ENCLOSURE 5

License Amendment Request

Callaway Unit No. 1
Renewed Facility Operating License NPF-30
NRC Docket No. 50-483

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

Baseline Core Damage Frequency (CDF) and Large Early Release Frequency (LERF)

1.0 INTRODUCTION

Section 4.0, Item 6 of the NRC Final Safety Evaluation (Reference 1) for NEI 06-09-A, Revision 0, "Risk-Informed Technical Specifications Initiative 4b, Risk-Managed Technical Specifications (RMTS) Guidelines" (Reference 2), requires that the license amendment request (LAR) provide the plant-specific total core damage frequency (CDF) and large early release frequency (LERF) to confirm applicability of the limits of Regulatory Guide (RG) 1.174, Revision 1 (Reference 3). (Note that RG 1.174, Revision 2 (Reference 4), issued by the NRC in May 2011, and RG 1.174, Revision 3 (Reference 13), issued by the NRC in January of 2018, did not revise these limits.)

The purpose of this enclosure is to demonstrate that the Callaway total CDF and total LERF are below the guidelines established in RG 1.174. RG 1.174 does not establish firm limits for total CDF and LERF, but recommends that risk informed applications be implemented only when the total plant risk is no more than about 1E-4/ year for CDF and 1E-5/year for LERF. Demonstrating that these limits are met confirms that the risk metrics of NEI-06-09-A can be applied to the Callaway Risk Informed Completion Time (RICT) Program.

2.0 Technical Approach

The Callaway PRA model maintenance and update process includes "model of record" updates which are full scope model updates that include all documentation required by the American Society of Mechanical Engineers (ASME)/American Nuclear Society (ANS) RA-Sa-2009 PRA Standard (hereafter "ASME/ANS PRA Standard"), "Addenda to ASME/ANS RA-S-2008 Standard for Level 1/Large Early Release Frequency Probabilistic Risk Assessment for Nuclear Power Plant Applications" (Reference 5). As documented in Enclosure 2, the current models of record are for Internal Events PRA Revision 9.01, Internal Flooding Revision 9.01, High Winds Revision 9.01, Fire Revision 9.01, and Seismic Events Revision 9.01. All of these models were used as a starting point to support creation of sample RICT timeframes in Enclosure 1.

Table E5-1 lists the Callaway CDF and LERF values that resulted from a quantification of the baseline Fire, High Winds, Internal Events, Seismic, and Internal Flooding Probabilistic Risk Assessment (PRA) models (References 7, 8, 9, 10, and 11, respectively). Other External Hazards are below accepted screening criteria and therefore do not contribute significantly to the totals (Reference 12).

Table E5-1. Callaway PRA Model Baseline CDF and LERF Values		
PRA Hazard Model	**Baseline CDF (Events/Year)**	**Baseline LERF (Events/Year)**
Internal Events	4.46E-06	6.23E-08
Internal Flooding	6.52E-06	1.51E-08
High Winds	5.40E-06	2.50E-07
Fire	1.09E-05	4.63E-08
Seismic Events	4.01E-05	4.43E-06
Other External Events	No significant contribution	No significant contribution
TOTAL	6.74E-05	4.80E-06

The best estimate mean point estimate values, calculated using optimized ACUBE capabilities, are presented in Table E5-1. The point estimate values below are generated using the EPRI UNCERT utility with varying levels of ACUBE processing. The mean values below are generated using the Monte Carlo sampling process used by UNCERT, using varying levels of ACUBE processing, representing a sampled mean which addresses the State of Knowledge Correlation (SOKC). Due to the inability to fully post-process with ACUBE, these mean value estimates are conservative.

Table E5-2. PRA Model Update 9.01 Parametric Uncertainty Analysis Results				
HAZARD	CDF (/yr)[1]		LERF (/yr)[1]	
	Point Estimate	Mean	Point Estimate	Mean
PRA-IE-UNCERT (Non-Flooding Internal Events)	4.47E-06	4.52E-06	6.23E-08	6.44E-08
PRA-IE-UNCERT_APP1, "Internal Flooding Uncertainty Analysis and Sensitivities"	6.50E-06	6.54E-06	1.51E-08	1.53E-08
PRA-IE-UNCERT_APP2, "Fire Uncertainty Analysis and Sensitivities"	1.21E-05	1.21E-05	5.55E-08	5.75E-08
PRA-IE-UNCERT_APP3, "Seismic Uncertainty Analysis and Sensitivities"	4.01E-05	5.34E-05	4.43E-06	5.93E-06
PRA-IE-UNCERT_APP4, "High Wind Uncertainty Analysis and Sensitivities"	5.97E-06	6.68E-06	2.55E-07	5.29E-07
Aggregate Risk[2]	6.91E-05	8.32E-05	4.82E-06	6.60E-06

Note 1: These values may vary slightly, depending on the selection of cutsets for ACUBE.
Note 2: Including uncertainties and State of Knowledge Correlation.

For PRA model update 9.01, the SOKC was addressed by the performance of a parametric uncertainty analysis for each hazard using the UNCERT code with a typical sample size in the tens of thousands. The SOKC becomes a concern for parameters that are represented by multiple basic events, with probabilities from the same data set, occurring in the same cutset and was addressed by linking such basic events to the same type code in the CAFTA database. The analyses compared the resulting mean value of the risk metric, as determined by UNCERT, to the corresponding point estimate to conclude that the point estimate is an acceptable representation of the mean value.

In relation to the information provided in Table E5-2, above, the same information was provided in response to NRC Audit Question APLA-06 – Total Risk Consideration, in Attachment 8 of Enclosure 1 to ULNRC-06678 (Reference 6) related to the submittal for adoption of 10 CFR 50.69. Subsequently, the NRC Staff issued RAI 01, Use of Mean Core Damage Frequency and Large Early Release Frequency Values and Consideration of the State of Knowledge Correlation (Reference 14). It should be noted that the clarifications provided in the response to RAI 01, found in the Enclosure to ULNRC-06689 (Reference 15) are also applicable to the Callaway RICT application request.

As demonstrated in Tables E5-1 and E5-2, the total CDF and total LERF are within the guidelines set forth in RG 1.174 and support small changes in risk that may occur during RICT entries following implementation of the RICT Program. Therefore, the proposed Callaway RICT Program implementation is consistent with NEI 06-09-A guidance.

3.0 REFERENCES

1. U.S. Nuclear Regulatory Commission (NRC) Letter from Jennifer M. Golder to Biff Bradley (NEI), “Final Safety Evaluation for Nuclear Energy Institute (NEI) Topical Report (TR) NEI 06-09, ‘Risk-Informed Technical Specifications Initiative 4b, Risk-Managed Technical Specifications (RMTS) Guidelines,’” May 17, 2007 (ADAMS Accession No. ML071200238).

2. Nuclear Energy Institute (NEI) Topical Report (TR) NEI 06-09-A, “Risk-Informed Technical Specifications Initiative 4b, Risk-Managed Technical Specifications (RMTS) Guidelines,” Revision 0, October 12, 2012 (ADAMS Accession No. ML12286A322).

3. Regulatory Guide 1.174, “An Approach For Using Probabilistic Risk Assessment in Risk-Informed Decisions on Plant-Specific Changes to the Licensing Basis,” Revision 1, November 2002. (ADAMS Accession No. ML023240437).

4. Regulatory Guide 1.174, “An Approach For Using Probabilistic Risk Assessment in Risk-Informed Decisions on Plant-Specific Changes to the Licensing Basis,” Revision 2, May 2011. (ADAMS Accession No. ML100910006).

5. ASME Standard ASME/ANS RA-Sa-2009, “Addenda to ASME/ANS RA-S-2008 Standard for Level 1/Large Early Release Frequency Probabilistic Risk Assessment for Nuclear Power Plant Applications", dated February 2, 2009.

6. Letter (ULNRC-06678) from Union Electric to the NRC, “Supplemental Information for Application to Adopt 10 CFR 50.69, ‘Risk-Informed Categorization and Treatment of Structures, Systems and Components For Nuclear Power Reactors'", dated July 29, 2021 (ADAMS Accession No. ML21210A025).

7. PRA-FIRE-17671_013, "Callaway NFPA 805 Fire PRA Integrated Fire Risk Report," Revision 1, May 2021.

8. PRA-HW-QUANT, "Quantification and Results of Plant Response Model," Revision 1, May 2021.

9. PRA-IE-QUANT, "At-Power Internal Events PRA, Quantification Analysis Notebook," Revision 2, May 2021.

10. PRA-SEISMIC-QUANT, "Seismic Probabilistic Risk Assessment, Quantification Analysis Notebook," Revision 1, June 2021.

11. PRA-FLOOD-QUANT, "At-Power Internal Flooding PRA, Modeling and Quantification Analysis Notebook," Revision 1, May 2021.

12. PRA-OEH-ANALYSIS, "Other External Hazards: Screening Assessment Notebook," Revision 0, September 2020.

13. Regulatory Guide 1.174, "An Approach for Using Probabilistic Risk Assessment in Risk-Informed Decisions on Plant-Specific Changes to the Licensing Basis," Revision 3, January 2018.

14. NRC Letter to Ameren Missouri, "Request for Additional Information - Callaway Plant, Unit 1 - License Amendment Request to Adopt 10 CFR 50.69, 'Risk-Informed Categorization and Treatment of Structures, Systems and Components for Nuclear Power Reactors,'" transmitted September 14, 2021 (ML21258A038).

15. Letter (ULNRC-06689) from Union Electric to the NRC, “Response to Request for Additional Information Regarding License Amendment Request to Adopt 10 CFR 50.69, 'Risk-Informed Categorization and Treatment of Structures, Systems and Components for Nuclear Power Reactors'", dated October 13, 2021 (ADAMS Accession No. ML21286A681).