NEXTera ENERGY
DUANE ARNOLD

May 31, 2016

NG-16-0118
10 CFR 50.90

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

Duane Arnold Energy Center
Docket No. 50-331
Renewed Op. License No. DPR-49

Supplemental Response to Request for Additional Information, License Amendment Request (TSCR-143) to Extend Containment Leakage Test Frequency

References:
1) License Amendment Request (TSCR-143) to Extend Containment Leakage Test Frequency, NG-15-0234, dated August 18, 2015 (ML15246A445)
2) Electronic Communication, Request to Additional Information – Extension of the 10 CFR 50 Appendix J Containment Type A & Type C Test Intervals, dated March 14, 2016
3) Letter, T. A. Vehec (NextEra) to U.S. NRC, "Response to Request for Additional Information, License Amendment Request (TSCR-143) to Extend Containment Leakage Test Frequency, NG-16-0076, dated April 14, 2016

In the Reference 1 letter, NextEra Energy Duane Arnold, LLC (hereafter NextEra Energy Duane Arnold) submitted a License Amendment Request for the Duane Arnold Energy Center (DAEC) pursuant to 10 CFR 50.90. The NRC Staff requested, via Reference 2, additional information regarding that application. NextEra Energy Duane Arnold submitted that additional information via Reference 3.

The Enclosure to this letter contains information to supplement that included in Reference 3.

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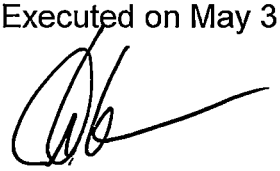
This additional information does not impact the 10 CFR 50.92 evaluation of "No Significant Hazards Consideration" previously provided in the referenced application.

This letter does not contain any new or revised commitments.

If you have any questions or require additional information, please contact J. Michael Davis at 319-851-7032.

I declare under penalty of perjury that the foregoing is true and correct.
Executed on May 31, 2016



T. A. Vehec
Vice President, Duane Arnold Energy Center
NextEra Energy Duane Arnold, LLC

Enclosure

cc: NRC Regional Administrator
NRC Resident Inspector
NRC Project Manager
A. Leek (State of Iowa)

Enclosure to NG-16-0118

Supplemental Response to Request for Additional Information, License Amendment Request (TSCR-143) to Extend Containment Leakage Test Frequency

7 pages follow

Introduction

In Reference 1, NextEra Energy Duane Arnold, LLC (hereafter, NextEra) provided a sensitivity analysis for seismic LERF and a sensitivity analysis for unresolved peer review findings regarding NextEra's license amendment request for ILRT Testing Interval Extension. An acceptable value of ΔLERF could be demonstrated, however, only if LERF for seismic initiated events was assumed to be greater than approximately 65 percent of the cited value for seismic CDF. During a clarification conference call on April 26, the NRC questioned whether a LERF to CDF fraction this high is reasonable given the LERF to CDF fraction for internal events is only 34 percent. (Note that for this application, ΔLERF associated with non-detected containment failures decreases as LERF increases. Therefore, high LERF/CDF ratios are characterized as non-conservative.)

In a separate call on May 10 on the same topic, it was suggested that an acceptable resolution would be to calculate the highest value of seismic CDF for which the ΔLERF criteria could still be met. This could then be compared to NextEra's realistic seismic CDF estimate to see if substantial margin exists between the two.

This evaluation first calculates ΔLERF using NextEra's realistic seismic CDF estimate of 6.99E-07 per year. It then adjusts seismic CDF upward until ΔLERF from both internal and external events is close to, but less than 1.0E-07 per year. The resulting value of seismic CDF is then compared to the realistic estimate. In both cases, the lower LERF to CDF fraction of 0.34 is used to determine seismic LERF from seismic CDF. In addition, CDF and LERF for Internal Events and for Internal Fire include the impact of unresolved peer review findings as documented in Part 2 of Reference 1.

Background

In Reference 1, a bounding value of 5.71E-06 per year was cited for CDF associated with seismic events. This is derived by integrating recent seismic hazard curves for DAEC with a plant-level fragility curve (Reference 2.) The single fragility curve reflects potential for core damage for seismic intensities beyond DAEC's safe shutdown earthquake. The calculation method does not, however, reflect the robust nature of the plant's safety related equipment which is believed to be able to survive well beyond the safe shutdown earthquake. It is for this reason that 5.71E-06 per year can be characterized as a bounding estimate of seismic CDF for DAEC.

More realistic estimates of seismic CDF for DAEC were made possible in the late-1990s through development of a site-specific seismic PRA. Upon updating with fault trees from the Revision 5 PRA in the mid-2000s, CDF was calculated to be 6.99E-07 per year. This model employs seismic fragility curves specific to various classes of equipment. Although the model does not conform to the ASME standard for seismic PRA and has not been peer reviewed, the following attributes lend a conservative nature to it.

- Event trees are developed and quantified for different discrete hazard intervals. To ensure the spectrum of risk is covered, the event tree for a specific seismic hazard interval uses the hazard frequency of the lower end of the interval as the event tree initiator but uses the hazard intensity of the upper end of the interval for the fragility calculations.

- Dependency among seismically induced component failures is accounted for in the seismic event trees and assumes complete dependence at a peak ground acceleration of 1.0 g.

- Credit is not given for recovery of offsite power lost due to a seismic event.

- Credit is not given for recovery of equipment lost due to a seismic event.

EPRI's updated seismic hazard curve from 2013 is used in the calculation of the bounding CDF value of 5.71 E-06 per year. For comparison purposes, CDF was also calculated using an older seismic hazard curve from NRC's RASP Handbook (Reference 3.) CDF was found to be higher using the older, RASP Handbook hazard curve. Since the older curve is the same one used in DAEC's seismic PRA estimate of 6.99E-07 per year, this value will be retained for use in the calculation below.

Evaluation

ΔLERF with Realistic Seismic CDF

An estimate of seismic and wind hazard LERF values can be made assuming the LERF to CDF fraction for these is similar to the LERF to CDF fraction for internal events. The internal events CDF is 4.24E-06 per year (Reference 4, Section 5.2.1) and the internal events LERF is 1.46E-06 per year (Reference 4, Table 5-1). The internal event fraction of LERF to CDF is:

$$LERF_{IE} / CDF_{IE} = 1.46E\text{-}06 / 4.24E\text{-}06 = 0.34$$

Applying this fraction to the seismic CDF of 6.99E-07 per year yields a seismic LERF of 2.38 E-07 per year. This value is judged to be conservatively low since LERF to CDF fractions are expected to be higher for external events than for internal events. External events are more likely to involve failure of components relevant to containment performance at the time of initiation rather than as a result of long term containment heating. The LERF to CDF fraction for fire initiated events at DAEC is consistent with this concept; using values from the table below, it is seen to be 0.62.

Revised CDF and LERF totals for external hazards and internal fire are shown below using the more realistic estimates for seismic events.

Summary of CDF and LERF Estimates for External Events		
Hazard	**CDF (/yr)**	**LERF (/yr)**
Seismicity	6.99E-07	2.38E-07
Internal Fire(1)	1.24E-05	7.72E-06
External Flood	< 1.0E-06	not calculated
Extreme Wind	1.41E-07	4.79E-08
Total	1.424E-05	8.006E-06

(1) CDF and LERF for Internal Fire include the impact of unresolved peer review findings as documented in Part 2 of Reference 1.

External events LERF attributed specifically to non-detected containment failures is conservatively estimated as follows, using the probabilities of a non-detected containment failure (p_{NDCF}).

$$LERF_{NDCF} = p_{NDCF,\Delta} * (CDF_{EE} - LERF_{EE})$$

Where,

$p_{NDCF,3/10}$ = 0.0023 (Reference 4, Section 5.3)

$p_{NDCF,1/10}$ = 0.0023 * 3.33

$p_{NDCF,1/15}$ = 0.0023 * 5.00

CDF_{EE} = 1.424E-05 /yr (from table above)

$LERF_{EE}$ = 8.006E-06 /yr (from table above)

$CDF_{EE} - LERF_{EE}$ = 6.234E-06 /yr

The following table summarizes the External Events LERF and ΔLERF values attributed specifically to non-detected containment failures. Reported ΔLERF values are relative to the 3 per 10 year surveillance interval.

External Events LERF and ΔLERF specific to Each ILRT Test Interval		
ILRT Interval	**LERF (/yr)**	**ΔLERF (/yr)**
3 per 10 years	1.43E-08	
1 per 10 years	4.77E-08	3.34E-08
1 per 15 years	7.17E-08	5.74E-08

The ΔLERF for the 1 per 10 year and 1 per 15 year ILRT intervals, relative to the base 3 per 10 year interval, are as follows:

$$\Delta LERF_{1/10} = \Delta LERF_{IE,1/10} + \Delta LERF_{EE,1/10}$$

and,

$$\Delta LERF_{1/15} = \Delta LERF_{IE,1/15} + \Delta LERF_{EE,1/15}$$

Internal event ΔLERF values are contained in Table 5 of Reference 1. These values include the impact of unresolved peer review findings as documented in Part 2 of Reference 1.

$\Delta LERF_{IE,1/10}$ = 1.74E-08/yr

$\Delta LERF_{IE,1/15}$ = 2.98E-08/yr

Therefore,

$\Delta LERF_{1/10}$ = 1.74E-08/yr + 3.34E-08/yr

= 5.08E-08/yr

and,

$\Delta LERF_{1/15}$ = 2.98E-08/yr + 5.74E-08/yr

= 8.72E-08/yr

Seismic CDF Sensitivity

In the following calculation, seismic CDF is raised until $\Delta LERF_{1/15}$ is equal to the ΔLERF acceptance criteria of 1.0E-07/yr. The ratio LERF to CDF is assumed to remain at 0.34 for the seismic and extreme wind hazards.

Revised CDF and LERF totals for external hazards and internal fire are shown below using the more realistic estimates for seismic events.

Summary of CDF and LERF Estimates for External Events		
Hazard	**CDF (/yr)**	**LERF (/yr)**
Seismicity	2.80E-06	9.52E-07
Internal Fire	1.24E-05	7.72E-06
External Flood	< 1.0E-06	not calculated
Extreme Wind	1.41E-07	4.79E-08
Total	1.634E-05	8.720E-06

External events LERF attributed specifically to non-detected containment failures is conservatively estimated as follows, using the probabilities of a non-detected containment failure (p_{NDCF}).

$$LERF_{NDCF} = p_{NDCF,\Delta} * (CDF_{EE} - LERF_{EE})$$

Where,

$p_{NDCF,3/10}$ = 0.0023

$p_{NDCF,1/10}$ = 0.0023 * 3.33

$p_{NDCF,1/15}$ = 0.0023 * 5.00

CDF_{EE} = 1.634E-05 /yr (from table above)

$LERF_{EE}$ = 8.720E-06 /yr (from table above)

CDF_{EE} - $LERF_{EE}$ = 7.620E-06 /yr

The following table summarizes the External Events LERF and ΔLERF values attributed specifically to non-detected containment failures. Reported ΔLERF values are relative to the 3 per 10 year surveillance interval:

External Events LERF and ΔLERF specific to Each ILRT Test Interval		
ILRT Interval	**LERF (/yr)**	**ΔLERF (/yr)**
3 per 10 years	1.75E-08	
1 per 10 years	5.84E-08	4.09E-08
1 per 15 years	8.76E-08	7.01E-08

The ΔLERF for the 1 per 10 year and 1 per 15 year ILRT intervals, relative to the base 3 per 10 year interval, are as follows:

$$\Delta LERF_{1/10} = \Delta LERF_{IE,1/10} + \Delta LERF_{EE,1/10}$$

and,

$$\Delta LERF_{1/15} = \Delta LERF_{IE,1/15} + \Delta LERF_{EE,1/15}$$

Internal event ΔLERF values are in Table 5 of NextEra's response to the Round 2 RAI.

$$\Delta LERF_{IE,1/10} = 1.74E\text{-}08/yr$$

$$\Delta LERF_{IE,1/15} = 2.98E\text{-}08/yr$$

Therefore,

$$\Delta LERF_{1/10} = 1.74E\text{-}08/yr + 4.09E\text{-}08/yr$$
$$= 5.83E\text{-}08/yr$$

and,

$$\Delta LERF_{1/15} = 2.98E\text{-}08/yr + 7.01E\text{-}08/yr$$
$$= 9.99E\text{-}08/yr$$

Conclusion

When a realistic seismic CDF of 6.99E-07 per year is used in conjunction with higher estimates of internal event and internal fire CDF and LERF to account for unresolved peer review findings, ΔLERF for the 1 per 15 year interval is 8.72E-08

per year. This result falls within RG 1.174 Region III for very small increases, where ΔLERF is less than 1.0E-07 per year.

When seismic CDF is raised to 2.80E-06 per year, ΔLERF raises to 9.99E-08 per year, just below the 1.0E-07 acceptance criteria. This value of seismic CDF is a factor of 4 greater than DAEC's realistic estimate of 6.99E-07 per year, which demonstrates substantial margin between the value needed to meet the acceptance criteria and the realistic estimate.

References

1. NextEra Energy Document, NG-16-0076, "Response to Request for Additional Information, License Amendment Request (TSCR-143) to Extend Containment Leakage Test Frequency," dated April 14, 2016.

2. NextEra Energy Document, DAEC-BFJR-14-015, Revision 0, "Duane Arnold Seismic CDF Estimate."

3. NRC RASP Handbook, "Risk Assessment of Operational Events Handbook, Volume 2 -- External Events," Revision 1.01, January 2008.

4. NextEra Energy Document, NG-15-0234, "License Amendment Request (TSCR-143) to Extend Containment Leakage Test Frequency," dated August 18, 2015, Attachment 4.