FPL.

L-2018-175
10 CFR 54.17

October 17, 2018

U.S. Nuclear Regulatory Commission
Attn: Document Control Desk
Washington, D.C. 20555-0001

Re: Florida Power & Light Company
Turkey Point Units 3 and 4
Docket Nos. 50-250 and 50-251
Turkey Point Units 3 and 4 Subsequent License Renewal Application
Safety Review Requests for Additional Information (RAI) Set 5 Responses

References:

1. FPL Letter L-2018-004 to NRC dated January 30, 2018, Turkey Point Units 3 and 4 Subsequent License Renewal Application (ADAMS Accession No. ML18037A812)
2. FPL Letter L-2018-082 to NRC dated April 10, 2018, Turkey Point Units 3 and 4 Subsequent License Renewal Application – Revision 1 (ADAMS Accession No. ML18113A134)
3. NRC RAI E-Mail to FPL dated September 17, 2018, Requests for Additional Information for the Safety Review of the Turkey Point Subsequent License Renewal Application – Set 5 (EPID No. L-2018-RNW-0002) (ADAMS Accession Nos. ML18260A242 and ML18260A243)

Florida Power & Light Company (FPL) submitted a subsequent license renewal application (SLRA) for Turkey Point Units 3 and 4 to the NRC on January 30, 2018 (Reference 1) and SLRA Revision 1 on April 10, 2018 (Reference 2).

The purpose of this letter is to provide, as attachments to this letter, responses to the safety review RAIs issued by the NRC on September 17, 2018 (Reference 3). Each RAI response and its corresponding attachment are indexed on page 2 of this letter. The attachments identify changes that will be made in a future revision of the SLRA (if applicable).

If you have any questions, or need additional information, please contact me at 561-691-2294.

A084
NRR

Florida Power & Light Company

700 Universe Boulevard, Juno Beach, FL 33408

I declare under penalty of perjury that the foregoing is true and correct.

Executed on October 17, 2018.

Sincerely,

William Maher
Senior Licensing Director
Florida Power & Light Company

WDM/RFO

Attachments: 16 RAI Responses (refer to Letter Attachment Index)

LETTER ATTACHMENT INDEX			
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8	B.2.3.8-2	16	B.2.3.17-3

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Regional Administrator, USNRC, Region II
Project Manager, USNRC, Turkey Point Nuclear
Plant Project Manager, USNRC, SLRA
Plant Project Manager, USNRC, SLRA Environmental
Ms. Cindy Becker, Florida Department of Health

NRC RAI Letter Nos. ML18260A242 and ML18260A243 dated September 17, 2018

1. Reactor Coolant Pump Motor Flywheel, TLAA 4.3.5

Regulatory Basis:

Pursuant to 10 CFR 54.21(c), the SLRA shall include an evaluation of time-limited aging analyses (TLAAs). The applicant shall demonstrate that (i) the analyses remain valid for the period of extended operation; (ii) the analyses have been projected to the end of the period of extended operation; or (iii) the effects of aging on the intended function(s) will be adequately managed for the period of extended operation. In accordance with 10 CFR 54.21(c)(1)(i), the applicant has proposed to disposition the SLRA Section 4.3.5 TLAA for the RCP motor flywheel in accordance with 10 CFR 54.21(c)(1)(i) to demonstrate that the CLB analyses remain valid for the subsequent period of extended operation (SPEO).

RAI 4.3.5-2

Background:

To support its TLAA disposition of § 54.21(c)(1)(i), the applicant included the PWR Owners Group report, PWROG-17011-NP, Rev. 0, August 2017 in Enclosure 4 of the SLRA. PWROG-17011-NP provides the generic SLR methodology for deterministic and risk-informed analyses related to integrity of Westinghouse RCP motor flywheels. PWROG-17011-NP is not approved by the NRC for use in SLR applications. In order to complete its review of this TLAA the staff must determine whether the applicant's proposed implementation of the generic SLR flywheel methodology in PWROG-17011-NP is acceptable for demonstrating, per § 54.21(c)(1)(i), that the CLB analyses of the PTN 3 and 4 flywheels will remain valid for the subsequent period of extended operation (SPEO).

Issue:

The risk assessment in PWROG-17011-NP, Section 3 used the probabilistic fracture mechanics (PFM) analysis methodology to generate conditional probability of failure (PoF) for reactor coolant pump (RCP) flywheels for the 80-year risk assessment. The staff noted that the PoFs for the case when ISI was performed every 4 years for only the first 10 years of operation in PWROG-17011-NP for 80-year SLR terms are lower than the corresponding PoFs in WCAP-15666-A for 60-year initial LR terms. The reason for this is not clear. In theory, when a selected flaw is given 20 more years to grow without any ISI, the PoF should be higher.

Request:

Please explain why the PoFs for the ISI case documented above are lower for the 80-year SLR analysis in PWROG-17011-NP compared to the corresponding PoFs for this ISI case for the 60 year LR analysis in WCAP-15666-A.

If there is an error in the PoF analysis for this ISI case, please provide the correct PoF calculations for the 60-year and/or 80-year analyses, as needed. Please revise the PWROG-17011-NP report, as needed, to show the correct PoF calculations.

FPL Response:

The original analysis (WCAP-14353A) informing the topical was done in 1996 and updated in 2003 (WCAP-15666-A) for initial license renewal periods of 40-60 years. The original code was re-run in 2017 to extend applicability to 80 years as part of a Pressurized Water Reactor Owners Group (PWROG) project in support of forthcoming plant SLR applications.

The evaluation of the RCP flywheel in WCAP-15666 justifying extending RCP Flywheel inspection intervals from 10 year to 20 years for 60 years of plant operation is a combination of both deterministic and risk assessed evaluations. In extending the conclusions of WCAP-15666-A to 80 years of operation as part of PWROG-17011, the deterministic analysis in WCAP-15666-A remains valid for 80 years.

The deterministic evaluation analyzed the critical speeds needed for both ductile and non-ductile failures and demonstrated that significant conservatisms exist in the analysis. Critical speeds needed to induce ductile failure are greater than 3000 rpm whereas the normal operating speed of an RCP flywheel is ~1200 rpm and is limited to 1500 rpm with LOCA overspeed. Also, the critical crack lengths (>3 in.) are very conservative compared to UT inspection capabilities (0.33 in.) and calculated fatigue crack growth rates are small. Additionally, the time factor in the deterministic fatigue analysis considers 6000 start-stop cycles which is a very conservative assumption. Lastly, a review of industry OE was performed as part of the 2017 work in extending the evaluation to 80 years. 81 flywheel inspections have been performed with only 4 resulting in recordable indications. All 4 of these indications were determined to be non-relevant to flywheel integrity and are attributed to the disassembly and reassembly during inspection. Additionally, all requirements and allowables specified in Reg. Guide 1.14 are met, thus there is no safety concern with the existing report, WCAP-15666-A.

A review of the probabilistic and risk-based evaluation of PWROG 17011 was also performed to establish why the RCP Flywheel PoFs reported in PWROG 17011 are slightly less than POFs reported in WCAP-15666-A. This included a review of the original probabilistic fracture mechanics source code used for WCAP-15666-A to validate that original results could be re-produced. Unfortunately, Westinghouse has been unable to re-produce the original results. This has been entered into the Westinghouse Corrective Actions Program and investigation is ongoing.

As a corrective action, the probabilistic fracture mechanics portion of the source code will be re-written with appropriate validations and verifications performed in order to update the probabilistic fracture mechanics and risk assessment of the analysis. The outputs of the probabilistic fracture mechanics will then be used to update the risk assessment.

Based on discussions with Westinghouse, FPL is confident that continued acceptability of the 20 year inspection intervals can be demonstrated and will meet RG 1.174 guidance for the extended time intervals out to 80 years.

The following evaluations are planned to be available for NRC review no later than November 12, 2018:

a) Demonstration that the analysis meets the acceptance criteria for ductile failure,
b) Demonstration that the analysis meets the acceptance criteria for non-ductile failure,
c) Demonstration of compliance with excessive deformation failure criteria, and
d) Demonstration of compliance with LOCA overspeed criteria.

The following evaluation is planned to be available for NRC review no later than November 20, 2018:

e) Demonstration of the conservatisms in the probabilistic risk assessment and how the PRA results demonstrate acceptability of the 20 year inspection interval.

References:

1) SLRA Section 4.3.6 References –

4.3.6.18 PWR Owners Group, PWROG-17011-NP, Rev. 0, "Update for Subsequent License Renewal: WCAP-14535A, "Topical Report on Reactor Coolant Pump Flywheel Inspection Elimination" and WCAP-15666-A, "Extension of Reactor Coolant Pump Motor Flywheel Examination", November 2017 (Enclosure 4, Attachment 10).

4.3.6.30 United States Nuclear Regulatory Commission, Office of Standards Development, Regulatory Guide 1.14, "Reactor Coolant Pump Flywheel Integrity," Revision 1, August 1975.

2) United States Nuclear Regulatory Commission, Office of Standards Development, Regulatory Guide 1.174, "An Approach for Using Probablistic Risk-Assessment in Risk-Informed Decisions on Plant-Specific Changes to the Licensing Basis," Revision 3, January 2018.

Associated SLRA Revisions:

None

Associated Enclosures:

None

NRC RAI Letter Nos. ML18260A242 and ML18260A243 dated September 17, 2018

2. Reactor Vessel Material Surveillance, GALL AMP XI.M31

The applicant credits the Reactor Vessel Materials Surveillance Aging Management Program with managing the effects of loss of fracture toughness due to neutron embrittlement of reactor pressure vessel (RPV) components. In order to determine if the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation in accordance with 10 CFR 54.21 (a)(3), the staff requires additional information, as detailed below.

Regulatory Basis:

Section 54.21(a)(3) of 10 CFR states for each structure and component subject to an aging management review per § 54.21(a)(1), the applicant shall demonstrate that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation.

RAI B.2.3.19-1

Background:

The GALL-SLR, Section XI.M31 provides guidance for the Reactor Vessel Material Surveillance AMP. The GALL-SLR, in the program description states in part that:

> This program includes withdrawal and testing of at least one surveillance capsule addressing the subsequent period of extended operation, with a neutron fluence of the surveillance capsule between one and two times the peak neutron fluence of interest projected at the end of the subsequent period of extended operation. The peak reactor vessel neutron fluence of interest at the end of the subsequent period of extended operation should address the time-limited aging analyses (TLAAs) described in the following sections of the Standard Review Plan for Review of Subsequent License Renewal Applications for Nuclear Power Plants (SRP-SLR), as applicable:
>
> Sections 4.2.2.1.2 (Upper-Shelf Energy), 4.2.3.1.3 (Pressurized Thermal Shock) and 4.2.3.1.4 (Pressure-Temperature Limits) for pressurized water reactors (PWRs); and Sections 4.2.2.1.2 (Upper-Shelf Energy), 4.2.3.1.4 (Pressure Temperature Limits), 4.2.3.1.5 (Elimination of Boiling Water Reactor Circumferential Weld Inspection) and 4.2.3.1.6 (Boiling Water Reactor Axial Welds) for boiling water reactors (BWRs). If a capsule meeting this neutron fluence criterion has not been tested prior to entering the subsequent period of extended operation, then the program includes the withdrawal and testing (or alternatively the retrieval from storage, reinsertion for additional neutron fluence accumulation, if necessary, and testing) of one capsule addressing the subsequent period of extended operation to meet this criterion.

> If a surveillance capsule was previously identified for withdrawal and testing to address the initial period of extended operation, it is not acceptable to redirect or postpone the withdrawal and testing of that capsule to achieve a higher neutron fluence that meets the neutron fluence criterion for the subsequent period of extended operation.

Both the "Parameters Monitored or Inspected" and "Monitoring and Trending" program element in GALL-SLR XI.M31 contain similar wording to the above.

The description of the applicant's Reactor Vessel Material Surveillance AMP states that this program includes withdrawal and testing of the X_4 surveillance capsule and that this capsule is demonstrated as being within one to two times the peak reactor vessel neutron fluence of interest at the end of the SPEO in the TLAAs for USE, PTS, and P-T limits. The applicant claimed that its Reactor Vessel Material Surveillance AMP (SLRA Section B.2.3.19) will be consistent with the 10 elements of NUREG-2191, Section XI.M31, "Reactor Vessel Material Surveillance."

Issue:

According to the Turkey Point Units 3 and 4 UFSAR, Capsule X4 is scheduled to be withdrawn at a fluence of 9.297×10^{19} n/cm^2. The staff's safety evaluation (SE) approving the most recent approved capsule withdrawal schedule for Turkey Point Units 3 and 4[1] indicates that this fluence is approximately equivalent to the projected 80 year (67 effective full power years (EFPY)) peak RPV fluence, considering extended power uprate conditions. The SE also concluded the proposed withdrawal fluence was between one and two times the peak RPV fluence at 60 years, and that the schedule would continue to meet the requirements of ASTM E185-82 and thus meet 10 CFR 50, Appendix H. However, the staff notes the neutron embrittlement time limited aging analyses in the SLRA are based on neutron fluences projected to 72 EFPY.

Per SLRA Table 4.2.1-1, three components for each unit have projected neutron fluence values at 80 years that exceed the projected withdrawal fluence for Capsule X_4. The components are as follows:

Turkey Point Units 3 and 4 intermediate shell forgings with a projected fluence of 1.08×10^{20} n/cm^2

- Turkey Point Unit 3 inner shell (IS) to lower shell (LS) circumferential welds, and LS forgings with projected ID fluences at 80 years (72 EFPY) of 9.86×10^{19} n/cm^2
- Turkey Point Unit 4 inner shell (IS) to lower shell (LS) circumferential welds, and LS forgings with projected ID fluences at 80 years (72 EFPY) of 9.81×10^{19} n/cm^2

The same fluence values are used in the pressurized thermal shock (PTS) TLAA evaluation and these are the highest projected fluence values for 80 years used in the neutron embrittlement TLAA evaluations. However, these fluence values are larger than the expected withdrawal fluence of Capsule X_4 documented in the UFSAR.

Therefore, it does not appear that Capsule X_4 will be withdrawn and tested at a neutron fluence sufficient to be between one and two times the peak RPV neutron fluence of interest projected at the end of the subsequent period of extended operation, consistent with the applicant's claim of consistency with GALL-SLR, Section XI.M31.

Furthermore, since Capsule X_4 is credited as fulfilling the guidance of the GALL Report for initial license renewal (i.e., 40 to 60 years of operation) to withdraw and test a capsule with between one and two times the peak RPV fluence at 60 years, extending the schedule for Capsule X_4 to cover both the 60 and 80 year peak RPV fluences would also not be consistent with the applicant's claim of consistency with GALL-SLR, Section XI.M31.

[1] Turkey Point Nuclear Plant, Units 3 and 4 - Review of Reactor Vessel Material Surveillance Program - Revised Surveillance Capsule Withdrawal Schedule (TAC NOS. ME9564 and ME9565). September 4, 2013 (ADAMS Accession No. ML13191A090)

Request:

Justify how the predicted fluence of Capsule X_4 at the time of withdrawal will be one to two times the peak RPV fluence of interest at 80 years.

If the predicted fluence of Capsule X_4 at withdrawal will be less than 1.0 times the peak RPV fluence at 80 years, justify the claim of consistency with GALL-SLR, Section XI.M31 or identify and justify an exception to the GALL-SLR, Section XI.M31.

FPL Response:

Capsule X_4 is the last remaining capsule applicable to both Turkey Point Units 3 and 4 capsule with the limiting Linde 80 flux and weld wire heat 71249, that can achieve an 80 year fluence before the SPEO. The Turkey Point standby capsule V_4 contains weld metal but the lead factor (lead factor of ~ 1.015) is too low to provide meaningful data until the end of the SPEO. All the other remaining standby capsules do not contain weld material. The current scheduled withdraw for capsule X_4 of 38.1 EFPY for the 60 year license was projected to meet the peak vessel fluence at 80 years (67 EFPY) as identified in L-2012-351 (Adams ML12262A287). The 80 year (67 EFPY) projection was estimated by taking the achieved EFPY after 40 years of operation for Turkey Point Units 3 and 4 of approximately 29.1 EFPY and 29.4 EFPY, respectively, and adding 38 EFPY (40 years at 95% capacity) for a total of ~ 67 EFPY.

The 72 EFPY fluence projections described in SLRA Section 4.2.1 were chosen so that all fluence based neutron embrittlement TLAA calculations would bound the maximum achievable EPFY at the end of 80 years with several EFPY's of margin.

Although the current withdraw schedule and fluence for capsule X_4 was projected to meet 80 years (67 EFPY) of neutron fluence as well as be between one and two times the peak RPV neutron fluence at the end of the 60 year period of extended operation, capsule X_4 will not meet the 72 EFPY projected fluence values that include margin, identified in the SLRA.

Using the 72 EFPY bounding fluence projections identified in SLRA Table 4.2.1-1 and as restated in the RAI 2.3.19-1 above, the Turkey Point capsule X_4 can achieve a fluence of 9.86×10^{19} n/cm^2 at 39.5 EFPY, which bounds the 72 EFPY fluence for the limiting Turkey Point Units 3 and 4 intermediate to lower shell forging circumferential welds. Capsule X_4 can achieve a fluence of 1.08×10^{20} n/cm^2 at 41.5 EFPY, which bounds the 72 EFPY maximum fluence for the Tukey Point Units 3 and 4 forgings.

Extending the withdraw schedule for capsule X_4 to account for the bounding 80 year fluence is considered an exception to the GALL-SLR, Section XI.M31. However, this incremental change to the capsule X_4 withdraw schedule will allow sufficient material data and dosimetry to be obtained to monitor irradiation embrittlement at the end of the subsequent period of extended operation (SPEO). Further, the test data from capsule X_4 will be available prior to entering the SPEO with a projected capsule removal of 41.5 EFPY that corresponds to a removal for testing in 2026 based on the current operating schedule.

Therefore, in accordance with 10 CFR Part 50, Appendix H, Paragraph III.B.3, approval is requested to extend the Turkey Point capsule X_4 withdraw schedule from 38.1 EFPY to the first refueling outage that meets or exceeds (≥) 41.5 EFPY with a projected fluence of 1.08×10^{20} n/cm^2 to bound the 80 year (72 EFPY) projected end of the SPEO fluence for the Turkey Point Units 3 and 4 reactor vessels.

The proposed changes to the surveillance capsule withdraw schedule from the Turkey Point Unit 3 & 4 UFSAR Table 4.4-2 is shown below as indicated by text deletion (strikethrough) and text addition (red underlined font).

Table 4.4-2

Surveillance Capsule Withdrawal Schedule

Turkey Point Units 3 & 4(e)

Capsule (Unit shown as subscript)	Capsule Location (Degree)	Withdrawal EFPY(b)	Lead Factor(d)	Fluence (n/cm^2, E > 1.0 MeV)
T3	270°	1.15	2.736	0.599×10^{19}
T4	270°	1.17	2.74	0.649×10^{19}
S3	280°	3.46	1.997	1.272×10^{19}
S4	280°	3.41	2.03	1.29×10^{19}
V3	290°	8.06	0.891	1.223×10^{19}

Capsule (Unit shown as subscript)	Capsule Location (Degree)	Withdrawal EFPY(b)	Lead Factor(d)	Fluence (n/cm^2, E > 1.0 MeV)
X3	270° / 50°(a)	19.85	1.129	2.897×10^{19}
X4	270° / 50°(a)	~~38.1 (c)~~ **41.5(c)**	2.088	~~9.297×10^{19}~~ **1.08×10^{20}**
V4	290°	Standby	1.015	
U3	30°	Standby	0.767	
U4	30°	Standby	0.767	
W3	40°	Standby	0.523	
W4	40°	Standby	0.523	
Y3	150°	Standby	0.767	
Y4	150°	Standby	0.767	
Z3	230°	Standby	0.523	
Z4	230°	Standby	0.523	

(a) Capsule X_3 and Capsule X_4 were moved from the 50° location to the 270° location in 1990.
(b) Effective Full Power Years (EFPY) from plant startup.
(c) Capsule X4 should be removed at **the first refueling outage that meets or exceeds 41.5** ~~38.1~~EFPY to fulfill the requirements of the "5th Capsule" to be withdrawn. This EPFY will yield a capsule fluence that is approximately equivalent to the 80-year (~~67~~**72** EFPY) peak vessel fluence of **1.08×10^{20}** ~~9.27×10^{19}~~n/cm_2 (E> 1.0 MeV).
(d) The lead factors listed for Capsule X_4 and the standby capsules are 48 EPFY projections and pertain to the most limiting core design case (lowest lead factor). The lowest lead factor is considered most limiting to prevent premature capsule withdrawal. Turkey Point Unit 3 and 4 operate under an integrated surveillance program. Therefore, the Unit 4 standby capsule lead factors are approximated to be equivalent to the Unit 3 standby capsule lead factors.
(e) Capsule removal changes require NRC approval per 10 CFR 50 Appendix H.

SLRA Section 3.1.2.2.3.2; Table 3.1-1, item 014; Table 3.1.2-3; Section 17.2.2.19; Section B.1.1; Table B-4; and Section B.2.3.19 are revised to indicate the exception to the Reactor Material Surveillance AMP below.

References:

1. FPL Letter No L-2012-351, Reactor Vessel Material Surveillance Program - Revised Capsule Withdrawal Schedule for X_4, Dated September 4, 2012 (ADAMS Accession # ML12262A287)

2. NRC Safety Evaluation (SE) Letter, Turkey Point Nuclear Generating Unit Nos. 3 and 4 - Reactor Vessel Material Surveillance Program - Revised Capsule Withdrawal Schedule (TAC Nos. ME9564 and ME9565), Dated September 4, 2013 (ADAMS

Accession # ML13191A090)

3. SLRA Section 4.2.6 references –

   4.2.6.1 Regulatory Guide 1.190, "Calculation and Dosimetry Methods for Determining Pressure Vessel Neutron Fluence," U.S. Nuclear Regulatory Commission, March 2001.

   4.2.6.2 Westinghouse Electric Company Document WCAP-14040-A, Revision 4, "Methodology Used to Develop Cold Overpressure Mitigating System Setpoints and RCS Heatup and Cooldown Limit Curves," May 2004.

Associated SLRA Revisions:

The following changes to SLRA Section 3.1.2.2.3.2, Table 3.1-1 (Item 014), Table 3.1.2-3, Section 17.2.2.19, Section B.1.1, Table B-4, and Section B.2.3.19 will be made in a future SLRA revision as indicated by text deletion (strikethrough) and text addition (red underlined font).

Revise the further evaluation in Section 3.1.2.2.3 on page 3.1-10 as follows:

2. *Loss of fracture toughness due to neutron irradiation embrittlement could occur in BWR and PWR reactor vessel beltline shell, nozzle, and welds exposed to reactor coolant and neutron flux. A reactor vessel material surveillance program monitors neutron irradiation embrittlement of the reactor vessel. The Reactor Vessel Material Surveillance program is either a plant-specific surveillance program or an integrated surveillance program, depending on matters such as the composition of limiting materials and the availability of surveillance capsules.*

   In accordance with 10 CFR Part 50, Appendix H, an applicant is required to submit its proposed withdrawal schedule for approval prior to implementation. Untested capsules placed in storage must be maintained for future insertion. Thus, further NRC staff evaluation is required for a subsequent license renewal (SLR). Specific recommendations for an acceptable AMP are provided in GALL-SLR Report AMP XI.M31, "Reactor Vessel Material Surveillance."

   A Neutron Fluence Monitoring program may be used to monitor the neutron fluence levels that are used as the time-dependent inputs for the plant's reactor vessel neutron irradiation embrittlement TLAAs. These TLAAs are the subjects of the topics discussed in SRP-SLR Section 3.1.2.2.3.1 and "acceptance criteria" and "review procedure" guidance in SRP-SLR Section 4.2. For those applicants that determine it is appropriate to include a Neutron Fluence Monitoring AMP in their SLRAs, the program is to be implemented in conjunction with the applicant's implementation of an AMP that corresponds to GALL-SLR Report AMP XI.M31, "Reactor Vessel Material Surveillance." Specific recommendations for an acceptable Neutron Fluence

Monitoring AMP are provided in GALL-SLR Report AMP X.M2, "Neutron Fluence Monitoring."

The neutron fluence TLAA in Section 4.2, "Reactor Vessel Neutron Embrittlement Analysis," is managed by the Neutron Fluence Monitoring AMP, which is addressed in Section B.2.2.2. The Neutron Fluence Monitoring AMP is a site-specific program. This AMP is consistent with 10 CFR Appendix H. The capsule withdrawal schedule has previously been approved by the NRC, and **with an incremental schedule adjustment** remains applicable for the SPEO. The Neutron Fluence Monitoring AMP monitors the plant conditions to ensure the assumptions of the TLAA remain bounding and is implemented in conjunction with the Reactor Vessel Material Surveillance AMP.

- Revise the discussion in Table 3.1-1 (Item # 3.1-1, 014) on page 3.1-30 as follows:

Table 3.1-1: Summary of Aging Management Evaluations for the Reactor Vessel, Internals, and Reactor Coolant System

Item Number	Component	Aging Effect/ Mechanism	Aging Management Program (AMP)/ TLAA	Further Evaluation Recommended	Discussion
3.1-1, 014	Steel (with or without cladding) reactor vessel beltline shell, nozzle, and weld components; exposed to reactor coolant and neutron flux	Loss of fracture toughness due to neutron irradiation embrittlement	AMP XI.M31, "Reactor Vessel Material Surveillance," and AMP X.M2, "Neutron Fluence Monitoring"	Yes (SRP-SLR Section 3.1.2.2.3.2)	Consistent with NUREG-2191, **with exception**. Loss of fracture toughness of the steel reactor vessel beltline shell, nozzle and welds in the beltline region will be managed with the Reactor Vessel Material Surveillance and Neutron Fluence Monitoring AMPs. Further evaluation is documented in Section 3.1.2.2.3, Item 2.

- Revise the pertinent rows and Notes in Table 3.1.2-3 on pages 3.1-102 and 3.1-103 as follows:

Table 3.1.2-3: Reactor Vessels – Summary of Aging Management Evaluation

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-2191 Item	Table 1 Item	Notes
Reactor vessel components: primary nozzles	Pressure boundary Structural support	Carbon steel with stainless steel clad	Neutron flux	Loss of fracture toughness	Reactor Vessel Material Surveillance Neutron Fluence Monitoring	IV.A2.RP-229	3.1-1, 014	**B** ~~A~~
Reactor vessel components: shells	Pressure boundary Structural support	Carbon steel with stainless steel clad	Neutron flux	Loss of fracture toughness	Reactor Vessel Material Surveillance Neutron Fluence Monitoring	IV.A2.RP-229	3.1-1, 014	**B** ~~A~~

Notes for Table 3.1.2-3

A. Consistent with component, material, environment, aging effect and AMP listed for NUREG-2191 line item. AMP is consistent with NUREG-2191 AMP description.

B. Consistent with component, material, environment, aging effect and AMP listed for NUREG-2191 line item. AMP has exceptions to NUREG-2191 AMP description.

C. Component is different, but consistent with material, environment, aging effect and AMP listed for NUREG-2191 line item. AMP is consistent with NUREG-2191 AMP description.

E. Consistent with NUREG-2191 material, environment, and aging effect but a different AMP is credited or NUREG-2191 identifies a plant-specific AMP.

- Revise the AMP description in Section 17.2.2.19 on page A-25 as follows:

17.2.2.19 Reactor Vessel Material Surveillance

The PTN Reactor Vessel Material Surveillance AMP is an existing AMP, formerly a portion of the PTN Reactor Vessel Integrity Program. This AMP includes withdrawal and testing of the X_4 surveillance capsule, identified in UFSAR Table 4.4-2. This capsule is demonstrated as being within one to two times the peak reactor vessel neutron fluence of interest **at 67 EFPY**. **This capsule will be within one to two times the peak reactor vessel neutron (72 EFPY) fluence at** the end of the SPEO **with a minimal adjustment to the approved withdrawal schedule**~~in the TLAAs for USE, PTS, and P-T temperature limits~~. The surveillance program adheres to the requirements of 10 CFR Part 50, Appendix H, as well as the American Society for Testing Materials (ASTM) standards incorporated by reference in 10 CFR Part 50, Appendix H. The surveillance capsule withdrawal schedule is per Attachment 1 of the PTN Reactor Material Surveillance Program. Surveillance capsules are designed and located to permit insertion of replacement capsules.

- Revise the AMP overview in Section B.1.1 on pages B-2 and B-3 as follows:

...

The new AMPs listed above will be consistent with NUREG-2191, without exception. The AMPs listed below will also be consistent with the 10 elements of their respective NUREG-2191 AMPs, but have one exception justified by technical data:

- Reactor Head Closure Stud Bolting AMP (Section B.2.3.3)
- Steam Generators (Section B.2.3.10)
- Closed Treated Water Systems AMP (Section B.2.3.12)
- Fuel Oil Chemistry AMP (Section B.2.3.18)
- **Reactor Vessel Material Surveillance AMP (Section B.2.3.19)**

- Revise the AMP overview in Table B-4 on page B-22 as follows:

PTN Aging Management Program	Section	PTN Site-Specific?	NUREG-2191 Comparison		
			NUREG-2191 Section	Enhancements?	Exceptions?
Reactor Vessel Material Surveillance	B.2.3.19	No	XI.M31	No	~~No~~**Yes**

- Revise the AMP description in Section B.2.3.19 on pages B-171 to B-173 as follows:

B.2.3.19 Reactor Vessel Material Surveillance

Program Description

This program includes withdrawal and testing of the X_4 surveillance capsule. This capsule is demonstrated as being within one to two times the peak reactor vessel neutron fluence of interest **at 67 EFPY**. **This capsule will be within one to two times the peak reactor vessel neutron (72 EFPY) fluence at** the end of the SPEO **with an incremental adjustment to the approved withdrawal schedule**~~in the TLAAs for USE, PTS, and P-T limits~~.

FPL was a member of the Babcock & Wilcox Owners Group (B&WOG) reactor vessel working group. The B&WOG designed an irradiation surveillance program (Master Integrated Reactor Vessel Program, MIRVP) (Reference B.3.144) in which member materials are irradiated at host plants. PTN materials are being irradiated in both reactor vessels (Units 3 and 4) at the site and in the MIRVP. The MIRVP Charpy values and direct fracture toughness (master curve) data will be used as supplemental data. To date this program has developed one set of Charpy values and two sets of irradiated "master curve" data relative to the PTN beltline materials. The PWROG is now the mechanism for the previous B&WOG reactor vessel working group activities, and FPL is a member of the PWROG. Recent changes to the MIRVP are currently being evaluated by the NRC. However, the implementation of the MIRVP in this Reactor Vessel Material Surveillance AMP is only for supplemental data and is not a part of the NRC-approved surveillance program. This AMP relies fully on onsite capsules.

The objective of the PTN Reactor Vessel Material Surveillance AMP is to provide sufficient material data and dosimetry to (a) monitor IE to a neutron fluence level which is greater than the projected peak neutron fluence of interest projected to the end of the SPEO, and (b) provide adequate dosimetry monitoring during the SPEO. Dosimetry monitoring during the SPEO is performed by the PTN Neutron Fluence Monitoring AMP (Section B.2.2.2). The PTN Reactor Vessel Material Surveillance AMP provides data on neutron embrittlement of the reactor vessel materials and neutron fluence data. These data are used to evaluate the TLAAs on neutron IE (e.g., USE, PTS, P-T limits evaluations, etc.) as needed to demonstrate compliance with the requirements of 10 CFR Part 50, Appendix G, and 10 CFR 50.61 and 10 CFR 50.61a for the SPEO, as described in NUREG-2192, Section 4.2. This AMP has one capsule that will attain neutron fluence between one and two times the peak reactor vessel wall neutron fluence of interest at the end of the SPEO. The AMP withdraws, and subsequently tests, the capsule(s) at an outage in which the capsule receives a neutron fluence of between one and two times the peak reactor vessel neutron fluence of interest at the end of the

SPEO. Test results from this capsule are reported, consistent with 10 CFR Part 50, Appendix H.

All pulled and tested samples placed in storage with reactor vessel neutron fluence less than 37.5 percent of the projected neutron fluence at the end of the SPEO, may be discarded. All pulled and tested samples with a neutron fluence greater than 37.5 percent of the projected reactor vessel neutron fluence at the end of the SPEO and all untested capsules are placed in storage (these specimens and capsules are saved for possible future reconstitution and reinsertion use) unless the NRC has approved discarding the pulled and tested samples or capsules. Tested surveillance specimens may be withdrawn from storage and used in research activities (e.g., microstructural examination, mechanical testing, and/or additional irradiation) without NRC approval as a sufficient number of specimens will remain. This PTN Reactor Vessel Material Surveillance AMP is a condition monitoring program that measures the increase in Charpy V-notch 30 foot-pound (ft-lb) transition temperature and the drop in the USE as a function of neutron fluence and irradiation temperature. The data from this surveillance program are used to monitor neutron irradiation embrittlement of the reactor vessel, and are inputs to the neutron embrittlement TLAAs. The PTN Reactor Vessel Material Surveillance AMP is also used in conjunction with the proposed PTN Neutron Fluence Monitoring AMP.

All surveillance capsules, including those previously withdrawn from the reactor vessel, must meet the test procedures and reporting requirements of the applicable ASTM standards referenced in 10 CFR Part 50, Appendix H, to the extent practicable, for the configuration of the specimens in the capsule. Any changes to the surveillance capsule withdrawal schedule must be approved by the NRC prior to implementation, in accordance with 10 CFR Part 50, Appendix H, Paragraph III.B.3.

NUREG-2191 Consistency

The PTN Reactor Vessel Material Surveillance AMP will be consistent with the 10 elements of NUREG-2191, Section XI.M31, "Reactor Vessel Material Surveillance"**,** **with the following exception**.

Exceptions to NUREG-2191

~~None~~**In order to achieve the peak 72 EFPY end-of-life fluence values identified in SLRA Table 4.2.1-1 and used in the TLAAs for USE, PTS, ART and P T limits, an incremental adjustment to the approved capsule withdrawal schedule for X_4 is requested. The Turkey Point standby capsule V_4 contains weld metal but the lead factor (lead factor of ~ 1.015) is too low to provide meaningful data until the end of the SPEO. All the remaining standby capsules do not contain weld material. The current approved withdrawal of capsule X_4 is scheduled at 38.1 EFPY, a**

fluence of 9.297x10^{19} n/cm^2, for the 60 year license and was projected to meet the peak vessel fluence at 80 year (67 EFPY).

Using the 72 EFPY bounding fluence projections identified in SLRA Table 4.2.1-1, Turkey Point capsule X_4 can achieve a fluence of 9.86x10^{19} n/cm^2 at 39.5 EFPY, which bounds the 72 EFPY projected fuence for the limiting Turkey Point Units 3 and 4 intermediate to lower shell forging circumferential welds. Capsule X_4 can achieve a fluence of 1.08x10^{20} n/cm^2 at 41.5 EFPY, which bounds the 72 EFPY maximum fluence for the Turkey Point Units 3 and 4 forgings. This incremental change to the capsule X_4 withdrawal schedule will allow sufficient material data and dosimetry to be obtained to monitor irradiation embrittlement through the end of the SPEO. Further, the test data from Capsule X_4 will be available prior to entering the SPEO with a projected capsule removal of 41.5 EFPY that corresponds to a removal for testing in 2026 based on the current operating schedule.

Associated Enclosures:

None

NRC RAI Letter Nos. ML18260A242 and ML18260A243 dated September 17, 2018

RAI B.2.3.19-2

Background:

GALL-SLR AMP XI.M31 states under "Monitoring and Trending" program element that if no in-vessel surveillance capsules are available, an alternative neutron fluence monitoring program uses alternative dosimetry, either from in-vessel capsules or ex-vessel capsules, to monitor neutron fluence during the subsequent period of extended operation, and that the methods used in this alternative neutron fluence monitoring program are consistent with RG 1.190, including appropriate benchmarking, as described in GALL-SLR Report AMP X.M2, "Neutron Fluence Monitoring."

The applicant claimed that its Reactor Vessel Material Surveillance AMP (SLRA Section B.2.3.19) will be consistent with the 10 elements of NUREG-2191, Section XI.M31, "Reactor Vessel Material Surveillance."

Issue:

The description of the RV Material Surveillance AMP does not describe any provisions for neutron fluence monitoring after capsule X_4 is withdrawn and tested, which is scheduled to occur during the initial license renewal period.

Request:

Describe how the RV fluence will be monitored after the last scheduled capsule is withdrawn and tested.

FPL Response:

Turkey Point Units 3 and 4 each have four (4) standby surveillance capsules in each of the reactor vessels. These capsules contain dosimetry material that could be used to evaluate and benchmark fluence projections. Ex-vessel dosimetry has also been used at Turkey Point in the past to evaluate significant changes in loading patterns.

The neutron transport methodology used to generate the current fluence projections followed the guidance of Regulatory Guide 1.190, are within the uncertainties identified in Regulatory Guide 1.190, and consistent with the United States Nuclear Regulatory Commission (USNRC) approved methodology described in WCAP-14040-A.

The Neutron Fluence Monitoring AMP monitors the plant conditions to ensure the assumptions of the TLAA remain bounding and is implemented in conjunction with the Reactor Vessel Material Surveillance AMP as described in SLRA Section B.2.2.2. Fluence estimates developed for the SLRA used a fuel loading pattern for the projection to 72 EFPY intended to provide a conservatively bounding fluence estimate during the SPEO. This bounding fuel loading pattern in addition to the bounding assumption of 72 EFPY considered for the 80 year period provides for a conservatively bounding fluence estimate.

Changes in fuel type or fuel loading pattern are followed and considered to ensure that neutron fluence calculations remain bounding with respect to actual plant operating conditions. Should significant changes in core operating conditions or fuel loading patterns be implemented that could result in these fluence estimates being exceeded, the fluence estimates would be revised to incorporate updated actual plant operating conditions and fuel loading pattern input to determine the impact to the 80 year period. Should the results determine that additional fluence measurements are necessary to assure the fluence estimates remain within the ranges of uncertainty in Regulatory Guide 1.190, either in-vessel standby capsules or ex-vessel dosimetry can be implemented.

References:

SLRA Section 4.2.6 references –

4.2.6.1 Regulatory Guide 1.190, "Calculation and Dosimetry Methods for Determining Pressure Vessel Neutron Fluence," U.S. Nuclear Regulatory Commission, March 2001.

4.2.6.2 Westinghouse Electric Company Document WCAP-14040-A, Revision 4, “Methodology Used to Develop Cold Overpressure Mitigating System Setpoints and RCS Heatup and Cooldown Limit Curves,” May 2004.

Associated SLRA Revisions:

None

Associated Enclosures:

None

NRC RAI Letter Nos. ML18260A242 and ML18260A243 dated September 17, 2018

3. Flux Thimble Tube Inspection, GALL AMP XI.M37

Regulatory Basis:

Section 54.21(a)(3) of 10 CFR states for each structure and component subject to an aging management review per § 54.21(a)(1), the applicant shall demonstrate that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation.

RAI B.2.3.24-1

Background:

SLRA Section B.2.3.24 and the "monitoring and trending" program element state that flux thimble tube wall thickness measurements are trended and wear rates are calculated using the methodology of either WCAP-12866, "Bottom Mounted Instrumentation Flux Thimble Wear" or PTN letter JPNS-PTN-91-5374, "BMI Thimble Tube Wear Evaluation."

The applicant also stated that the methodology set forth in these documents includes sufficient conservatism to ensure that wall thickness acceptance criteria continue to be met during plant operation between scheduled inspections.

Issue:

The applicant stated its program is consistent with the "detection of aging effects," and "monitoring and trending" program elements. However, the applicant did not explain or justify how the methodology in either of these documents provide conservative estimates of flux thimble tube wear and include sufficient conservatism to ensure that wall thickness acceptance criteria continue to be met during plant operation between scheduled inspections.

Furthermore, the applicant did not explain the criteria that will be used to determine which methodology will be used (i.e., WCAP-12866 or PTN letter JPNS-PTN-91-5374) to trend flux thimble tube wall thickness measurements and calculate wear rates.

Request:

- Discuss the differences between the two methodologies (i.e., WCAP-12866 and PTN letter JPNS-PTN-91-5374) used to trend flux thimble tube wall thickness measurements and calculate wear rates.
- Discuss the correlation between these two methodologies and justify the criteria that will be used to determine which methodology will establish the inspection schedule of the flux thimble tubes.

- Justify that the methods in WCAP-12866 and PTN letter JPNS-PTN-91-5374 provide conservative estimates of flux thimble tube wear and include sufficient conservatism to ensure that wall thickness acceptance criteria continue to be met during plant operation between scheduled inspections.

FPL Response:

- The PTN Flux Thimble Tube Wear AMP relies on inspections of flux thimble tubes as well projections of expected tube wear consistent with NUREG 2191 XI.M37 Elements 4 and 5. The calculational methodology in JPNS-PTN-91-5374 is taken directly from WCAP-12866 with no differences.
- WCAP-12866 provides two methodologies for calculating wear rates. One methodology is provided for cases with sufficient existing data for tube wall thickness (at least two prior inspections), and one for cases without sufficient existing data. The methodology implemented in JPNS-PTN-91-5374 is consistent with the WCAP-12866 methodology for cases where data for at least two prior tube wall thickness measurements have been taken. The JPNS-PTN-91-5374 methodology is applicable to all thimble tubes with sufficient existing data. The alternative methodology presented in WCAP-12866 will be used for cases where the existing data is known to no longer be applicable, such as replacement of a tube, or changes to flow rates.
- The extent of wall loss is based on an exponentially decreasing curve with a tube specific exponent value calculated using two previous PTN inspection results for the tube of interest. Alternatively, when a tube does not have sufficient inspection history, a conservative exponent value, provided by WCAP-12866, is applied.

  The calculated exponent projection methodology is a best representation of wall loss rate over time. A conservative projection is created when the WCAP-12866 defined exponent value is applied to tubes without sufficient inspection history. To ensure the wall thickness acceptance criteria continue to be met during plant operation between scheduled inspections the PTN Flux Thimble Tube Wear AMP will be enhanced ensure the two most limiting data points are used when calculating a tube specific exponent value.

References:

1. NUREG-2191, Generic Aging Lessons Learned for Subsequent License Renewal (GALL-SLR), U.S. NRC Office of Nuclear Reactor Regulation, Final Report

Associated SLRA Revisions:

The following changes to SLRA Appendix A Table 17-3 and Section B.2.3.24 will be made in a future SLRA revision as indicated by text deletion (strikethrough) and text addition (red underlined font).

Revise SLRA Appendix Table 17-3 as follows:

Table 17-3

List of SLR Commitments and Implementation Schedule

No.	Aging Management Program or Activity (Section)	NUREG-2191 Section	Commitment	Implementation Schedule
28	Flux Thimble Tube Inspection (17.2.2.24)	XI.M37	Continue the existing PTN Flux Thimble Tube Inspection AMP, including enhancement to: a) Establish the interval between inspections such that no flux thimble tube is predicted to incur wear that exceeds the established acceptance criteria before the next inspection. b) Remove from service the flux thimble tubes that cannot be inspected over the tube length, yet are subject to wear due to restriction or other defects, but cannot be shown by analysis to be satisfactory for continued service. This ensures the integrity of the RCS pressure boundary.	No later than 6 months prior to the SPEO, i.e.: PTN3: 1/19/2032 PTN4: 10/10/2032

Table 17-3

List of SLR Commitments and Implementation Schedule

No.	Aging Management Program or Activity (Section)	NUREG-2191 Section	Commitment	Implementation Schedule
			c) Use the default exponent value methodology from WCAP-12866 to calculate the wear rate. When three or greater data points exist, a calculated exponent value from the two most limiting data points may be used in accordance with the WCAP-12866 methodology.	

Revise SLRA Section B.2.3.24 as follows:

B.2.3.24 Flux Thimble Tube Inspection

Program Description

The PTN Flux Thimble Tube Inspection AMP, previously the PTN Thimble Tube Inspection Program, is an existing condition monitoring program used to inspect for thinning of the flux thimble tube wall, which provides a path for the incore neutron flux monitoring system detectors and forms part of the RCS pressure boundary. This AMP manages the aging effect of loss of material due to fretting wear.

The flux thimble tube inspection associated with this AMP encompasses all of the flux thimble tubes that form part of the RCS pressure boundary. This AMP monitors flux thimble tube wall thickness to detect loss of material from the flux thimble tubes during the SPEO. The flux thimble tubes are subject to loss of material at certain locations in the reactor vessel where flow-induced fretting causes wear at discontinuities in the path from the reactor vessel instrument nozzle to the fuel assembly instrument guide tube. Periodic bobbin coil eddy current testing (ECT) is used to monitor for loss of material and wear of the flux thimble tubes during the SPEO. This inspection AMP implements the recommendations of NRC Bulletin 88-09 (Reference B.3.53), "Thimble Tube Thinning in Westinghouse Reactors."

The frequency of examinations is based on site-specific wear data and wear predictions. The basic examination schedule was developed by Westinghouse based on evaluation of results obtained from the 2004 and 2005 RFOs. The Westinghouse examination schedule defines examinations to be performed at least every two or three fuel cycles. Thimble tube wear rates are projected over future operating cycles and future examination intervals are determined based on the disposition of examination results and engineering evaluations that have been completed, as this is required to substantiate the decision for an alternate examination interval.

Flux thimble tube wall thickness measurements are trended and wear rates are calculated using the methodology of WCAP-12866 (Reference B.3.148), "Bottom Mounted Instrumentation Flux Thimble Wear"<u>.</u> ~~or PTN letter JPNS-PTN-91-5374 (Reference B.3.137), "BMI Thimble Tube Wear Evaluation." The methodology set forth in these documents includes sufficient conservatism to ensure that wall thickness acceptance criteria continue to be met during plant operation between scheduled inspections.~~ <u>**To ensure sufficient conservatism, the conservative exponential wear variable will be used. If greater than three data points exist for a tube, the two most conservative data points may be used to create a tube specific exponential variable.**</u> Corrective actions are taken when trending results project that acceptance criteria would not be met prior to the next planned inspection or the end of the SPEO.

Inspection results (including wall loss) are reported using the PTN CAP and are provided to the appropriate engineering personnel who evaluate, disposition and recommend any necessary corrective actions. The evaluation must determine the need for repositioning, capping or replacing the applicable damaged thimble tubing, or may provide justification to retain the original configuration of the existing thimble tube if it remains within the acceptance criteria. A maximum depth of 80 percent through-wall wear with a maximum scar length of 5.0 inches was established as the maximum acceptable through-wall wear, based on WCAP-12866. A more conservative depth of 70 percent through-wall wear is applied at PTN to ensure that the integrity of pressure boundary is maintained. This conservative depth includes allowances for instrument uncertainty and other inaccuracies.

NUREG-2191 Consistency

The PTN Flux Thimble Tube Inspection AMP, with enhancements, will be consistent with the 10 elements of NUREG-2191, Section XI.M37, “Flux Thimble Tube Inspection.”

Exceptions to NUREG-2191

None

Enhancements

The PTN Flux Thimble Tube Inspection AMP will be enhanced as follows, for alignment with NUREG-2191. There are no new inspections required for SLR; however, existing inspection frequencies may change. The changes and enhancements are to be implemented no later than six months prior to entering the SPEO.

Element	Enhancement
4. Detection of Aging Effects	Revise the governing AMP procedure to specify the interval between inspections be established such that no flux thimble tube is predicted to incur wear that exceeds the established acceptance criteria before the next inspection.
5. Monitoring and Trending	**Revise the governing AMP procedure to state the calculational methodology will use the default exponent value methodology from WCAP-12866 to calculate the wear rate. When three or greater data points exist, a calculated exponent value from the two most limiting data points may be used in accordance with the WCAP-12866 methodology.**

Element	Enhancement
7. Corrective Actions	Revise the governing AMP procedure to state the following: Flux thimble tubes that cannot be inspected over the tube length, that are subject to wear due to restriction or other defects, and that cannot be shown by analysis to be satisfactory for continued service are removed from service to ensure the integrity of the RCS pressure boundary.

Associated Enclosures:

None

NRC RAI Letter Nos. ML18260A242 and ML18260A243 dated September 17, 2018

RAI B.2.3.24-2

Background:

SLRA Section B.2.3.24 and the "detection of aging effects' program element indicate that the Flux Thimble Tube Inspection Program includes periodic bobbin coil eddy current testing used to monitor for loss of material and wear of the flux thimble tubes during the SPEO and that the frequency of examinations is based on site-specific wear data and wear predictions.

During its audit, the staff reviewed the applicant's results from previous flux thimble inspections and noted that several flux thimble tubes were projected to not exceed the through-wall acceptance criteria through the SPEO.

Issue:

During its audit, the staff noted from past inspections that it appears the applicant's program does not rely solely on site-specific wear data and wear predictions to schedule future inspections. However, based on the applicant's program basis document and current procedures it's not clear how long the inspection interval can be prolonged based on site-specific wear data and wear predictions before an inspection is performed to confirm these predictions.

Request:

- Verify whether the Flux Thimble Tube Inspection Program includes periodic inspections that confirm the site-specific wear predictions are accurate or conservative during the SPEO.
- Discuss how long the inspection interval for flux thimble tubes can be prolonged based on site-specific wear data and wear predictions before an inspection is performed to confirm that wear predictions are accurate or conservative? Justify that this amount of time is appropriate to ensure the acceptance criteria for through-wall wear is not exceeded prior to this confirmation.

FPL Response:

- The PTN Flux Thimble Tube AMP examination schedules are established based on disposition of the most recent examination results. The basic examination interval recommended by Westinghouse is based on PTN flux thimble tube inspections from 2004 and 2005 and recommends inspections be performed every two or three outages. Examination intervals may deviate from this recommendation provided the new schedule is established through an engineering disposition of the most recent examination results and considers industry initiatives regarding inspection frequency.

- Per PTN SLRA Commitment 28 in Appendix A Table 17-3, inspection intervals are established such that no flux thimble tube is predicted to incur wear that exceeds the established acceptance criteria before the next inspection. This is consistent with the guidelines on inspection interval provided in NUREG-2191 XI.M37 Element 4. Currently, a full reinspection of all flux thimble tubes is scheduled for the upcoming outages at PTN Units 3 and 4 (3R30 and 4R31).

References:

1. NUREG-2191, Generic Aging Lessons Learned for Subsequent License Renewal (GALL-SLR), U.S. NRC Office of Nuclear Reactor Regulation, Final Report

Associated SLRA Revisions:

None

Associated Enclosures:

None

NRC RAI Letter Nos. ML18260A242 and ML18260A243 dated September 17, 2018

4. Boric Acid Corrosion, GALL AMP XI.M10

Regulatory Basis:

Section 54.21(a)(3) of 10 CFR requires an applicant to demonstrate that the effects of aging for structures and components will be adequately managed so that the intended function(s) will be maintained consistent with the current licensing basis for the period of extended operation. One of the findings that the staff must make to issue a renewed license (10 CFR 54.29(a)) is that actions have been identified and have been or will be taken with respect to managing the effects of aging during the period of extended operation on the functionality of structures and components that have been identified to require review under 10 CFR 54.21, such that there is reasonable assurance that the activities authorized by the renewed license will continue to be conducted in accordance with the current licensing basis. As described in SRP-SLR, an applicant may demonstrate compliance with 10 CFR 54.21(a)(3) by referencing the GALL-SLR Report. In order to complete its review and enable the formulation of a finding under 10 CFR 54.29(a), the staff requires additional information in regard to the matters described below.

RAI B.2.3.4-1

Background:

The original boric acid wastage surveillance program for the initial license renewal (PTN-ENG-LRAM-00-0028, Revision 4) limited the scope of the walkdowns to carbon steel components. Subsequent aging management guidance in the GALL and GALL-SLR Reports AMP XI.M10 included copper alloy with greater than 15 percent zinc as a material susceptible to loss of material due to boric acid corrosion. Although the program basis document (FLPCORP020-REPT-074, Revision 1) states that the "AMP covers any susceptible structures and components on which boric acid corrosion may occur," the implementing procedure (0-ADM-537, Boric Acid Corrosion Control Program, Revision 13) only discusses steel components and does not specifically identify copper alloy with greater than 15 percent zinc.

SLRA Table 3.2.2-1, "Emergency Containment Cooling," and SLRA Table 3.3.2-10, "Normal Containment Cooling," (which address systems in the engineered safety features and auxiliary systems, respectively) include heat exchanger tubes made from copper alloy greater than 15 percent zinc. However, the discussion in SLRA Table 3.2-1 for item 3.2.1-008 states that there are no components made from copper alloy with greater than 15 percent zinc, exposed to air with borated water leakage, in the engineered safety features systems. Similarly, the discussion in SLRA Table 3.3-1 for item 3.3.1-009 only addresses steel components and by inference indicates that there are no components made from copper alloy with greater than 15 percent zinc, exposed to air with borated water leakage, in the auxiliary systems. The staff notes that these AMR items for copper alloy only cite an environment of condensation, whereas, other AMR items in both systems for components made from steel include an environment of "air with borated water leakage," and credit the Boric Acid Corrosion program for managing loss of material. The staff also notes that the external surfaces of the heat exchanger tubes made from copper alloy with greater than 15 percent zinc in SLRA Tables 3.2.2-1 and 3.3.2-10, are not being managed for loss of material.

Issue:

It is unclear to the staff that the components made from copper alloy with greater than 15 percent zinc that are located inside the containment building will not be exposed to air with borated water leakage. As discussed in industry operating experience cited in the GALL-SLR Report (LER 346/2002-008), air-side fouling of the containment air coolers resulted from boric acid deposition due to reactor coolant system leakage. Based on the lack of AMR items and the lack of specificity in the boric acid corrosion program implementing procedure (0-ADM-537), the staff is unsure whether inspections of the external surfaces for components made from the copper alloy with greater than 15 percent zinc will be included in the program.

Request:

a) Provide the bases to justify the lack of consideration for an external environment of "air with borated water leakage," for heat exchanger tubes in either the emergency or normal containment cooling systems that are made from copper alloy with greater than 15 percent zinc.

b) Confirm that the Boric Acid Corrosion program will manage loss of material due to boric acid corrosion for all components made from copper alloy with greater than 15 percent zinc when exposed to an external environment of air with borated water leakage.

FPL Response:

a) The heat exchanger tubes in the emergency containment cooling system that are made of copper alloy > 15% Zn are enclosed in containment cooler housings. The containment cooler housings are listed in Table 3.2.2-2 as Heat exchanger (shell), with an air with borated water leakage environment managed by the Boric Acid Corrosion AMP. Borated water leakage, in the form of moist steam, could plate out inside the containment cooler housings and is addressed by enhancement to the Boric Acid Corrosion Program as described in Section B.2.3.4 and Table 17-3 Item 8. The emergency containment cooling unit housings can be opened to inspect the heat exchanger tubes. Clarification that the copper alloy > 15% Zn heat exchanger tubes in the emergency containment coolers experience a borated water leakage environment, that is managed by the Boric Acid Corrosion AMP, is warranted.

Therefore, a row for "Copper alloy >15% Zn" "Heat exchanger (tubes)" exposed to "air with borated water leakage" is added to Table 3.2.2-1. Also, the entries 3.2-1, 008 and 3.3-1, 009 in Tables 3.2-1 and 3.3.-1 respectively have been revised to include copper alloy > 15% Zn.

In the response to RAI 3.3.2.10-1 in Attachment 32 of Reference 1, the material of the heat exchanger tubes in the normal containment ventilation system were determined to be copper alloy and not copper alloy > 15% Zn.

b) The PTN Boric Acid Corrosion AMP will manage loss of material for copper alloy components with greater than 15% Zn when exposed to borated water leakage. As described in SLRA Table 17-3, item 8 and B.2.3.4, enhancement 3, containment air cooler thermal performance will be included in the AMP (for corroborating increases in containment atmosphere temperature or humidity with decreases in cooler efficiency due to boric acid plate out).

Per B.2.3.4, the AMP covers any susceptible structures and components (SCs) on which boric acid corrosion may occur and electrical components onto which borated water may leak. Upon FPL review, it was determined that copper alloy components >15% Zn in some portions of the systems in tables 3.3.2-2, 3.3.2-4, and 3.3.2-15 are also susceptible to loss of material in an air with borated water leakage environment. These tables have been revised to reflect these additions.

Additionally, SLRA Sections 17.2.2.4 and B.2.3.4 are revised to clarify which materials are susceptible to loss of material in air with treated borated water.

References:

1. Florida Power & Light Company letter to U. S. Nuclear Regulatory Commission, "Turkey Point Units 3 and 4 Subsequent License Renewal Application Safety Review Requests for Additional Information (RAI) Set 3 Responses"

Associated SLRA Revisions:

The following changes to SLRA Tables 3.2-1, 3.2.2-1, 3.3-1, 3.3.2-2, 3.3.2-4, and 3.3.2-15 will be made in a future SLRA revision as indicated by text deletion (strikethrough) and text addition (red underlined font).

Revise SLRA Table 3.2-1 item 008 as follows:

Table 3.2-1: Summary of Aging Management Evaluations for the Engineered Safety Features

Item Number	Component	Aging Effect / Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.2-1, 008	Copper alloy (>15% Zn) piping, piping components exposed to air with borated water leakage	Loss of material due to boric acid corrosion	AMP XI.M10, "Boric Acid Corrosion"	No	~~Not applicable.~~ ~~There are no copper alloy (>15% Zn) piping or piping components exposed to air with borated water leakage in the Engineered Safety Features systems.~~ **Consistent with NUREG-2191. The Boric Acid Corrosion AMP will be used to manage oss of material of copper alloy > 15% Zn surfaces exposed to air with borated water leakage.**

Revise SLRA Table 3.2.2-1 as follows:

Table 3.2.2-1: Emergency Containment Cooling – Summary of Aging Management Evaluation								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-2191 Item**	**Table 1 Item**	**Notes**
Heat exchanger (tubes)	**Pressure boundary**	**Copper alloy >15% Zn**	**Air with borated water leakage**	**Loss of material**	**Boric Acid Corrosion**	**V.E.EP-38**	**3.2-1, 008**	**C**

Revise SLRA Table 3.3-1 item 009 as follows:

Table 3.3-1: Summary of Aging Management Evaluations for the Auxiliary Systems					
Item Number	**Component**	**Aging Effect / Mechanism**	**Aging Management Programs**	**Further Evaluation Recommended**	**Discussion**
3.3-1, 009	Steel, copper alloy (>15% Zn) external surfaces, piping, piping components exposed to air with borated water leakage	Loss of material due to boric acid corrosion	AMP XI.M10, "Boric Acid Corrosion"	No	Consistent with NUREG-2191. The Boric Acid Corrosion AMP will be used to manage loss of material of steel **and copper alloy > 15% Zn** surfaces exposed to air with borated water leakage.

Revise SLRA Table 3.3.2-2 as follows:

Table 3.3.2-2: Component Cooling Water – Summary of Aging Management Evaluation								
Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-2191 Item	Table 1 Item	Notes
Valve body	Pressure boundary	Copper alloy >15% Zn	Air with borated water leakage	Loss of material	Boric Acid Corrosion	VII.I.AP-66	3.3-1, 009	A, 1

Plant-Specific Notes for Table 3.3.2-2

1. The Boric Acid Corrosion AMP is used only for those components that are in areas that contain borated water systems.

Revise SLRA Table 3.3.2-4 as follows:

Table 3.3.2-4: Chemical and Volume Control – Summary of Aging Management Evaluation								
Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-2191 Item	Table 1 Item	Notes
Heat exchanger (shell)	Pressure boundary	Copper alloy >15% Zn	Air with borated water leakage	Loss of material	Boric Acid Corrosion	VII.I.AP-66	3.3-1, 009	A
Valve body	Pressure boundary	Copper alloy >15% Zn	Air with borated water leakage	Loss of material	Boric Acid Corrosion	VII.I.AP-66	3.3-1, 009	A

Revise SLRA Table 3.3.2-15 as follows:

Table 3.3.2-15: Fire Protection – Summary of Aging Management Evaluation								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-2191 Item**	**Table 1 Item**	**Notes**
Nozzle	**Pressure boundary**	**Copper alloy >15% Zn**	**Air with borated water leakage**	**Loss of material**	**Boric Acid Corrosion**	**VII.I.AP-66**	**3.3-1, 009**	**A, 4**
Tubing	**Pressure boundary**	**Copper alloy >15% Zn**	**Air with borated water leakage**	**Loss of material**	**Boric Acid Corrosion**	**VII.I.AP-66**	**3.3-1, 009**	**A, 4**
Valve body	**Pressure boundary**	**Copper alloy >15% Zn**	**Air with borated water leakage**	**Loss of material**	**Boric Acid Corrosion**	**VII.I.AP-66**	**3.3-1, 009**	**A, 4**

Plant-Specific Notes for Table 3.3.2-15

1. The Fire Water System AMP is enhanced to manage the wall thinning due to erosion aging effect.
2. The Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components AMP is used to manage loss of material due to wear for elastomeric components.
3. The Selective Leaching AMP is used to manage loss of material due to Selective Leaching for water that could pool at the bottom of lube oil coolers.
4. **The Boric Acid Corrosion AMP is used only for those components that are in areas that contain borated water systems.**

The following changes to SLRA Section 17.2.2.4 will be made in a future SLRA revision as indicated by text deletion (strikethrough) and text addition (red underlined font).

The PTN Boric Acid Corrosion AMP is an existing AMP, previously the PTN Boric Acid Wastage Surveillance Program, that manages the aging effects of loss of material and mechanical closure integrity due to aggressive chemical attack resulting from borated water leaks. This AMP addresses the reactor coolant system (RCS) and SCs containing, or exposed to, borated water.

This AMP utilizes systematic inspections, leakage evaluations, and corrective actions for all components subject to AMR that may be adversely affected by some form of borated water leakage. This ensures that boric acid corrosion does not lead to degradation of pressure boundary, leakage boundary or structural integrity of components, supports, or structures, including electrical equipment in proximity to borated water systems. **Susceptible components include those composed of carbon steel, cast iron, and copper alloy >15% Zn materials.** The effects of boric acid corrosion on reactor coolant pressure boundary materials in the vicinity of nickel alloy components are also addressed by the PTN Cracking of Nickel-Alloy Components and Loss of Material Due to Boric Acid-Induced Corrosion in Reactor Coolant Pressure Boundary Components AMP, which is associated with NUREG-2191 XI.M11B, "Cracking of Nickel-Alloy Components and Loss of Material Due to Boric Acid-Induced Corrosion in Reactor Coolant Pressure Boundary Components (PWRs Only)." Additionally, this AMP relies in part on the response to, and includes commitments to, NRC Generic Letter (GL) 88-05, "Boric Acid Corrosion of Carbon Steel Reactor Pressure Boundary Components in PWR Plants," to identify, evaluate, and correct borated water leaks that could cause corrosion damage. This AMP includes provisions to initiate evaluations and assessments when leakage is discovered by activities not associated with the program. This AMP also follows the guidance described in Section 7 of Westinghouse Commercial Atomic Power (WCAP)-15988-NP, Revision 2, "Generic Guidance for an Effective Boric Inspection Program for Pressurized Water Reactors."

The following changes to SLRA Section B.2.3.4 will be made in a future SLRA revision as indicated by text deletion (strikethrough) and text addition (red underlined font).

The PTN Boric Acid Corrosion AMP covers any susceptible structures and components (SCs) on which boric acid corrosion may occur and electrical components onto which borated ~~reactor~~ water may leak. **Susceptible components include those composed of carbon steel, cast iron, and copper alloy >15% Zn materials.** This AMP includes provisions in response to the recommendations of NRC GL 88-05 (Reference B.3.32).

This AMP provides the following:

Associated Enclosures:

None

NRC RAI Letter Nos. ML18260A242 and ML18260A243 dated September 17, 2018

5. Flow-Accelerated Corrosion, GALL AMP XI.M17

Regulatory Basis:

10 CFR 54.21(a)(3) requires an applicant to demonstrate that the effects of aging for structures and components will be adequately managed so that the intended function(s) will be maintained consistent with the current licensing basis for the period of extended operation. One of the findings that the staff must make to issue a renewed license (10 CFR 54.29(a)) is that actions have been identified and have been or will be taken with respect to managing the effects of aging during the period of extended operation on the functionality of structures and components that have been identified to require review under 10 CFR 54.21, such that there is reasonable assurance that the activities authorized by the renewed license will continue to be conducted in accordance with the current licensing basis. As described in SRP-SLR, an applicant may demonstrate compliance with 10 CFR 54.21(a)(3) by referencing the GALL-SLR Report. In order to complete its review and enable the formulation of a finding under 10 CFR 54.29(a), the staff requires additional information in regard to the matters described below.

RAI B.2.3.8-1

Background:

The "scope of program" program element for NUREG-2191, AMP XI.M17, "Flow-Accelerated Corrosion," states that the program, described by the Electric Power Research Institute (EPRI) guidelines in Nuclear Safety Analysis Center (NSAC)-202L, "Recommendations for an Effective Flow-Accelerated Corrosion Program," includes procedures and administrative controls to assure that structural integrity is maintained for piping components. NSAC-202L, Revisions 2, 3, and 4, Section 3.1, "Governing Document," recommends the inclusion of quality assurance requirements.

Procedure 0-ADM-530, "Flow-Accelerated Corrosion (FAC) Inspection Implementation Program," Revision 0D, defines CHECWORKS™ and CHEC-NDE™ as computer software developed by EPRI to predict susceptible components and to input component inspection results into a plant database. Procedure IM-AA-101, "Software Quality Assurance Program," Revision 12, provides the essential elements to meet the quality assurance standards established in the Quality Assurance Topical Report. Procedure IM-AA-101 also defines four levels of software classification based on the task for which the output is to be used.

Procedure ENG-FAC-2.3-7, "Validation of Flow-Accelerated Corrosion Program Software," Revision 9, notes that CHECWORKS™ is classified as software quality assurance Level C, "Business Critical." However, the software classification determination in JIM-MIS-1178-EPRI, Revision 1, for CHECWORKS™ states that the software is classified as Level D, "Other."

Issue:

It is not clear to the staff whether the software products used in the Flow-Accelerated Corrosion program (i.e., CHECWORKS™ and CHEC-NDE™) are currently classified as Level C or Level D. In addition, it is not clear to the staff whether for subsequent license renewal these software products would meet the classification criteria for Level A, "Safety-Related," (if the generated calculations or data are relied upon as the means of decision making for supporting safety-related operational function), or Level B, "Regulatory / Quality-Related," (if the software will ensure compliance with commitments that are required by nuclear regulations).

Request:

For any software products used in the Flow-Accelerated Corrosion program, provide the software quality assurance classification, as delineated in Procedure IM-AA-101, "Software Quality Assurance Program," and the bases for the classification.

FPL Response:

The only two software programs used by the Turkey Point (PTN) FAC Aging Management Program (AMP) are CHECWORKS™ Steam/Feedwater Application (SFA) and FAC Manager Web Edition (FMWE). It is noted that CHEC-NDE™ is not used by the PTN FAC AMP.

CHECWORKS™ SFA and FMWE are classified as SQA Level C software per IM-AA-101 for the current licensing basis. This same classification is also applicable throughout the subsequent period of extended operations (SPEO) and the basis is documented on the two respective software classification determination (SCD) forms.

References:

None

Associated SLRA Revisions:

None

Associated Enclosures:

None

NRC RAI Letter Nos. ML18260A242 and ML18260A243 dated September 17, 2018

RAI B.2.3.8-2

Background:

The GALL-SLR Report AMP XI.M17, "Flow-Accelerated Corrosion," "detection of aging effects" program element states that the inspection program delineated in NSAC-202L includes the identification of susceptible locations. Procedure ER-AA-111, "Flow-Accelerated Corrosion (FAC) Program," Revision 1, Section 5.1, "Program Scope," states that the "System Susceptibility Evaluation (SSE) developed from this section becomes a Basis Document for the FAC Program." It also states that the SSE should include guidance from NSAC-202L; that it should be updated to include additions and deletions of systems; and that it should be maintained to ensure changes in chemistry, operation, and design are appropriately addressed. NSAC-202L, Revisions 2, 3, and 4, Section 4.2, "Identifying Susceptible Systems," recommends that the Susceptibility Analysis identify the systems, or portions of systems excluded from the FAC program and the basis for their exclusion.

Issue:

The program basis documentation associated with the Flow-Accelerated Corrosion program neither discussed nor referenced a System Susceptibility Evaluation. The staff notes that the SLRA discusses an enhancement to the "detection of aging effects" program element that will reassess piping systems that have been excluded from wall thickness monitoring based on operation less than 2 percent of plant operating time. It is unclear to the staff how this reassessment can be performed if there is no current system susceptibility evaluation that documents which systems or portions of systems have been excluded based on limited operation.

Request:

Provide information regarding the development of the System Susceptibility Evaluation discussed in Procedure ER-AA-111, "Flow-Accelerated Corrosion (FAC) Program," Section 5.1, "Program Scope." Include a discussion about the enhancement to the "detection of aging effects" program element to perform a "re-assessment" of excluded components if an initial assessment of excluded components does not exist.

FPL Response:

Regulatory requirements for the Flow-Accelerated Corrosion Aging Management Program are administratively controlled by procedure and identify NSAC-202L-R3, including predecessor / successor revisions, as the source of regulatory requirements. The instructions for developing an SSE are specified in the procedure mentioned in the RAI "Request" section as follows:

All components potentially susceptible to FAC degradation should be identified through a System Susceptibility Evaluation. Station piping specifications, line lists, and piping design tables can identify systems which contain components constructed of materials susceptible to FAC damage. The Station heat balance diagram and line list can identify systems that operate at conditions which can result in FAC degradation. In general, all carbon steel plant systems which are exposed to fluids under conditions which can result in FAC should be included in the inspection program. However, a line is considered non-susceptible to FAC and may be excluded from the scope of the program if it meets one or more of the following criteria from NSAC-202L:

(1) *Lines constructed of stainless steel piping or low alloy steel with a nominal chromium content greater than or equal to 1.25%.*

(2) *Dry or superheated steam systems. Drains from these systems should not automatically be excluded. In lines considered to be superheated, operating conditions may have changed to allow reduction of superheat. These lines should be considered for inspection if wet steam is suspected.*

(3) *Single phase systems operating at less than 200°F.*

(4) *Systems with high dissolved oxygen (oxygen > 1,000 ppb) such as service water, circulating water, and fire protection.*

(5) *Systems with no flow or infrequently used lines with a total operating and testing time that is less than 2% of the plant operating time. However, this exclusion should only be applied to lines that do not operate under severe conditions (e.g., flashing conditions).*

(6) *Systems not containing water or steam.*

The System Susceptibility Evaluation (SSE) becomes a Basis Document for the station FAC Program. This Basis Document should include sufficient information to document the SSE. This should be updated to include the addition and/ or deletion of systems as required by plant or industry experience; or as justified by inspection results or material replacement. In addition, the SSE should be maintained to ensure that changes in operation, chemistry, or design that could impact FAC susceptibility are addressed appropriately. Use NSAC-202L for reference and guidance.

The most recent SSE for the PTN Flow-Accelerated Corrosion Aging Management Program was documented in August 2017. Since an SSE currently does exist, a re-assessment of excluded components can occur. The SSE gives an “EI” classification to components that are excluded due to infrequent operation and gives an “EC” classification to components that are excluded due to a combination of infrequent operations above a temperature threshold. Components assigned these classifications in the SSE require a reassessment to ensure that the exclusion remains valid and applicable for operation beyond 60 years.

While researching this RAI, it was observed that PTN SLRA Appendix A Sections 17.2.2.8 and 17.5 and Appendix B had a reference discrepancy. See the "Associated SLRA Revisions" section for the correction.

References:

None

Associated SLRA Revisions:

The following changes to SLRA Appendix A, Section 17.2.2.8 and Reference 55, and SLRA Appendix B, Reference B.3.113, will be made in a future SLRA revision as indicated by text deletion (strikethrough) and text addition (red underlined font).

Revise SLRA Appendix A, Section 17.2.2.8 paragraph 2, as follows:

The AMP is based on commitments made in FPL letter, L-89-265, which was in response to the NRC GL 89-08. This AMP relies on implementation of the EPRI guidelines in NSAC-202L-R3, "Recommendations for an Effective Flow Accelerated Corrosion Program (~~1015425~~**1011838**)," and use of the predictive analytical software, CHECWORKS™.

Revise SLRA Appendix A, Section 17.5 Reference 55, as follows:

55. EPRI, NSAC-202L, Revision 3, "Recommendations for an Effective Flow-Accelerated Corrosion Program (~~1015425~~**1011838**)," Electric Power Research Institute, Palo Alto, California, Nuclear Safety Analysis Center (NSAC), ~~August 10, 2007~~ **May 2, 2006**.

Revise SLRA Appendix B, Reference B.3.113, as follows:

B.3.113 EPRI, NSAC-202L, Revision 3, "Recommendations for an Effective Flow-Accelerated Corrosion Program (~~1015425~~**1011838**)," Electric Power Research Institute, Palo Alto, California, Nuclear Safety Analysis Center (NSAC), ~~August 10, 2007~~ **May 2, 2006**.

Associated Enclosures:

None

NRC RAI Letter Nos. ML18260A242 and ML18260A243 dated September 17, 2018

RAI B.2.3.8-3

Background:

The "acceptance criteria" program element for NUREG-2191, AMP XI.M17, "Flow-Accelerated Corrosion," states "The minimum allowable wall thickness is the thickness needed to satisfy the component's design loads under the original code of construction." Turkey Point Report FPLCORP020-REPT-079, "Aging Management Program Basis Document – Flow-Accelerated Corrosion," Revision 1, Section 4.6, "Acceptance Criteria," states that this element of the AMP is consistent without exception with NUREG-2191.

FPL SPEC-M-006, Revision 5, Section 6.4, "Acceptance Criteria for Underthickness," states: "Section III of the ASME Code allows the use of the 10% rule as given in 6.4.1." SPEC-M-006, Section 6.4.1, "Ten Percent Rule," states: "When the measured thickness is greater than 0.9 times the calculated required thickness, the item meets the provisions of the ASME Code."

Issue:

Based on the staff's review of FPL SPEC-M-006, the ASME Code Section III "10% rule" acceptance criterion is based on the opinion of a participating ASME Code member. There is no evidence in plant-specific documents, or in ASME Code language or formal interpretations that this opinion has been endorsed by an industry consensus process. Lacking an industry consensus review, it is not clear that the ASME Code Section III "10% rule" acceptance criterion is consistent with the acceptance criteria in GALL-SLR AMP XI.M17.

Request:

Provide the specific statements from the ASME Code Section III that explicitly state the acceptability of the "10 percent rule."

FPL Response:

Appendix A to FPL SPEC-M-006, Revision 5, provides the explicit statements in the ASME Code forming the basis for "the 10% Rule" used to assist in performing engineering evaluations for pipe wall thinning. Evaluations that invoke "the 10% Rule" allow for the thickness of metallic piping installed at PTN to be less than the minimum required thickness where a local discontinuity or local wall thinning occurs or is suspected to occur. These evaluations are only used to support continued plant operation until such time that repairs can be implemented. "The 10% Rule" is not used to justify underthickness in new materials used for construction or repair.

The provisions for acceptance of underthickness in localized areas have remained unchanged from the original publication of the ASME nuclear code in 1963 to the present. ASME Boiler and Pressure Vessel (B&PV) Code, Section III, 1971 Edition, Subsection NB 3213.10 defines local primary-membrane stress; figure NB-3221-1 summarizes stress categories and limits of stress intensity for design conditions. Guidelines provided in SPEC-M-006 are based on the fact that the ASME B&PV Code allows a 10% increase in allowable stress or stress intensity for primary-membrane stresses and uses stress conditions to define a local area. If the local area stress does not exceed $1.1^{*}S_m$ (110% of the general primary-membrane stress, S_m), then the local area's stress does not exceed the allowable stress intensity limits. Therefore, such underthickness is acceptable.

SPEC-M-006 also references the analyses and test data from Electric Power Research Institute (EPRI) report NP5911SP as evidence supporting engineering judgement that safety margin is not compromised when a measured wall thickness is at 90% of the minimum (design) wall thickness. NP5911SP develops curves defining an acceptable degree of local thinning for piping designed to different Codes based on the local membrane stress requirement contained in ASME Section III, NB-3200.

It is noted that even if the "10% Rule" is used to justify a local deformity, SPEC-M-006 still requires a condition report to be written and reinspection or repair/replacement based on projected remaining life (i.e., time until thickness reaches $0.9t_{min}$).

References:

American Society of Mechanical Engineers, ASME Boiler and Pressure Vessel Code, Section III, Subsection NB, 1971 Edition.

1. Electric Power Research Institute (EPRI), NP-5911SP, "Acceptance Criteria for Structural Evaluation of Erosion-Corrosion Thinning Carbon Steel Piping," July, 1988, Palo Alto, California.

Associated SLRA Revisions:

None

Associated Enclosures:

None

NRC RAI Letter Nos. ML18260A242 and ML18260A243 dated September 17, 2018

6. External Surfaces Monitoring of Mechanical Components, GALL AMP XI.M36

Regulatory Basis:

Section 54.21(a)(3) of 10 CFR requires an applicant to demonstrate that the effects of aging for structures and components will be adequately managed so that the intended function(s) will be maintained consistent with the current licensing basis for the period of extended operation. One of the findings that the staff must make to issue a renewed license (10 CFR 54.29(a)) is that actions have been identified and have been or will be taken with respect to managing the effects of aging during the period of extended operation on the functionality of structures and components that have been identified to require review under 10 CFR 54.21, such that there is reasonable assurance that the activities authorized by the renewed license will continue to be conducted in accordance with the current licensing basis. As described in SRP-SLR, an applicant may demonstrate compliance with 10 CFR 54.21(a)(3) by referencing the GALL-SLR Report. In order to complete its review and enable the formulation of a finding under 10 CFR 54.29(a), the staff requires additional information in regard to the matters described below.

RAI B.2.3.23-1

Background:

As provided in Enercon Report FPLCORP020-REPT-094, "Aging Management Program Basis Document – External Surfaces Monitoring of Mechanical Components," Procedure 0-ADM-564, "Systems / Programs Monitoring," implements the associated program. Section 4.1, "Requirements," of this implementing procedure states that license renewal walkdowns shall be done in accordance with Attachment 2, "System/Component Groups Requiring Inspection for License Renewal Walkdown Report." Procedure 0-ADM-564, Attachment 2 includes forms for individual systems, or portions of systems, and specifies the components, material, and purpose of the inspection (e.g., valves, carbon steel, external loss of material).

Report FPLCORP020-REPT-094, Section 6.0, "Implementing Documents," identifies procedural actions for the program's implementing procedures. For Procedure 0-ADM-564, the specified action is to include the enhancements from the "parameters monitored or inspected," "detection of aging effects," "acceptance criteria," and "corrective actions" program elements. The staff notes that these enhancements do not revise the "scope of program" program element to include any components in aging management review (AMR) reports that are not currently listed in the implementing procedures.

Issue:

It is not clear that all of the AMR items crediting the External Surfaces Monitoring of Mechanical Components program for subsequent license renewal are currently included in the implementing procedure's walkdown forms. For example, SLRA Table 3.3.2-15, "Fire Protection," includes a number of components that credit the External Surfaces Monitoring of Mechanical Components AMP; however, there is no corresponding form in Procedure 0-ADM-564, Attachment 2 for any components in the fire protection system. In addition, although SLRA Table 3.2.2-2, "Containment Spray," includes stainless steel components that credit the External Surfaces Monitoring of Mechanical Components AMP, Procedure 0-ADM-564, Attachment 2, Form 30, "Containment Spray," only identifies carbon steel or cast iron components and does not include any stainless steel components.

Request:

Clarify whether all AMR items that credit the External Surfaces Monitoring of Mechanical Component program for subsequent license renewal are currently included in the associated implementing procedures, or delineate which existing enhancement will update the implementing procedures to include all such AMR items.

FPL Response:

AMR items that credit the External Surfaces Monitoring of Mechanical Components program for subsequent license renewal are not currently included in the associated implementing procedures. The associated implementing procedures implement the Systems and Structures Monitoring program for the current period of extended operation. The transition of the Systems and Structures Monitoring program from the current period of extended operation to the External Surfaces Monitoring of Mechanical Components program for subsequent license renewal is addressed in the External Surfaces Monitoring of Mechanical Components AMP, including revisions of implementing procedures and / or development of new procedures.

Per NUREG-2192, enhancements are, "those activities needed to ensure consistency with the GALL-SLR Report recommendations." As stated in SLRA Table 17-3, item 27, there are numerous enhancements required for consistency with Section XI.M36 of NUREG-2191 for subsequent license renewal. The transition of the System and Structures Monitoring program credited in the current PEO to the External Surfaces Monitoring of Mechanical Components AMP for the SPEO is described in the AMP basis document. Implementation of the External Surfaces Monitoring of Mechanical Components AMP will include both the identified enhancements and administrative clarifications. Both will be addressed through revision of existing procedures or development of new procedures.

References:

1. NUREG-2192, Final Report, Standard Review Plan for Review of Subsequent License Renewal Applications for Nuclear Power Plants

Associated SLRA Revisions:

The following changes to SLRA Table 17-3 will be made in a future SLRA revision as indicated by text deletion (strikethrough) and text addition (red underlined font).

Revise the introduction sentence in the "Commitment" column to SLRA Table 17-3, item 27 as follows:

No.	Aging Management Program or Activity (Section)	NUREG-2191Section	Commitment	Implementation Schedule
27	External Surfaces Monitoring of Mechanical Components (17.2.2.23)	XI.M36	Transition and ~~C~~continue the existing PTN External Surfaces Monitoring of Mechanical Components AMP, including enhancement to:	No later than 6 months prior to the SPEO, i.e.: PTN3: 1/19/2032 PTN4: 10/10/2032

Associated Enclosures:

None

NRC RAI Letter Nos. ML18260A242 and ML18260A243 dated September 17, 2018

RAI B.2.3.23-2

Background:

As provided in Enercon Report FPLCORP020-REPT-094, "Aging Management Program Basis Document – External Surfaces Monitoring of Mechanical Components," Procedure 0-ADM-564, "Systems / Programs Monitoring," implements the associated program. Procedure 0-ADM-564, Attachment 2, "System/Component Groups Requiring Inspection for License Renewal Walkdown Report," provides forms for recording inspection results. For a number of system/component groups, the forms state "Walkdown is performed under PTN-LRAM-00-0028." The staff notes that PTN-LRAM-00-0028, "Boric Acid Wastage Surveillance Program – License Renewal Basis Document," is part of the original license renewal documentation and was added to Procedure 0-ADM-564 in December 2017. The stated purpose of PTN-LRAM-00-0028 is to document those activities of the Boric Acid Wastage Surveillance Program, which are credited as part of the license renewal process.

Issue:

The current implementing procedure for the External Surfaces Monitoring of Mechanical Components Program, 0-ADM-564, appears to credit the boric acid corrosion inspections performed through PTN-LRAM-00-0028. However, the program basis document, FPLCORP020-REPT-094, does not include any discussion regarding inspections associated with the boric acid corrosion program. Consequently, it is not clear to the staff if all aspects of the inspections (e.g., scope, extent, action request flagging) being performed through PTN-LRAM-00-0028 have commensurate requirements as the inspections detailed in Procedure 0-ADM-564, Section 4.3, "Performance of Walkdowns."

Request:

Clarify the extent to which walkdowns being performed under PTN-LRAM-00-0028 are being credited for walkdowns in Procedure 0-ADM-564, as stated on applicable walkdown forms in 0-ADM-564, Attachment 2. For those portions of the walkdowns that credit PTN-LRAM-00-0028, provide information to show that the applicable inspection requirements in Procedure 0-ADM-564 are either included or are not required to be included in the walkdowns being performed under PTN-LRAM-00-0028.

FPL Response:

Procedure 0-ADM-564 is an implementing procedure for the System and Structures Monitoring AMP for original license renewal. During the current period of extended operation, the boric acid corrosion inspections for limited components and systems are such that system and structures monitoring requirements are also satisfied and a separate inspection deemed unnecessary. As stated in SLRA Table 17-3, item 27, there are several enhancements required for the External Surfaces Monitoring of Mechanical Components AMP for SLR. As described in the program basis document, the relevant enhancements to the existing System and Structures Monitoring AMP that will be reflected in the SLR External Surfaces Monitoring of Mechanical Components AMP will be captured through revision of the implementing procedures or development of new procedures. As described in the AMP basis document, relevant enhancements to the System and Structures Monitoring program for SLR will be reflected in the External Surfaces Monitoring of Mechanical Components AMP through revision of implementing procedures or development of new procedures. The portions of the implementing procedure that refer to external surfaces monitoring walkdowns being performed under a different AMP will be removed or clarified to more clearly indicate that the requirements of both AMPs are met for the limited components and systems.

References:

None

Associated SLRA Revisions:

None

Associated Enclosures:

None

NRC RAI Letter Nos. ML18260A242 and ML18260A243 dated September 17, 2018

RAI B.2.3.23-3

Background:

The discussion for the Operating Experience in SLRA Section B.2.3.23, "External Surfaces Monitoring of Mechanical Components," states that, during the December 2017 AMP effectiveness review, the "systems" sub-part of the Systems and Structures Monitoring Program failed the "scope of programs," "detection of aging effects," and "corrective actions" program elements. The Operating Experience section also states that "corrective actions have been initiated and completed to resolve AMP issues regarding the ineffectiveness of the Systems and Structures Monitoring AMP." The staff notes that recent changes to Procedure 0-ADM-564 included: (December 2017) revising Attachment 2, Walkdown Forms and (April 2018) adding several instructions to action requests when significant deficiencies are identified during license renewal walkdowns.

Recent NRC inspection reports (05000250/2017003 and 05000250/2017007), include findings associated with: a) failure to promptly identify and correct external corrosion on component cooling water piping, and b) failure to inspect intake cooling water piping in accordance with procedure 0-ADM-564, respectively. The staff notes that the associated findings were documented in inspection reports dated October 2, 2017, and November 9, 2017, and would have been appropriate for consideration during the December 2017 AMP effectiveness review discussed in the SLRA.

In addition, NRC inspection report 05000250/2017004 includes an adverse trend related to identification and resolution of corrosion-related issues on the intake cooling water and component cooling water systems. This inspection report discusses walkdowns performed by a Turkey Point Coatings Task Force in November 2017 that identified numerous corrosion issues on the intake cooling water valve pits, including the issues recently found by NRC inspectors. The NRC inspection report identifies the licensee's findings that various corrosion control procedures were not being adequately implemented, with system engineers and other plant personnel not identifying corrosion-related issues, believing that they were being addressed by other programs. The NRC inspection report also states that at the end of the inspection period (December 31, 2017) the licensee's investigations and development of corrective actions to address the programmatic issues with identification and resolution of corrosion-related issues were not completed.

Issue:

The operating experience discussion for the External Surfaces Monitoring of Mechanical Components AMP states that corrective actions have been completed to resolve the identified ineffectiveness issues for the existing AMP.

However, based on information in NRC inspection reports, programmatic issues from the Turkey Point Coatings Task Force (chartered in November 2017) had not yet been completed. The staff notes that the only change made to the implementing procedure (0-ADM-564) after December 2017 was the addition of instructions for including keywords and descriptions to corrective action documents that identify significant deficiencies identified during license renewal walkdowns. It was not clear to the staff that this change addressed the various identification and resolution of corrosion-related issues discussed in the NRC inspection reports.

Request:

Provide a discussion regarding the findings and long term corrective actions for the programmatic corrosion issues identified by the Turkey Point Coatings Task Force, as discussed in NRC inspection report 05000250/2017004. Include a description of changes to the External Surfaces Monitoring of Mechanical Components program that will result from the corrective actions being considered.

FPL Response:

Various action requests were entered into the PTN corrective action program based on the issues identified in the referenced NRC inspections along with the initial and ongoing actions of the Turkey Point Coatings Task Force. The specific issues identified in the NRC inspection reports are as follows:

1) Failure to promptly identify and correct component cooling water (CCW) external pipe corrosion that led to a through-wall flaw and leak on the Unit 3 CCW surge tank makeup line (Reference 1).
2) Failure to inspect Intake Cooling Water (ICW) piping in accordance with license renewal commitments (Reference 2).
3) Failure to promptly identify and correct an adverse condition to quality that led to continued corrosion and significant scaling and pitting of the Unit 4 CCW 18-inch headers at the penetration seals from the CCW heat exchanger room to the 10-foot pipeway (Reference 3).
4) The inspectors identified an adverse trend related to identification and resolution of corrosion-related issues on the ICW and CCW SSCs (Reference 3).

As identified in the referenced inspection reports, ARs were generated to address the organizational and programmatic drivers associated with these adverse trends.

For the current period of operation, a comprehensive list was developed to highlight existing material condition deficiencies, vulnerabilities, and increase interdepartmental focus to resolve the issues. This list is used so that the repairs could be prioritized based on the extent of the deficiency and the system risk assessment. Additionally, a list of all preventive actions and maintenance practices was created so that any gaps could be identified and corrected associated with components that may not receive as much focus as needed.

The longer term actions include better defining the roles and responsibilities of the site personnel that are responsible for identifying and correcting coatings or corrosion deficiencies along with various programmatic changes. This resulted from an organizational effectiveness investigation checklist being performed by system engineering staff. This checklist concluded that corrosion/coatings issues have been identified in the past and were not corrected due to prioritization and resource challenges. The following specific actions were taken.

1. The fleet system and program health reporting procedure was revised to clarify the guidance for red and yellow actions to consider known single failures, component failures or degradations that impact generation, and corrosion degradation. Yellow designations are unacceptable conditions that require action to achieve improvement. Degradation exists requiring near term attention to minimize operational challenges, safety, and/or reliability concerns. Red designations are unacceptable conditions that require prompt action to achieve improvement. Significant degradation requires focus and attention to minimize the impact to safe, reliable, and efficient operation. Instructions added for those work orders elevated to red or yellow are to be presented to the plant health committee for review in order to ensure aggressive identification, scheduling, and correction of known gaps in station system, component, or program health. Process improvements to directly link the work order, action request, action, and engineering change in the site configuration management database (NAMS) were also made.

2. A fleet corrosion monitoring action program procedure was developed from the St. Lucie procedure. The purpose of this procedure is to clarify the requirements and strategies to monitor and control externally initiated general and localized corrosion of safety related equipment and piping in outdoor or exposed environments. The External Surfaces Monitoring of Mechanical Components AMP is enhanced to include interfacing with the fleet corrosion monitoring action program to identify problem areas and track resolution of deficiencies.

3. Two separate spreadsheets were created for PTN based on spreadsheets that had demonstrated effectiveness at St. Lucie. These spreadsheets include "structures" and "coatings" as part of "The Top Material Condition and Nuclear Coatings Issues." The purpose of the spreadsheets is to highlight existing material condition deficiencies, vulnerabilities, and increase interdepartmental focus to resolve the issues. These spreadsheets/lists are defined by deficiencies in plant equipment or structures stemming from degradation in material condition. Common failure mechanisms include corrosion or structural degradation from ambient factors. Deficiencies may be addressed with protective coatings but

most of the listed critical issues require more extensive repairs, replacement or modification. The lists also contain resulting tasks with established priorities. The lists contain an action plan with owners and milestones. The two separate lists are each a living document and will continue to be revised as actions are completed and additional issues are added. The lists are reviewed and approved by the Plant Health Committee. These lists will include all referenced tracking information such as work order number, action request number, long term action milestone number, engineering change number, color/priority, cost estimate, and budget approvals. The External Surfaces Monitoring of Mechanical Components AMP is enhanced to include these tracking lists.

4. An information sharing document was developed and issued to all site engineering. This document identifies all site and fleet procedures associated with structures, corrosion, and coatings monitoring program. All site engineers were trained to this document to re-emphasize their responsibilities for identifying and providing notification of issues in the plant to the individual engineers that are tasked with managing the program. Ongoing engineering training addresses the roles and responsibilities of the engineers at the plant.

The External Surfaces Monitoring of Mechanical Components AMP for SLR credits the existing System and Structures Monitoring AMP plus the enhancements in SLRA Table 17-3, item 27 to ensure that aging effects will adequately be managed in the SPEO. An enhancement is made to interface with new fleet corrosion monitoring program procedure identified in item 2 above as defense in depth to the other required AMP activities for the External Surfaces Monitoring of Mechanical Components AMP. The findings of the NRC Inspection report and associated corrective actions relative to external corrosion address improvements / corrections to the tools used by site personnel as part of the Systems and Structures Monitoring program during the current period of extended operation. The External Surfaces Monitoring of Mechanical Components AMP for SLR is enhanced to include the specific improvements made to the existing Systems and Structures Monitoring program related to the spreadsheets used to track resolution of deficiencies.

In addition, the transition to and implementation of the External Surfaces Monitoring of Mechanical Components AMP will be based on the pertinent portions of the current revision of the implementing procedures for the Systems and Structures Monitoring program, at the time of implementation, as well as, the enhancements in SLRA Table 17-3, item 27 to ensure that aging effects will be adequately managed through the SPEO. As described in the basis document for the External Surfaces Monitoring of Mechanical Components AMP, the implementation may be through procedure revision or development of new procedures. In accordance with SLRA Section B.2.3.23, "PTN is actively implementing and managing its AMPs overall and seeking to identify areas that would improve the effectiveness of aging management." PTN is committed to improve the effectiveness of aging management programs at the site. As stated in Section B.1.4

of the SLR application, FPL is committed to incorporating site operating experience to better inform and improve the effectiveness of aging management at the site.

References:

1. NRC Letter from LaDonna B. Suggs to Mano Nazar, Turkey Point Nuclear Generating Station – Nuclear Regulatory Commission Integrated Inspection Report 05000250/2017003 and 05000251/2017003, November 9, 2017 (ML17313B131)
2. NRC Letter from Jonathan H. Bartley to Mano Nazar, Turkey Point Nuclear Generating Station – NRC Design Bases Assurance Inspection (Team) Report Number 05000250/2017007 and 05000251/2017007, October 2, 2017 (ML17277A837)
3. NRC Letter from LaDonna B. Suggs to Mano Nazar, Turkey Point Nuclear Generating Station – Nuclear Regulatory Commission Integrated Inspection Report 05000250/2017004 and 05000251/2017004, February 8, 2018 (ML18039A046)

Associated SLRA Revisions:

The following changes to SLRA Appendix A Table 17-3 and Section B.2.3.23 will be made in a future SLRA revision as indicated by text deletion (strikethrough) and text addition (red underlined font).

Revise SLRA Section B.2.3.23 Paragraph 2 as follows:

Components that are within the scope of both the PTN External Surfaces Monitoring of Mechanical Components AMP and the PTN Internal Coatings/Linings for In-Scope Piping, Piping Components, Heat Exchangers, and Tanks AMP may have these inspections performed in lieu of wall thickness measurements. Inspections are performed by personnel qualified in accordance with site procedures and programs to perform the specified task. When required by the ASME Code, inspections are conducted in accordance with the applicable code requirements. Non-ASME Code inspections and tests follow site procedures that include inspection parameters for items such as lighting, distance offset, surface coverage, and presence of protective coatings. The inspections are capable of detecting age-related degradation and, with the exception of examinations to detect cracking in stainless steel or aluminum components, are performed at a frequency not to exceed one refueling cycle. This frequency accommodates inspections of components that may be in locations normally accessible only during refueling outages (e.g., high dose areas). Surfaces that are not readily visible during plant operations and refueling outages are inspected when they are made accessible and at such intervals that would ensure the components' intended functions are maintained. **The AMP owner maintains spreadsheets of all known deficiencies associated with the program to monitor, trend, and resolve issues. For each deficiency, all referenced tracking information such as work order number, action request number, long term action milestone number, engineering**

change number, color/priority, cost estimate, and budget approvals are listed in the spreadsheet. The AMP owner will interface with the fleet corrosion monitoring action program to identify problem areas and track resolution of deficiencies. Additionally, the requirement to project identified degradation to the next inspection and/or confirm the timing of subsequent inspections will maintain component intended function.

Add the following item to the enhancements table in SLRA Section B.2.3.23 as follows:

Element Accepted	Enhancement
5. Monitoring and Trending	**1. Include spreadsheets for tracking deficiencies associated with the program to monitor, trend, and resolve issues.** **2. The AMP owner will interface with the fleet corrosion monitoring action program to identify problem areas and track resolution of deficiencies. Additionally, the requirement to project identified degradation to the next inspection and/or confirm the timing of subsequent inspections will maintain component intended function.**

Revise the last paragraph in the Operating Experience portion of Section B.2.3.23 on Page B-199 as follows.

PTN is actively implementing and managing its AMPs overall and seeking to identify areas that would improve the effectiveness of aging management. ~~As described, corrective~~ **Corrective** actions have been initiated **through multiple ARs** ~~and completed~~ to resolve AMP issues regarding the identified ineffectiveness of the Systems and Structures Monitoring AMP. As an extent of condition, the latest AMP effectiveness assessment requires all AMP owners to review the assessment findings and take corrective action, as necessary, to resolve any similar weaknesses. In addition, AMP effectiveness for this AMP will be re-assessed in 2018 per NEI 14-12.

Revise SLRA Appendix Table 17-3 as follows:

Table 17-3
List of SLR Commitments and Implementation Schedule

No.	Aging Management Program or Activity (Section)	NUREG-2191 Section	Commitment	Implementation Schedule
27	External Surfaces Monitoring of Mechanical Components (17.2.2.23)	XI.M36	**k) Include spreadsheets for tracking deficiencies associated with the program to monitor, trend, and resolve issues.** **l) The AMP owner will interface with the fleet corrosion monitoring action program to identify problem areas and track resolution of deficiencies. Additionally, the requirement to project identified degradation to the next inspection and/or confirm the timing of subsequent inspections will maintain component intended function.**	No later than 6 months prior to the SPEO, i.e.: PTN3: 1/19/2032 PTN4: 10/10/2032

Associated Enclosures:

None

NRC RAI Letter Nos. ML18260A242 and ML18260A243 dated September 17, 2018

7. Fire Protection, GALL AMP XI.M26

Regulatory Basis:

Section 54.21(a)(3) of 10 CFR requires an applicant to demonstrate that the effects of aging for structures and components will be adequately managed so that the intended function(s) will be maintained consistent with the current licensing basis for the period of extended operation. One of the findings that the staff must make to issue a renewed license (10 CFR 54.29(a)) is that actions have been identified and have been or will be taken with respect to managing the effects of aging during the period of extended operation on the functionality of structures and components that have been identified to require review under 10 CFR 54.21, such that there is reasonable assurance that the activities authorized by the renewed license will continue to be conducted in accordance with the current licensing basis. As described in the SRP-SLR, an applicant may demonstrate compliance with 10 CFR 54.21(a)(3) by referencing the GALL-SLR Report. In order to complete its review and enable making a finding under 10 CFR 54.29(a), the staff requires additional information in regard to the matters described below.

RAI 3.5.2.10-1

Background:

For AMP XI.M26, "Fire Protection," the GALL-SLR Report recommends visual inspection by fire protection qualified personnel of penetration seals, fire barrier walls, ceilings, floors, doors, fire damper assemblies, and other fire barrier materials at a frequency in accordance with an NRC-approved fire protection program. Table 3.5.2-10 of the SLRA cites the Fire Protection AMP to manage loss of material and cracking of stainless steel drip shields over thermo-lag exposed to outdoor air. The staff reviewed 0-ADM-016, "Fire Protection Program" and FPL-CORP020-REPT-086, "Aging Management Program Basis Document – Fire Protection" and noted that credited raceway protection located beneath the turbine/generator bearings is potentially exposed to leaking oil and that metal drip shields are installed to reduce direct impact effects of oil leaking on the 1-hour fire rated barrier system.

Issue:

The staff noted that the plant-specific procedures do not address how cracking and loss of material will be managed for the drip shields. It is unclear to the staff how the loss of material and cracking for these stainless steel drip shields will be managed by the Fire Protection AMP.

Request:

Discuss how loss of material and cracking of these stainless steel drip shields will be managed by the Fire Protection program. Provide a description of the inspections performed and procedures used to inspect the stainless steel drip shields such that the intended functions are not impaired by either aging effect.

FPL Response:

Thermo-lag barriers and raceway protection are among the fire-rated assemblies described in the SLR screening results for non-containment structures. The intended function specified for "stainless steel drip shields over Thermolag (Turbine Building)" is to provide shelter/protection to those in-scope "fire barriers - raceway protection - Thermolag fireproofing" that have an intended function to provide a rated fire barrier to confine or retard a fire from spreading between adjacent areas of the plant. The subject drip shields are in outdoor fire zones comprising the Turbine Building, within 50 ft. of a major *in situ* combustible and within 20 ft. of the postulated turbine lube oil spill zone-of-influence, where 1-hour fire rated electrical raceway fire barrier systems (ERFBS) were required by the deterministic analysis supporting the plant's Appendix R fire protection program.

However, Thermo-lag is not credited for separation in the outdoor fire zones as part of the risk-informed performance-based (i.e., NFPA 805) Fire Protection Program that went into effect in May 2015 at PTN Units 3 and 4 (Reference 1). While Thermo-lag is credited for ERFBS in the NFPA 805 analyses for some other fire areas, the wrap beneath the turbine/generator bearings is abandoned in place and not required to demonstrate compliance with the NRC's regulations for fire protection.

Therefore, the subject drip shields no longer perform a function within the scope of subsequent license renewal and discussion in the SLRA regarding stainless steel drip shields over Thermo-lag in the Turbine Building is no longer necessary.

Accordingly, irrelevant text related to fire-rated assemblies is deleted from the SLRA.

References:

1. Klett, Audrey, U. S. Nuclear Regulatory Commission, letter to Nazar, Mano, NextEra Energy, "Turkey Point Nuclear Generating Unit Nos. 3 and 4 – Issuance of Amendments Regarding Transition to a Risk-Informed, Performance-Based Fire Protection Program in accordance with Title 10 of the Code of Federal Regulations Section 50.48(c) (TAC NOS. ME8990 and ME8991)," dated May 28, 2015 (ADAMS Accession No. ML15061A237).

Associated SLRA Revisions:

The following changes to SLRA Sections and Tables will be made in a future SLRA revision as indicated by text deletion (strikethrough) and text addition (red underlined font).

Revise SLRA Table 2.4.2-9 as follows:

Component Type	Component Intended Function(s)
~~Drip shields over Thermolag~~	~~Fire barrier~~

Revise 1st bulleted list in SLRA Section 3.5.2.1.10 as follows:

The materials of construction for the fire rated assemblies components are:

- Carbon steel
- Cementitious fireproofing
- Cerafiber
- Flamemastic
- Galvanized steel
- Sealant
- Silicone elastomer
- ~~Stainless steel~~
- Thermo-lag

Revise SLRA Table 3.5.2-10 as follows:

Table 3.5.2-10: Fire Rated Assemblies — Summary of Aging Management Evaluation

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-2191 Item	Table 1 Item	Notes
~~Drip shields over Thermo-lag~~	~~Fire barrier~~	~~Stainless steel~~	~~Air – outdoor~~	~~Loss of material~~ ~~Cracking~~	~~Fire Protection~~	~~III.B2.T-37b~~	~~3.5-1, 100~~	~~E~~
Electrical fireproofing protection	Fire barrier	Thermo-lag	Air – indoor uncontrolled Air – indoor controlled ~~Air – outdoor~~	Hardening Loss of strength Shrinkage	Fire Protection	VII.G.A-19	3.3-1, 057	C

Associated Enclosures:

None

NRC RAI Letter Nos. ML18260A242 and ML18260A243 dated September 17, 2018

8. Stress Corrosion Cracking

RAI 3.5.2.1.2-1

Regulatory Basis:

Section 54.21(a)(3) of 10 CFR requires the applicant to demonstrate that the effects of aging for structures and components will be adequately managed so that the intended function(s) will be maintained consistent with the current licensing basis for the period of extended operation. As described in SRP-SLR, an applicant may demonstrate compliance with 10 CFR 54.21(a)(3) by referencing the GALL-SLR Report and when evaluation of the matter in the GALL-SLR Report applies to the plant.

Background:

SRP-SLR Table 3.5-1, item 010, recommends that stainless steel (SS) penetration sleeves and penetration bellows, and dissimilar metal welds be managed for cracking due to stress corrosion cracking (SCC) by the AMP XI.S1, "ASME Section XI, Subsection IWE," and AMP.

XI.S4, "10 CFR Part 50, Appendix J" programs. SRP-SLR Section 3.5.2.2.1.6, associated with SRP-SLR Table 3.5-1, item 010, recommends a further evaluation of additional appropriate examination/evaluation methods that needs to be implemented to detect this aging effect in SS components and dissimilar metal welds of the containment pressure-retaining boundary.

Subsequent license renewal application (SLRA) Section 3.5.2.2.1.6, associated with SLRA Table 3.5-1, item 3.5-1, 010, states that cracking of dissimilar metal welds for containment penetrations will be managed by the ASME Section XI, Subsection IWE and 10 CFR Part 50, Appendix J, Aging Management Programs (AMPs) with no additional examinations. The SLRA claims that theses dissimilar metal welds are not considered susceptible to SCC since it requires a concentration of chloride contaminants that is not normally present in significant quantities, as well as high stress and temperatures greater than 140°F, and no site operating experience (OE) of cracking has been identified for dissimilar metal welds.

The summary statement for “scope of program” element in Section 4.1.b of the program basis document FPLCORP020-REPT-102 (PBD) for the SLRA Section B.2.3.30 “ASME Section XI, Subsection IWE” AMP states, in part, that the AMP is credited with managing the effects of cracking of dissimilar metal welds associated with penetration sleeves and SS fuel transfer tube.

Issue:

The general visual examinations of ASME Section XI, Subsection IWE AMP are not capable of detecting cracking due to mechanisms such as stress corrosion cracking (SCC) or fatigue loading until failure. The "detection of aging effects" program element in PBD Section 4.4.b and the program enhancement included in LRA Section B.2.3.30 do not include any augmented techniques (e.g., surface examination) capable of detecting such cracking, nor does the AMP credit appropriate local leak rate testing capable of detecting such cracking that is being performed for these components (i.e., dissimilar metal welds and SS components such as fuel transfer tube). It is not clear to the staff if the "detection of aging effects" program element in the SLRA Section B.2.3.30 AMP is adequate for managing aging effects with regard to capability to detect cracking.

Based on the information provided in the SLRA, it is not clear how cracking due to stress corrosion cracking (SCC) will be managed by the ASME Section XI, Section IWE and the 10 CFR Part 50, Appendix J Programs for the containment penetrations with dissimilar metal welds, and the stainless steel penetrations and expansion joints from the spent fuel storage and handling structures. The programs in the SLRA do not include an enhancement to implement additional appropriate examination/evaluation methods to detect this aging effect.

Additionally, sufficient technical justification was not provided in the SLRA Section 3.5.2.2.1.6 to consider the SCC aging effect as not applicable since (1) the SLRA Section 3.5.2.2.1.6 states that these are high-temperature piping systems where localized temperatures at penetrations are less than 200°F by design (i.e., are/can be exposed to more than 140°F – temperature needed for SCC to develop), and (2) these components are exposed to an air – indoor uncontrolled and air – outdoor environment (SLRA items in Tables 3.5.2-1 and 3.5.2-15) for which other SCC factors (e.g., contaminants) are not being controlled or managed adequately to demonstrate that this aging effect will be prevented from occurring.

The staff notes that the SRP-SLR Table 3.5 1, item 010, recommendation is intended to address the aging effect of cracking due to SCC in SS and dissimilar metal weld material in penetrations sleeves and penetration bellows. Line items in SLRA Table 3.5.2-1 and 3.5.2-15, associated with SLRA Table 3.5.1, Item 3.5-1, 010, have a note A indicating that they are consistent with the GALL-SLR Report item for component, material, environment and aging effect.

Request:

1. Clarify if dissimilar metal welds in penetrations sleeves, and SS fuel transfer tube (including penetration sleeves and expansion joints) will be managed for cracking due to SCC using the ASME Section XI, Section IWE and the 10 CFR Part 50, Appendix J programs. Otherwise, provide adequate technical justification for not requiring management of the aging effects of cracking due to SCC for these components.

2. If these components will be managed for cracking due to SCC, clarify how the ASME Section XI, Section IWE and the 10 CFR Part 50, Appendix J programs will be enhanced to provide additional examination and/or evaluation methods that are capable of detecting this aging effect, consistent with the recommendations from the GALL-SLR Report, and the further evaluation in SRP-SLR Section 3.5.2.2.1.6. If an Appendix J local leak rate test is credited, identify the leak rate test and the interval at which it is being performed for each component, and justify its appropriateness for detecting cracking.

FPL Response:

Dissimilar metal welds in penetration sleeves and the stainless steel fuel transfer tube (including penetration sleeves and expansion joints) will be managed for cracking due to SCC by the PTN ASME Section XI, Subsection IWE AMP and the PTN 10 CFR Part 50 Appendix J AMP as described in SLRA Table 3.5-1, item 10 and Section 3.5.2.2.1.6. This will include a one-time supplemental examination to a) confirm the lack of OE on cracking of the dissimilar metal welds and b) provide additional assurance that no additional examinations/evaluations are required.

As described in SLRA Section 3.5.2.2.1.6, the penetration sleeves (assemblies) penetrating the containment at PTN are carbon steel. As such, SCC is not an applicable aging mechanism for the penetration sleeves. However, piping systems that are stainless steel and penetrate the containment include dissimilar metal welds of the flued heads of each steel penetration assembly to the outside of the (stainless steel) pipe. The stainless steel piping material including the dissimilar metal welds are susceptible to SCC if there is a sufficient concentration of chloride (halide) contaminants, stress and temperatures greater than 140ºF.

The Unit 3 and Unit 4 containment buildings are located a distance away from the wave effects of the Atlantic Ocean, such that chlorides in the ambient coastal air were not considered significant for PTN containment penetrations. However, considering contaminant concentrations are neither controlled nor monitored, the ambient PTN air is potentially aggressive, as described elsewhere in the SLRA. Thus, penetrations associated with stainless steel piping systems which have the potential to operate above 140°F are potentially susceptible to SCC.

Penetrations (piping and dissimilar metal welds) for the following stainless steel piping systems for each unit may experience temperatures above 140°F during normal plant operation:

- Chemical and Volume Control (CVCS)
    - Letdown to the non-regenerative heat exchanger

- Primary Sampling
  - Reactor Coolant System (RCS) Hot Leg
  - RCS Pressurizer steam
  - RCS Pressurizer liquid
- Residual Heat Removal (RHR)

In addition, the stainless steel fuel transfer tube in the Spent Fuel Storage and Handling system is susceptible to SCC as listed in SLRA Table 3.5.2-16.

The ASME Section XI, Subsection IWE AMP will be enhanced to include a supplemental one-time inspection, performed by qualified personnel using methods capable of detecting cracking due to SCC, of a stainless steel fuel transfer tube (including penetration sleeve and expansion joints), and of the dissimilar metal welds for a penetration associated with a stainless steel piping system that is exposed to temperatures above 140°F to provide a representative sample of the susceptible penetrations and transfer tubes for both PTN units.

Moreover, visual inspection (VT-3) of the dissimilar metal welds and stainless steel fuel transfer tube via the ASME Section XI, Subsection IWE AMP and integrated leak rate testing/general visual inspections via the 10 CFR Part 50 Appendix J AMP will continue to provide adequate management of containment penetrations to ensure they are capable of performing their intended function through the SPEO. In addition, local leak rate testing of various penetrations is addressed in the implementing procedure and directed through the 10 CFR Part 50 Appendix J AMP, as warranted. Furthermore, the seals for the fuel transfer tube flange for each unit receive a local leak rate test (LLRT) through the 10 CFR Part 50 Appendix J AMP. This type B LLRT is performed prior to and after each opening of the transfer tube flanges.

The SLRA is revised to indicate the technical justification in Section 3.5.2.2.1.6 will be confirmed through a supplemental inspection. The ASME Section XI, Subsection IWE AMP will be revised as necessary to reflect the enhancement to perform this supplemental, confirmatory inspection.

References:

None

Associated SLRA Revisions:

The following changes to SLRA Section 3.5.2.2.1.6, Section 17.2.2.30, Table 17-3 (Item 34), and Section B.2.3.30 will be made in a future SLRA revision as indicated by text deletion (strikethrough) and text addition (red underlined font).

Revise the further evaluation in Section 3.5.2.2.1.6 on page 3.5-23 as follows:

Stress corrosion cracking (SCC) of stainless steel (SS) penetration sleeves, penetration bellows, vent line bellows, suppression chamber shell (interior surface), and dissimilar metal welds could occur in PWR and/or BWR containments. The existing program relies on ASME Code Section XI, Section IWE and10 CFR Part 50, Appendix J, to manage this aging effect. Further evaluation, including consideration of SCC susceptibility and applicable operating experience (OE) related to detection, is recommended of additional appropriate examinations/evaluations implemented to detect this aging effect for these SS components and dissimilar metal welds.

The penetration sleeves (assemblies) penetrating the containment at Turkey Point are carbon steel. As such, SCC is not an applicable aging mechanism for penetration sleeves at Turkey Point. High-temperature piping systems that are stainless steel and penetrate the containment include dissimilar metal welds of the flued head of the steel penetration assembly to the outside of the pipe. These dissimilar metal welds are not considered susceptible to SCC. SCC requires a concentration of chloride contaminants, which are not normally present in significant quantities in containment, as well as high stress and temperatures greater than 140ºF. The containment bulk ambient temperature during operation is between 50ºF and 120ºF, and localized temperatures at penetrations are less than 200ºF by design. Furthermore, there has been no site OE of cracking of these dissimilar metal welds. Therefore, cracking of dissimilar metal welds for containment penetrations will be managed by the ASME Section XI, Subsection IWE and 10 CFR Part 50, Appendix J AMPs~~, and no additional examinations are required~~. **A supplemental one-time inspection of the stainless steel fuel transfer tube and dissimilar metal welds for a representative penetration associated with a high-temperature stainless steel piping system will be included as an enhancement to the ASME Section XI, Subsection IWE AMP to provide confirmation that no additional examinations/evaluations are required.**

- Add the following to the next to last paragraph of Section 17.2.2.30 on page A-35:

The PTN ASME Section XI, Subsection IWE, AMP is an existing AMP that was formerly the PTN ASME Section XI, Subsection IWE, Inservice Inspection Program. This condition monitoring AMP is in accordance with ASME Code Section XI, Subsection IWE, and consistent with 10 CFR 50.55a, “Codes and Standards,” with supplemental recommendations. This AMP includes periodic visual, surface, and volumetric examinations, where applicable, of the metallic liner of Class CC pressure-retaining components and their integral attachments.

This AMP also provides inspection and examination of containment surfaces, moisture barriers, pressure retaining bolting, and pressure retaining components for signs of degradation, damage, and irregularities, including discernable liner plate bulges. In conjunction with 10 CFR Part 50 Appendix J AMP (Section 17.2.2.33), this AMP manages loss of material, loss of leak tightness, loss of sealing, and loss of preload, as well as cracking (of dissimilar metal welds associated with penetration sleeves and fuel transfer tube). Observed conditions that have the potential for impacting an intended function are evaluated for acceptability in accordance with ASME requirements and corrected in accordance with the corrective action program.

Coated areas are examined for distress of the underlying metal shell or liner. Acceptability of inaccessible areas of the concrete containment steel liner is evaluated when conditions found in accessible areas indicate the presence of, or could result in, flaws or degradation in inaccessible areas. Inspection results are compared with prior recorded results in acceptance of components for continued service. In the case of significant conditions adverse to quality, measures are implemented to ensure that the cause of the condition is determined, and that corrective action is taken to preclude recurrence. The examination of containment, Class MC and Class CC components, is in accordance with ASME Section XI, Subsection IWE, 2001 edition 2003 addenda, as mandated and modified by 10 CFR 50.55a.

If triggered by site-specific OE, this AMP also includes a one-time supplemental volumetric examination by sampling both randomly selected and focused liner locations susceptible to corrosion that are inaccessible from one side. **This AMP also includes a one-time supplemental surface or enhanced visual examination of a stainless steel transfer tube and of dissimilar metal welds for a representative penetration associated with a high-temperature stainless steel piping system in frequent use.**

PTN has no pressure-retaining components subject to cyclic loading without CLB fatigue analysis; therefore, a supplemental surface examination to detect cracking for such pressure retaining components is not required.

Revise Table 17-3 item 34 on page A-103 as follows:

No.		Aging Management Program or Activity (Section)	NUREG-2191 Section	Commitment	Implementation Schedule
34		ASME Section XI, Subsection IWE (17.2.2.30)	XI.S1	Continue the existing PTN ASME Section XI, Subsection IWE AMP, including enhancement to: a) Include preventive actions, consistent with industry guidance, to provide reasonable assurance that bolting integrity is maintained for structural bolting, and if high strength bolting is used, the appropriate guidance in Section 2 of Research Council for Structural Connections publication "Specification for Structural Joints Using High-Strength Bolts" is to be considered. b) Implement a one-time inspection of metal liner surfaces that samples randomly selected as well as focused locations susceptible to loss of thickness due to corrosion from the concrete side if triggered by site-specific OE identified through code inspections. **c) Implement a one-time surface or enhanced visual examination of the stainless steel fuel transfer tube**	Complete any applicable pre-SPEO one-time inspections no later than 6 months or the last RFO prior to SPEO. Corresponding dates are as follows: PTN3: 1/19/2032 PTN4: 10/10/2032

No.		Aging Management Program or Activity (Section)	NUREG-2191 Section	Commitment	Implementation Schedule
				<u>**(including penetration sleeve and expansion joints) and of dissimilar metal welds for a representative penetration associated with a high-temperature stainless steel piping system in frequent use.**</u>	

Add the following discussion to Section B.2.3.30 on pages B-230 to B-232:

The PTN ASME Section XI, Subsection IWE AMP is an existing AMP that was formerly the PTN ASME Section XI Subsection IWE ISI Program. This AMP is performed in accordance with ASME Code Section XI, Subsection IWE, and consistent with 10 CFR 50.55a "Codes and Standards," with supplemental recommendations. This AMP includes periodic visual, surface, and volumetric examinations, where applicable, of the metallic liner of class CC pressure retaining components and their integral attachments.

This AMP provides inspection and examination of containment surfaces, moisture barriers, pressure-retaining bolting, and pressure retaining components for signs of degradation, damage, and other irregularities including discernable liner plate bulges. This AMP also manages loss of material, loss of leak tightness, loss of sealing, and loss of preload, as well as cracking (of dissimilar metal welds associated with penetration sleeves and the fuel transfer tube). Coated areas are examined for distress of the underlying metal shell or liner. Acceptability of inaccessible areas of the concrete containment steel liner is evaluated when conditions found in accessible areas indicate the presence of, or could result in, flaws or degradation in inaccessible areas. Inspection results are compared with prior recorded results in acceptance of components for continued service. In the case of significant conditions adverse to quality, measures are implemented to ensure that the cause of the condition is determined, and that corrective action is taken to preclude recurrence.

If site-specific OE identified after the approval of the SLRA triggers the requirement to implement a one-time supplemental volumetric examination, then this inspection is performed by sampling randomly-selected, as well as focused, liner locations susceptible to corrosion that are inaccessible from one side. The trigger for this one-time examination is site-specific occurrence or recurrence of liner corrosion that is determined to originate from the inaccessible (concrete) side. Any such instance would be identified through code inspections performed since June 6, 2002. **Furthermore, a one-time surface or enhanced visual examination is performed of a stainless steel transfer tube (including penetration sleeve and expansion joints) and of dissimilar metal welds for a representative penetration, with temperatures above 140°F, associated with a high-temperature stainless steel piping system in frequent use.**

Coated surfaces are visually inspected for evidence of conditions that indicate degradation of the underlying base metal. Coatings are a design feature of the base material and are not credited with managing loss of material. The PTN Protective Coating Monitoring and Maintenance AMP (Section B.2.3.37) is used for the monitoring and maintenance of protective containment coatings in relation to reasonable assurance of emergency core cooling system operability. Concrete portions of containments are inspected by the separate PTN ASME Section XI, Subsection IWL AMP (Section B.2.3.31).

Surface conditions are monitored through visual examinations to determine the existence of corrosion. Surfaces are examined for evidence of flaking, blistering, peeling, discoloration, wear, pitting, excessive corrosion, arc strikes, gouges, surface discontinuities, dents, or other signs of surface irregularities. Pressure-retaining bolting is examined for loosening and material conditions that cause the bolted connection to affect either containment leak-tightness or structural integrity. Moisture barriers are visually inspected for degradation per Category E-A.

PTN has no pressure-retaining components subject to cyclic loading without CLB fatigue analysis. Pressure retaining components associated with the containment liner, including attachments and penetrations, are addressed by a fatigue evaluation.

This AMP meets the requirements of IWE-3000 and IWE-3410. Most of the acceptance standards rely on visual examinations. Inspection results are evaluated against the acceptance standards provided in the PTN IWE Program. Areas identified with damage or degradation that exceed acceptance standards require an engineering evaluation or require correction by repair or replacement. Such areas are corrected by repair or replacement in accordance with IWE-3122 or accepted by engineering evaluation.

NUREG-2191 Consistency

The PTN ASME Section XI, Subsection IWE AMP, with enhancements, will be consistent with the 10 elements of NUREG-2191, Section XI.S1, "ASME Section XI, Subsection IWE."

Exceptions to NUREG-2191

None

Enhancements

The PTN ASME Section XI, Subsection IWE AMP will be enhanced as follows for alignment with NUREG-2191. The changes and enhancements will be implemented no later than six months prior to entering the SPEO.

Element Affected	Enhancement
3. Preventive Actions	Include preventive actions, consistent with industry guidance, to provide reasonable assurance that bolting integrity is maintained for structural bolting. That is, proper bolting material and lubricants, and appropriate installation torque or tension to prevent or minimize loss of bolting preload. Include indication that if high strength bolting is used, the appropriate guidance is to be considered.

Element Affected	Enhancement
4. Detection of Aging Effects	If site-specific OE identified after the approval of the SLRA triggers the requirement to implement a one-time supplemental volumetric examination, then perform this inspection by sampling randomly-selected, as well as focused, liner locations susceptible to corrosion that are inaccessible from one side. The trigger for this one-time examination is site-specific occurrence or recurrence of liner corrosion that is determined to originate from the inaccessible (concrete) side. Any such instance would be identified through code inspections performed since June 6, 2002.
4. Detection of Aging Effects	**Implement a one-time surface or enhanced visual examination of the stainless steel fuel transfer tube (including penetration sleeve and expansion joints) and of dissimilar metal welds for a representative penetration associated with a high-temperature stainless steel piping system in frequent use to detect any evidence of cracking.**

Associated Enclosures:

None

NRC RAI Letter Nos. ML18260A242 and ML18260A243 dated September 17, 2018

9. Atmospheric Metallic Tanks, GALL AMP XI.M29

Regulatory Basis:

Section 54.21(a)(3) of 10 CFR requires an applicant to demonstrate that the effects of aging for structures and components will be adequately managed so that the intended function(s) will be maintained consistent with the current licensing basis for the subsequent period of extended operation. One of the findings that the staff must make to issue a renewed license (10 CFR 54.29(a)) is that actions have been identified and have been or will be taken with respect to managing the effects of aging during the period of extended operation on the functionality of structures and components that have been identified to require review under 10 CFR 54.21, such that there is reasonable assurance that the activities authorized by the renewed license will continue to be conducted in accordance with the current licensing basis (CLB). As described in SRP-LR, an applicant may demonstrate compliance with 10 CFR 54.21(a)(3) by referencing the GALL Report. In order to complete its review and enable making a finding under 10 CFR 54.29(a), the staff requires additional information in regard to the matters described below.

RAI B.2.3.17-2

Background:

UFSAR Section 9.15.1.2.2 states that the Unit 4A and Unit 4B emergency diesel generator diesel oil storage tanks (DOST) are constructed of reinforced concrete with a steel lining.

SLRA Table 3.5.2-9 states that there are no aging effects or aging management program for the Unit 4 DOST carbon steel liners exposed to concrete.

GALL-SLR Report, Section 3.2.2.2.9 states that there are no aging effects for carbon steel components exposed to concrete unless ground water intrusion (in this case, water from precipitation) could occur.

During the audit, the staff walked down the 4A DOST and noted that with the exception of the manway enclosures, tank sample connections, and flame arrestors (all located on the top of the tank), all of the penetrations into the tank are located inside the attached emergency diesel generator building. The staff noted that each of the penetrations on the roof are sealed or caulked at the component to concrete interface. The staff could not walk down the 4B emergency diesel rooms because work was being conducted on the A train.

SLRA Section B.2.3.35, "Structures Monitoring," Program Enhancement No.1 states that the Unit 4 DOST liner will be added to the scope of the program.

SLRA Table 3.5.2-9, "Emergency Diesel Generator Building," states that managing loss of sealing for elastomeric weather proofing materials exposed to outdoor air is managed by the Structures Monitoring Program. This AMR cites SRP-SLR item 3.5.1-072.

Issue:

The statement that there are no aging effects for the Unit 4 DOST carbon steel liners exposed to concrete and the addition of the Unit 4 DOST liners to the scope of the Structures Monitoring Program appear to conflict. If the elastomeric seals for the manway enclosures, tank sample connections, and flame arrestors associated with the Unit 4 DOST liners were to degrade, water could intrude between the steel liner and concrete.

It is not clear whether the AMR items in SLRA Table 3.5.2.9 that cite SRP-SLR item 3.5.1-072 would include the manway enclosures, tank sample connections, and flame arrestors for the 4A and 4B DOST, because SLRA Table 3.5.2-9 states that there are no aging effects for the DOST liner.

Request:

State whether the 4B DOST has any penetrations exposed to outdoor air other than the manway enclosure, tank sample connections, and flame arrestor located on the roof.

State whether loss of sealing will be managed for the manway enclosures, tank sample connections, and flame arrestors associated with the 4A and 4B DOSTs by the Structures Monitoring Program.

FPL Response:

A review of piping isometrics and piping and instrumentation drawings for the PTN 4A and 4B DOST confirms that all connections to the 4A and 4B DOSTs other than the manway enclosures, tank sample connections, and flame arrestors penetrate through the south wall of the 4A and 4B diesel oil transfer pump rooms inside of the Unit 4 emergency diesel generator (EDG) building. Therefore, the 4A and 4B DOSTs do not have any penetrations exposed to outdoor air other than the manway enclosures, tank sample connections, and flame arrestors, which are located on the Unit 4 EDG building roof.

Table 2.4.2-8 of the Revision 1 to the PTN SLRA includes the component type "Weatherproofing" for the PTN EDG buildings and Note 1 of the table states that the "Weatherproofing" component includes seals other than fire barrier seals. Therefore, the subject seals are within the scope of SLR for PTN.

Table 3.5.2-9 of the Revision 1 to the PTN SLRA includes the component type "Weatherproofing" made from elastomer, rubber and other similar materials for the PTN

EDG buildings. The table appropriately identifies the aging effect as "Loss of sealing" and credits the PTN Structures Monitoring AMP for managing this aging effect.

References:

None

Associated SLRA Revisions:

None

Associated Enclosures:

None

NRC RAI Letter Nos. ML18260A242 and ML18260A243 dated September 17, 2018

RAI B.2.3.17-3

Background:

SLRA Section B.2.3.17 states that the tank design of the condensate storage tanks (CST), refueling water storage tanks (RWST), and Unit 3 diesel oil storage tank (DOST) does not specify the use of sealant or caulking for the tank-to-concrete interface.

During the on-site audit, the staff noted that the CSTs, RWSTs, and Unit 3 DOST tank to concrete interface joint appeared to be sealed with either an elastomeric compound or an unknown hard material. Except in minor degraded areas, the interface joint is coated.

During the audit, the staff also noted that the tank to concrete interface:

- For the CSTs, is above ground elevation; however, there is an approximately ½-inch deep depressed area that could accumulate moisture around the entire circumference of each tank.
- For the RWSTs, is essentially at ground elevation including some areas where the joint is covered with stone and some sediment and there are some locations where it appears that the ground slopes towards the tank to concrete interface.
- For the Unit 3 DOST, is approximately 3-inches above grade.

During the audit, the staff reviewed plant-specific documents and noted the following:

- For the CSTs: (a) there is a 1/8-inch layer of asphalt between the tank bottom and foundation; and (b) the concrete outside of the tank to concrete interface has a 1-inch slope away from the tank over the concrete foundation's width.
- For the RWST and Unit 3 DOST, the concrete outside of the tank to concrete interface has a 1-inch slope away from the tank over the concrete foundation's width.

Issue:

The tank bottom to concrete interface joint is subject to loss of material that is not readily observable if the joint is not sealed or the tank configuration does not readily drain water away from the joint. GALL-SLR Report AMP XI.M29 recommends periodic wall thickness measurements of the tank bottom, but does not include specific recommendations for the quantity of data points or location of the bottom thickness measurements. However, when there is the potential for water intrusion under the tank; the staff requires further information in this regard to complete its evaluation.

Based on the walkdowns and the review of plant-specific documents, the staff has concluded that the following tanks could be susceptible to periodic wetting at the tank to concrete interface if the sealant is not a permanent part of the design of the tank to concrete interface and if permanently installed, inspections are not conducted on the sealant.

- For the CSTs because based on observation during the audit, water could accumulate in the depressed area sufficient to overcome the 1-inch slope away from the tank over the concrete foundation's width.
- For the RWSTs because the tanks are essentially at ground elevation including some areas where the area is covered with stone and some sediment and there are some locations where it appears that the ground slopes towards the tank to concrete interface.
- For the Unit 3 DOST because even though the tank is above grade and there is a 1-inch slope away from the tank over the concrete foundation's width, local weather conditions will probably result in periodic challenges to the sealant.

It should be noted that the low-frequency electromagnetic testing (LFET) technique can be capable of scanning the entire bottom of the tank in order to detect discrete locations where augmented bottom thickness measurements should be conducted. The staff's evaluation of the use of this technique is documented in NUREG-2172, "Safety Evaluation Report Related to the License Renewal of Callaway Plant, Unit 1," Section 3.0.3.2.8.

Request:

1. Is the installed sealant (elastomeric or other) at the base of the CSTs, RWSTs, and Unit 3 DOST a permanent plant feature that will be credited as a preventive action for the tank to concrete interface joint? If yes, what is the sealant material type and will the sealant be inspected?

   If applicable, what is the method and what are the acceptance criteria for the inspection results?

If the response is no to either portion of this question, respond to questions 2 and 3.

2. State the quantity and location of data points for the periodic bottom thickness measurements of the tanks. In addition, state the basis for why the quantity and location of data points will be sufficient to detect loss of material due to pitting or crevice corrosion.
3. If the LFET technique will be used, state the criteria for followup discrete tank thickness measurements. If other scanning techniques will be used, state the basis for the effectiveness of these techniques in detecting loss of material due to pitting or crevice corrosion and the criteria for followup discrete tank thickness measurements.

FPL Response:

The installed sealant (elastomeric or other) at the base of the CSTs, RWSTs, and Unit 3 DOST will not be a permanent plant feature credited as a preventive action for the tank to concrete interface joints.

The carbon steel CSTs, RWSTs, and the Unit 3 DOST will be volumetrically inspected per a new procedure with a method and inspection interval consistent with the relevant portion of NUREG-2191, Table XI.M29-1 shown below. The carbon steel primary water storage tanks (PWSTs), which are now in the scope of the PTN SLRA per the FPL response to previous NRC RAI B.2.3.17-1, as well as the demineralized water storage tank (DWST) will also be volumetrically inspected as described above for the CSTs, RWSTs, and Unit 3 DOST.

Table XI.M29-1. Tank Inspection Recommendations[1,2]				
Inspections to Identify Degradation of Inside Surfaces of Tank Shell, Roof[4], and Bottom[5,6]				
Material	**Environment**	**Aging Effect Requiring Management (AERM)**	**Inspection Technique[3]**	**Inspection Frequency**
Steel	Air, condensation	Loss of material	Visual from inside surface (IS) or Volumetric from outside surface (OS)[7]	Each 10-year period starting 10 years before the subsequent period of extended operation
	Raw water, waste water	Loss of material		Each 10-year period starting 10 years before the subsequent period of extended operation
	Treated water	Loss of material		One-time inspection conducted in accordance with GALL-SLR Report AMP XI.M32[8]

Inspections to Identify Degradation of External Surfaces[9] of Tank Shell, Roof, and Bottom				
Material	**Environment**	**AERM**	**Inspection Technique[3]**	**Inspection Frequency**
Steel	Air – indoor uncontrolled Air – outdoor	Loss of material	Visual from OS	Each refueling outage interval
	Soil, concrete	Loss of material	Volumetric from IS[12]	Each 10-year period starting 10 years before the subsequent period of extended operation[13]

Table XI.M29-1. Tank Inspection Recommendations[1,2]

1. GALL-SLR Report AMP XI.M30, "Fuel Oil Chemistry," is used to manage loss of material on the internal surfaces of fuel oil storage tanks. However, for outdoor fuel oil storage tanks exposed to soil or concrete and indoor tanks exposed to periodically wetted concrete or exposed to soil, inspections to identify aging of the external surfaces of tanks are conducted in accordance with GALL-SLR Report AMP XI.M29. GALL-SLR Report AMP XI.M41 is used to manage loss of material and cracking for the external surfaces of buried tanks.
2. When one-time internal inspections in accordance with these footnotes are used in lieu of periodic inspections, the one-time inspection must occur within the 5-year period before the start of the subsequent period of extended operation.
3. Alternative inspection methods may be used to inspect both surfaces (i.e., internal, external) or the opposite surface (e.g., inspecting the internal surfaces for loss of material from the external surface, inspecting for corrosion under external insulation from the internal surfaces of the tank) as long as the method has been demonstrated to be effective at detecting the AERM and a sufficient amount of the surface is inspected to provide reasonable assurance that localized aging effects are detected. For example, in some cases, subject to being demonstrated effective by the applicant, the low frequency electromagnetic technique (LFET) can be used to scan an entire surface of a tank. If follow-up ultrasonic examinations are conducted in any areas where the wall thickness is below nominal, an LFET inspection can effectively detect loss of material in the tank shell, roof, or bottom.
4. Nonwetted surfaces on the inside of a tank (e.g., roof, surfaces above the normal waterline) are inspected in the same manner as the wetted surfaces based on the material, environment, and AERM.
5. Visual inspections to identify degradation of the inside surfaces of tank shell, roof, and bottom cover all the inside surfaces. Where this is not possible because of the tank's configuration (e.g., tanks with floating covers or bladders), the SLRA includes a justification for how aging effects will be detected before the loss of the tank's intended function.
6. For tank configurations in which deleterious materials could accumulate on the tank bottom (e.g., sediment, silt), the internal inspections of the tank's bottom include inspections of the side wall of the tank up to the top of the sludge-affected region.
7. At least 20 percent of the tank's internal surface is to be inspected using a method capable of precisely determining wall thickness. The inspection method is capable of detecting both general and pitting corrosion and be demonstrated effective by the applicant.
8. At least one tank for each material and environment combination is inspected at each site. The tank inspection can be credited towards the sample population for GALL-SLR Report AMP XI.M32.
9. For insulated tanks, the external inspections of tank surfaces that are insulated are conducted in accordance with the sampling recommendations in this AMP. If the initial inspections meet the criteria described in the preceding "Alternatives to Removing Insulation" portion of this AMP, subsequent inspections may consist of external visual inspections of the jacketing in lieu of surface examinations. Tanks with tightly adhering insulation may use the "Alternatives to Removing Insulation" portion of this AMP for initial and all follow-on inspections.
10. Not used.
11. A minimum of either 25 sections of the tank's surface (e.g., 1-square-foot sections for tank surfaces, 1-linear-foot sections of weld length) or 20 percent of the tank's surface are examined. The sample inspection points are distributed in such a way that inspections occur in those areas most susceptible to degradation (e.g., areas where contaminants could collect, inlet and outlet nozzles, welds).
12. When volumetric examinations of the tank bottom cannot be conducted because the tank is coated, an exception is stated, and the accompanying justification for not conducting inspections includes the considerations in footnote 13, below, or propose an alternative examination methodology.
13. A one-time inspection conducted in accordance with GALL-SLR Report AMP XI.M32 may be conducted in lieu of periodic inspections if an evaluation conducted before the subsequent period of extended operation and during each 10-year period during the subsequent period of extended operation demonstrates that the soil under the tank is not corrosive using actual soil samples that are analyzed for each individual parameter (e.g., resistivity, pH, redox potential, sulfides, sulfates, moisture) and overall soil corrosivity. The evaluation includes soil sampling from underneath the tank.

    Alternatively, a one-time inspection conducted in accordance with GALL-SLR Report AMP XI.M32 may be conducted in lieu of periodic inspections if the bottom of the tank has been cathodically protected in such a way that the availability and effectiveness criteria of GALL-SLR Report AMP XI.M41, 'Buried and Underground Piping and Tanks'," Table XI.M41-3., "Inspections of Buried Tanks for all Inspection Periods," have been met beginning 5 years prior to the subsequent period of extended operation, and the criteria continue to be met throughout the subsequent period of extended operation.

The new PTN procedure will employ the low-frequency electromagnetic testing (LFET) technique and follow-up ultrasonic examinations as necessary to implement volumetric inspection of the CST, RWST, Unit 3 DOST, DWST, and the PWST bottom surfaces exposed to concrete. Because LFET can scan the entire CST, RWST, Unit 3 DOST, DWST, and PWST bottom surfaces, specific data points for bottom thickness measurements are not identified. The new procedure will implement the alternate inspection method as described in Note 3 of Table XI.M29-1 (above) and will effectively detect loss of material due to pitting and crevice corrosion in the CST, RWST, Unit 3 DOST, DWST, and PWST bottom surfaces.

Since the LFET technique will be used, the criteria for follow-up discrete tank thickness measurements will be as follows:

> Any regions below nominal plate thickness will have a follow-up ultrasonic thickness reading. If there are areas of significant loss of material that could impact the pressure boundary function, future ultrasonic thickness measurements and trending will be performed.

This response is consistent with the response provided for RAI B.2.3.16-3 provided in Attachment 13 to FPL letter L-2018-152 (ML18248A257 dated August 31, 2018).

References:

None

Associated SLRA Revisions:

The following changes to SLRA Tables 3.2-1, 3.2.2-4, and 3.3.2-18 will be made in a future SLRA revision as indicated by text deletion (strikethrough) and text addition (red underlined font). Note that a markup of Table 3.2.2-15 is also provided to correct an omission in the table.

Revise SLRA Table 3.2-1 as follows:

Table 3.2-1: Summary of Aging Management Evaluations for the Engineered Safety Features					
Item Number	**Component**	**Aging Effect/Mechanism**	**Aging Management Program (AMP)/TLAA**	**Further Evaluation Recommended**	**Discussion**
3.2-1, 068	Steel tanks (within the scope of AMP XI.M29, "Outdoor and Large Atmospheric Metallic Storage Tanks") exposed to soil, concrete, air, condensation	Loss of material due to general, pitting, crevice corrosion, MIC (soil only)	AMP XI.M29, "Outdoor and Large Atmospheric Metallic Storage Tanks"	No	Consistent with NUREG-2191. The Outdoor and Large Atmospheric Metallic Storage Tanks AMP will be used to manage loss of material of the steel refueling water storage tanks exposed to ~~outdoor~~ air **or concrete**.

Revise SLRA Table 3.2.2-4 as follows:

Table 3.2.2-4: Safety Injection - Summary of Aging Management Evaluation								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-2191 Item**	**Table 1 Item**	**Notes**
Tank	**Pressure boundary**	**Carbon steel**	**Concrete**	**Loss of material**	**Outdoor and Large Atmospheric Metallic Storage Tanks**	**V.D1.E-402**	**3.2-1, 068**	**A**

Revise SLRA Table 3.3.2-15 as follows:

Table 3.3.2-15: Fire Protection - Summary of Aging Management Evaluation								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-2191 Item**	**Table 1 Item**	**Notes**
Tank	Pressure boundary	Carbon steel	Concrete	Loss of material	Fire Water System	VII.G.A-412	3.3-1, 136	A

Revise SLRA Table 3.3.2-18 as follows:

Table 3.3.2-18: Emergency Diesel Generator Fuel and Lubricating Oil - Summary of Aging Management Evaluation								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-2191 Item**	**Table 1 Item**	**Notes**
Tank	Pressure boundary	Carbon steel	Concrete	Loss of material	Outdoor and Large Atmospheric Metallic Storage Tanks	VII.H1.A-401	3.3-1, 128	A

Associated Enclosures:

None