Duane Arnold Energy Center

Subsequent License Renewal Application – Safety Pre-Submittal Meeting

October 21, 2026

NEXTera ENERGY
DUANE ARNOLD

Agenda

- Introductions
- Background
- Subsequent License Renewal Application (SLRA) - Safety
  - Schedule
  - SLRA Details
  - NUREG-2191 Consistency
  - AMP Summary and Exceptions
  - TLAAs
- Questions

Opening Remarks & Introductions

NextEra Energy Duane Arnold

Mike Davis
DAEC Restart Licensing Project Manager

ENERCON

Rebecca Gardener
Senior Project Manager (SLRA)

Bryan Hess
SLR Senior Manager

Spring Bradley
SLR Manager

Background

- DAEC commenced commercial operation in 1974.
- One BWR unit with thermal output of 1,912 MWt, output of 610 MWe.
- License renewal granted in December 2010, with the current operating license expiring in 2034.
- Ceased operations in 2020. Currently, idled and in decommissioning status.
- On January 23, 2025, NextEra Energy Duane Arnold, LLC announced its intent to evaluate resumption of plant operations.
- Presented the DAEC restart overview and regulatory path to reauthorization of power operations.
- Submitted its request for exemption from 10 CFR 50.82(a)(2), officially notifying NRC of NextEra Energy's intention to return the site to power operation.
- DAEC is owned and operated by NextEra Energy Duane Arnold, LLC.



SLRA - Safety

Schedule

- Entered PEO February 21, 2014
- Submit SLRA to the NRC by February 19, 2027
- Entering SPEO February 21, 2034

Proprietary Information

- Minimized in the SLRA
- Affects SLRA Section 4 (TLAAs) and Section 3.5.2.2.2 (Irradiation of Concrete)

Initial Assumptions for the SLRA

- CLB is defined as UFSAR (Rev. 26) and TS (Amendment 311, TS Bases Rev. 305) active prior to Decommissioning (UFSAR And TS in process of being restored)
  - SLRA to be updated with CLB information per annual updates required by 10 CFR Part 54
- Cutoff date for incorporating comments from SLRI activities into the SLRA – July 6, 2026
  - Technical comments incorporated, as applicable on a case-by-case basis

Note: The SLRA Details are subject to change as the SLRA is completed.

SLRA - Details

Industry Guidance

- NUREG-2191 Revision 1 & NUREG-2192 Revision 1
- NEI 17-01
- Previous NRC-approved SLRAs

Application of OE

- Latest available keywords utilized (239 age-related and general total)
  - The AR search covered the period from January 1, 2010, to April 23, 2025
  - 74,000+ initial hits screened, over 5,500 identified for further review with 3+ keyword hits
  - 2,000+ were identified as potentially addressing age-related degradation and screened in the OE Report

SLRA - Details

Application of Lessons Learned

- Review and address recent applicant RCIs, RAIs, and Supplements (St. Lucie, Monticello, and Peach Bottom)
  - Separate section in each AMP basis document summarizes how the RAIs were addressed
  - SLRA related reports and AMP basis documents will be available to reviewers on CERTREC
- Senior, LR/SLR experienced engineers in key positions
- Review and incorporation of industry LR operating experience including implementation
- Lessons learned from DAEC initial LR application
- Lessons Learned from other NEE SLRA/SLRI projects

SLRA - Details

DAEC SLRA will be a full-typical application

- Scoping & Screening
- Sections 2 & 3 will contain all in-scope SLR systems
- Section 3 AMR Tables will contain all rows, and applicable notes, for each system and associated component type
  - Section 3.5.2.2.2 will contain input from Structural Integrity Associates (SIA) regarding irradiation of concrete
- Section 4 & Appendix A TLAAs will be updated with evaluations from SIA & TransWare (TW) deliverables
- Appendix A
  - Will contain all AMPs & Commitment table will contain all commitments including enhancements & exceptions
- Appendix B will contain all AMPs
- Appendix C will contain the dispositions for the BWRVIP Action Items
- Appendix D will have no anticipated TS changes

SLRA - Details

Total Reports

- **105 ENERCON Reports**
  - 2 Scoping Reports (Scoping & an NFPA 805 Topical report)
  - 1 Operating Experience (OE) Report
  - 1 Shutdown Environments Evaluation Report
  - 47 AMP Reports
  - 5 Further Evaluation Reports (4 Mechanical and 1 Civil/Structural)
  - 42 Screening and Aging Management Review (SAMR) Reports
  - 3 SLRA reports (Section 1, Appendix C, & Appendix D)
  - 4 TLAA reports (Identification, Evaluation, & 2 Topical Reports)
- **23 Additional Deliverables**
  - 20 SIA deliverables and 3 TW deliverables

SLRA - Details

Consistency with NUREG-2191, Revision 1

- **AMRs (SLRA Section 3)**
  - ~3500 AMR line items
  - Very Consistent
    - Notes A through D >98%
    - Notes E through J <2%

SLRA - Details

DAEC AMPs

- SLRA Appendix B - Goal is to maximize consistency with NUREG-2191, Revision 1

AMP Category	AMPs Consistent with GALL	AMPs Consistent with Enhancements	AMPs with Exceptions	AMPs with Enhancements and Exceptions	Plant Specific AMPs
Existing - 40	6	28	1	4	1
New - 7	7	0	0	0	0

  - 47 AMPs Total
  - 5 AMPs Total with Exceptions

SLRA - Details

DAEC AMPs with Exceptions (exceptions listed below each)

- XI.E4 Metal Enclosed Bus (No Enhancements)
  - Exception to Element 4, Detection of Aging Effects.
  - NUREG-2191 Section XI.E4 recommends a five-year frequency for visual inspections when no thermographic inspections are performed. This DAEC AMP takes an exception to the five-year frequency, and performs the visual inspections on a six-year frequency consistent with the CLB.

- XI.E5 Fuse Holders
  - Exception to Element 3, Parameters Monitored or Inspected
  - The DAEC Fuse Holders AMP takes an exception to inspecting for the following aging mechanisms that are listed in NUREG-2191, Section XI.E5, Element 3: Vibration.

DAEC AMPs with Exceptions (Cont.)

– XI.M30 Fuel Oil Chemistry

Exception to Element 1, Scope of Program

The AMP Program Description identifies several representative guidelines of the American Society for Testing and Materials (ASTM) Standards, such as ASTM D 0975, D 1796, D 2276, D 2709, D 6217, and D 4057, that may be used to monitor, maintain, and control fuel oil quality. The DAEC Fuel Oil Chemistry Program does not use this optional modified ASTM D 2276, Method A, which requires a 3.0 micrometer filter pore size. Instead, DAEC continues using the earlier non-modified version of ASTM D 2276 which requires a smaller more conservative filter pore size of 0.8 micrometers. The DAEC operating experience and the general industry Operating Experience shows this to be acceptable.

DAEC AMPs with Exceptions (Cont.)

- XI.S5 Masonry Walls

  Exception to Element 4, Detection of Aging Effects

  Inspection frequency may exceed 5 years for areas that are normally inaccessible when the plant is online. These normally inaccessible areas are inspected at the next scheduled refueling outages following the 5-year interval.

- XI.S6 Structures Monitoring

  Exception to Element 4, Detection of Aging Effects

  The DAEC Structures Monitoring AMP takes an exception to monitoring all structures on an interval not to exceed 5 years. The areas that are normally inaccessible, when the plant is online, are monitored during refueling outages, which occur on a 24-month interval. The following areas are inspected during every third refueling outage, which results in a 6-year examination interval:

Drywell interior	TIP room	Steam tunnel
Reactor water clean-up pump room	RHRSW/ESW pits	Stilling basin
Circ Water pit	RWS Intake pits	Air ejector room
Condenser bay	Heater bay	Turbine area
Turbine building roof	Cooling towers	Diesel generator fuel oil tank

Shutdown Environments

- Conditions during the decommissioning period at DAEC required evaluation to determine if any new aging effects were introduced that could cause significant degradation during the subsequent period of extended operation (SPEO).
- Browns Ferry & Watts Bar were reviewed for Lessons Learned
- A new section, Section 3.0.1 – Summary of the Evaluation of the Decommissioning Period, will be added to the SLRA to summarize the results of the report.
- All SLRA Systems were evaluated.
- While some conditions during the decommissioning period were potentially more aggressive than they would have been had the plant remained in operation, no new aging effects requiring management during the SPEO were identified by this evaluation.

SLRA - Details

Time-Limited Aging Analyses (TLAAs)

- **Vendors**
  - ENERCON
  - TransWare (TW) – Fluence & dose calculations
  - Structural Integrity Associates (SIA) – Embrittlement & fatigue calculations
- **4 ENERCON Reports**
  - TLAA Identification
  - TLAA Evaluations
  - HELB Evaluation
    - Incorporated as a Lesson Learned from the MNGP SLRA
  - Crane Fatigue Evaluation

SLRA - Details

TLAAs Continued

Generic TLAA (NUREG-2192, Table 4.1-2)		Applicability to DAEC
Upper-Shelf Energy (USE)	Neutron Fluence	Yes
	Pressurized Thermal Shock (PWRs Only)	No (1)
	Upper Shelf Energy (PWRs and BWRs)	Yes
	Pressure Temperature (P-T) Limits (PWRs and BWRs)	Yes
	Low Temperature Overpressure Protection System Setpoints (PWRs Only)	No (1)
	Ductility Reduction Evaluation for Reactor Internals (B&W designed PWRs only)	No (1)
	Reactor Vessel Circumferential Weld Relief-Probability of Failure and Mean Adjusted Reference Temperature Analysis for the RV Circumferential Welds (BWRs only)	Yes
	Reactor Vessel Axial Weld Probability of Failure and Mean Adjusted Reference Temperature Analysis (BWRs only)	Yes
Metal Fatigue	Metal Fatigue of ASME Class 1 Components	Yes
	Metal Fatigue of Non-Class 1 Components	Yes
	Environmentally Assisted Fatigue (EAF)	Yes
	High-Energy Line Break Analyses	Yes
	Cycle-Dependent Fracture Mechanics or Flaw Evaluations	Yes
	Cycle-dependent Fatigue Waivers	Yes
Environmental Qualification of Electrical Equipment		Yes
Concrete Containment Tendon Prestress		No (3)
Containment Liner Plate, Metal Containments, and Penetrations Fatigue		Yes (3)

SLRA - Details

TLAAs Continued

Potential TLAAs (for BWRs only) (NUREG-2192, Table 4.7-1)	Applicability to DAEC
Re-Flood Thermal Shock of the Reactor Pressure Vessel (RPV)	Yes
Re-Flood Thermal Shock of the Core Shroud and Other Reactor Vessel Internals	No (2)
Loss of Preload for Core Plate Rim Holddown Bolts	Yes
Erosion of the Main Steam Line Flow Restrictors	No (2)
Susceptibility to Irradiation-Assisted Stress Corrosion Cracking	Yes
Fatigue of Cranes (Crane Cycle Limits)	Yes
Fatigue of the Spent Fuel Pool Liner	No (2)
Corrosion Allowance Calculations	No (2)
Flaw Growth Due to Stress Corrosion Cracking	No (2)
Predicted Lower Limit	No (3)

Note(s)

(1) Duane Arnold Energy Center is not a Pressurized Water Reactor.

(2) There is no analysis for this TLAA contained in the DAEC CLB.

(3) The DAEC containment design does not employ prestressed concrete tendons, nor a containment liner plate.

SLRA - Details

TLAAs List

TLAA	Resolution	Section	Vendor
Reactor Vessel Neutron Embrittlement		4.2	
RPV Neutron Fluence	10 CFR 54.21(c)(1)(iii)	4.2.1.1	TransWare
RVI Neutron Fluence	10 CFR 54.21(c)(1)(iii)	4.2.1.2	TransWare
RPV Materials Upper Shelf Energy (USE) Reduction Due to Neutron Embrittlement	10 CFR 54.21(c)(1)(ii)	4.2.2	SIA
Adjusted Reference Temperature (ART) for RPV Materials Due to Neutron Embrittlement	10 CFR 54.21(c)(1)(ii)	4.2.3	SIA
RPV Thermal Limit Analysis: Operating Pressure – Temperature (P-T) Limits	10 CFR 54.21(c)(1)(iii)	4.2.4	SIA
RPV Circumferential Weld Examination Relief	10 CFR 54.21(c)(1)(iii)	4.2.5	SIA
RPV Axial Weld Failure Probability	10 CFR 54.21(c)(1)(ii)	4.2.6	SIA
Re-Flood Thermal Shock of the Reactor Pressure Vessel (RPV)	10 CFR 54.21(c)(1)(ii)	4.2.7	SIA
Loss of Preload for Core Plate Rim Hold-Down Bolts	10 CFR 54.21(c)(1)(ii)	4.2.8	SIA
Susceptibility to Irradiation-Assisted Stress Corrosion Cracking	10 CFR 54.21(c)(1)(iii)	4.2.9	SIA

SLRA - Details

TLAAs List (Continued)

TLAA	Resolution	Section	Vendor
Metal Fatigue		4.3	SIA
80-Year Transient Cycle Projections	N/A	4.3.1	SIA
ASME Section III, Class 1 Fatigue Waivers	10 CFR 54.21(c)(1)(iii)	4.3.2	SIA
RPV Fatigue Analyses	10 CFR 54.21(c)(1)(iii)	4.3.3	SIA
Metal Fatigue of Class 1 Components	10 CFR 54.21(c)(1)(i) 10 CFR 54.21(c)(1)(iii)	4.3.4	SIA
Metal Fatigue of Non-Class 1 Components	10 CFR 54.21(c)(1)(i)	4.3.5	SIA
High Energy Line Break (2)	10 CFR 54.21(c)(1)(i)	4.3.6	ENERCON
Environmentally Assisted Fatigue	10 CFR 54.21(c)(1)(iii)	4.3.7	SIA
Environmental Qualification (EQ) of Electric Components	10 CFR 54.21(c)(1)(iii)	4.4	
Containment Liner Plate, Metal Containments, and Penetrations Fatigue Analyses		4.6	
Fatigue Analysis of the Suppression Chamber		4.6.1	SIA
Fatigue of the Torus Shell	10 CFR 54.21(c)(1)(ii)	4.6.1.1	SIA
Fatigue of the Torus Weld	10 CFR 54.21(c)(1)(ii)	4.6.1.2	SIA
Fatigue Analysis of the Suppression Chamber Vent System		4.6.2	SIA
Fatigue Analysis of Suppression Chamber External Piping and Penetrations	10 CFR 54.21(c)(1)(ii)	4.6.3	SIA
Stress Report, Design Calculations Containment Vessel	10 CFR 54.21(c)(1)(ii)	4.6.4	SIA
Design Analysis of Flued Heads for Class 1 Penetrations	10 CFR 54.21(c)(1)(ii)	4.6.5	SIA

TLAAs List (Continued)

TLAA	Resolution	Section	Vendor
Other Plant-Specific Time-Limited Aging Analyses		4.7	
Fatigue of Cranes	10 CFR 54.21(c)(1)(ii)	4.7.1	ENERCON
Evaluation of the Fatigue Life of the Stabilizer Assembly	10 CFR 54.21(c)(1)(ii)	4.7.2	SIA
Evaluation of Existing Dollar Weld Indication	10 CFR 54.21(c)(1)(ii)	4.7.3	SIA
Evaluation of Thermal Fatigue Effects on Steam Lead and Inlet to RPV	10 CFR 54.21(c)(1)(ii)	4.7.4	SIA
Fatigue Analysis of Control Rod Drive Mechanism	10 CFR 54.21(c)(1)(ii)	4.7.5	SIA
Main Steam Isolation Valve D Flaw Evaluation	10 CFR 54.21(c)(1)(ii)	4.7.6	SIA
Bellows Design Analysis	10 CFR 54.21(c)(1)(ii)	4.7.7	SIA


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