UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

REQUEST FOR ADDITIONAL INFORMATION

LICENSE AMENDMENT REQUEST TO ADOPT TSTF-505, REVISON 2

RISK-INFORMED COMPLETION TIMES

EXELON GENERATION COMPANY

LIMERICK GENERATING STATION, UNITS 1 AND 2

DOCKET NOS. 50-352 AND 50-353

By application dated December 13, 2018 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML18347B366), as supplemented by letter(s) dated February 14, August 12 and August 27, 2019 (ADAMS Accession No. ML19045A011, ML19224B705, and ML19239A004) Exelon Generation Company, LLC (the licensee) submitted a license amendment request (LAR) for Limerick Generating Station, Units 1 and 2 (LGS).

The amendment would revise technical specification (TS) requirements to permit the use of risk-informed completion times (RICTs) for actions to be taken when limiting conditions for operation (LCOs) are not met. The proposed changes are based on Technical Specifications Task Force (TSTF) Traveler TSTF-505, Revision 2, "Provide Risk-Informed Extended Completion Times – RITSTF Initiative 4b," dated July 2, 2018 (ADAMS Accession No. ML18183A493). The U.S. Nuclear Regulatory Commission (NRC or the Commission) issued a final model safety evaluation (SE) approving TSTF-505, Revision 2, on November 21, 2018 (ADAMS Accession No. ML18253A085 and ML18267A259).

To complete its review, the NRC staff from Probabilistic Risk Assessment (PRA) Licensing Branch A (APLA) requests the follow-up information detailed below.

PRA RAI 3.01 – Potential Credit for FLEX Equipment or Actions

The NRC memorandum dated May 30, 2017, "Assessment of the Nuclear Energy Institute 16-06, 'Crediting Mitigating Strategies in Risk-Informed Decision Making,' Guidance for Risk-Informed Changes to Plants Licensing Basis" (ADAMS Accession No. ML17031A269), provides the NRC's staff assessment of the challenges of incorporating diverse and flexible (FLEX) coping strategies and equipment into a PRA model in support of risk-informed decision-making in accordance with the guidance of RG 1.200, Revision 2 (ADAMS Accession No. ML090410014).

With regards to human reliability analysis (HRA), NEI 16-06 Section 7.5 recognizes that the current HRA methods do not translate directly to human actions required for implementing mitigating strategies. Sections 7.5.4 and 7.5.5 of NEI 16-06 describe such actions to which the current HRA methods cannot be directly applied, such as: debris removal, transportation of portable equipment, installation of equipment at a staging location, routing of cables and hoses; and those complex actions that require many steps over an extended period, multiple personnel and locations, evolving command and control, and extended time delays. In the May 30, 2017 memo, the NRC staff concludes (Conclusion 11):

> Until gaps in the human reliability analysis methodologies are addressed by improved industry guidance, [Human Error Probabilities] HEPs associated with actions for which the existing approaches are not explicitly applicable, such as actions described in Sections 7.5.4 and 7.5.5 of NEI 16-06, along with assumptions and assessments, should be submitted to NRC for review.

The response to APLA RAI 03.b.i states that credit is taken in the PRA models for FLEX equipment, such as: deploying and aligning the portable FLEX 480V generators; deploying and aligning the portable FLEX pumps; and prolonged Reactor Core Isolation Cooling (RCIC) operation via partial Reactor Pressure Vessel (RPV) depressurization and venting containment using the permanently installed Hardened Containment Vent System (HCVS). The response to RAI 3.b.ii listed the following FLEX operator actions credited in the PRA:

- Success of the FLEX generators includes required operator actions for DC Load Shed, deploy and start the FLEX generators, align the FLEX generators to the battery chargers, and refuel the FLEX generators .

- Success of the FLEX pumps includes required operator actions for aligning the FLEX pumps from the fire water system, aligning the FLEX pumps for RPV injection from the spray pond, and refueling the FLEX pumps.

- Success of prolonged RCIC operation includes required operator actions for performing partial RPV depressurization, opening of the hardened vent at the HCVS panel, aligning the FLEX pumps for suppression pool makeup from the spray pond, and refueling the FLEX pumps.

The NRC staff notes that the actions listed in the RAI response appear to contain actions described in Sections 7.5.4 and Sections 7.5.5 of NEI 16-06 to which the current HRA methods are not, and perhaps cannot, be directly applied.

In RAI 03.d the NRC staff requested the licensee to describe the sensitivity studies that will be used to identify the Risk-Informed Completion Times (RICTs) proposed in this application for which FLEX equipment and/or operator actions are key assumptions or sources of uncertainty. The response to RAI 03.d discussed sensitivity studies on equipment failure probabilities, but no discussion was provided on operator action HEPs.

a) Uncertainty exists in modeling FLEX operator actions and therefore the FLEX operator actions can be key assumptions and sources of uncertainties for RICTs proposed in the application if the credit for FLEX equipment substantively changes the RICT. The guidance in NEI 06-09-A states:

   > PRA modeling (i.e., epistemic) uncertainties shall be considered. This [uncertainty] evaluation should include an LCO specific assessment of key assumptions that address key uncertainties in modeling of the specific out of service SSCs. For LCOs in which it is determined that identified uncertainties could significantly impact the calculated RICT, sensitivity studies should be performed for their potential impact on the RICT calculations. […] Insights obtained from these sensitivity studies should be used to develop appropriate compensatory risk management actions.

   The NRC SE for NEI 06-09 states:

TR NEI 06-09, Revision 0, requires sensitivity studies to assess the impact of key sources of uncertainties of the PRA on the RMTS. Where the sensitivity analyses identify a potential impact on the calculated RICT, programmatic changes must be identified and implemented, such as additional [Risk Management Actions] RMAs or program restrictions which would address the impact of the uncertainties, or the use of bounding analyses which address the impact of the uncertainty.

Consistent with the guidance in NEI 06-09-A, investigate and address the source of uncertainty associated with FLEX operator actions as follows:

i. Perform, justify and provide results of LCO specific sensitivity studies that assess impact from the FLEX independent and dependent HEPs associated with deploying and staging FLEX portable equipment on the RICTs proposed in this application. Part of the response include the following:

   1. Justify independent and joint HEP values selected for the sensitivity studies, including justification of why the chosen values constitute bounding realistic estimates.

   2. Provide numerical results on specific selected RICTs and discussion of the results;

   3. Discuss composite sensitivity studies of the RICT results to the operator action HEPs and the equipment reliability uncertainty sensitivity study provided in response to PRA RAI 3.d.

ii. NEI 06-09, Revision 0-A states that the insights from the sensitivity studies should be used to develop appropriate compensatory 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.

   Describe how the source of uncertainty due to the uncertainty in FLEX operator actions HEPs will be addressed in the RICT program. Describe specific RMAs being proposed, and how these RMAs are expected to reduce the risk associated with this source of uncertainty.

b) Alternatively, to a) above, provide the following discussion of the uncertainties associated with the following items listed in supporting requirements (SR) HR-G3 and HR-G7 of the ASME/ANS RA-Sa-2009 PRA Standard to support detailed NRC review:

   i. the level and frequency of training that the operators and/or non-operators receive for deployment of the FLEX equipment (performance shaping factor (a)),

   ii. performance shaping factor (f), regarding estimates of time available and time required to execute the response,

   iii. performance shaping factor (g) regarding complexity of detection, diagnosis and decision making and executing the required response,

   iv. Performance shaping factor (h) regarding consideration of environmental conditions, and

v. Human action dependencies as listed in SR HR-G7 of the ASME/ANS RA-Sa-2009 PRA Standard.

PRA RAI 8.01 PRA Modeling of Isolation Actuation Instrumentation

In response to APLA RAI-08.a, regarding PRA modeling of Instrumentation and Controls (I&C), the licensee provided several tables that showed examples of individual components that are specifically modeled for each instrumentation TS function included within the scope of the RICT program. With regards to the containment isolation initiation instrumentation, the response appears to indicate that most of the signals are not explicitly modeled in the PRA, and that a surrogate is being proposed. The response provides the following note in the table:

> "input to high pressure break outside containment initiator; signal contribution will be treated as failed for RICT calculation when out of service"

Explain the statement above, what surrogate is being proposed and how a RICT can be estimated when entering the LCO conditions associated with the isolation signals.