REQUEST FOR ADDITIONAL INFORMATION

BY THE CONTAINMENT AND VENTILATION BRANCH AND

PRA LICENSING BRANCH

LICENSE AMENDMENT REQUEST – EXTENSION OF THE 10 CFR 50 APPENDIX J

CONTAINMENT TYPE A & TYPE C TEST INTERVALS

DUANE ARNOLD ENERGY CENTER

DOCKET NO.: 50-331

By application dated August 18, 2015 (Reference 1), NextEra Energy Duane Arnold, the Licensee, requested changes to the Technical Specifications (TSs) for Duane Arnold Energy Center (DAEC). The proposed change would permit the existing Containment 10 CFR 50 Appendix J Type A test Integrated Leak Rate Test (ILRT) intervals to be extended from 10 years to 15 years and the Type C test Local Leak-Rate Test (LLRT) intervals to be extended from 5 years up to 75 months on a permanent basis.

The NRC staff has reviewed the License Amendment Request (LAR) and requests the following additional information to complete its review:

CONTAINMENT AND VENTILATION BRANCH (SCVB) RAI

SCVB RAI-1

LAR Section 3.1.2 provides the LLRT failures during RFO23 and RFO24. With respect to Section 3.1.2 the staff requests additional information about:

1) The root cause of the LLRT failure of CV2211 during RFO24. Where did the dirt in the HPCI system come from? What was the long term corrective action to prevent re-occurrence of the failed LLRT?

2) The inspection of CV5704B during RFO23 identified the following as-found degraded conditions: The valve body and piping contained dirt, indications of a packing leak on the stem, dirt on the stem, dirt on the seat, dirt on the disc, and excessive wear on the stem back seat. Where did the Operating Staff of DAEC conclude that the dirt in the system came from? What assurance was provided that the dirt in the system would not continue to cause component operability problems after the system was returned to service? Was the dirt in the system the cause of the excessive wear on the stem back seat?

3) The inspection of CV4305 that failed its LLRT during RFO23 attributed failure to "… the set screw that actuates the spool valve to pressurize the T-seal was found loose." The Licensee explained "The hex head screw is typically secured to the lever by a lock nut on CV4305. Following this failure, the set screw was able to be adjusted by hand indicating that the lock nut was not engaged. After reviewing the maintenance procedure, it was determined that there was no step to ensure that the lock nut is engaged. In order to prevent recurrence of this failure on CV4305, the maintenance

procedure has been revised to include this step." From this Licensee explanation, it is not clear how ensuring the lock nut is engaged prevents the set screw from becoming loose again in the future. The staff request further clarification.

4) Troubleshooting of CV4300 "…identified that the hex head screw was not fixed in place and would allow the plunger to reposition and deflate the seal. A work order was initiated to repair the valve by applying loctite to threads of the hex head screw. The as-left LLRT was then successfully performed with a measured leakage of 70 sccm.… To prevent recurrence of this failure on CV4300, a reduced height locknut was installed. This locknut is sufficient to secure the hex head screw in place and not allow the plunger of the spool valve to move and release the seal pressure." This troubleshooting synopsis leads the staff to ask: (a) Was the installation of a reduced height locknut considered a design change? If not, why not? (b) Is this a 10CFR 50 Part 21 issue? (c) How did the "oversized" locknut get installed? (d) What corrective action process controls have been put in place to prevent re-occurrence? (e) Are there other similar valves like CV4300 at DAEC that are in need of a similar corrective action?

5) What Type B penetrations and Type C CIVs have had repetitive failures since the start of RFO 18 in 2003? Have there been repetitive failures with similar or identical causes?

SCVB-RAI-2

The staff notes that NEI 94-01, Revision 3-A (Reference 7) Section 11.3.1 "Performance Factors" indicates that prior to determining and implementing extended test intervals for Type B and Type C components, an assessment of the plant's containment penetration and valve performance should be performed and documented. Factors that should be considered during the assessment include (but not limited to): "Past Component Performance"; "Service"; "Design"; "Safety Impact"; and "Cause Determination". In addition Section 11.3.2 "Programmatic Controls" indicates that the review to establish extended test intervals should include the additional considerations of "As-found Tests", "Schedule" and "Review" "However, the Technical Evaluation section of the LAR does not address how these factors and considerations will be incorporated into the DAEC plant specific 10 CFR 50, Appendix J, Testing Program. The staff requests that NextEra Energy Duane Arnold provide the details of how DAEC considered or plans to consider these factors and considerations in its 10 CFR 50, Appendix J, Testing Program.

SCVB-RAI-3

Attachment 1 to the submittal dated August 18, 2015 (Reference 1) Section 3.1.1 "Type A Testing" contains a Table entitled "DAEC Type A Test Historical Results Since 1985" that provides the details of the historical ILRT "As-found Leakage Rate" and "As-Left Leakage Rate" values.

DAEC TS 5.5.12 "Primary Containment Leakage Rate Testing Program" reads in part:

c) The peak calculated containment internal pressure for the design basis loss of coolant accident, P_a, is 45.7 psig.

d) The maximum allowable primary containment leakage rate, L_a, at P_a, shall be 2.0% of primary containment air weight per day.

e) Leakage rate acceptance criteria are:

   I. Primary Containment leakage rate acceptance criteria is ≤1.0 L_a. During the first unit startup following testing in accordance with this program, the leakage rate acceptance criteria are: ≤ 0.60 L_a for the Type B and Type C tests; and ≤ 0.75 L_a for Type A tests; and …

All historical ILRT values contained in the Table "DAEC Type A Test Historical Results Since 1985" are below the Limits of TS 5.5.12.d and of TS 5.5.12.e.1. However, the P_a test pressure values for the four most recent ILRT "As-Found" leakage rates were not included in the Table or elsewhere in the LAR.

Section 9.2.3 of NEI TR 94-01, Revision 2 (Reference 2) states that:

> "Type A testing shall be performed during a period of reactor shutdown at a frequency of at least once per 15 years based on acceptable performance history. Acceptable performance history is defined as successful completion of two consecutive periodic Type A tests where the calculated performance leakage rate was less than 1.0 L_a [the maximum allowable Type A test leakage rate at P_a, where P_a equals the calculated peak containment internal pressure related to the design-basis loss-of- coolant accident]. A preoperational Type A test may be used as one of the two Type A tests that must be successfully completed to extend the test interval, provided that an engineering analysis is performed to document why a preoperational Type A test can be treated as a periodic test. Elapsed time between the first and last tests in a series of consecutive satisfactory tests used to determine performance shall be at least 24 months."

The staff notes that the last sentence of Section 9.2.3 "Extended Test Intervals" of NEI 94-01 Revision 2-A (Reference 3) reads "In the event where previous Type A tests were performed at reduced pressure (as described in 10 CFR 50, Appendix J, Option A), at least one of the two consecutive periodic Type A tests shall be performed at peak accident pressure (P_a)."

Based on these NEI 94-01 excerpts, the staff requires additional P_a information to confirm that at least one of the actual ILRT test pressures employed during the two most recent DAEC Type A tests bound (per the guidance of ANS 56.8-1994 Section 3.2.11 – Reference 4) the P_a (i.e. 45.7 psig) value of DAEC TS 5.5.12.c. The staff notes that Section 4.4 of the test procedure referenced in LAR Section 3.1.1, BN-TOP-1 (Reference 8), records the P_a test values in terms of absolute pressure. Accordingly, the associated atmospheric pressure associated with P_a will be relevant to the Licensee's response.

The staff requests:

That the Licensee provide the P_a values for the four most recent "As Found" Type A tests; and
That the Licensee confirm that the P_a requirement of NEI 94-01 Revision 2-A Section 9.2.3 has been satisfied.

SCVB-RAI-4

LAR Section 3.4.2 “June 8, 2012 NRC Safety Evaluation” (Pages 20 through 22 of 30) Response to Condition 2, Issue 1 reads in part:

> “The change in going from a 60 month extended test interval for Type C tested components to a 75 month interval, as authorized under NEI 94-01, Revision 3-A, represents an increase of 25 percent in the local leak rate test periodicity. As such, NextEra Energy Duane Arnold will conservatively apply a potential leakage understatement adjustment factor of 1.25 to the as-left leakage total for each Type C component currently on the 75 month extended test interval. This will result in a combined conservative Type C total for all 75 month local leak rate tests being carried forward and included whenever the total leakage summation is required to be updated (either while operating on-line or following an outage). When the potential leakage understatement adjusted leak rate total for those Type C components being tested on a 75 month extended interval is summed with the non-adjusted total of those Type C components being tested at less than the 75 month interval and the total of the Type B tested components, if the minimum pathway leak rate is greater than the DAEC administrative leakage summation limit of 0.50 L_a, but less than the regulatory limit of 0.60 L_a, then an analysis and corrective action plan shall be prepared to restore the leakage summation value to less than the administrative leakage limit. The corrective action plan shall focus on those components that have contributed the most to the increase in the leakage summation value and the manner of timely corrective action (as deemed appropriate) that best focuses on the prevention of future component leakage performance issues.”

This paragraph, could be interpreted to mean that a component tested at 70 months would not be adjusted for the understatement adjustment factor of 1.25 which would not be consistent with the intent of NEI 94-01, Revision 3-A. Please clarify the meaning of the cited paragraph.

SCVB-RAI-5

In LAR (Reference 1) Attachment 1 Section 3.4.1 Table “June 25, 2008 NRC Safety Evaluation (SE) Limitations and Conditions”, the fourth “Limitation/Condition” reads “The licensee addresses any tests and inspections performed following major modifications to the containment structure, as applicable. (Refer to SE Section 3.1.4).” The “Response for DAEC” reads:

> “Engineering Change (EC) 281991 is to install a new Hardened Containment Vent System (HCVS). The design will remove the existing 8" containment isolation control valve CV-4357. The new cap installed on the remaining 8"HBC-140 piping within the SE corner room will be the containment boundary. The modification adds two new 10" PCIVs and actuators and a new rupture disk. The two new PCIVs provide a containment isolation function. The rupture disk prevents the use of this system prior to the containment pressure exceeding 50 psig, unless the rupture disk is manually ruptured. The new pipe and valves are the containment penetration boundaries. The system is manually operated from the control room or remote location. Associated tests and inspections will confirm the leak tightness of the abandon penetration, the new PCIVs, and the piping

> from the containment to the new PCIVs. Testing procedures have yet to be developed."

SE Section 3.1.4 (Reference 9) reads:

> "Section 9.2.4 of NEI TR 94-01, Revision 2, states that: "Repairs and modifications that affect the containment leakage integrity require LLRT or short duration structural tests as appropriate to provide assurance of containment integrity following the modification or repair. This testing shall be performed prior to returning the containment to operation." Article IWE-5000 of the ASME Code, Section XI, Subsection IWE (up to the 2001 Edition and the 2003 Addenda), would require a Type A test after major repair or modifications to the containment. In general, the NRC staff considers the cutting of a large hole in the containment for replacement of steam generators or reactor vessel heads, replacement of large penetrations, as major repair or modifications to the containment structure. At the request of a number of licensees, the NRC staff has agreed to a relief request from the IWE requirements for performing the Type A test and has accepted a combination of actions consisting of ensuring that: (1) the modified containment meets the pre-service non-destructive evaluation (NDE) test requirements (i.e., as required by the construction code), (2) the locally welded areas are examined for essentially zero leakage using a soap bubble, or an equivalent, test, and (3) the entire containment is subjected to the peak calculated containment design basis accident pressure for a minimum of 10 minutes (steel containment) and 1 hour (concrete containment), and (4) the outside surfaces of concrete containments are visually examined as required by the ASME Code, Section XI, Subsection IWL, during the peak pressure, and that the outside and inside surfaces of the steel surfaces are examined as required by the ASME Code, Section XI, Subsection IWE, immediately after the test. This is defined as a short duration structural test of the containment. For minor modifications (e.g., replacement or addition of a small penetration), or modification of attachments to the pressure retaining boundary (i.e., repair/replacement of steel containment stiffeners), leakage integrity of the affected pressure retaining areas should be verified by a LLRT."

The third paragraph of LAR Section 3.1.1 "Type A Testing" reads:

> Repair or replacement activities (including any unplanned activities) performed on the pressure retaining boundary of the primary containment prior to the next scheduled Type A test would be subject to the leakage test requirements of American Society of Mechanical Engineers Boiler and Pressure Vessel Code (ASME Code) Section XI, Paragraph IWE-5221, "Leakage Test."

The SCVB staff notes that the above LAR excerpts are "forward looking" with respect to plans for any future Containment modification. In contrast, the DAEC Containment has been in service for approximately 40 years. The SCVB staff requests that the Licensee provide additional historical information (i.e. a synopsis) about any modifications to the DAEC Containment and about the subsequent post modification testing. The synopsis should demonstrate consistency with guidance of SE Section 3.1.4.

In addition, it is not clear from the above Engineering Change (EC) 281991 description whether the new Hardened Containment Vent System (HCVS) will use an existing containment penetration or whether a new containment penetration will have to be created to accommodate the two new 10" PCIVs and the new rupture disk of the HCVS. The staff requests clarification of this issue.

SCVB RAI-6

Per the guidance of NEI 94-01 Revision 0 (Reference 6) ,Sections 10.2.1.2 and 10.2.3.2, and subject to the four exemptions identified in Regulatory Position “C” of Regulatory Guide 1.163 (Reference 5), the DAEC is currently allowed to extend the test intervals for Type B penetrations up to 120 months and for Type C CIVs up to 60 months.

Section 10.2.1.2 of NEI 94-01, Revision 0 reads in part: “The test intervals for Type B penetrations may be increased based upon completion of two consecutive periodic As-found Type B tests where results of each test are within a licensee's allowable administrative limits.” Section 10.2.3.2 of NEI 94-01, Revision 0 reads in part: “Test intervals for Type C valves may be increased based upon completion of two consecutive periodic As-found Type C tests where the result of each test is within a licensee's allowable administrative limits.”

The staff requests that the Licensee provide additional information about:

1) What is the total number (i.e. population) and what percentage of that total number of DAEC Type B tested components are currently on 120-month extended performance-based test interval?

2) The two most recent individual “As-found” Type B test results, including Administrative Limits, for all DAEC Containment penetrations.

3) What is the total number (i.e. population) and what percentage of that total number of Unit 1 Type C tested Containment Isolation Valves (CIVs) are currently on 60-month extended performance-based test interval?

4) The two most recent individual “As-Found” Type C test results, including Administrative Limits, for all DAEC Containment Isolation Valves.

5) How the percentages reported in (1) and (3) support the LAR of allowing an extended test interval of up to 75 months for Type C tested CIVs in accordance with the guidance of NEI 94-01, Revision 3-A?

SCVB RAI-7

Section 9,2,3 of NEI 94-01, Revision 0 reads in part: “For purposes of determining an extended test interval, the performance leakage rate is determined by summing the UCL (determined by containment leakage rate testing methodology described in ANSI/ANS 56.8-1994) with As-left MNPLR leakage rates for penetrations in service, isolated or not lined up in their accident position (i.e., drained and vented to containment atmosphere) prior to a Type A test. In addition, any leakage pathways that were isolated during performance of the test because of excessive leakage must be factored into the performance determination. If the leakage can be determined by a local leakage rate test, the As-found MNPLR for that leakage path must also be added to the Type A UCL. If the leakage cannot be determined by local leakage rate testing, the performance criteria for the Type A test are not met."

LAR Table "DAEC Type A Test Historical Results Since 1985" displays the Type A test results since 1985 (Reference 1 – page 6 of 30). For the Type A test of March 13, 2007, the staff requests that the Licensee provide a detailed and comprehensive breakdown of the test specific data for the DAEC Containment "As Found Leak Rate" of 0.355 percent primary containment air weight per day.

Consistent, with the above excerpt from Section 9.2.3, the detailed breakdown should include the individual "as left" MNPLR leakage rate penetration and CIV test values used to derive the "As Found Leak Rate" of 0.355 % wt/day.

PRA LICENSING BRANCH RAI

1. According to Regulatory Issue Summary 2007-06, "Regulatory Guide 1.200 Implementation," the U.S. Nuclear Regulatory Commission (NRC) staff expects that licensees fully address all scope elements with Revision 2 of Regulatory Guide (RG) 1.200 by the end of its implementation period (i.e., one year after the issuance of Revision 2 of RG 1.200). Revision 2 of RG 1.200 endorses, with exceptions and clarifications, the combined American Society of Mechanical Engineers (ASME)/American Nuclear Society (ANS) probabilistic risk assessment (PRA) standard (ASME/ANS RA-Sa-2009).

   In Regulatory Position 4.2 of RG 1.200, Revision 2, the NRC staff stated that it expects licensees to submit a discussion of the resolution of the peer review findings that are applicable to the parts of the PRA required for the application.

   The licensee stated in Attachment 5, "Documentation of Probabilistic Risk Assessment Technical Adequacy," to the license amendment request (LAR) that the Duane Arnold Energy Center (DAEC) PRA is judged sufficient for the integrated leak rate test (ILRT) interval risk-informed application in accordance with RG 1.200, Revision 1. The licensees stated in their application for adoption of National Fire Protection Association's Standard 805 (NFPA 805) that a revision of the DAEC PRA model used to support the NFPA 805 application was reviewed against RG 1.200, Revision 2. Attachment U of the DAEC NFPA 805 LAR provides the licensee's dispositions to facts and observations (F&Os). The licensee dispositioned those F&Os by assessing the impact of F&Os on the Fire PRA and the results for the NFPA-805 application.

   a. Given that the implementation date of RG 1.200, Revision 2, was April 2010, clarify whether the revision of DAEC PRA model used to support the application for extending the Type A test interval to 15 years has been reviewed against RG 1.200, Revision 2

   b. Provide a list of all findings from the past peer reviews and self-assessments relevant to this submittal for which the PRA did not meet the ASME/ANS PRA Standard Capability Category (CC) I supporting requirements. Summarize why not meeting each CC I requirement will have no impact on this application.

2. Electric Power Research Institute (EPRI) EPRI TR-1009325, Revision 2-A states that "[w]here possible, the analysis should include a quantitative assessment of the contribution of external events (for example, fire and seismic) in the risk impact assessment for extended ILRT intervals. For example, where a licensee possesses a quantitative fire analysis and that analysis is of sufficient quality and detail to assess the impact, the methods used to obtain the impact from internal events should be applied for the external event." The licensee stated in Section 7.3 of Attachment 4 to the LAR that DAEC performed a Seismic Margins Assessment (SMA) in support of their Individual Plant Examination of External Events (IPEEE) submittal. The licensee further stated that while the SMA methodology used for the IPEEE does not estimate seismic core damage frequency (CDF), in 2008 the DAEC assessment of Severe Accident Mitigation Alternatives (SAMA) developed a seismic CDF estimate of 6.99×10^{-7} per year.

   Results of the NRC study published in "Results of Safety/Risk Assessment of Generic Issue (GI) 199, 'Implications of Updated Probabilistic Seismic Hazard Estimates in Central and Eastern United States on Existing Plants'" (ADAMS Accession No. ML100270582) estimated CDF of 1.7×10^{-5} for DAEC using a simple average. This estimate is more than one order of magnitude larger than the licensee's estimate.

   Discuss whether using the seismic risk results from GI-199 study would significantly impact this application and change the risk metrics associated with this application.

3. EPRI TR-1009325, Revision 2-A states that "[t]he most relevant plant-specific information should be used to develop population dose information. The order of preference shall be plant-specific best estimate, SAMA for license renewal, and scaling of a reference plant population dose."

   a. Given that plant-specific population dose estimates were available as part of the DAEC SAMA analysis, discuss the reasons for the decision to estimate the population dose based on scaling of Peach Bottom Atomic Power Station population doses.

   b. Discuss whether using information from SAMA analysis would significantly change the estimated increase in population dose resulted from extending the Type A frequency.

4. Section 5.1.5.1 of EPRI TR-1009325, Revision 2-A uses the Calvert Cliffs methodology in evaluating the impact of liner corrosion on the extension of ILRT testing intervals. This assessment was based on two observed corrosion events at North Anna Power Station, Unit 2 and Brunswick Steam Electric Plant, Unit 2. As there have been additional instances of liner corrosion that could be relevant to this assessment, provide a more complete accounting of all observed corrosion events relevant to DAEC containment, and an evaluation of the impact on risk results when all relevant corrosion events are included in the risk assessment.

REFERENCES

1. NextEra Duane Arnold Letter (NG-15-0234) dated August 18, 2015, "License Amendment Request (TSCR-143) to Extend Containment Leakage Test Frequency", Duane Arnold Energy Center, Docket No. 50-331, License No. DPR-49, [Agencywide Documents Access and Management System (ADAMS) Accession No. ML15246A445].

2. Nuclear Energy Institute Topical Report NEI 94-01, Revision 2, "Industry Guideline for Implementing Performance-Based Option of 10 CFR Part 50, Appendix J" and Electric Power Research Institute Report No. 1009325, Revision 2, August 2007, "Risk Impact Assessment of Extended Integrated Leak Rate Testing Intervals*."* [ADAMS Accession No. ML072970206].

3. Nuclear Energy Institute Topical Report NEI 94-01, Revision 2-A, "Industry Guideline for Implementing Performance-Based Option of 10 CFR Part 50, Appendix J," October 2008 [ADAMS Accession No. ML100620847].

4. ANSI/ANS-56.8-1994, "Containment System Leakage Testing Requirements".

5. NRC Regulatory Guide 1.163, dated September 1995, "Performance-Based Containment Leak-Rate Testing program," [ADAMS Accession No. ML003740058].

6. Nuclear Energy Institute (NEI) Topical Report NEI 94-01, Revision 0, dated July 21, 1995, *"Industry Guideline for Implementing Performance-Based Option of 10 CFR Part 50, Appendix J,"* [ADAMS Accession No. ML11327A025].

7. Nuclear Energy Institute (NEI) Technical Report NEI 94-01, Revision 3-A, dated July, 31, 2012, "Industry Guideline for Implementing Performance-Based Option of 10 CFR Part 50, Appendix J" [ADAMS Accession No. ML12221A202].

8. Bechtel Corporation Procedure BN-TOP-1, Revision 1 dated November 1, 1972, "Testing Criteria For Integrated Leakage Rate Testing Of Primary Containment Structures" [ADAMS Accession No. ML083540173].

9. NRC Staff Safety Evaluation, dated June 25, 2008, "Final Safety Evaluation For Nuclear Energy Institute Topical Report (TR) 94-01, Revision 2, "Industry Guideline For Implementing Performance-Based Option Of 10 CFR Part 50, Appendix J" And Electric Power Research Institute (EPRI) Report No. 1009325, Revision 2, August 2007, "Risk Impact Assessment Of Extended Integrated Leak Rate Testing Intervals" (TAC No. MC9663)" [ADAMS Accession No. ML081140105].