supplement [2] identified LCOs (3.8.1.D and 3.8.1.E) where RICT results were impacted by FLEX sensitivities which set the FLEX equipment basic event values to a factor of 5x and increased the FLEX Human Failure Events (HFEs) to their 95th percentile values (and in some cases by a factor of 10x). These LCOs have the following condition statements and PRA model configurations as quantified in the Supplement [2]:

TS LCO 3.8.1.D - two or more offsite circuits inoperable

- 2 Startup (2SU) Transformer Switchgear unavailable and 343SU Transformer Switchgear unavailable (both set to TRUE in PRA quantifications).

TS LCO 3.8.1.E - one offsite circuit inoperable AND one DG inoperable

- 2SU Transformer Switchgear unavailable (basic event set to TRUE in PRA quantifications), AND
- a diesel generator (DG) unavailable (calculated RICTs to obtain results with each DG unavailable, where the DG basic event is set to TRUE in PRA quantifications).

Initially, the configuration settings quantified for these LCOs in the LAR Submittal and Supplement sample calculations were considered to be a conservative configuration that the site could be in when entering the LCO. The conservative assumptions for these cases are that the site entered emergent RICTs due to equipment unavailability as opposed to inoperability (where equipment is considered available). Additionally, the normal breaker alignment at the plant was used in these PRA model quantifications as it was assumed that there was no time for breaker realignment to any available SU Transformer Switchgear given the emergent RICT entry. Note that the equipment that is unavailable is set to TRUE in the PRA model whereas equipment that is identified as inoperable (but available) may not be set to TRUE in the PRA model for RICT calculations.

Further inspection identified that when the 2SU and 343SU Transformer Switchgear sources are unavailable, no power is provided to both the 00A19 and 00A20 4kV buses and therefore the plant would trip and the RICT program would not apply. This was also confirmed during a

PBAPS operator interview held on January 15, 2021 [3]. During this interview, more reasonable, yet likely conservative, configurations were identified as the appropriate sample cases to quantify for LCOs 3.8.1.D and 3.8.1.E. A summary of these results is provided in Table 1a. For the purposes of this RAI response, these representative cases calculate new RICT base LCO results that are used to compare to the new FLEX sensitivity cases which focus on the FLEX HEP uncertainties.

Circuits are defined as qualified offsite circuits consisting of all breakers, transformers, switches, interrupting devices, cabling, and controls required to transmit power from the offsite transmission network to the onsite Class 1E emergency bus or buses. Table 1a defines "Circuit 1" as that using the 00A19 4kV emergency bus and "Circuit 2" as that using the 00A20 4kV emergency bus. For each LCO, there are many different plant configurations that are possible which would allow entrance into the RICT program. These different configurations are a result of a variety of equipment (or combination of equipment) being either unavailable (set to TRUE in the PRA model quantifications) or inoperable but available (not set to TRUE in the PRA model quantifications). The plant configurations identified in Table 1a were quantified using the PRA model with the conservative assumption that the buses identified become unavailable due to an emergent issue and, therefore, the PRA model configuration for these cases includes the normal breaker alignments from the SU Transformer Switchgear (00A03, 00A09, and 00A04) to the Unit Auxiliary Switchgear (20A01, 20A02, 30A01, and 30A02). These represent conservative sample calculation results as a reasonable plant configuration would likely be a planned unavailability of a SU Transformer Switchgear where the breakers are realigned to the appropriate switchgear or where the SU Transformer Switchgear that is inoperable would still be available (may not be failed for purposes of the PRA model RICT calculation).

The FLEX sensitivities performed for the LAR Supplement [2] and this RAI have slightly different sensitivity case settings applied. The LAR Supplement [2] sensitivity cases quantified in response to 5.b.ii set the FLEX equipment basic events to 5x their nominal failure probabilities. However, during the PBAPS RICT RAI Clarification Call [4] that was held via teleconference on January 8, 2021, it was discussed that the operator actions were the focus of the FLEX uncertainty and therefore the FLEX equipment basic event failure probabilities could be set back to their nominal values (as opposed to 5x their nominal values) for the purposes of the FLEX sensitivities run for this RAI response. Additionally, some of the FLEX related Joint HEPs (JHEPs) were set to a value of 10x in the LAR Supplement sensitivity cases quantified in response to 5.b.ii and were re-evaluated for the sensitivities run in this RAI response to calculate a more appropriate 95th percentile value using the mean probability and error factor for a lognormal distribution. As a result, the probabilities for some of the FLEX related JHEPs were reset to a factor of 3.75x of their nominal value for the purposes of this sensitivity (instead of 10x) which is consistent with the 95th percentile value for those JHEPs.

The results provided in Supplement [2] Table 5.b.ii-2 show that 3.8.1.D and 3.8.1.E were the only LCOs evaluated in the LAR Supplement [2] where RICT estimates were affected by the FLEX sensitivity. Therefore, RICT estimates for LCOs 3.5.1.C, 3.6.2.3.A, 3.8.1.A, and 3.8.1.B were not recalculated for the purposes of this RAI response as the new FLEX sensitivity performed no longer includes the 5x factor of FLEX equipment probabilities and as a result will have less impact to the original RICT estimate for each LCO.

The LCOs in the scope of the RMTS program but not evaluated in Table 5.b.ii-2 of the LAR Supplement [2], were investigated further to determine if there were any that had core damage frequency (CDF) or large early release frequency (LERF) results that were significantly impacted by the contribution from the FLEX HEPs (10% or greater). The base importance measures from the LCO cases were reviewed and additional LCOs were selected for further evaluation. In addition to cases that had a significant impact, cases where FLEX HFE Fussell-Vesely values (FVs) were slightly below the 10% RMA criteria were chosen to confirm that the RICT estimates would not change significantly. RICT estimates for these LCOs were calculated with the FLEX HEPs and JHEPs at their 95^{th} percentile values (similar sensitivity to that quantified in Table 1a below). The comparison between the RICT estimates for the base LCO case and the FLEX sensitivity case are provided in Table 1b below.

Table 1a: Example RICT Calculations for LCOs 3.8.1.D and 3.8.1.E

Tech Spec	TS Condition	Case	Plant Configuration (1,2)	Inoperable Offsite AC Power Circuits(3)	LAR Supplement [2] Results			RAI Results		
					Base RICT Estimate (days)	FLEX Sens RICT Estimate (days)	% Chg	Base RICT Estimate (days)	FLEX Sens RICT Estimate (days)	% Chg
3.8.1.D	Two or more offsite AC power circuits inoperable	1	2SU (UA) 343SU (UA)(4)	Circuit 1 Circuit 2	15.4	8.8	43%	15.4	11.6	24%
		2	2SU (UA) 3SU (UA) 343SU (INOP)	Circuit 1 Circuit 2	--	--	--	7.5	6.4	15%
		3	2SU (INOP) 3SU (UA) 343SU (UA)	Circuit 1 Circuit 2	--	--	--	30.0	30.0	0%
3.8.1.E	One offsite AC power circuit AND one DG inoperable	4	2SU (UA) DG (UA)	Circuit 1	25.7	20.6	20%	25.7	25.1	3%
		5	343SU (UA) DG (UA)	Circuit 2	--	--	--	19.2	18.8	2%

Notes:

1. Plant configuration definitions:
    a. UA – Unavailable (failed in PRA model case quantification)
    b. INOP – inoperable but available (not failed in PRA model case quantification)
2. Equipment descriptions:
    a. 2SU – Offsite Power Supply 1: 230 kV Nottingham-Cooper line, normal offsite power supply to 2SU-E circuit
    b. 3SU – Offsite Power Supply 2: North Substation 500/230 kV auto-transformer line, alternate offsite power supply to 2SU-E / 3SU-E circuits
    c. 343SU - Offsite Power Supply 3: North Substation 230 kV Peach Bottom-Newlinville line, normal offsite power supply to 3SU-E circuit
3. Circuit definitions:
    a. Circuit 1 – utilizes the 00A19 4kV emergency bus
    b. Circuit 2 – utilizes the 00A20 4kV emergency bus
4. The 2SU and 343SU being unavailable with normal breaker alignments satisfies the LCO entry condition requirement of two offsite AC power circuits being inoperable. However, this configuration leads to a plant trip as both the 4kV emergency buses 00A19 and 00A20 are unavailable and therefore the RICT program does not apply. The RICT for this configuration was re-calculated using the new FLEX sensitivity settings for purposes of comparison to the LAR Supplement results only.

Table 1b: Additional Example RICT Calculations Evaluated for FLEX Sensitivity Impact

Tech Spec	TS Condition	Case	Plant Configuration (1)	RAI Results		
				Base RICT Estimate (days)	FLEX Sens RICT Estimate (days)	% Chg
3.3.5.1.D	One or more required channels inoperable as required by Action A.1 and referenced in Table 3.3.5.1-1 – HPCI CST low level and Suppression Pool high level	6	Level Switch (UA)	30.0	30	0%
3.6.1.2.C	Primary containment air lock inoperable for reasons other than Condition A (door) or B (mechanical interlock)	7	Containment Pathway (UA)	17.2	17.1	1%
3.8.4.A(2)	One Unit 3 DC electrical power subsystem inoperable due to performance of SR 3.8.4.7 or SR 3.8.6.6	8a	Battery (UA)	8.2	8.2	0%
		8b	Battery (UA)	33.7(3)	22.9	32%
3.8.7.A	One or more required Unit 3 AC electrical power distribution subsystems inoperable	9	4kV AC Bus (UA)	27.7	26.4	5%

Notes:
HPCI – High Pressure Coolant Injection
CST – Condensate Storage Tank

1. Plant configuration definitions:
    a. UA – Unavailable (failed in PRA model case quantification)
    b. INOP – inoperable but available (not failed in PRA model case quantification)
2. Multiple quantifications were performed to evaluate different plant configurations that could enter this LCO. The Case 8a LCO results are the limiting RICT estimates provided in the PBAPS RICT LAR Submittal [1] for TS 3.8.4.A. When quantifying the Case 8b plant configuration in the PRA model, the FLEX HEPs have a significant contribution to the PRA model results and therefore this configuration was chosen as a representative case to analyze with the modified FLEX HEPs.
3. The RICT estimate for the base LCO case for 8b reaches the 30-day backstop but the calculated RICT beyond 30 days is provided to analyze the actual percent change to the RICT when quantifying the FLEX sensitivity.

The results in Table 1a show that the plant configurations modeling the LCO conditions of TS 3.8.1.D and 3.8.1.E combined with removal of some of the over-conservatisms in the original sensitivity cases (as provided in the LAR Supplement [2]) produce RICT estimates that are much less affected by the FLEX sensitivities. Table 1a shows that the percent change to the RICT estimate is 15% for the plant configuration defined in "Case 2" (2SU UA, 3SU UA, 343SU INOP). While this result indicates that the FLEX HEP uncertainties have an impact on the RICT estimate, it should be noted that this quantification is an example conservative representation of the plant configuration that could enter this LCO (equipment unavailable and normal breaker alignments). A similar configuration allowing entrance to this RICT would be with equipment inoperable (but available) leading to the circuits being declared inoperable (but available). In this configuration, the PRA model quantifications may not set the equipment basic events to TRUE (depending on the PRA functionality review) and there could be enough time for the appropriate breaker alignments.

The RICT estimates for "Case 2" are being driven by Full Power Internal Events (FPIE) results. A review of the FPIE PRA CDF and LERF base importance measures for this case shows that the sum of the FLEX HFE FVs would be greater than 10% in both the LCO base case and sensitivity case. Therefore, the importance of the FLEX actions would be identified per the existing RMA process when evaluating the base LCO case importance measures for RMA development. See the response to Item b) of this RAI response for additional details on RMAs.

The RICT estimates presented in Table 1b for Cases 6, 7 and 9 were reduced by 5% or less when calculating the FLEX HEPs at their 95th percentile. While these impacts to RICT estimates are not considered significant, a review of the base LCO cutset importance measures shows that the FLEX HFE FV contribution either exceeds or is close to the 10% threshold and, therefore, the RMTS program RMA development process may initiate the creation of FLEX RMAs for these specific plant configurations.

The FLEX HEPs contribute to the FPIE PRA CDF results for Case 7 (LCO 3.6.1.2.C – containment air lock inoperable) although the Fire PRA (FPRA) LERF results drive the RICT estimate in both the base LCO and sensitivity cases provided in Table 1b. Therefore, the FLEX sensitivity impact on the FPIE CDF results is lessened by the impact from the containment air lock inoperability on the FPRA LERF model. Case 9 (LCO 3.8.7.A – AC electrical power distribution subsystems inoperable) is similar to Case 7 in that the base case FPIE CDF results have a large contribution from the FLEX HEPs although the FPRA results are not significantly impacted by the FLEX HEPs. Additionally, the FPRA CDF results drive the RICT estimate in both the base LCO and sensitivity cases provided in Table 1b. Therefore, the FLEX sensitivity impact on the FPIE CDF results is lessened by the impact from the LCO plant configuration on the FPRA CDF model results.

Multiple quantifications were performed to evaluate the different plant configurations that could enter LCO 3.8.4.A (identified as Cases 8a and 8b in Table 1b). The specific plant configuration that has the most significant FLEX HEP FV contribution is identified as Case 8b and reaches the RICT backstop of 30 days. The large FLEX HEP contribution in Case 8b is specific to the FPIE and Fire PRA CDF results and as shown in Table 1b, the FLEX sensitivity has an impact on the overall RICT estimates. The importance of the FLEX actions would be identified per the existing RMA process when evaluating the LCO base case importance measures for RMA development.

The plant configuration for LCO 3.8.4.A with the most limiting RICT estimate (8.2 days as reported in the PBAPS RICT LAR Submittal [1]) was also selected as a representative case to assess the impact from the FLEX sensitivity. This case is identified as 8a in Table 1b. Based on review of the Case 8a importance measures, the FLEX HEPs do not have a significant contribution to the overall results and therefore would not meet the FV criteria for RMA development. The FLEX sensitivity quantified for case 8a did not have much impact on the RICT estimate which is consistent with FLEX HEPs having a small contribution given this plant configuration.

Given the results from the numerous examples provided in Tables 1a and 1b, it can be concluded that the RMTS program RMA development process accounts for the potential uncertainty regarding the FLEX HFEs. See the response to Item b) of this RAI response for additional details on RMAs.

Further evaluations were performed to assess the impact to RICT estimates given plant configurations involving multiple LCO entries and which include LCOs 3.8.1.D or 3.8.1.E. When considering additional LCOs, the scope was limited to a manageable set of LCOs that involve a single train or loop of a system. Note that additional electrical LCOs were not considered as the emergent RICT entries for LCOs 3.8.1.D and 3.8.1.E already evaluate conservative plant configurations for the electrical systems. The additional set of LCOs evaluated in addition to 3.8.1.D and 3.8.1.E are presented in Table 2 below.

Table 2: Example RICT Calculations for Multiple LCOs Involving 3.8.1.D and 3.8.1.E

Tech Spec	TS Condition	Case(1)	Additional LCO	Additional TS Condition	Plant Configuration(2)	Base RICT Estimate (days)	FLEX Sensitivity RICT Estimate (days)	% Change
3.8.1.D	Two or more offsite AC power circuits inoperable	2	--	--	--	7.5	6.4	15%
		2a	3.5.1.C	HPCI System inoperable.	HPCI (UA)	4.9	4.4	10%
		2b	3.5.3.A	RCIC System inoperable.	RCIC (UA)	2.8(3)	2.6(3)	6%
		2c	3.6.2.3.A	One RHR suppression pool cooling subsystem inoperable.	RHR Loop A (UA)	6.0	5.1	16%
		2d	3.6.2.3.A	One RHR suppression pool cooling subsystem inoperable.	RHR Loop B (UA)	1.5(3)	1.3(3)	15%
		3	--	--	--	30.0	30.0	0%
		3a	3.5.1.C	HPCI System inoperable.	HPCI (UA)	24.2	24.0	1%
		3b	3.5.3.A	RCIC System inoperable.	RCIC (UA)	25.8	25.6	1%
		3c	3.6.2.3.A	One RHR suppression pool cooling subsystem inoperable.	RHR Loop A (UA)	30.0	30.0	0%
		3d	3.6.2.3.A	One RHR suppression pool cooling subsystem inoperable.	RHR Loop B (UA)	27.9	27.2	2%
3.8.1.E	One offsite AC power circuit AND one DG inoperable	4	--	--	--	25.7	25.1	3%
		4a	3.5.1.C	HPCI System inoperable.	HPCI (UA)	11.2	11.1	1%
		4b	3.5.3.A	RCIC System inoperable.	RCIC (UA)	12.1	12.0	1%
		4c	3.6.2.3.A	One RHR suppression pool cooling subsystem inoperable.	RHR Loop A (UA)	18.9	18.2	4%
		4d	3.6.2.3.A	One RHR suppression pool cooling subsystem inoperable.	RHR Loop B (UA)	13.9	13.3	4%

Notes:
RCIC – Reactor Core Isolation Cooling
RHR – Residual Heat Removal

1. See Table 1a for the specific plant configuration of the respective 3.8.1.D and 3.8.1.E LCO cases.
2. In addition to the plant configuration identified in Table 1a, these cases also include the plant configuration identified in this column to reflect the FLEX uncertainty impact on multiple LCO conditions.
3. Voluntary entrance into the configuration would be prohibited given the RICT quantitative CDF (≥ 1E-03 / yr) or LERF (≥ 1E-04 / yr) criteria outlined in NEI 06-09 [6].

Consistent with the Table 1a results, Table 2 identifies that the RICT estimates for multiple LCO cases quantified using "Case 2" as the starting plant configuration are impacted the most by the FLEX HFE sensitivity. As discussed previously, the "Case 2" base case RICT estimates are driven by FPIE results. However, when adding additional LCOs (Cases 2a, 2b, 2c and 2d), both the FPIE and FPRA results drive the RICT estimates. The CDF and / or LERF base case importance measures for cases 2a, 2b, 2c and 2d identify that the sum of the FVs for the FLEX HFEs would be greater than 10%. Therefore, the importance of the FLEX actions would be identified per the existing RMTS program RMA process when evaluating the base LCO case importance measures. See the response to Item b) of this RAI response for additional details on RMAs.

Response

Item b)

The FLEX HFE basic events typically appear in separate cutsets as failing the FLEX logic built in the PRA model. The summation of the base FLEX HEPs in the PRA model is approximately 0.2 whereas the total for the FLEX HEPs used in the sensitivity cases (95th percentile values) is greater than 0.5. These contributions provided in Table 3 below show that the FLEX HEPs evaluated for the sensitivity cases are likely overly conservative and that the values for these HFEs in the base PRA models provide a reasonably conservative representation of the credit for FLEX.

Table 3: FLEX HFE Contribution in PRA Model

FLEX HFEs	Description	Base Case Value (Nominal)$^{(1)}$	FLEX Sensitivity Value (95th)$^{(1)}$
QHUDFUELDXI2	OPS FAILS TO REFUEL FLEX DIESEL	5.0E-02	1.3E-01
QHUFXL13DXI2	OPERATOR FAILS TO ALIGN FLEX GENERATOR TO LC E134 AND LC E334	3.7E-02	1.0E-01
QHUFXRPVDXI2	OPERATOR FAILS TO ALIGN FLEX FLOW PATH TO RPV	2.5E-02	7.1E-02
QHUFXTRSDXI2	OPERATOR FAILS TO ALIGN FLEX FLOW PATH TO TORUS	2.6E-02	7.3E-02
QHULS-ACDXI2	DEEP DC LOAD SHED WHEN ELAP DECLARED (STEPS FOR RCIC)	1.9E-02	5.3E-02
QHUPFUELDXI2	OPS FAILS TO REFUEL FLEX PUMP	5.0E-02	1.3E-01
Total FLEX HEP Contribution		2.1E-01	5.5E-01

Note:

1. The HEP values provided in this table are specific to the FPIE PRA model, though the FPRA model HEP values are very similar.

Details of the RMA development process are described in response to APLA Question 5 of the LAR Supplement [2]. There are numerous ways to develop RICT RMAs, one of which is by evaluating the PRA model importance measures to identify the top two HFEs (or HFE groups) specific to the plant configuration that contribute to 10% or more of the overall cutset result [7].

Based on the importance measure review for the base LCO case cutsets quantified involving LCO 3.8.1.D (Tables 1a and 2), FLEX HFEs are identified as important operator actions and therefore RMAs would likely be developed during implementation of the RICT program. An example FLEX HFE RMA for this LCO could be "Review and brief the FLEX procedures to increase the risk awareness and control." A similar RMA will be developed for any cases having a large contribution from FLEX HEPs such as some of the cases identified in Table 1b. The results from the variety of cases quantified to support this RAI response emphasizes the fact that these cases (and any future cases performed for other plant configurations) adequately capture the importance of FLEX HFEs (using base case assumed HEPs) such that the existing RMA development process would create FLEX RMAs when necessary. Therefore, evaluating the importance measures of the sensitivity results (FLEX HEPs set to their 95th percentile value) does not provide any additional insights to be used in RMA development.

RAI #1 References

1. Peach Bottom Atomic Power Station, Units 2 and 3, Subsequent Renewed Facility Operating License Nos. DPR-44 and DPR-56, NRC Docket Nos. 50-277 and 50-278, License Amendment Request to Revise Technical Specifications to Adopt Risk Informed Completion Times TSTF-505, Revision 2, "Provide Risk-Informed Extended Completion Times – RITSTF Initiative 4b," May 29, 2020.
2. Peach Bottom Atomic Power Station, Units 2 and 3, Subsequent Renewed Facility Operating License Nos. DPR-44 and DPR-56, NRC Docket Nos. 50-277 and 50-278, Supplement to License Amendment Request to Revise Technical Specifications to Adopt Risk Informed Completion Times TSTF-505, Revision 2, "Provide Risk-Informed Extended Completion Times – RITSTF Initiative 4b," December 2, 2020.
3. PBAPS Operator Interview (via teleconference), Art Holtz (Jensen Hughes), Greg Zucal (Jensen Hughes), Brian Albinson (Jensen Hughes), Charlie Young (Jensen Hughes), Brian Wright (Exelon), January 15, 2021.
4. "NRC Clarification Call - PBAPS TSTF-505 LAR RAI #2," January 8, 2021.
5. Technical Specification Bases Document, Section 3.8.1, "Electrical Power Systems."
6. NEI 06-09, "Risk Informed Technical Specifications Initiative 4b: Risk-Managed Technical Specifications (RMTS) Guidelines," Revision 0-A May 2007.
7. Exelon Operations RICT Procedure.

<u>RAI #2</u>

The Nuclear Energy Institute (NEI) Topical Report NEI 06-09, Revision 0-A, "Risk-Informed Technical Specifications Initiative 4b, Risk-Managed Technical Specifications (RMTS) Guidelines, Industry Guidance Document," dated November 2006 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML122860402) (hereafter NEI 06-09-A), and the U.S. Nuclear Regulatory Commission (NRC) Final Safety Evaluation (SE) for NEI 06-09-A, dated May 17, 2007 (ADAMS Accession No. ML071200238), specify that the license amendment request (LAR) should identify key assumptions and sources of uncertainty and *should assess/disposition each as to its impact on the RMTS application. LAR Enclosure 9, Table E9-3, identifies the key assumptions and sources of uncertainty for the fire probabilistic risk assessment (PRA) and provides dispositions for each source of uncertainty for this application. The NRC staff reviewed the dispositions provided in LAR Table E9-3 to the key assumptions and sources of modeling uncertainty and noted that not all uncertainties that have the potential to impact the risk-informed completion time (RICT) calculations appeared to be appropriately dispositioned.*

In LAR supplement dated December 2, 2020, the response to APLB audit Question 10.a provided results for the parametric uncertainty analysis for the fire PRA. The results show an increase in fire core damage frequency (CDF) of 5 percent for both Units 2 and 3, however, the increase in fire large early release frequency (LERF) was 31 and 40 percent for Units 2 and 3, respectively. The response stated that a relay panel in each unit, 20C032 and 30C032 respectively, were the significant contributors to the increase in fire LERF. When the fire scenarios associated with these components were removed from the analysis, the difference in fire LERF between the point estimate and mean was 10 and 4 percent, respectively, for Units 2 and 3. The response states that these scenarios are associated with fire-induced hot shorts, which result in spurious depressurization and valve closures. However, it is unclear to the NRC staff why the removal of these fire scenarios is appropriate in concluding that the epistemic uncertainty associated with the modeling of these scenarios (e.g., post-fire operator actions, spurious operation probabilities, etc.) does not impact the RICT proposed in the LAR. In light of these observations, provide the following information:

i. Justify why the epistemic uncertainty associated with the fire PRA LERF estimates does not significantly impact the RICT calculations proposed in the LAR (e.g., describe how the removal of the fire scenarios associated with relay panels 20C032 and 30C032 is appropriate for consideration of epistemic uncertainty and/or demonstrate that the use of fire PRA point estimates instead of the mean values does not impact the proposed RICTs).

ii. Alternatively to Part (i), explain what risk management actions (RMAs) will be incorporated into the RMTS program to minimize the potential adverse impact of the epistemic uncertainty associated with the fire PRA LERF estimates. The explanation should address how any identified RMAs address the impact of this uncertainty.

Response

Item i.

In the LAR Supplement dated December 2, 2020 (RAI #1 Reference [2] above), the response to APLB Audit Question 10.a provided results for the parametric uncertainty analysis for the fire PRA. The results show, for the average maintenance model, an increase in fire CDF of 5% for both Units 2 and 3; however, the increase in fire LERF was 31% and 40% for Units 2 and 3, respectively. For the base case Online Maintenance Model (OLM), the increase in CDF was 6% and 5% for Units 2 and 3, respectively, and an increase in LERF of 34% and 45% for Units 2 and 3, respectively. Table 2.2-1 below provides the base case results for the Peach Bottom FPRA model.

Table 2.2-1: FPRA Base Results

Model	Case	FPRA Point Estimate Risk (/yr)	FPRA Propagated Mean Risk (/yr)	Delta Risk	% Difference
Unit 2 CDF	Average Maintenance	2.82E-05	2.95E-05	1.28E-06	5%
	Online Maintenance	2.35E-05	2.48E-05	1.31E-06	6%
Unit 3 CDF	Average Maintenance	3.97E-05	4.19E-05	2.17E-06	5%
	Online Maintenance	3.37E-05	3.55E-05	1.74E-06	5%
Unit 2 LERF	Average Maintenance	2.28E-06	3.00E-06	7.15E-07	31%
	Online Maintenance	2.10E-06	2.81E-06	7.16E-07	34%
Unit 3 LERF	Average Maintenance	2.26E-06	3.17E-06	9.13E-07	40%
	Online Maintenance	2.05E-06	2.97E-06	9.23E-07	45%

The cutsets involving fire scenarios associated with 20C032 and 30C032 for Unit 2 and Unit 3 respectively, were the significant contributors to the increase in fire LERF. These cutsets lead to spurious depressurization due the opening of Automatic Depressurization System (ADS) valves and the inability to use low pressure injection systems which are caused by fire induced failures. Several fire induced failures in the cutsets credit the conditional probabilities of fire induced hot shorts. As a part of the parametric uncertainty analysis many hot short probabilities are treated as correlated. Therefore, the cutsets involving multiple hot short probabilities are significantly impacted during the uncertainty analysis.

A review of the LERF cutsets involving the postulated fire scenarios for 20C032 and 30C032 showed that the only basic events impacted by the RICT program in the cutsets would be limited to Low Pressure Coolant Injection (LPCI) B for Unit 2 and LPCI A for Unit 3. Therefore, the only equipment unavailability that could significantly impact a RICT calculation are those involving LPCI B for Unit 2 and LPCI A for Unit 3 (TS 3.5.1.A).

A sensitivity study was performed that used the Fire CDF and Fire LERF propagated mean in calculating a RICT for Unit 2 LPCI B out of service as well as for Unit 3 LPCI A out of service. These results were compared against the calculated RICT that was determined by using the Fire PRA CDF and LERF point estimate. The results of this study are shown in Table 2.2-2 below and demonstrate that proposed RICTs are not impacted by the use of the propagated mean.

Table 2.2-2: Results of Propagated Mean Sensitivity Study

Model	Case	FPRA Point Estimate (PE)	FPRA Propagated Mean (PM)	PM-PE	% Difference
Unit 2 CDF	OLM Base	2.35E-05	2.48E-05	1.31E-06	6%
	LPCI B	7.33E-05	7.53E-05	2.02E-06	3%
	Delta[1]	4.99E-05	5.06E-05	7.15E-07	1%
	RICT (Days)	**43.9**	**43.5**	-0.37	-1%
Unit 3 CDF	OLM Base	3.37E-05	3.55E-05	1.74E-06	5%
	LPCI A	7.36E-05	7.67E-05	3.02E-06	4%
	Delta[1]	3.99E-05	4.12E-05	1.28E-06	3%
	RICT (Days)	**44.2**	**43.6**	-0.68	-2%
Unit 2 LERF	OLM Base	2.10E-06	2.81E-06	7.16E-07	34%
	LPCI B	5.12E-06	6.30E-06	1.18E-06	23%
	Delta[1]	3.02E-06	3.48E-06	4.67E-07	15%
	RICT (Days)	**41.7**	**39.6**	-2.11	-5%
Unit 3 LERF	OLM Base	2.05E-06	2.97E-06	9.23E-07	45%
	LPCI A	4.22E-06	5.44E-06	1.22E-06	29%
	Delta[1]	2.18E-06	2.47E-06	2.92E-07	13%
	RICT (Days)	**43.6**	**42.1**	-1.47	-3%

1) Includes Delta from Internal Events, Seismic penalty factor and High Winds penalty factor
FPIE Unit 2 CDF Delta = 1.32E-06 /yr
FPIE Unit 3 CDF Delta = 1.06E-05 /yr
SPRA CDF Penalty Factor = 2.20E-05/yr
HW CDF Penalty Factor = 1.00E-05/yr
FPIE Unit 2 LERF Delta = 3.32E-07/yr
FPIE Unit 3 LERF Delta = 8.03E-07/yr
SPRA LERF Penalty Factor = 4.40E-06/yr
HW LERF Penalty Factor = 1.00E-06/yr

Additionally, the increase in the FPRA delta LERF calculation is minimal when using the propagated mean and would have an even smaller impact on any potential RICTs with a shorter duration involving LPCI B for Unit 2 and LPCI A for Unit 3. The change in the LPCI B delta LERF calculation is 4.67E-07/yr (3.48E-06/yr – 3.02E-06/yr) for Unit 2 and LPCI A delta calculation is 2.92E-07/yr (2.47E-06/yr – 2.18E-06/yr) for Unit 3. As such, it is expected that the difference between FPRA LERF PM and PE would not significantly change when combined with additional equipment unavailability, where a shorter than 30-day RICT estimate may have been calculated. With the delta LERF impacts from the propagated mean for the impacted scenarios listed above, the RICT estimates are summarized in Table 2.2-3 below.

Table 2.2-3: FPRA Propagated Mean Impact on Various RICT Calculations

Model	Original RICT		Adjustment	Adjusted RICT		Change in Calculated Days
	Calculated Days	Delta CDF / LERF	PM-PE Delta	Delta CDF / LERF	Calculated Days	
Unit 2 CDF	5	7.30E-04	7.15E-07	7.31E-04	5.0	0.00
	10	3.65E-04		3.66E-04	10.0	-0.02
	15	2.43E-04		2.44E-04	15.0	-0.04
	20	1.83E-04		1.83E-04	19.9	-0.08
	25	1.46E-04		1.47E-04	24.9	-0.12
	30	1.22E-04		1.22E-04	29.8	-0.18
	43.9	8.32E-05		8.39E-05	43.5	-0.37[1]
Unit 3 CDF	5	7.30E-04	1.28E-06	7.31E-04	5.0	-0.01
	10	3.65E-04		3.66E-04	10.0	-0.03
	15	2.43E-04		2.45E-04	14.9	-0.08
	20	1.83E-04		1.84E-04	19.9	-0.14
	25	1.46E-04		1.47E-04	24.8	-0.22
	30	1.22E-04		1.23E-04	29.7	-0.31
	44.2	8.25E-05		8.38E-05	43.6	-0.68[1]
Unit 2 LERF	5	7.30E-05	4.67E-07	7.35E-05	5.0	-0.03
	10	3.65E-05		3.70E-05	9.9	-0.13
	15	2.43E-05		2.48E-05	14.7	-0.28
	20	1.83E-05		1.87E-05	19.5	-0.50
	25	1.46E-05		1.51E-05	24.2	-0.77
	30	1.22E-05		1.26E-05	28.9	-1.11
	41.7	8.75E-06		9.22E-06	39.6	-2.11[1]
Unit 3 LERF	5	7.30E-05	2.92E-07	7.33E-05	5.0	-0.02
	10	3.65E-05		3.68E-05	9.9	-0.08
	15	2.43E-05		2.46E-05	14.8	-0.18
	20	1.83E-05		1.85E-05	19.7	-0.31
	25	1.46E-05		1.49E-05	24.5	-0.49
	30	1.22E-05		1.25E-05	29.3	-0.70
	43.6	8.38E-06		8.67E-06	42.1	-1.47[1]

1) There is no change in the applied RICT as both the Original RICT calculated days and Adjusted Calculated days both exceed the backstop of 30 days. Therefore, the applied RICT for both Original and Adjusted RICT is 30 days.

<u>Item ii.</u>

N/A. See response to Item i.