FPL

L-2018-223
10 CFR 54.17

December 14, 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 - November 15, 2018 Public Meeting Action Item 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 Public Meeting Agenda dated November 5, 2018, Telecon Between NRC and FPL to Discuss Items Associated with the Safety Review of the Turkey Point Subsequent License Renewal Application (ADAMS Accession No. ML 18315A004)

4. FPL Letter L-2018-166 to NRC dated October 16, 2018, Turkey Point Units 3 and 4 Subsequent License Renewal Application – Safety Review Requests for Additional information (RAI) Set 3 Responses (ADAMS Accession No. ML18296A024)

5. FPL Letter L-2018-175 to NRC dated October 17, 2018, Turkey Point Units 3 and 4 Subsequent License Renewal Application – Safety Review Requests for Additional information (RAI) Set 5 Responses (ADAMS Accession No. ML18292A642)

6. FPL Letter L-2018-193 to NRC dated November 2, 2018, Turkey Point Units 3 and 4 Subsequent License Renewal Application – Safety Review Requests for Additional information (RAI) Set 6 Responses (ADAMS Accession No. ML18311A299)

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7. FPL Letter L-2018-176 to NRC dated October 17, 2018, Turkey Point Units 3 and 4 Subsequent License Renewal Application – Response to the August 2018 NRC On-Site Regulatory Audit Follow-up Items (ADAMS Accession No. ML18292A641)

On April 10, 2018, Florida Power & Light Company (FPL) submitted to the NRC Revision 1 of the subsequent license renewal application (SLRA) for Turkey Point Units 3 and 4 (Reference 1), as well as supplemental information for the SLRA Environmental Report (ER) (Reference 2). On November 15, 2018, the NRC and FPL held a public meeting (teleconference) to discuss items associated with the safety review of the SLRA for Turkey Point Units 3 and 4 (Reference 3).

The purpose of this letter is to provide, as attachments to this letter, responses to the discussion topic action items assigned to FPL during the referenced public meeting. These responses revise and supersede (or supplement) the corresponding RAI and On-Site Regulatory Audit Follow-up Item responses in References 4, 5, 6 and 7.

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

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

Executed on December 14, 2018.

Sincerely,

William Maher
Senior Licensing Director
Florida Power & Light Company

WDM/RFO

Attachments: 14 RAI/On-Site Audit Follow-up Item Response Updates (refer to Letter Attachment Index)

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cc:

Senior Resident Inspector, USNRC, Turkey Point Plant
Regional Administrator, USNRC, Region II
Project Manager, USNRC, Turkey Point Plant
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**

**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 Revised Response:**

This revised RAI response supersedes in its entirety the RAI response provided in Attachment 14 of Reference 1 discussed during the November 15, 2018 NRC public meeting with FPL (Reference 2).

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 140°F.

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 (penetration number and nominal pipe size in parentheses):

- Chemical and Volume Control (CVCS)
  - Letdown to the non-regenerative heat exchanger (#14, 2")
  - Excess letdown (#25, 3")
- Primary Sampling
  - Reactor coolant system (RCS) hot leg (#20, 3/8")
  - RCS pressurizer steam (#8, 3/8")
  - RCS pressurizer liquid (#9, 3/8")
- Residual Heat Removal (RHR)
  - Supply to RCS (#2, 12")
  - Return from RCS (#1, 14")

Based on the above, there are 7 penetrations per unit with dissimilar metal welds for stainless steel piping systems which may experience temperatures above 140°F during normal plant operation.

In addition, the stainless steel fuel transfer tube in the Spent Fuel Storage and Handling system on each unit 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 the stainless steel fuel transfer tube (including penetration sleeve and expansion joints) on each unit, and a representative sample of the dissimilar metal welds for penetrations associated with stainless steel piping systems that are exposed to temperatures above 140°F. Consistent with the guidance in NUREG-2191, a representative sample size is 20 percent of the population at each unit. As a result, two of the above penetrations (20% of the population) will be inspected on each unit as part of this one-time supplemental inspection. If SCC is detected as a result of the supplemental one-time inspections, additional inspections will be conducted in accordance with the site's corrective action process.

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 to reflect the enhancement to perform this supplemental, confirmatory one-time inspection.

**References:**

1. FPL Letter L-2018-175 to NRC dated October 17, 2018, Turkey Point Units 3 and 4 Subsequent License Renewal Application, Safety Review Requests for Additional Information (RAI) Set 5 Responses, ADAMS Accession No. ML18292A642

2. NRC Public Meeting Agenda dated November 5, 2018, Telecon Between NRC and FPL to Discuss Items Associated with the Safety Review of the Turkey Point Subsequent License Renewal Application, ADAMS Accession No. ML18315A004

**Associated SLRA Revisions:**

SLRA Section 3.5.2.2.1.6, Section 17.2.2.30, Table 17-3 (Item 34), and Section B.2.3.30 are amended as indicated by the following text deletion (strikethrough) and text addition (red underlined font) and supersede the ones in Reference 1.

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 140°F. The containment bulk ambient temperature during operation is between 50°F and 120°F, and localized temperatures at penetrations are less than 200°F 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 on each unit, and a representative sample of penetrations with dissimilar metal welds associated with high-temperature stainless steel piping systems, will be included as an enhancement to the ASME Section XI, Subsection IWE AMP to provide confirmation that no additional examinations/evaluations are required. Consistent with the guidance of NUREG-2191, a representative sample size is 20 percent of the population up a maximum of 25 components at each unit. As a result, two of the penetrations with dissimilar metal welds associated with high-temperature stainless steel piping systems will be inspected on each unit. Additionally, if SCC is detected as a result of the supplemental one-time inspections, additional inspections will be conducted in accordance with the site's corrective action process.**

Add the following to the next to last paragraph of Section 17.2.2.30 on page A-35 and revise the discussion on liner plate fatigue per supplemental responses to RAIs 3.5.1.9-1 and -2 in this letter:

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 supplemental one-time inspection of the stainless steel fuel transfer tube on each unit, and a representative sample of penetrations with dissimilar metal welds associated with high-temperature stainless steel piping systems, will be included as an enhancement to the ASME Section XI, Subsection IWE AMP to provide confirmation that no additional examinations/evaluations are required. Consistent with the guidance of NUREG-2191, a representative sample size is 20 percent of the population at each unit. As a result, two of the penetrations with dissimilar metal welds associated with high-temperature stainless steel piping systems will be inspected on each unit. Additionally, if SCC is detected as a result of the supplemental one-time inspections, additional inspections will be conducted in accordance with the site's corrective action process.**

PTN has no pressure-retaining **piping** components subject to cyclic loading without CLB fatigue analysis; therefore, a supplemental surface examination to detect cracking for such pressure retaining **piping** components is not required. **Cracking due to cyclic loading of the containment liner and non-piping penetrations are managed by the PTN IWE AMP.**

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:<br>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.<br>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.<br>c) **Implement a one-time surface or enhanced visual examination of the stainless steel fuel transfer** | 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:<br>PTN3: 1/19/2032<br>PTN4: 10/10/2032 |

| | | | | | |
|---|---|---|---|---|---|
| | | | | **tube (including penetration sleeve and expansion joints) on each unit, and a representative sample of penetrations (two) associated with high-temperature stainless steel piping systems in frequent use on each unit. Additionally, if stress corrosion cracking (SCC) is detected as a result of the supplemental one-time inspections, additional inspections will be conducted in accordance with the site's corrective action process.** | |

Add the following discussion to Section B.2.3.30 on pages B-230 to B-232 and revise the discussion on liner plate fatigue per supplemental responses to RAIs 3.5.1.9-1 and -2 in this letter:

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 supplemental one-time inspection of the stainless steel fuel transfer tube on each unit, and a representative sample of penetrations with dissimilar metal welds associated with high-temperature stainless steel piping systems, will be included as an enhancement to the ASME Section XI, Subsection IWE AMP to provide confirmation that no additional examinations/evaluations are required. Consistent with the guidance of NUREG-2191, a representative sample size is 20 percent of the population at each unit. As a result, two of the penetrations with dissimilar metal welds associated with high-temperature stainless steel piping systems will be inspected on each unit. Additionally, if SCC is detected as a result of the supplemental one-time inspections, additional inspections will be conducted in accordance with the site's corrective action process.**

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 **piping** components subject to cyclic loading without CLB fatigue analysis. Pressure retaining **piping** components are addressed by a fatigue evaluation. **Cracking due to cyclic loading of the containment liner and non-piping penetrations are managed by the PTN IWE AMP. See response to RAIs 3.5.1.9-1 and -2.**

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. |
| 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) on each unit, and a representative sample (two) of penetrations with dissimilar metal welds associated with high-temperature (temperatures above 140°F) stainless steel piping systems in frequent use on each unit.** |
| **7. Corrective Actions** | **If SCC is detected as a result of the supplemental one-time inspections, additional inspections will be conducted in accordance with the site's corrective action process. As a minimum, two additional penetrations per unit will be inspected upon detection of SCC.** |

## Associated Enclosures:

None

**NRC RAI Letter Nos. ML18269A227 and ML18269A228 Dated October 04, 2018**

**Containment Liner Plate, Metal Containments, and Penetrations Fatigue Analyses, TLAA 4.6**

Regulatory Basis:

Section 54.21(c)(1) of 10 CFR requires the applicant to evaluate time limited aging analyses (TLAA). 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. 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.

**RAI 3.5.1.9-1**

Background:

Section 4.6 of the SRP-SLR states that containment metal liner plates, metal containments and penetrations (including personnel airlocks, equipment hatches, sleeves, dissimilar metal welds, and bellows), may be designed in accordance with requirements of Section III of the American Society of Mechanical Engineers Boiler and Pressure Vessel Code (ASME Code). The SRP-SLR also states that if a plant's code of record requires a fatigue parameter evaluation (fatigue analysis or fatigue waiver), then this analysis may be a time limited aging analyses (TLAA) and must be evaluated in accordance with 10 CFR 54.21(c)(1) for the subsequent period of extended operation.

SRP-SLR Table 3.5-1, item 009, associated with the further evaluation section 3.5.2.2.1.5, recommends that metal liner, metal plates, and penetrations (including personnel airlocks, equipment hatches, penetration sleeves, bellows, vent lines, etc.) be managed for cumulative fatigue damage due to cyclic loading using the TLAA disposition from SRP-SLR Section 4.6, if a current licensing basis (CLB) fatigue analysis exists. Otherwise, if a CLB fatigue analysis does not exist for these components, SRP-SLR Table 3.5-1, item 027, recommends these components to be managed for cracking due to cyclic loading using the GALL-SLR Report AMP XI.S1, "ASME Section XI, Subsection IWE," and AMP XI.S4, "10 CFR Part 50, Appendix J" aging management programs (AMPs).

Turkey Point subsequent license renewal application (SLRA) Table 3.5-1, item 3.5-1, 009, states that the containment liner plate fatigue analysis is addressed in SLRA Section 4.6 and that the further evaluation is documented in SLRA Section 3.5.2.2.1.5. The SLRA further evaluation for "Cumulative Fatigue Damage" states that liner and connections to penetration sleeves and hatches for the containment structures is addressed in SLRA Section 4.6. SLRA Section 4.6, "Containment Liner Plate, Metal Containments, and

Penetrations Fatigue," addresses a TLAA for containment liner plate and piping penetrations. Additionally, SLRA Table 3.5-1, item 3.5-1, 027, states that this item is not applicable.

Also, SLRA Section B.2.3.30 "ASME Section XI, Subsection IWE" AMP states: "PTN [Turkey Point] has no pressure-retaining components subject to cyclic loading without CLB fatigue analysis. ..." Further, there are no enhancements proposed in the SLRA AMP to perform recommended supplemental surface examination or other applicable technique capable of detecting fine cracking; and no Appendix J leak rate tests are credited.

Issue:

Based on the information provided in the SLRA, it is not clear if a fatigue analysis or fatigue waiver exists for containment penetrations other than piping penetrations (e.g. personnel airlocks, equipment hatch and/or personnel hatch, electrical penetrations, etc.), or how the aging effect of cracking due to cyclic loading will be adequately managed, in accordance with 10 CFR 54.21(a)(3), for these components.

The staff notes that the SLRA does not clearly state if a CLB fatigue analysis exists for the components described above, or how these components were designed for cyclic loading. If a CLB fatigue analysis or fatigue waiver exists for these components, it is not clear how these analyses were dispositioned in SLRA Section 4.6, or why Table 3.5-1, item 3.5-1, 009, its associated Table 2 items, and Section 3.5.2.2.1.5 of the SLRA does not address these components to demonstrate that the aging effect of cumulative fatigue damage due to cyclic loading will be adequately managed during the subsequent period of extended operation. Likewise, if a CLB fatigue analysis or fatigue waiver does not exist for these components, it is not clear how cracking due to cyclic loading will be adequately managed for these components during the subsequent period of extended operation since SLRA Table 3.5-1, item 3.5-1, 027, states that this item is not applicable.

Request:

1. Clarify if a fatigue analysis or fatigue waiver exists for containment penetrations other than piping penetrations (i.e. personnel airlocks, equipment hatch, personnel hatch, electrical penetrations, etc.)
2. If a fatigue analysis or fatigue waiver exists, address with supporting justification the disposition under 10 CFR 54.21(c)(1) of each containment penetration fatigue analysis or fatigue waiver, and describe the following for each analyzed component:
    a. the name of the transients considered in each analysis,
    b. the design cycle limits of each transient,
    c. the projected cycles to 80-years of operation for each transient, and

d. the review of the calculated cumulative usage factor (CUF), if applicable.

Otherwise, pursuant to 10 CFR 54.21(a)(3), if fatigue analysis or fatigue waiver does not exist, clarify how containment penetrations other than piping penetrations will be adequately managed for cracking due to cyclic loading during the subsequent period of extended operation (i.e. SRP-SLR Table 3.5-1, item 027, with GALL-SLR Report recommendation for supplemental surface examinations using AMP XI.S1, "ASME Section XI, Subsection IWE" or identifying and crediting appropriately justified Appendix J leak rate tests).

**FPL Revised Response:**

This revised RAI response supersedes in its entirety the RAI response provided in Attachment 10 of Reference 1 discussed during the November 15, 2018 NRC public meeting with FPL (Reference 2).

Responses to the above numbered requests are as follows:

1. Turkey Point UFSAR Appendix 5B, Section B.2.1 provides a description of the fatigue analysis that was performed for the containment liner plate and penetrations. However, based on a review of available documentation, FPL has been unable to locate the original fatigue analysis, or confirm if a fatigue waiver exits for the Turkey Point non-piping containment penetrations.
2. Considering the response to item 1 above, the PTN SLRA is revised to indicate cracking due to cyclic loading of non-piping containment penetrations (hatches, electrical penetrations, etc.) will be managed by the 10 CFR 50, Appendix J AMP (XI.S4), and periodic supplemental surface examinations incorporated into and consistent with the frequency of the ASME Section XI, Subsection IWE AMP (XI.S1).

**References:**

1. FPL Letter L-2018-193 to NRC dated November 2, 2018, Turkey Point Units 3 and 4 Subsequent License Renewal Application, Safety Review Requests for Additional Information (RAI) Set 6 Responses (ADAMS Accession No. ML18292A642)
2. NRC Public Meeting Agenda dated November 5, 2018, Telecon Between NRC and FPL to Discuss Items Associated with the Safety Review of the Turkey Point Subsequent License Renewal Application (ADAMS Accession No. ML18315A004)

**Associated SLRA Revisions:**

SLRA Section 3.5.2.2.1.5, Table 3.5-1, Table 3.5.2-1, Table 3.5.2-15 and Appendix A, Table 17-3, and Section B.2.3.30 are amended as indicated by the following text deletion (strikethrough) and text addition (red underlined font) revisions. Note these changes include the changes associated with the response to RAI 3.5.1.9-2 below.

SLRA Section 3.5.2.2.1.5 is revised as follows:

Cumulative fatigue damage for the Turkey Point liner **plate** and ~~connections to~~ **piping** penetration**s** **and** sleeves ~~and hatches~~ for the containment structures is addressed in the Containment Liner Plate and Penetrations Fatigue Analysis TLAA in Section 4.6. **Cumulative fatigue damage for non-piping penetrations (hatches, electrical penetrations, etc.), dissimilar metal welds, and the fuel transfer tube expansion joints will be managed by periodic supplemental surface examinations incorporated into and consistent with the frequency of the ASME Section XI, Subsection IWE AMP (XI.S1) and the 10 CFR Part 50, Appendix J AMP.**

SLRA Table 3.5-1 is revised as follows:

**Table 3.5-1: Summary of Aging Management Evaluations for the Containment, Structures, and Component Supports**

| Item Number | Component | Aging Effect/Mechanism | Aging Management Program (AMP)/TLAA | Further Evaluation Recommended | Discussion |
|---|---|---|---|---|---|
| 3.5-1, 009 | Metal liner, metal plate, personnel airlock, equipment hatch, control rod drive (CRD) hatch, penetration sleeves; penetration bellows, steel elements: torus; vent line; vent header; vent line bellows; downcomers, suppression pool shell; unbraced downcomers, steel elements: vent header; downcomers | Cumulative fatigue damage due to cyclic loading (Only if CLB fatigue analysis exists) | TLAA, SRP-SLR Section 4.6, "Containment Liner Plate and Penetration Fatigue Analysis" | Yes (SRP-SLR Section 3.5.2.2.1.5) | **<u>TLAA applies to liner plate and piping penetrations only.</u>** Further evaluation **<u>for other components</u>** is documented in Section 3.5.2.2.1.5. |
| 3.5-1, 027 | Metal liner, metal plate, airlock, equipment hatch, CRD hatch; penetration sleeves; penetration bellows, steel elements: torus; vent line; vent header; vent line bellows; downcomers, suppression pool shell | Cracking due to cyclic loading (CLB fatigue analysis does not exist) | AMP XI.S1, "ASME Section XI, Section IWE," and AMP XI.S4, "10 CFR Part 50, Appendix J" | No | ~~Not applicable. CLB fatigue analysis is described in Section 4.6.~~<br><br>**<u>Consistent with NUREG-2191 for non-piping penetrations (hatches, electrical penetrations, etc.), dissimilar metal welds and fuel transfer tube expansion joints.</u>** |

SLRA Table 3.5.2-1 is revised as follows:

**Table 3.5.2-1: Containment Structure and Internal Structural Components — 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 |
|---|---|---|---|---|---|---|---|---|
| Liner plate, **piping penetrations** | Pressure boundary<br>Fire barrier | Carbon steel | Air – indoor uncontrolled | Cumulative fatigue damage | TLAA - Containment Liner Plate, Metal Containments, and Penetrations Fatigue | II.A.3.C-13 | 3.5-1, 009 | A |
| **Liner plate, non-piping penetrations (hatches, electrical penetrations, etc.), dissimilar metal welds** | **Pressure boundary**<br>**Fire barrier** | **Carbon steel** | **Air – indoor uncontrolled** | **Cracking due to cyclic loading** | **ASME Section XI, Subsection IWE**<br>**10 CFR Part 50, Appendix J** | **II.A3.CP-37** | **3.5-1, 027** | **A** |

SLRA Table 3.5.2-15 is revised as follows:

**Table 3.5.2-15: Spent Fuel Storage and Handling —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 |
|---|---|---|---|---|---|---|---|---|
| **Fuel transfer tube (including penetration sleeves and expansion joints)** | **Pressure boundary** | **Stainless steel** | **Air – indoor uncontrolled** | **Cracking due to cyclic loading** | **ASME Section XI, Subsection IWE**<br>**10 CFR Part 50, Appendix J** | **II.A3.CP-37** | **3.5-1, 027** | **A** |

SLRA Table 17-3 is revised 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:<br><br>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.<br>b) (See response to RAI B.2.3.30-1, Attachment 8 to this letter).<br>c) (See response to RAI 3.5.2.1.2-1, Attachment 14 to Reference 1).<br>d) (See response to RAI B.2.3.30-2, Attachment 9 to this letter).<br>**<u>e) Perform periodic supplemental surface examinations on the same frequency as other IWE inspections to detect cracking due to cyclic loading of non-piping penetrations (hatches, electrical penetrations, etc.), dissimilar metal welds, and fuel transfer tube expansion joints.</u>** | 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:<br><br>PTN3: 1/19/2032<br><br>PTN4: 10/10/2032 |

SLRA Section B.2.3.30, paragraph 6 is revised as follows (also see additional changes to this section as a result of the response to RAI B.2.3.30-1, Attachment 8 to Reference 1):

PTN has no pressure-retaining components **associated with the liner and piping penetrations** subject to cyclic loading without CLB fatigue analysis (Turkey Point UFSAR Appendix 5B, Section B.2.1). Pressure retaining components associated with the containment liner, including attachments and **piping** penetrations, are addressed by a fatigue evaluation. **Cracking due to cyclic loading of non-piping penetrations (hatches, electrical penetrations, etc.), dissimilar metal welds, and the fuel transfer tube expansion joints will be managed by periodic supplemental surface examinations incorporated into and consistent with the frequency of the ASME Section XI, Subsection IWE AMP (XI.S1) and the 10 CFR 50, Appendix J AMP (XI.S4).**

| Element Affected | Enhancement |
|---|---|
| 4. Detection of Aging Effects | **The AMP will be enhanced to perform periodic supplemental surface examinations to detect cracking due to cyclic loading of non-piping penetrations (hatches, electrical penetrations, etc.), dissimilar metal welds, and fuel transfer tube expansion joints.** |

**Associated Enclosures:**

None

**NRC RAI Letter Nos. ML18269A227 and ML18269A228 Dated October 04, 2018**

**RAI 3.5.1.9-2**

Background:

Section 4.6 of the SRP-SLR states that dissimilar metal welds are used to connect the piping penetrations to the bellows or stainless steel (SS) plates to provide a leak-tight penetration, and high energy piping penetrations and the fuel transfer tubes in some plants are equipped with SS bellow assemblies. The SRP-SLR also states that these components may be designed in accordance with the requirements of Section III of the American Society of Mechanical Engineers Boiler and Pressure Vessel Code (ASME Code), and if a plant's code of record requires a fatigue parameter evaluation (fatigue analysis or fatigue waiver), then this analysis may be a time limited aging analyses (TLAA) and must be evaluated in accordance with 10 CFR 54.21(c)(1) for the subsequent period of extended operation.

GALL-SLR Report item II.A3.C-13, associated with SRP-SLR Table 3.5-1, item 009, addresses, in part, the cumulative fatigue damage due to fatigue for penetrations with dissimilar metal welds and penetration bellows when a current licensing basis (CLB) fatigue analysis exists. Likewise, SLR-GALL Report item II.A3.CP-37, associated with SRP-SLR Table 3.5-1, item 027, addresses, in part, cracking due to cyclic loading for penetrations with dissimilar metal welds and penetration bellows when a CLB fatigue analysis does not exist.

Subsequent license renewal application (SLRA) Section 3.5.2.2.1.6 states that stainless steel piping from high-temperature piping systems that penetrates the containment uses dissimilar metal welds between the flued head of the steel penetration assembly and the outside of the pipe. SLRA Table 3.5-1, item 3.5-1, 009, and the associated further evaluation in SLRA Section 3.5.2.2.1.5, addresses only the disposition of carbon steel penetration sleeves and containment liner plate. SLRA Table 3.5-1, item 3.5-1, 027, states that this item is not applicable.

During the in-office audit, the staff reviewed drawing no. 5610-C-204, "Containment Structure Reactor Fuel Transfer Tube," and noted that the fuel transfer tube has two "expansion joints" as part of its design.

Issue:

Based on the information provided in the SLRA, it is not clear if (1) a fatigue analysis or fatigue waiver analysis exists for penetrations with dissimilar metal welds and for penetration bellows which may require an evaluation in accordance with 10 CFR 54.21(c)(1), and (2) how the aging effect of cracking due to cyclic loading will be adequately managed, in accordance with 10 CFR 54.21(a)(3), for these components during the subsequent period of extended operation.

The staff noted that the SLRA does not clearly state if a CLB fatigue analysis exists for the penetrations with dissimilar metal welds and the "expansion joints" described in the background section (above), or how these components where evaluated for cumulative fatigue damage due to fatigue. If a CLB fatigue analysis or fatigue waiver exists for these components, it is not clear how these analyses were dispositioned in SLRA Section 4.6, or why Table 3.5-1, item 3.5-1, 009, its associated Table 2 items, and Section 3.5.2.2.1.5 of the SLRA do not address these components to demonstrate that the associated aging effect will be adequately managed during the subsequent period of extended operation. Likewise, if a CLB fatigue analysis or fatigue waiver does not exist for these components, it is not clear how cracking due to cyclic loading will be adequately managed for these components during the subsequent period of extended operation since SLRA Table 3.5-1, item 27, states that this item is not applicable.

Also, SLRA Section B.2.3.30 "ASME Section XI, Subsection IWE" AMP states: "PTN [Turkey Point] has no pressure-retaining components subject to cyclic loading without CLB fatigue analysis...." Further, there are no enhancements proposed in the SLRA AMP to perform recommended supplemental surface examination or other applicable technique capable of detecting fine cracking; and no Appendix J leak rate tests are credited.

Request:

1. Clarify if a fatigue analysis or fatigue waiver analysis exists for dissimilar the piping penetrations with dissimilar metal welds (including the welds) described in SLRA Section 3.5.2.2.1.6.
2. Clarify if a fatigue analysis or fatigue waiver exists for the expansion joints illustrated in drawing 5610-C-204, "Containment Structure Reactor Fuel Transfer Tube,"
3. If a fatigue analysis or fatigue waiver exists for any on the components discussed above, address with supporting justification the disposition under 10 CFR 54.21(c)(1) of each the fatigue analysis or fatigue waiver, and describe the following for each analyzed component:
    - the name of the transients considered in each analysis,
    - the design cycle limits of each transient,
    - the projected cycles to 80-years of operation for each transient, and
    - the review of the calculated cumulative usage factor (CUF), if applicable.

Otherwise, pursuant to 10 CFR 54.21(a)(3), if fatigue analysis or fatigue waiver does not exists, clarify how these components will be adequately managed for cracking due to cyclic loading during the subsequent period of extended operation (i.e. SLRA Table 3.5-1, item 3.5-1, 027, with GALL-SLR Report recommendation for supplemental surface examinations using AMP XI.S1, "ASME Section XI, Subsection IWE" or identifying and crediting appropriately justified Appendix J leak rate tests).

**FPL Revised Response:**

This revised RAI response supersedes in its entirety the RAI response provided in Attachment 11 of Reference 1 discussed during the November 15, 2018 NRC public meeting with FPL (Reference 2).

Responses to the above numbered requests are as follows:

1. Turkey Point UFSAR Appendix 5B, Section B.2.1 provides a description of the fatigue analysis that was performed for the containment liner plate and penetrations. However, based on a review of available documentation, FPL has been unable to locate the original fatigue analysis, or confirm if a fatigue waiver exists for dissimilar metal welds associated with piping penetrations.
2. Turkey Point UFSAR Appendix 5B, Section B.2.1 provides a description of the fatigue analysis that was performed for the containment liner plate and penetrations. However, based on a review of available documentation, FPL has been unable to locate the original fatigue analysis, or confirm if a fatigue waiver exists for the fuel transfer tube expansion joints.
3. Considering the responses to items 1 and 2 above, the SLRA is revised to indicate cracking due to cyclic loading of dissimilar metal welds associated with piping penetrations and the fuel transfer tube expansion joints will be managed by periodic supplemental surface examinations incorporated into and consistent with the frequency of the ASME Section XI, Subsection IWE AMP (XI.S1) and the 10 CFR 50, Appendix J AMP (XI.S4).

**References:**

1. FPL Letter L-2018-193 to NRC dated November 2, 2018, Turkey Point Units 3 and 4 Subsequent License Renewal Application, Safety Review Requests for Additional Information (RAI) Set 6 Responses (ADAMS Accession No. ML18292A642)
2. NRC Public Meeting Agenda dated November 5, 2018, Telecon Between NRC and FPL to Discuss Items Associated with the Safety Review of the Turkey Point Subsequent License Renewal Application (ADAMS Accession No. ML18315A004)

**Associated SLRA Revisions:**

Changes to the SLRA as a result of this response are included with the response to RAI 3.5.1.9-1.

**Associated Enclosures:**

None

**NRC RAI Letter Nos. ML18269A227 and ML18269A228 Dated October 04, 2018**

**RAI B.2.3.35-2**

Background:

The "parameters monitored or inspected" and "detection of aging effects" program elements of GALL-SLR Report AMP XI.S6, "Structures Monitoring," recommends monitoring and trending leakage volumes and chemistry for signs of concrete or steel reinforcement degradation if through-wall leakage or groundwater infiltration is identified. The GALL-SLR Report also recommends, in part, assessing the indication thru engineering evaluation, more frequent inspections, or destructive testing of affected concrete to validate existing concrete properties. Additionally, it recommends to include analysis of the leakage pH, along with mineral, chloride, sulfate and iron content in the water when leakage volumes allow such analyses.

The subsequent license renewal application (SLRA), Section B.2.3.35, "Structures Monitoring," states that structures are monitored to confirm the absence of water in-leakage or signs of concrete leaching, chemical attack or steel reinforcement degradation. The SLRA also states that the aging management program (AMP), with exception and enhancements, will be consistent with the 10 elements of NUREG-2191, Section XI.S6, "Structures Monitoring."

Issue:

During the audit, the staff reviewed procedure 0-ADM-561, "Structures Monitoring Program," and Report No. FPLCORP020-REPT-107, "Aging Management Program Basis Document – Structures Monitoring," and was not able to verify consistency with the "parameters monitored or inspected" and "detection of aging effects" program elements of the GALL-SLR Report because the AMP (1) does not provide requirements to monitor and trend leakage volumes and chemistry for signs of concrete or steel reinforcement degradation when through-concrete leakage is identified, and (2) does not clearly identify how indications of groundwater infiltration or through-concrete leakage will be assessed for aging effects.

The staff notes that the program currently monitors structures elements to confirm the absence of water in-leakage. However, no AMP enhancement was provided in the SLRA to include the monitoring, trending and assessment of aging effects if through-concrete leakage is identified, to be consistent with the GALL-SLR Report recommendations.

Request:

Clarify how Turkey Point Structures Monitoring Program will be consistent with the "parameters monitored or inspected," and "detection of aging effects" program elements from the GALL-SLR Report, with respect to through-concrete leakage. Otherwise, provide adequate justification if an exception is taken to the GALL-SLR Report recommendations.

**FPL Revised Response:**

This response supersedes the response provided in FPL's November 2, 2018 RAI response (Attachment 15 of Reference 1; FPL Letter L-2018-193) per discussion during the November 15, 2018 NRC public meeting with FPL (Reference 2). This information addresses the concerns regarding management of groundwater infiltration and through-wall leakage.

Structures are monitored to confirm the absence of water in-leakage. Structures are acceptable without further evaluation if the absence of through-wall leakage or groundwater infiltration is confirmed for concrete surfaces. Observed concrete surface conditions with evidence of degradation or that are found to be detrimental to the structural or functional integrity are considered unacceptable and in need of further technical evaluation. This further technical evaluation is performed through the corrective action program, if needed. As such, the Turkey Point Structures Monitoring AMP is consistent with the 'parameters monitored or inspected' and 'detection of aging effects' elements of NUREG-2191, XI.S6, as described in SLRA Section B.2.3.35.

As described in the exception in Section B.2.3.35, the groundwater/soil at PTN is aggressive (chlorides > 500 ppm), and periodic sampling and testing is not necessary. As such, inclusion of information supporting the 'further technical evaluation' in the AMP governing procedure is warranted for the SPEO. This includes monitoring leakage volumes and chemistry if through-wall leakage or groundwater infiltration is identified, as well as analysis of that leakage for pH and mineral, chloride, sulfate or iron content of the water if leakage volumes permit. Should through-wall leakage or groundwater infiltration be identified, engineering evaluation, more frequent inspections, or destructive testing of affected concrete (to validate properties and determine pH), and analysis of the leakage may be necessary. To that end, and for closer consistency with NUREG-2191, pertinent SLRA sections are revised.

**References:**

1. FPL Letter L-2018-193 to NRC Dated November 2, 2018, Turkey Point Units 3 and 4 Subsequent License Renewal Application Safety Review Requests for Additional Information (RAI) Set 6 Responses (ADAMS Accession Number ML18311A299)
2. NRC Public Meeting Agenda dated November 5, 2018, Telecon Between NRC and FPL to Discuss Items Associated with the Safety Review of the Turkey Point Subsequent License Renewal Application (ADAMS Accession No. ML18315A004)
3. FPL Letter L-2018-191 to NRC Dated November 28, 2018, Turkey Point Units 3 and 4 Subsequent License Renewal Application Safety Review Requests for Additional Information (RAI) Set 7 Responses (ADAMS Accession No. ML18334A182)

**Associated SLRA Revisions:**

SLRA Table 17-3, Item 39, and Section B.2.3.35 are amended as indicated by the following text deletion (strikethrough) and text addition (red underlined font) revisions. These revisions supersede the revisions provided in L-2018-193 Attachment 15 (Reference 1).

Additionally, unrelated revisions were made to SLRA Table 17-3, Item 39, and Section B.2.3.35 via L-2018-191, Attachments 4 and 7 (Reference 3) which are not included in this markup. The L-2018-191 Attachment 4 SLRA revisions are related to clarifying Structures Monitoring Program inspection frequencies, and the L-2018-191 Attachment 7 are related to the site-specific enhancement to the Structures Monitoring AMP for inspections of inaccessible concrete.

Revise the commitments for the Structures Monitoring AMP in Table 17-3, item 39, on page A-107 as follows:

| No. | Aging Management Program or Activity (Section) | NUREG-2191 Section | Commitment | Implementation Schedule |
|---|---|---|---|---|
| | | | g) Revise inspection procedures to include guidance on monitoring for indications of cracking and expansion due to reaction with aggregates in concrete structures.<br><br>**h) Update inspection procedure(s) to include monitoring volumes and chemistry, more frequent inspections, or destructive testing of affected concrete (to validate properties and determine pH), and analysis of the leakage pH and mineral, chloride, sulfate and iron content of the water if leakage volumes permit, IF through-wall leakage or groundwater infiltration is identified.** | |

Revise the pertinent enhancement in SLRA Section B.2.3.35 on page B-257 as follows:

The PTN Structures Monitoring AMP will be enhanced as follows, for alignment with NUREG-2191. The changes and enhancements are to be implemented no later than six months prior to entering the SPEO.

| **Element Affected** | **Enhancement** |
|---|---|
| 4. Detection of Aging Effects | Update the governing AMP procedure with a site-specific enhancement that may include evaluations, destructive testing, and/or focused inspections of representative accessible (leading indicator) or below-grade, inaccessible concrete structural elements exposed to aggressive groundwater/soil. The respective evaluation/inspection/testing interval is not to exceed 5 years.<br>Update the governing AMP procedure with guidance on monitoring for indications of cracking and expansion due to reaction with aggregates in concrete structures.<br>Update the governing AMP procedure to clarify that tactile inspection may be needed for detection of elastomer hardening.<br>**Update the governing AMP procedure to clarify that engineering evaluation, more frequent inspections, or destructive testing of affected concrete (to validate properties and determine pH) are required, along with analysis of the leakage pH and mineral, chloride, sulfate and iron content of the water if leakage volumes permit, IF through-wall leakage or groundwater infiltration is identified.** |

**Associated Enclosures:**

None

**NRC RAI Letter Nos. ML18269A227 and ML18269A228 Dated October 04, 2018**

**RAI B.2.3.35-3**

Background:

The "detection of aging effects" program element of GALL-SLR Report AMP XI.S6, "Structures Monitoring," recommends that a plant-specific aging management program (AMP) accounting for the extent of the degradation experienced should be implemented to manage the concrete aging during the subsequent period of extended operation if the plant has an aggressive groundwater/soil environment. The GALL-SLR Report provides examples of what actions may be included as part of the plant-specific AMP. The SRP-SLR Appendix A provides the staff positions and guidance for a plant-specific AMP.

The subsequent license renewal application (SLRA), Section B.2.3.35, "Structures Monitoring," states that groundwater/soil at Turkey Point is aggressive (chlorides > 500 ppm), and that the AMP, with exception and enhancements, will be consistent with the 10 elements of NUREG-2191, Section XI.S6, "Structures Monitoring." The SLRA provides an enhancement to address aggressive groundwater/soil that may include evaluations, destructive testing, and/or focused inspections of representative accessible (leading indicator) or below-grade, inaccessible concrete structural elements exposed to aggressive groundwater/soil. The SLRA enhancement also states that the respective evaluation, inspection and testing interval is not to exceed 5 years.

During the on-site audit the staff noted several plant-specific operating experience items related to corrosion degradation in accessible areas of concrete structures exposed to air-outdoor environment. These degradations were attributed to the significant chloride level present at the site, which is the same aging effect mechanism expected from an aggressive groundwater/soil environment.

Issue:

The staff was not able to verify consistency with the "detection of aging effects" program element of the GALL-SLR Report since the enhancement provided in the SLRA restates the general examples provided in the GALL-SLR Report for a plant-specific AMP, and does not provide an adequate plant-specific AMP description or enhancements to the different program elements in accordance with SRP-SLR Appendix A, Section A.1, to ensure that structures and components exposed to an aggressive groundwater/soil environment will be adequately managed as required by 10 CFR 54.21(a)(3). Staff review of the SLRA AMP program elements did not identify how the applicant plans to address the aging effects of structures and components exposed to an aggressive groundwater/soil environment using the focused inspections, evaluations, and/or destructive testing suggested by GALL-SLR Report, and/or using other acceptable method(s). Also, it is not clear how the plant-specific operating experience associated with corrosion from accessible areas of the structures were considered in the implementation of the plant-specific AMP to ensure that inaccessible areas exposed to aggressive groundwater/soil environment are adequately managed. The staff notes that the aging effect mechanism present in accessible areas of concrete structures exposed to an air-outdoor environment is the same as in the inaccessible areas of the structures exposed to an aggressive ground/soil environment (i.e. significant chloride levels).

Request:

Provide the Turkey Point plant-specific AMP description or enhancements for each of the program elements in the Structures Monitoring Program (as applicable) to demonstrate that structures and components exposed to an aggressive groundwater/soil environment will be adequately managed for the subsequent period of extended operation. The proposed program or enhancements should account for any plant-specific OE with aggressive groundwater, and the on-going corrosion degradation observed in accessible areas of the structures due to the presence of chloride.

**FPL Revised Response:**

This response supersedes FPL's November 2, 2018 RAI response (Attachment 16 of Reference 1; FPL Letter L-2018-193) per discussion during the November 15, 2018 NRC public meeting with FPL (Reference 2). This information addresses clarifications regarding the site-specific enhancement to the Structures Monitoring AMP.

The below response also considers the L-2018-191 Attachment 4 and 7 (Reference 5) responses.

As stated in SLRA Section B.2.3.35, from comparison with the chloride level for seawater, the groundwater/soil at PTN is considered as aggressive (chlorides > 500 ppm). Since the chloride levels for seawater are much greater than 500 ppm, there is reasonable certainty that any groundwater/soil chemistry tests will consistently result in chloride level readings that are greater than 500 ppm which indicates an aggressive groundwater/soil classification, and periodic sampling and testing is not necessary. Therefore, PTN is required to account for the extent of degradation experienced due the aggressive groundwater/soil and water-flowing aging effects. The PTN Structures Monitoring AMP contains a site-specific enhancement to manage the concrete aging during the SPEO rather than implementing a site-specific AMP. For clarity, the existing enhancement to the detection of aging effects element will be replaced with a site-specific enhancement to the pertinent elements (scope of program, parameters monitored or inspected, detection of aging effects, monitoring and trending, acceptance criteria). The site-specific enhancement includes the following:

1. A baseline inspection of inaccessible concrete will be conducted prior to the SPEO.
   a) The baseline inspection locations will consider site-specific OE. OE considered will include known degradation due to chlorides in ambient air and the potential

for further degradation due to the aggressive groundwater as well as whether leaching and carbonation is occurring in the water-flowing environment.

b) The baseline inspection will include excavation, visual inspection, and physical inspection of the inaccessible concrete through pH analysis and a chloride concentration test at a location close to the coastline/intake and a location in the main plant area for comparison. The baseline inspection of these two locations is a representative sample since the baseline sample is 20 percent of the population of structures most likely to experience degradation associated with groundwater (Unit 3 and 4 intake structure, discharge structure, containment structure, and auxiliary building).

2. A baseline evaluation will be performed prior to the SPEO.

   a) The baseline evaluation will consider the baseline inspection results to determine the additional actions (if any) that are warranted. The baseline inspection results are evaluated on acceptance criteria provided in ACI 349.3R and will also consider the correlation between the chloride ion concentration necessary to induce corrosion and alkalinity level of the concrete (Reference 3). The highly alkaline environment of concrete protects the steel reinforcement from corrosion (Reference 4). Additional actions may include: enhanced inspection techniques and/or frequency, destructive testing, and focused inspections of representative accessible concrete (leading indicator) or below grade, inaccessible concrete structural elements exposed to aggressive groundwater/soil (or to leaching and carbonation in water-flowing if determined to impact intended function).

   b) The baseline inspection and evaluation results will set the subsequent inspection requirements and inspection intervals (not to exceed 5 years) for the SPEO.

3. Periodic inspections at a frequency determined in the baseline evaluation (not to exceed 5 years) will be performed, either focused or opportunistic when locations are excavated for other reasons.

4. Periodic evaluation updates will be performed (not to exceed 5 years).

   a) Updates will be based on OE, periodic inspections, and

   b) will consider the opportunistic or focused inspection results during the interval. The periodic evaluation results will update subsequent inspection requirements and inspection intervals (not to exceed 5 years) for the SPEO as required.

Accessible areas of in-scope concrete structures are inspected through the Structures Monitoring AMP for aging affects related to aggressive chemical attack such as loss of material (spalling, scaling), cracking, and other irregularities (increase in porosity and permeability. Issues related to accessible areas of concrete are entered into the corrective action program. Pertinent SLRA sections are revised to reflect the Structures Monitoring AMP site-specific enhancement.

**References:**

1. FPL Letter L-2018-193 to NRC Dated November 2, 2018, Turkey Point Units 3 and 4 Subsequent License Renewal Application Safety Review Requests for Additional Information (RAI) Set 6 Responses (ADAMS Accession Number ML18311A299)
2. NRC Public Meeting Agenda dated November 5, 2018, Telecon Between NRC and FPL to Discuss Items Associated with the Safety Review of the Turkey Point Subsequent License Renewal Application (ADAMS Accession No. ML18315A004)
3. NUREG/CR-5466 (NISTIR 89-4086), Service Life of Concrete, Published November 1989 (ADAMS Accession No. ML061430380)
4. ACI 222.3R, Design and Construction Practices to Mitigate Corrosion of Reinforcement in Concrete Structures
5. FPL Letter L-2018-191 to NRC Dated November 28, 2018, Turkey Point Units 3 and 4 Subsequent License Renewal Application Safety Review Requests for Additional Information (RAI) Set 7 Responses (ADAMS Accession No. ML18334A182)

**Associated SLRA Revisions:**

SLRA Section 17.2.2.35, Table 17-3 Item 39, and Section B.2.3.35 Structures Monitoring AMP, as also amended by L-2018-191 Attachment 7 (Reference 5), are amended as indicated by the following text deletion (strikethrough) and text addition (red underlined font) revisions. These revisions supersede the revisions provided in L-2018-193 Attachment 16 (Reference 1).

Additionally, unrelated revisions were made to SLRA Table 17-3, Item 39, and Section B.2.3.35 via L-2018-191, Attachment 4 (Reference 5) which are not included in this markup. The L-2018-191 Attachment 4 SLRA revisions are related to clarifying Structures Monitoring AMP inspection frequencies. L-2018-191 Attachment 7 (Reference 5) revisions to SLRA Table 17-3, Item 39, and Section B.2.3.35 are directly related to this response are included in this markup. The L-2018-191 Attachment 7 revisions are related to the site-specific enhancement to the Structures Monitoring AMP for inspections of inaccessible concrete.

Revise the Appendix A Section 17.2.2.35 on page A-37 as follows:

The PTN Structures Monitoring AMP is an existing condition monitoring program that consists primarily of periodic visual inspections of plant SCs for evidence of deterioration or degradation, such as described in the American Concrete Institute (ACI) Standards 349.3R, ACI 201.1R, and Structural Engineering Institute/American Society of Civil Engineers Standard (SEI/ASCE) 11. Quantitative acceptance criteria for concrete inspections are based on ACI 349.3R. Inspections and evaluations are performed using criteria derived from industry codes and standards contained in the plant CLB including but not limited to ACI 349.3R, ACI 318, SEI/ASCE 11, and the American Institute of Steel Construction (AISC) specifications. The AMP includes preventive actions to ensure

structural bolting integrity. Results from periodic inspections are trended. Due the presence of aggressive groundwater chemistry (Chlorides > 500 parts per million (ppm)), ~~the AMP includes site-specific evaluations, destructive testing, if warranted, and/or focused inspections of representative accessible (leading indicator) or below-grade, inaccessible concrete structural elements exposed to aggressive groundwater/soil, on an interval not to exceed five years.~~ **the AMP includes a site-specific enhancement to conduct a baseline visual inspection, pH analysis, a chloride concentration test, and evaluation to address the degradation of concrete due to exposure of aggressive chemical attack. The baseline evaluation will consider site-specific OE and the baseline inspection results and will determine the additional actions that are warranted. Periodic inspections (either focused or opportunistic) and evaluation updates (not to exceed 5 years) will be performed throughout the SPEO to ensure aging of inaccessible concrete is adequately managed.**

Revise the Structures Monitoring "Program Description" in Section B.2.3.35 on page B-256 as follows:

A dewatering system is not used or part of the CLB for PTN. Structures are monitored to confirm the absence of water in-leakage or signs of concrete leaching, chemical attack or steel reinforcement degradation. Due to the presence of high chloride levels in the groundwater a site-specific enhancement to manage the concrete aging during SPEO will ~~include evaluations, destructive testing, and/or focused inspections of representative accessible (leading indicator) or below-grade, inaccessible concrete structural elements exposed to aggressive groundwater/soil, on an interval not to exceed 5 years.~~ **include a baseline visual inspection, pH analysis, and a chloride concentration test prior to the SPEO. The inspection will include a location close to the coastline/intake and a location in the main plant area for comparison and consider site-specific OE. The baseline inspection results will be used to conduct a baseline evaluation that will determine the additional actions that are warranted. Additionally, the baseline evaluation results will set the subsequent inspection requirements and inspection intervals (not to exceed 5 years). Periodic inspections (either focused or opportunistic) and evaluation updates (not to exceed 5 years) will be performed throughout the SPEO to ensure aging of inaccessible concrete is adequately managed.**

Revise the Exceptions to NUREG-2191 in Section B.2.3.35 on page B-256 and B-257 as follows:

The groundwater/soil at PTN is aggressive (chlorides > 500 ppm). Since the chloride levels for seawater are much greater than 500 ppm, there is reasonable certainty that any groundwater/soil chemistry tests will consistently result in chloride level readings that are greater than 500 ppm which indicates an aggressive groundwater/soil classification, and periodic sampling and testing is not necessary and of little value. Rather, the PTN Structures Monitoring AMP includes a site-specific enhancement to address aggressive groundwater soil **and water-flowing.**~~, that may include evaluations, destructive testing if warranted, and/or focused inspections of representative accessible (leading indicator) or below-grade, inaccessible concrete structural elements exposed to aggressive groundwater/soil, based on site OE but not to exceed 5 year intervals.~~ **The site-specific enhancement includes the following:**

1. **A baseline inspection of inaccessible concrete will be conducted prior to the SPEO.**
    a) **The baseline inspection locations will consider site-specific OE. OE considered will include known degradation due to chlorides in ambient air and the potential for further degradation due to the aggressive groundwater as well as whether leaching and carbonation is occurring in the water-flowing environment.**
    b) **The baseline inspection will include excavation, visual inspection, and physical inspection of the inaccessible concrete though pH analysis and a chloride concentration test at a location close to the coastline/intake and a location in the main plant area for comparison. The baseline inspection of these two locations is a representative sample since the baseline sample is 20 percent of the population of structures most likely to experience degradation associated with groundwater (Unit 3 and 4 intake structure, discharge structure, containment structure, and auxiliary building).**
2. **A baseline evaluation will be performed prior to the SPEO.**
    a) **The baseline evaluation will consider the baseline inspection results to determine the additional actions (if any) that are warranted. The baseline inspection results are evaluated on acceptance criteria provided in ACI 349.3R and will also consider the correlation between the chloride ion concentration necessary to induce corrosion and alkalinity level of the concrete (Reference 3). The highly alkaline environment of concrete protections the steel reinforcement from corrosion (Reference 4). Additional actions may**

**include: enhanced inspection techniques and/or frequency, destructive testing, and focused inspections of representative accessible concrete (leading indicator) or below grade, inaccessible concrete structural elements exposed to aggressive groundwater/soil (or to leaching and carbonation in water-flowing if determined to impact intended function).**

b) **The baseline inspection and evaluation results will set the subsequent inspection requirements and inspection intervals (not to exceed 5 years) for the SPEO.**

3. **Periodic inspections at a frequency determined in the baseline evaluation (not to exceed 5 years) will be performed, either focused or opportunistic when locations are excavated for other reasons.**

4. **Periodic evaluation updates will be performed (not to exceed 5 years) throughout the SPEO.**

   a) **Updates will be based on OE, periodic inspections, and**

   b) **will consider opportunistic or focused inspection results during the interval. The periodic evaluation results will update subsequent inspection requirements and inspection intervals (not to exceed 5 years) for the SPEO as required.**

Revise the Enhancements in Section B.2.3.35 on page B-258 as follows:

| Element Affected | Enhancement |
|---|---|
| 4. Detection of Aging Effects | ~~Update the governing AMP procedure with a site-specific enhancement that may include evaluations, destructive testing, and/or focused inspections of representative accessible (leading indicator) or below-grade, inaccessible concrete structural elements exposed to aggressive groundwater/soil. The respective evaluation/inspection/ testing interval is not to exceed 5 years.~~<br><br>Update the governing AMP procedure with guidance on monitoring for indications of cracking and expansion due to reaction with aggregates in concrete structures.<br><br>Update the governing AMP procedure to clarify that tactile inspection may be needed for detection of elastomer hardening. |

**<u>A new implementing procedure, or new attachment to the AMP governing procedure, for management of concrete exposure to aggressive groundwater/soil and water-flowing will also be developed that addresses:</u>**

| **<u>Element Affected</u>** | **<u>Enhancement</u>** |
|---|---|
| **1. <u>Scope</u>** | **<u>Inaccessible concrete/foundations exposed to groundwater/soil and water-flowing in scope.</u>** |
| **3. <u>Parameters Monitored or Inspected</u>** | **<u>Monitoring of the condition of inaccessible concrete, including pH and chloride concentration, of concrete exposed to groundwater/soil and water-flowing environment for evidence of aggressive chemical attack or leaching and carbonation.</u>** |

| **Element Affected** | **Enhancement** |
|---|---|
| **4. Detection of Aging Effects** | **Guidance on baseline excavation with visual inspection, and physical inspection of the inaccessible concrete though pH analysis and a chloride concentration test of concrete exposed to groundwater/soil and water-flowing at a location near the coastline and a location in the main plant area for comparison prior to the SPEO. Include periodic inspections (either focused or opportunistic) at a frequency determined in the baseline evaluation (not to exceed 5 years).** |

| Element Affected | Enhancement |
|---|---|
| 5. Monitoring and Trending | Guidance for the evaluation of the baseline inspection results and related OE, with concrete exposed to ambient air and to groundwater/soil, for concrete susceptible to aging effects related to an aggressive environment prior to the SPEO to determine subsequent inspection/evaluation requirements and intervals (not to exceed 5 years), with periodic updates based on periodic inspections (either focused or opportunistic) and OE.<br>Guidance for the evaluation of baseline inspection results and related OE related to concrete exposed to water-flowing for evidence of leaching of calcium hydroxide and carbonation, prior to the SPEO<br>The baseline evaluation will determine whether leaching and carbonation are occurring and the impact to intended function, if so. Subsequent inspection/evaluation requirements and intervals (not to exceed 5 years), with periodic updates based on periodic inspections (either focused or opportunistic) and OE will be developed if leaching or carbonation is occurring in accessible or inaccessible areas that impacts intended function. |
| 6. Acceptance Criteria | Acceptance criteria in ACI 349.3R and considers the correlation between the chloride ion concentration necessary to induce corrosion and alkalinity level of the concrete for inaccessible concrete exposed to groundwater and water-flowing. |

Revise the Table 17-3, Item 39 on page A-107 as follows:

**Table 17-3**

**List of SLR Commitments and Implementation Schedule (Continued)**

| No. | Aging Management Program or Activity (Section) | NUREG-2191 Section | Commitment | Implementation Schedule |
|---|---|---|---|---|
| 39 | Structures Monitoring (17.2.2.35) | XI.S6 | f) ~~Perform evaluations, destructive testing, and/or focused inspections of representative accessible (leading indicator) or below-grade, inaccessible concrete structural elements exposed to aggressive groundwater/soil. The respective evaluation/inspection/ testing interval is not to exceed 5 years.~~ **Develop a new implementing procedure or attachment to an existing implementing procedure to address aging management of inaccessible areas exposed to groundwater/soil and water-flowing. The document will include guidance to conduct a baseline visual inspection, pH analysis, and a chloride concentration test prior to the SPEO at a location close to the coastline/intake and a location in the main plant area for comparison. The baseline inspection results will be used to conduct a baseline evaluation that will determine the additional actions that are warranted. Additionally, the baseline evaluation results will set the subsequent inspection requirements and inspection intervals (not to exceed 5 years). Periodic inspections (either focused or opportunistic) and evaluation updates (not to exceed 5 years) will be performed throughout the** | |

| | | | | |
|---|---|---|---|---|
| | | | **SPEO to ensure aging of inaccessible concrete is adequately managed.** | |

**Associated Enclosures:**

None

**NRC RAI Letter Nos. ML18269A227 and ML18269A228 Dated October 04, 2018**

**ASME Section XI, Subsection IWE, GALL AMP XI.S1**

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 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.

**RAI B.2.3.30-1**

Background:

The "detection of aging effects" program element of GALL-SLR AMP XI.S1 states, in part:

> The requirements of ASME Code Section XI, Subsection IWE and 10 CFR 50.55a are further supplemented to require a one-time volumetric examination of metal shell or liner surfaces that are inaccessible from one side, only if triggered by plant-specific OE [operating experience]. The trigger for this supplemental examination is plant-specific occurrence or recurrence of measurable metal shell or liner corrosion (base metal material loss exceeding 10 percent of nominal plate thickness) initiated on the inaccessible side or areas, identified since the date of issuance of the first renewed license. This supplemental volumetric examination consists of a sample of one-foot square locations that include both randomly-selected and focused areas most likely to experience degradation based on OE and/or other relevant considerations such as environment. Any identified degradation is addressed in accordance with the applicable provisions of the AMP. The sample size, locations, and any needed scope expansion (based on findings) for this one-time set of volumetric examinations should be determined on a plant-specific basis to demonstrate statistically with 95 percent confidence that 95 percent of the accessible portion of the containment liner is not experiencing corrosion degradation with greater than 10 percent loss of nominal thickness. Guidance provided in EPRI TR–107514 may be used for sampling considerations. (emphasis added)

SLRA Section B.2.3.30 states that the Turkey Point ASME Section XI, Subsection IWE AMP, with enhancements, will be consistent with the 10 elements of NUREG-2191 AMP XI.S1. Further, in SLRA Section B.2.3.30, the enhancement to the "detection of aging effects" program element states:

> 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. (emphasis added).

Issue:

The staff is unable to determine that the "detection of aging effects" program element, with the stated enhancement, will be consistent with that in GALL-SLR AMP XI.S1 because of the following issues identified with regard to the enhancement.

1. Contrary to the GALL-SLR specification that the one-time volumetric examination would be triggered by plant-specific OE identified since the date of issuance of the first renewed license (i.e., June 6, 2002 for Turkey Point U3 and U4), the enhancement states the trigger to be "site-specific OE identified after the approval of the SLRA."
2. The trigger specified in the GALL-SLR is the site-specific occurrence or recurrence of the stated plant-specific OE without regard to the method by which (how) it is identified. Contrary to this, the SLRA enhancement states that the triggering OE would be specific to that identified through code inspections.
3. The enhancement does not include the sampling specifications in the GALL-SLR program element that the sample size, locations and any needed scope expansion for this one-time volumetric examination shall demonstrate statistically with 95 percent confidence that 95 percent of the accessible portion of the containment liner is not experiencing corrosion degradation with greater than 10 percent loss of nominal thickness.
4. Based on information provided in the SLRA and on the electronic portal, the staff is unable to positively determine whether or not there has been operating experience of containment liner corrosion initiated on the inaccessible (concrete) side of Turkey Point Unit 3 or Unit 4 identified since the June 6, 2002, issuance of first renewed license.

Request:

1) Provide a revised enhancement to the "detection of aging effects" program element in SLRA Section B.2.3.30, that addresses the issues identified in 1 through 3 above and would make the Turkey Point AMP program element

consistent with that in GALL-SLR AMP XI.S1, or explain why a revised enhancement is unnecessary.

2) State if there has been operating experience of containment liner corrosion initiated on the inaccessible (concrete) side identified at Turkey Point Unit 3 or Unit 4 since the June 6, 2002, issuance of the first renewed license.

3) If the response to Request 2 is yes, then (i) describe the operating experience and how it was addressed in the corrective action program; and (ii) explain how the conduct of the "triggered" supplemental volumetric examination, including schedule, is sufficiently captured in the revised enhancement in response to Request 1.

**FPL Revised Response:**

This response supersedes in its entirety the response provided in Attachment 8 of Reference 1 including additional clarification discussed during the November 15, 2018 NRC public meeting with FPL (Reference 2). This revised response corrects information provided in the SLRA and Reference 1, and clarifies that the containment liner plate operating experience at Turkey Point has not initiated the conduct of the "triggered" supplemental volumetric examination specified in GALL-SLR AMP XI.S1 in response to Item 3.

1) SLRA Section 17.2.3.30, Table 17-3, item 34, and Section B.2.3.30 are revised as described below –
   - to provide further clarification of when site specific OE will trigger volumetric examinations,
   - clarify that degradation may be detected by maintenance or testing activities (in addition to code inspections), and
   - include sample size, location and scope expansion considerations from the AMP basis document.

2) There has been no containment liner corrosion attributed to the inaccessible (concrete) side. The small hole found in the floor of the Unit 4 reactor cavity sump liner plate in 2006 that is described in SLRA Sections B.2.3.4 (pg B-7) and B.2.3.30 (pg B-235) was determined to originate on the accessible side of the liner plate. These sections of the SLRA are corrected as noted below.

   Thus, there has been no operating experience of liner corrosion attributed to the inaccessible side since issuance of the PTN renewed licenses. Site operating experience since 2011 is expressly described in SLRA Section B.2.3.30 (pg B-233 to B-234). Moisture barrier and toe plate (between the moisture barrier and liner) degradation was identified and corrected for Unit 3 in 2015, with no degradation of the liner itself. Some minor sealant degradation and toe plate degradation where identified for Unit 4 in 2016, with only surface discoloration of the liner due to outage-related activities in a congested area. These indications were also corrected. A 2010 instance of liner degradation in the lower region of the reactor pit was addressed and repaired through augmented visual and ultrasonic examinations. The degradation initiated from the accessible side due to boric acid. There was no evidence of corrosion on the concrete side. The degraded liner section was replaced and a proper coating applied. A similar coating was applied to the lower region of the Unit 4 reactor pit.

3) As described in SLRA Section B.2.3.5 (pg B-72), a small hole in the floor of the Unit 4 reactor cavity sump liner plate was found and corrected in November 2006. The corrosion was attributed to a combination of boric acid and galvanic corrosion.

   A walkdown revealed water trickling out of the hole below a steel plate used to support one of the sump pumps, when it was displaced, and evaluation considered the shim material used for the plate. The water was attributed to either ground water intrusion or possibly the water used to cut the hole in the containment wall to support the reactor vessel head replacement project that reached the cavity sump area. However this water, regardless of the source, was determined not to be the cause of the corrosion. The hole was plugged and welded, the area was left with steel shims, and the steel support plate returned. The repair was leak tested successfully. In addition, periodic inspections of sump areas were added to the ASME Section XI, Subsection IWE program so that future degradation can be identified before the condition adversely impacts structural steel components or coatings. Subsequent inspections found the area acceptable. Furthermore, numerous UT measurements were taken in the sump pit area around the time of this repair and no additional sample expansion was warranted.

   Therefore, this localized corrosion that originated on the accessible (liner) side of the liner plate does not affect the ASME Section XI, Subsection IWE AMP for SLR beyond the operating experience discussion in the AMP basis document that is summarized in SLRA Section B.2.3.30, and identifying the cavity sump pit as a likely area for focused inspection.

Based on the above PTN plant specific OE, the supplemental volumetric examination specified in GALL-SLR AMP XI.S1 has not been "triggered". However, periodic inspections of sump areas on both units were added to the ASME Section XI Subsection IWE AMP (Section B.2.3.30) so that any future degradation can be identified before the condition adversely impacts structural steel components or coatings. Note that subsequent volumetric thickness measurements and visual examinations of the containment sump in 2010 and 2011 on both units have not revealed corrosion initiated on the concrete side of the liner plate.

SLRA Sections 17.2.2.30, B.2.3.4, and B.2.3.30, as well as Table 17-3, item 34 are revised as described below. The response to Set 5 RAI 3.5.2.1.2-1 submitted via FPL Letter L-2018-175 includes unrelated revisions to SLRA Section 17.2.3.30; Table 17-3, Item 34, and B.2.3.30.

**References:**

1. FPL Letter L-2018-193 to NRC dated November 2, 2018, Turkey Point Units 3 and 4 Subsequent License Renewal Application, Safety Review Requests for Additional Information (RAI) Set 6 Responses (ADAMS Accession No. ML18292A642)
2. NRC Public Meeting Agenda dated November 5, 2018, Telecon Between NRC and FPL to Discuss Items Associated with the Safety Review of the Turkey Point Subsequent License Renewal Application (ADAMS Accession No. ML18315A004)

**Associated SLRA Revisions:**

SLRA Sections 17.2.2.30, B.2.3.4, B.2.3.30 and Table 17-3 (Item 34) are amended as indicated by the following text deletion (strikethrough) and text addition (red underlined font) revisions.

Revise Section 17.2.2.30, paragraph 3 on page A-35 as follows:

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 **(such as a reactor cavity sump pit)** susceptible to corrosion that are inaccessible from one side. **This sampling is conducted to demonstrate, with 95% confidence, that 95% of the accessible portion of the liner is not experiencing greater than 10% loss of wall thickness.**

Revise Section B.2.3.4, 1st numbered paragraph on page B-72 as follows:

1. In November 2006, a small hole was found in the floor of the Unit 4 reactor cavity sump liner plate. The corrosion was attributed to **a combination of boric acid and galvanic corrosion on the accessible (liner) side of the containment liner.** ~~water trapped behind the liner plate when high pressure water was used to cut a hole in the Containment building to facilitate reactor vessel head replacement. Bulges in the liner plate provided a path for retained water to collect beneath the reactor sump floor.~~ The hole was plugged and welded and the area was left with ~~stainless~~ steel **shims** ~~on~~ **for a** ~~stainless~~ steel **support plate**. The repair was leak tested successfully. **Therefore, PTN operating experience to date does not "trigger" the supplemental volumetric examination specified in GALL-SLR AMP XI.S1. However,** ~~P~~**p**eriodic inspections of sump areas **on both units** were added to the ASME Section XI Subsection IWE AMP (Section B.2.3.30) ~~program~~ so that **any** future degradation can be identified before the condition adversely impacts structural

steel components or coatings. **Note that subsequent volumetric thickness measurements and visual examinations of the containment sump in 2010 and 2011 on both units have not revealed corrosion initiated on the concrete side of the liner plate.**

Revise Section B.2.3.30, 3rd paragraph on page B-230 as follows:

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 **(such as cavity sump pit)**, 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 **or other maintenance/testing activities** performed since June 6, 2002.

Revise Enhancements for Section B.2.3.30 on page B-232 as follows:

| 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 **(such as cavity sump pit)**, liner locations susceptible to corrosion that are inaccessible from one side. **This sampling is conducted to demonstrate, with 95% confidence, that 95% of the accessible portion of the liner is not experiencing greater than 10% wall loss.** 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 **or other maintenance/testing activities** performed since June 6, 2002. |

Revise 1st paragraph of industry operating experience for Section B.2.3.30 on page B-232 as follows:

NRC IN 2010-12 was issued to inform addressees of the then-recent issues involving the corrosion of the steel reactor containing building liner. The NRC expected recipients to review the information for applicability of their facilities and to consider actions, as appropriate, to avoid similar problems. In response, PTN issued an AR which evaluated that the containment liner inspection programs in effect at PTN are effective in detecting and addressing any found degradation of the containment liner due to corrosion, and ensure that the structural integrity and design function of the component are maintained. Additionally, the planned ASME Section XI Subsection IWE inspection **of Unit 3 the liner** in 2010 effectively located and corrected liner plate corrosion **prior to a loss of function**. ~~Further discussion is located in Section iii below.~~

Revise site-specific operating experience for Section B.2.3.30 on 3rd full paragraph on page B-233 as follows:

**There has been no evidence of corrosion degradation on the inaccessible (concrete) side of the liner plate. Thus, the supplemental volumetric examination specified in GALL-SLR AMP XI.S1 has not been "triggered".** The following review of site-specific OE provides examples of how PTN is managing aging effects associated with the PTN ASME Section XI, Subsection IWE.

Revise the commitment for the ASME Section XI Subsection IWE AMP in 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 AMP (17.2.2.30) | XI.S1 | Continue the existing PTN ASME Section XI, Subsection IWE AMP, including enhancement to:<br>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.<br>b) Implement a one-time inspection of metal liner surfaces that samples randomly selected as well as focused **(such as cavity sump pit)** locations susceptible to loss of thickness due to corrosion from the concrete side if triggered by site-specific OE identified through code inspections **or other maintenance/testing activities** performed since June 6, 2002. **This sampling is conducted to demonstrate, with 95% confidence, that 95% of the accessible** | Complete any applicable pre-SPEO one-time inspections no later than 6 months or the last RFO prior to SPEO.<br>Corresponding dates are as follows:<br>PTN3: 1/19/2032<br>PTN4: 10/10/2032 |

| | | | | |
|---|---|---|---|---|
| | | | **portion of the liner is not experiencing greater than 10% wall loss.** | |

**Associated Enclosures:**

None

**NRC RAI Letter Nos. ML18269A227 and ML18269A228 Dated October 04, 2018**

**RAI B.2.3.30-2**

Background:

The "operating experience" program element of GALL-SLR AMP XI.S1 includes industry operating experience described in NRC Information Notice (IN) 2014-07 concerning degradation of inaccessible areas of containment liner due to moisture intrusion into leak-chase channel systems through degraded interfaces at the containment floor level from lack of inspection of these interface components that serve a moisture barrier function.

The staff's review of Drawing 5610-C-164, Revision 4, Containment Structure Floor Liner Plate Plan, indicates the existence of an air chase system along the circumference as well as at inner locations of the containment floor for Turkey Point Unit 3 and Unit 4. The typical air test connection shown in Details 2, 3 and 9 and "Typical Air Test Connection" details on the drawing appear to indicate that these connections provide pathways, at the containment floor-level interface, for potential intrusion of moisture into inaccessible areas of the liner plate.

Issue:

Based on review of the Program Basis Document for the IWE AMP and the Second IWE Inspection Interval Program Plan, it is not clear if barriers (e.g., pipe cap, pipe plug, etc.) associated with the air chase system test connections at containment floor-level interfaces, intended to prevent moisture intrusion, are being inspected under IWE program as discussed in NRC IN 2014-07.

Request:

Discuss whether or not the air chase test connection components at the containment floor-level interfaces, that serve a function to prevent moisture intrusion into inaccessible areas of the liner, are examined in the IWE Program as discussed in NRC IN 2014-07. If not, justify the adequacy of the Turkey Point ASME Section XI, Subsection IWE to manage liner degradation in inaccessible areas related to operating experience described in NRC IN 2014-07.

**FPL Revised Response:**

This revised response supersedes in its entirety the response to RAI B.2.3.30-2 submitted via L-2018-193 (Reference 2, Attachment 9) and includes clarifications relative to topics addressed at the November 15, 2018 public meeting (Reference 3.

The evaluation of subject NRC Information Notice (IN) 2014-07, through the Turkey Point Corrective Action Program, was based on consideration of previous inspection reports and pictures from the Inservice Inspection (ISI) group. Actions were assigned for ISI personnel to perform walkdowns of the containment floor level to search for possible accessible interfaces of the air chase system with the containment liner plate. New action requests were to be generated if any accessible interface is discovered that is not covered or inspected by the current IWE inspection program. Walkdowns of the 14' floor elevation of the Containment, in PT4-28 (2014) and PT3-28 (2015), by ISI personnel observed multiple air chase system connections in satisfactory condition. No new ARs were required at the time of the walkdowns. As such, though not formally included in the implementing procedures for the ASME Section XI, Subsection IWE AMP, accessible air chase system connections have been inspected.

Each air chase channel/angle is seal welded to the containment liner, for leak tight integrity. The test connections for the air chase system include standard threaded pipe caps and, except for the toe plate connections, a concrete cover with lean grout after tests were completed and approved. There have been no instances of loose or degraded air chase test connections at PTN. Some instances of moisture barrier degradation in the early 2000s included evaluation of air chase angle (toe plate), which was considered an interference surface for installation of the containment floor moisture barrier sealant. These instances included confirmation of no degradation, or only surface degradation, of the angle (or seal weld) and no degradation of the liner as well as repair of the moisture barrier. Degraded air chase angle evaluated in 2006 included removal of a portion of the angle and inspection along with thickness measurement of the liner beneath. The air chase angle degradation was repaired and the moisture barrier restored. Therefore, there has been no evidence of moisture intrusion through the accessible air-chase system test connections to inaccessible portions of the containment liner plate.

For completeness, the IWE inspection plan will be enhanced to include general visual inspection of 100% of the accessible air chase test connections at the containment floor-level interfaces. SLRA Sections B.2.3.30 and 17.2.2.30, as well as Table 17-3, item 34, are revised as described below. The responses to Set 5 RAI 3.5.2.1.2-1, submitted via FPL Letter L-2018-175 (Reference 1, Attachment 14), and Set 6 RAIs 3.5.1.9-1, 3.5.1.9-2 and B.2.3.30-1 submitted via FPL Letter L-2018-193 (Reference 2, Attachments 10, 11 and 8), include unrelated revisions to SLRA Table 17-3, Item 34, and Sections 17.2.2.30 and B.2.3.30. These unrelated revisions are further supplemented in Attachments 1, 2, 3, and 6 of this letter (L-2018-223), respectively.

**References:**

1. FPL Letter L-2018-175 to NRC dated October 17, 2018, Turkey Point Units 3 and 4 Subsequent License Renewal Application, Safety Review Requests for Additional Information (RAI) Set 5 Responses (ADAMS Accession No. ML18292A642)

2. FPL Letter L-2018-193 to NRC dated November 2, 2018, Turkey Point Units 3 and 4 Subsequent License Renewal Application, Safety Review Requests for Additional Information (RAI) Set 6 Responses (ADAMS Accession No. ML18311A299)
3. NRC Public Meeting Agenda dated November 5, 2018, Telecon Between NRC and FPL to Discuss Items Associated with the Safety Review of the Turkey Point Subsequent License Renewal Application (ADAMS Accession No. ML18315A004)

**Associated SLRA Revisions:**

SLRA Sections B.2.3.30, 17.2.2.30 and Table 17-3 (Item 34) are further amended as indicated by the following text deletion (strikethrough) and text addition (red underlined font) revisions. These SLRA revisions replace those provided in Attachment 9 of L-2018-193 (Reference 2) in their entirety and consider the other revisions to those sections in this letter.

Revise enhancement and operating experience discussions in SLRA Section B.2.3.30 on page B-232 as follows:

| Element Affected | Enhancement |
|---|---|
| 10. Operating Experience | **Update inspection procedure/plan to formally include general visual examination of 100% of the accessible air chase system test connections at the containment floor-level.**<br>**Acceptance criterion for this inspection is no evidence of loose or degraded air chase test connections.**<br>**If a loose or degraded test connection is identified, it will be opened prior to repair and the test connection and air chase channel inspected internally to confirm no water intrusion to the air chase.** |

**Operating Experience**

Industry Operating Experience

NRC IN 2010-12 was issued to inform addressees of the then-recent issues involving the corrosion of the steel reactor containing building liner. The NRC expected recipients to review the information for applicability of their facilities and to consider actions, as appropriate, to avoid similar problems. In response, PTN issued an AR which evaluated that the containment liner inspection programs in effect at PTN are effective in detecting and addressing any found degradation of the containment liner due to corrosion, and ensure that the structural integrity and design function of the component are maintained. Additionally, the planned ASME Section XI Subsection IWE inspection in 2010 effectively located and corrected liner plate corrosion.

**NRC IN 2014-07 was issued to inform addressees of identified issues concerning degradation of floor weld leak channel systems of steel containment shell and concrete containment metallic liner that could affect leak-tightness and aging management of containment structures. This IN provides examples of operating experience at some plants of water accumulation and corrosion degradation in the leak-chase channel system that has the potential to affect the leak-tight integrity of the containment shell or liner plate. In each of the examples, the licensee had no provisions in its ISI plan to inspect any portion of the leak-chase channel system for evidence of moisture intrusion and degradation of the containment metallic shell or liner within it. The moisture intrusion and associated degradation found within leak chase channels, if left uncorrected, could have resulted in more significant corrosion degradation of the containment shell or liner and associated seam welds.**

**Turkey Point does have an air chase system inside the Unit 3 and Unit 4 containment structures, similar to the leak chase system discussed in IN 2014-07. Walk-downs for accessible air chase test connection condition were conducted during a recent outage (PT3/4-28). Test connection (grouted pipe cap) condition was determined to be satisfactory or indeterminate (inaccessible). The inspection procedure/plan will be updated to formally include the accessible air chase system test connections in future IWE inspections along with opening of any identified loose or degraded test connection for internal inspection of the test connection and channel/angle to ensure no moisture intrusion to the air chase.**

Add the following paragraph to the end of the as-amended SLRA Section 17.2.2.30 on Attachments 1-3 and 6 of this letter as follows:

**The PTN ASME Section XI, Subsection IWE AMP will also be updated to formally include general visual inspection of 100% of the accessible air chase system test connections for loose or degraded connections. If a loose or degraded test connection is discovered, it will be opened prior to repair for internal inspection of the test connection and channel/angle to confirm no water intrusion to the air chase.**

Revise the as-amended commitments for the ASME Section XI, Subsection IWE AMP in Table 17-3, item 34, and on page A-103 as follows (Note: See Attachments 1-3 and 6 of this letter for revised Items b), c) and e) to this commitment):

| No. | Aging Management Program or Activity (Section) | NUREG-2191 Section | Commitment | Implementation Schedule |
|---|---|---|---|---|
| 34 | ASME Section XI, Subsection IWE AMP (17.2.2.30) | XI.S1 | Continue the existing PTN ASME Section XI, Subsection IWE AMP, including enhancement to:<br>d) **Update inspection procedure/plan to formally include general visual inspection of 100% of the accessible air chase system test connections at the containment floor-level. If a loose or degraded test connection is discovered, it will be opened for internal inspection of the test connection and channel/angle to confirm no water intrusion to the air chase.** | Complete any applicable pre-SPEO one-time inspections no later than 6 months or the last RFO prior to SPEO.<br>Corresponding dates are as follows:<br>PTN3: 1/19/2032<br>PTN4: 10/10/2032 |

**Associated Enclosures:**

None

**On-Site Regulatory Audit Regarding the Turkey Point Nuclear Generating Unit Nos. 3 and 4 – Subsequent License Renewal Application, August 27-31, 2018**

**Concrete Containment Tendon Prestress TLAA**

During the NRC site audit at Turkey Point from August 30, 2018 questions were raised regarding SLRA Section 4.5 Concrete Containment Tendon Prestress TLAA and the supporting calculations. These questions included clarification of:

- Whether the predicted lower limit (PLL) is evaluated as a TLAA
- Why a greater number of tendons were included than those required for examination
- Why certain plotted data exhibits considerable tendon lift-off force variation
- Why the reportable data for regression analysis for trending of tendon prestress force and safety evaluation is not limited to the prestress minimum required value (MRV) and PLL line.
- Why the regression analyses trend lines were omitted from the SLRA Figures 4.5-1 through 4.5-6.
- The staff is not clear on how ascending tendon prestress force trend lines are possible when concrete experiences creep and shrinkage and the tendons undergo relaxation.

**FPL Revised Response:**

This response revises the audit follow-up response in Attachment 2 of FPL's November 2, 2018 response (Reference 1) as a result of discussions during the NRC public meeting on November 15, 2018 (Reference 2) related to further clarifications regarding the Concrete Containment Tendon Prestress TLAA. That response is superseded in its entirety for clarity. The conclusions in Reference 1 Attachment 2 were carried forward unchanged in this revised response.

The Containment Tendon Loss of Prestress Time Limited Aging Analysis (TLAA) for License Renewal and Subsequent License Renewal calculation was updated to differentiate the containment tendons that were affected by the PTN Unit 3 and Unit 4 Reactor Vessel Closure Head (RVCH) Replacement project. The analysis was also updated to only include "physical" surveillance data where the tendon force is measured. The two units alternate between "physical" and "visual" inspections at each surveillance period.

The requested clarifications are summarized as follows:

- Added statement in the calculation and SLRA Section 4.5 that the PLL is evaluated as a TLAA.

- The tendon surveillance for Units 3 and 4 were performed at one, three, and five years after the containment Initial Structural Integrity Test, and every five years thereafter. In response to the NRC Final Rule 61 FR 41303 (Reference 4) which required implementation of the revised requirements for containment examination by September 9, 2001, FPL submitted proposed license amendments to incorporate the revisions to 10 CFR Section 50.55a(b)(2)(vi) (Reference 5). The revision to 10 CFR Section 50.55a(b)(2)(vi) states that ASME Section XI, Subsection IWL, as modified and supplemented by the requirements in Section 50.55a(b)(2)(viii), shall be used by licensees when performing containment examinations.

  Prior to the 30th year surveillance in 2001, the NRC approved the proposed license amendments (Reference 3) on the basis that the staff found the proposed containment examination requirements were equivalent to, or more rigorous than the previous Technical Specification requirement. Therefore, the NRC issued Amendment No. 210 to Facility Operating License No. DPR-31 and Amendment No. 204 to Facility Operating License No. DPR-41 for Turkey Point, Units 3 and 4, respectively (Reference 3). The amendments updated Technical Specification 3/4.6.1.6.1 tendon and containment surface surveillance to conform to IWL inspection requirements (containment structural integrity shall be demonstrated during inspection periods specified in IWL-2410 and IWL-2420). The current licensing basis for IWL inspections accepts the Turkey Point Unit 3 and Unit 4 containments as "twin" units. Therefore, the modified examination requirements of IWL-2421(b) were used to define the examination interval for the 30$^{th}$ through the 45th year surveillance and will continue as the interval requirement for surveillance periods thereafter (including throughout the subsequent period of extended operation).

  Tendons are selected to undergo a "physical" inspection per IWL-2500 requirements every 10 years. Turkey Point Unit 3 and Unit 4 meet the criteria of Section IWL-2421(a), as described in Attachment 3 of Reference 1, and the other unit undergoes a "visual" inspection per IWL-2524 and IWL-2525. The two units alternate between "physical" and "visual" inspections at each 5 year surveillance period. Figures 4.5-1 through 4.5-6 are updated to differentiate the surveillance year data based on the two units alternating between "physical" and "visual" inspections.

A "visual" tendon examination per IWL-2524 and IWL-2525 consists of sheathing filler inspection and testing, inspection for free water, anchorage inspection, concrete inspection around tendon bearing plates, and replacement of grease caps and grease after completion of all inspections. A "physical" tendon surveillance per IWL-2500 consists of a visual inspection, plus force monitoring and inspection, as well as tensile testing of removed wire samples. The tendon loss of prestress calculation was updated to only include "physical" surveillance data.

- The Turkey Point Unit 3 and Unit 4 RVCH Replacement Projects required a containment access opening consisting of the removal and later replacement of a section of the containment structures. The Unit 3 and Unit 4 tendons affected by the RVCH modification are considered as augmented scope tendons and are analyzed separately from the Unit 3 and Unit 4 tendons for SLR. The tendon loss of prestress calculation was updated to separate the augmented scope tendons from the original scope tendons which eliminated the considerable tendon lift-off force variation.

- Although the trending of tendon prestress force can be limited to the MRV and PLL line, additional, non-critical data is included in the regression analysis to be consistent with the analysis from the PTN original license renewal regression analysis.

- SLRA Figures 4.5-1 through 4.5-6 were updated to include regression analysis trendlines consistent with the containment loss of prestress calculation update. SLRA Figures 4.5-1 through 4.5-6 were also updated to differentiate the control tendons (also referred to as common or historical tendons) for regression analysis after the reanalysis to consider high-temperature effects following the 20$^{th}$ year surveillance.

  The control tendons for the 20$^{th}$ through the 45$^{th}$ surveillance years are differentiated in the figures. Previously undisturbed tendons that were surveilled in the 20$^{th}$ year surveillance, were selected as control (historical) tendons for the 20$^{th}$ through the 45$^{th}$ surveillance years. Tendons were identified and surveilled to establish control tendons for historical data to be used to correlate existing data, assumptions and conclusions noted in previous engineering evaluations and surveillances.

- The Unit 3 and Unit 4 tendons affected by the RVCH modification are considered as augmented scope tendons and are analyzed separately from the Unit 3 and Unit 4 tendons for SLR. The containment loss of prestress calculation was updated to separate the augmented scope tendons from the original scope tendons for the regression analysis to remove the false impression of an ascending (rather than descending) trend of the tendon prestress force.

The number of tendons selected for the augmented RVCH scope is defined by IWL-2521.2 and Table IWL-2521-2. The full augmented sample size (used for the 35th and 40th year surveillance) consists of two hoop tendons and three vertical tendons on Unit 3 and three hoop tendons and three vertical tendons on Unit 4. The 45th year surveillance used a reduced augmented sample size of two hoop tendons and two vertical tendons on Unit 3 (visual inspection) and two hoop tendons and two vertical tendons on Unit 4 (physical inspection). The reduced augmented sample size is valid since the results from the previous two inspections (35th and 40th year) were within acceptable limits, allowing the reduced sample size of 2%.

In Figure 4.5-8, one result is listed for the Unit 4 hoop tendon 45th year (vs. the sample size of two) since one of the RVCH tendons (tendon 15H35) was surveyed as an alternate for the planned inspection RVCH tendon (tendon 15H32) that was determined to be inaccessible. The data for the alternate RVCH tendon (tendon 15H35) was not displayed in the TLAA Figure 4.5-8 since only average lift-off force for the tendon could be reported. The tendon lift-off data analyzed and presented in the TLAA for License Renewal (surveillance years 1-25) and the 30th and 35th years' surveillance reports is presented as normalized lift-off forces. The data in the 40th and 45th years' surveillance reports is presented as average lift-off forces. Instead of applying the Normalization Factor to the as-found lift-off force, the 40th and 45th surveillance report methodology applies the Normalization Factor to the Baseline Predicted Force. The 45th years' tendon selection and predicted forces report is used to convert the average lift-off force data to normalized lift-off force data by back-calculating the Normalization Factor from the Baseline Predicted Force. Since tendon 15H35 was not a planned inspection tendon, the predicted force (PF) and baseline predicted force (BPF) were not calculated in the tendon selection and predicted forces report. Therefore, the Normalization Factor could not be determined. The average lift-off force is greater than the PF and BPF; therefore, the tendon force is acceptable.

**References:**

1. FPL Letter L-2018-176 to NRC Dated October 17, 2018, Turkey Point Units 3 and 4 Subsequent License Renewal Application, Response to NRC On-Site Regulatory Audit Follow Up Items (ADAMS Accession Number ML18292A641)
2. NRC Public Meeting Agenda dated November 5, 2018, Telecon Between NRC and FPL to Discuss Items Associated with the Safety Review of the Turkey Point

Subsequent License Renewal Application (ADAMS Accession Number ML18315A004)

3. NRC letter from Kahtan N. Jabbour to Mr. T. F. Plunkett, Turkey Point Units 3 and 4 – Issuance of Amendments Regarding Changes to Containment Structural Integrity Technical Specifications (TAC NOS. MA9047 and MA9048), dated January 31, 2001(ADAMS Accession Number ML010360301)
4. NRC Federal Register Volume 61, Number 154 (Thursday, August 8, 1996), 61 FR 41303
5. FPL letter from R.J. Hovey to NRC, L-2000-072, Turkey Point Units 3 and 4 Docket Nos. 50-250 and 50-251 Proposed License Amendments Changes to Containment Structural Integrity Technical Specifications (ADAMS Accession Number ML003719523)

**Associated SLRA Revisions:**

SLRA Section 4.5 is amended as indicated by the following text deletion (strikethrough) and text addition (red underlined font) revisions. These revisions supersede the revisions provided in L-2018-176 Attachment 2.

Revise the TLAA Description in Section 4.5 on page 4.5-1 as follows:

**TLAA Description**

The Turkey Point Units 3 and 4 containment buildings are post-tensioned, reinforced concrete structures composed of vertical cylinder walls and a shallow dome, supported on a conventional reinforced concrete base slab. The cylinder walls are provided with vertical tendons and horizontal hoop tendons. The dome is provided with three groups of tendons oriented 120-degrees apart.

Over time, the containment prestressing forces decrease due to relaxation of the steel tendons and due to creep and shrinkage of the concrete. The containment tendon prestressing forces were calculated during the original design considering the magnitude of the tendon relaxation and concrete creep and shrinkage over the 40-year life of the plant. The Concrete Containment Unbonded Tendon Prestress AMP (Section B.2.2.3) and ASME Section XI, Subsection IWL AMP (Section B.2.3.31) perform periodic surveillances of individual tendon prestressing values. Predicted lower limit (PLL) force values are calculated for each tendon prior to the surveillances to estimate the magnitude of the tendon relaxation and concrete creep and shrinkage for the given surveillance period. The prestressing forces are measured and plotted, and trend lines are developed, to ensure the average tendon group prestressing values remain above the respective minimum required values (MRVs) until the next scheduled surveillance. The predicted lower limit force values and regression analyses, utilizing actual measured tendon forces, are used to evaluate the acceptability of the containment structure to perform its intended function over the current 60-year life of the plant, and therefore, are TLAAs requiring evaluation for the SPEO.

**The PTN Unit 3 and Unit 4 Reactor Vessel Closure Head (RVCH) Replacement Projects required a temporary containment access opening consisting of the removal and later replacement of a section of the containment structures which was necessary for RVCH replacement. The Unit 3 and Unit 4 tendons affected by the RVCH modification are considered as augmented scope tendons and are analyzed separately from the Unit 3 and Unit 4 tendons for SLR. Since the Unit 3 and Unit 4 tendons affected by the RVCH modification are considered as augmented scope, the RVCH tendons are considered with a separate regression analysis than those in the original scope.**

Revise the TLAA Evaluation in Section 4.5 on page 4.5-1 and 4.5-2:

**Baseline Predicted Force (BPF)**

**The regression analysis for the RVCH tendons is based on comparing the tendon surveillance data versus the BPF and MRV. As an alternative to the PLL, Reg. Guide 1.35.1 allows for the use of the expected force based directly on plant design losses. It states, "In lieu of the variations [for concrete shrinkage, concrete creep, and steel relaxation], the designer may use the conservatively estimated design values for the time-dependent factors." The "actual" predicted prestress force will always be greater than the PLL. Using this method, the RVCH-affected tendon's Predicted Force uses the actual expected losses listed in PTN TS, Section 5.1.4.4, and does not consider the tolerance allowance of Reg. Guide 1.35.1. The calculation of a tendon's individual Predicted Force, which is used as the final acceptance criteria for that tendon, begins with the calculation of the Baseline Predicted Force (BPF) described in Reg. Guide 1.35.1. The BPF considers the expected stress losses for the type of tendon and the time period over which the losses occur for each specific tendon. Equations are generated to calculate the expected force for any tendon at any particular time after installation.**

Revise the Assessment in Section 4.5 on page 4.5-2 as follows:

Assessment

The regression analyses associated with the tendons have been reanalyzed to extend the trend lines from 60 years to 80 years. The extended trend lines have been calculated using individual tendon prestressing force values based on data incorporating the latest surveillances for Turkey Point Units 3 and 4 in 2017. In all cases, the regression analyses predict the prestressing forces will remain above the respective group MRVs through the SPEO.

Figures 4.5-1 through 4.5-6 contain the reanalyzed regression analyses for each tendon group at PTN. Extended trend lines have been developed for all tendons within the respective group, including the control tendons (also referred to as common or historical tendons), and plotted with the MRVs **(also referred to minimum prestressing force)** over the 80-year period. **The predicted lower limit force values and regression analyses, utilizing actual measured tendon forces, are also plotted to evaluate the acceptability of the containment structure to perform its intended function, and therefore, are TLAAs requiring evaluation for the SPEO. The control tendon (also referred to as common or historical tendon) for each regression analysis for the 20th through the 45th surveillance years are differentiated in Figures 4.5-1 through 4.5-6.**

**Figures 4.5-7 through 4.5-10 contain the reanalyzed regression analysis for the tendon groups affected by the RVCH replacement project. The surveillance data is plotted with the MRVs over the 80-year period. The number of tendons selected for the augmented RVCH scope is defined by IWL2521.2 and Table IWL-21521-2.**

The Concrete Containment Unbonded Tendon Prestress AMP (Section B.2.2.3) will monitor and manage the TLAA and the associated loss of tendon prestressing forces during the SPEO. The regression analyses are periodically updated following successive surveillances to ensure that estimated values remain above the MRVs until the next scheduled surveillance, and potentially for the life of the plant. Individual measured tendon prestressing forces will be compared to predicted PLL values**, BPF values (as related to the containment tendons affected by the PTN RVCH replacement project),** and trend lines developed for the SPEO.

New **predicted** upper limit ~~curves~~**lines**, **predicted** lower limit ~~curves~~**lines, BPF lines (as related to the containment tendons affected by the PTN RVCH replacement project),** and trend lines of measured prestressing forces have been established for all tendons through the SPEO as part of the Concrete Containment Unbonded Tendon Prestress AMP (Section B.2.2.3). The predicted final effective preload at the end of 80 years exceeds the minimum required preload for all containment tendons.

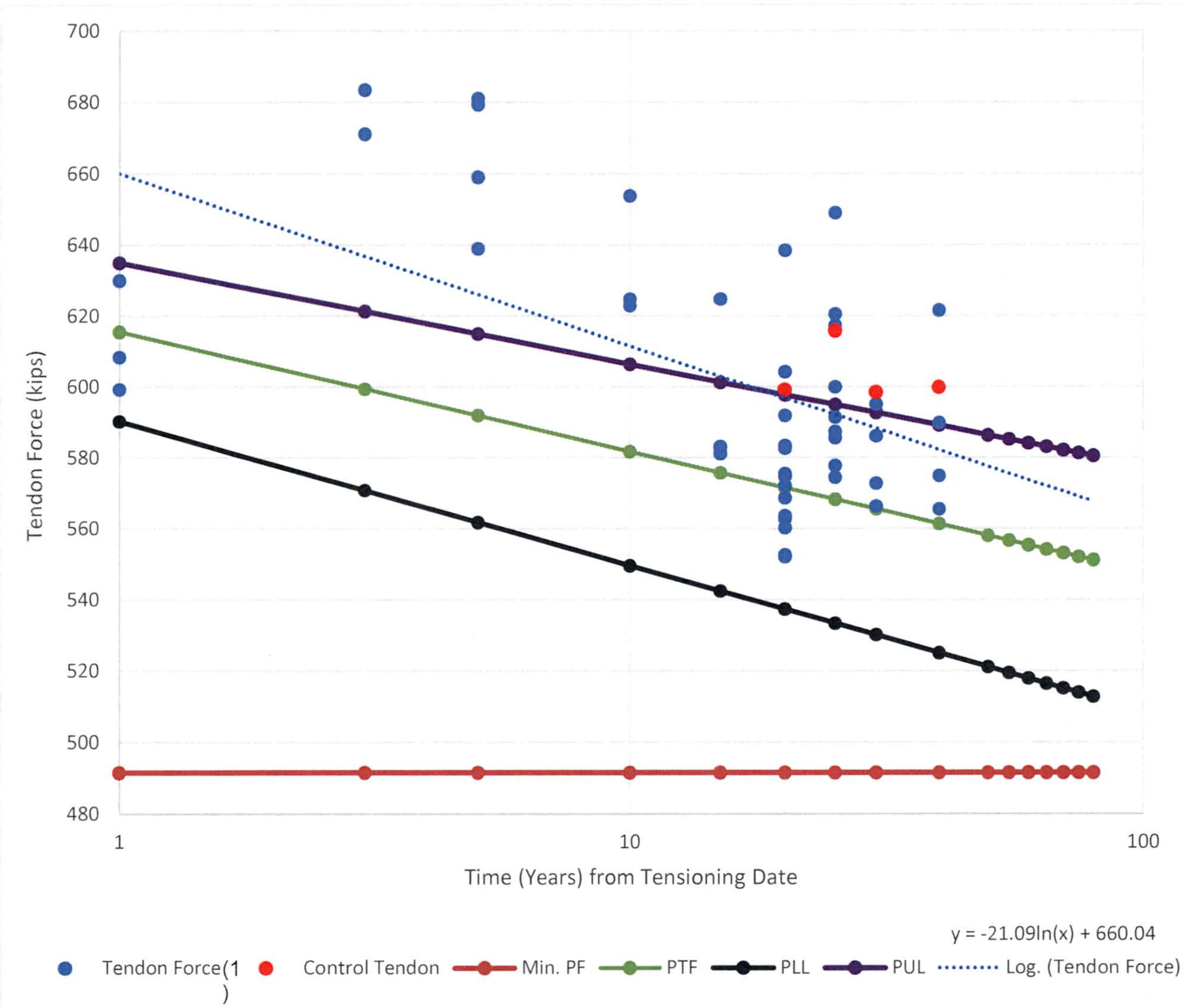
Consequently, the post-tensioning system will continue to perform its intended function throughout the SPEO.

Revise Figures 4.5-1, 2, 3, 4, 5, 6 pages 4.5-4 – 4.5-9 as follows:

**Figure 4.5-1**

**Unit 3 Hoop Tendons**

**1st Through 45th Year Tendon Surveillance**




Notes:

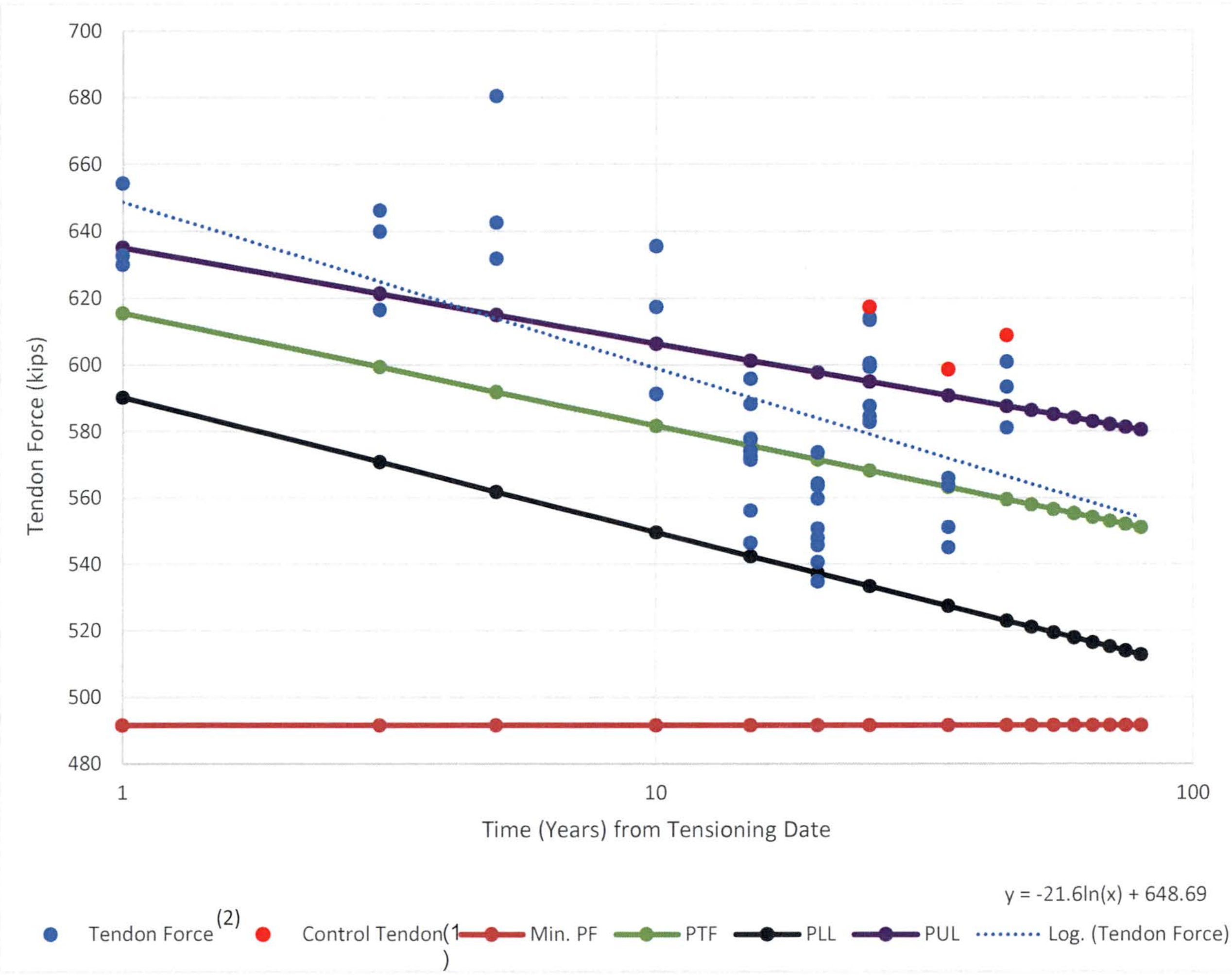
(1) After the 30th surveillance year, the Tendon Force is only represented for the 30th and 40th year since Turkey Point meets the criteria of Section IWL-2421, which

allows the two units alternate between “physical” and “visual” inspections at each surveillance period. Unit 3 underwent a “physical” inspection 30th and 40th surveillance years and will continue every ten years throughout the SPEO.

**Figure 4.5-2**

**Unit 4 Hoop Tendons**

**1st Through 45th Year Tendon Surveillance**




Notes:

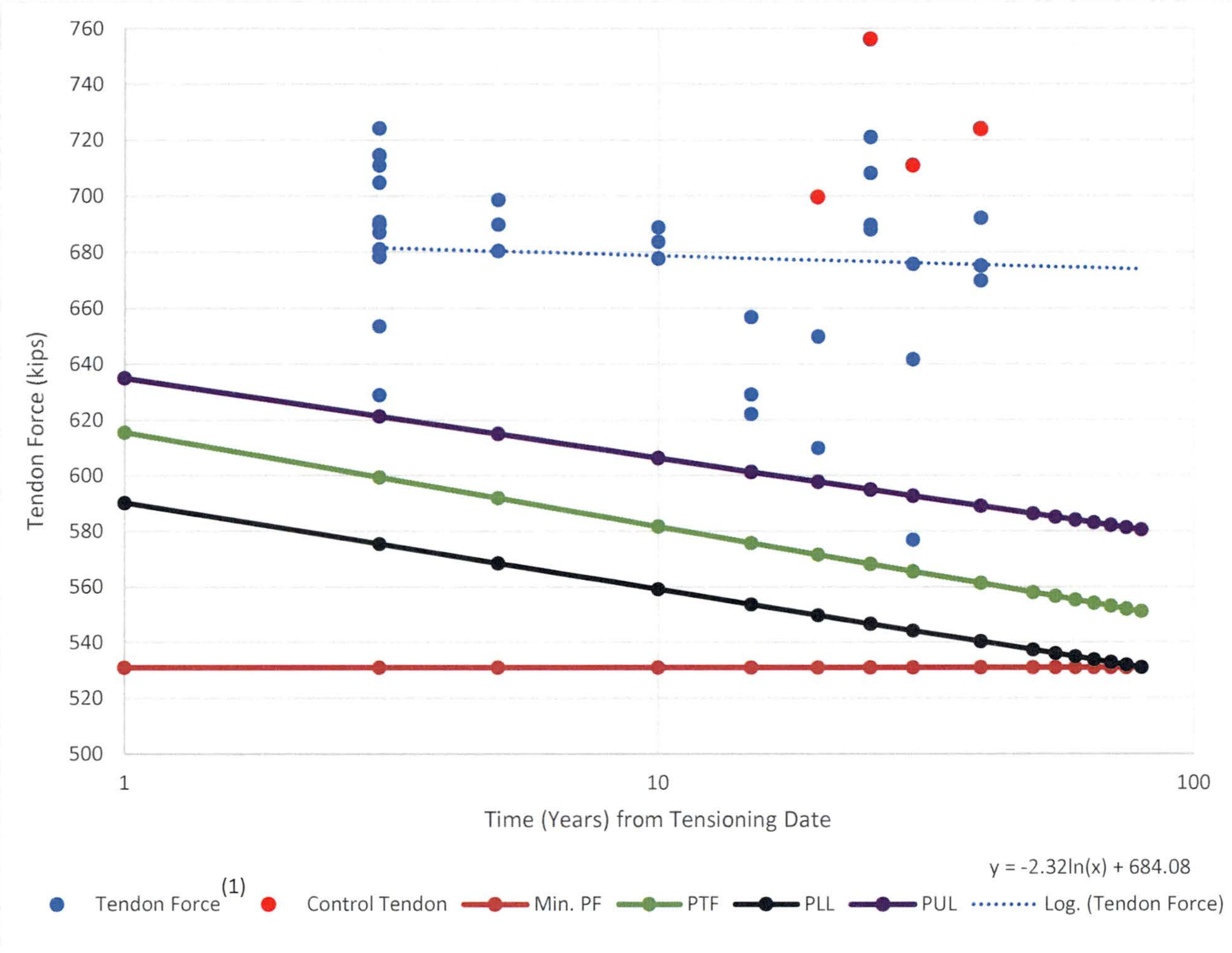
(1) The control tendon for the 20th year surveillance is not shown since the initial control tendon selection was revised due to difficult access.

(2) After the 30th surveillance year, the Tendon Force is only represented for the 30th and 40th year since Turkey Point meets the criteria of Section IWL-2421, which allows the two units alternate between "physical" and "visual" inspections at each surveillance period. Unit 4 underwent a "physical" inspection 35th and 45th surveillance years and will continue every ten years throughout the SPEO.

**Figure 4.5-3**

**Unit 3 Dome Tendons**

**3rd Through 45th Year Tendon Surveillance**



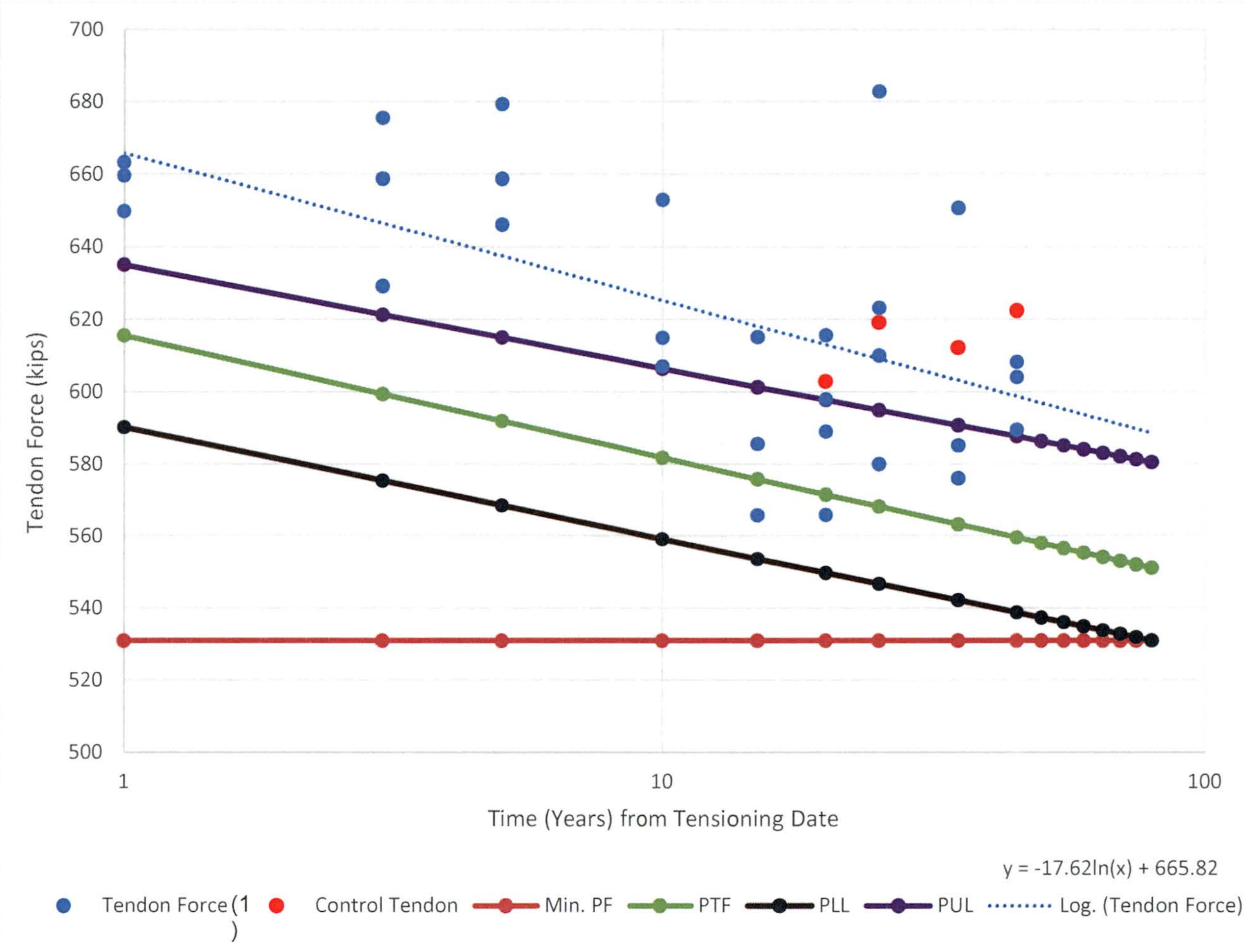

Notes:

(1) After the 30th surveillance year, the Tendon Force is only represented for the 30th and 40th year since Turkey Point meets the criteria of Section IWL-2421, which allows the two units alternate between "physical" and "visual" inspections at each surveillance period. Unit 3 underwent a "physical" inspection 30th and 40th surveillance years and will continue every ten years throughout the SPEO.

**Figure 4.5-4**

**Unit 4 Dome Tendons**

**1st Through 45th Year Tendon Surveillance**



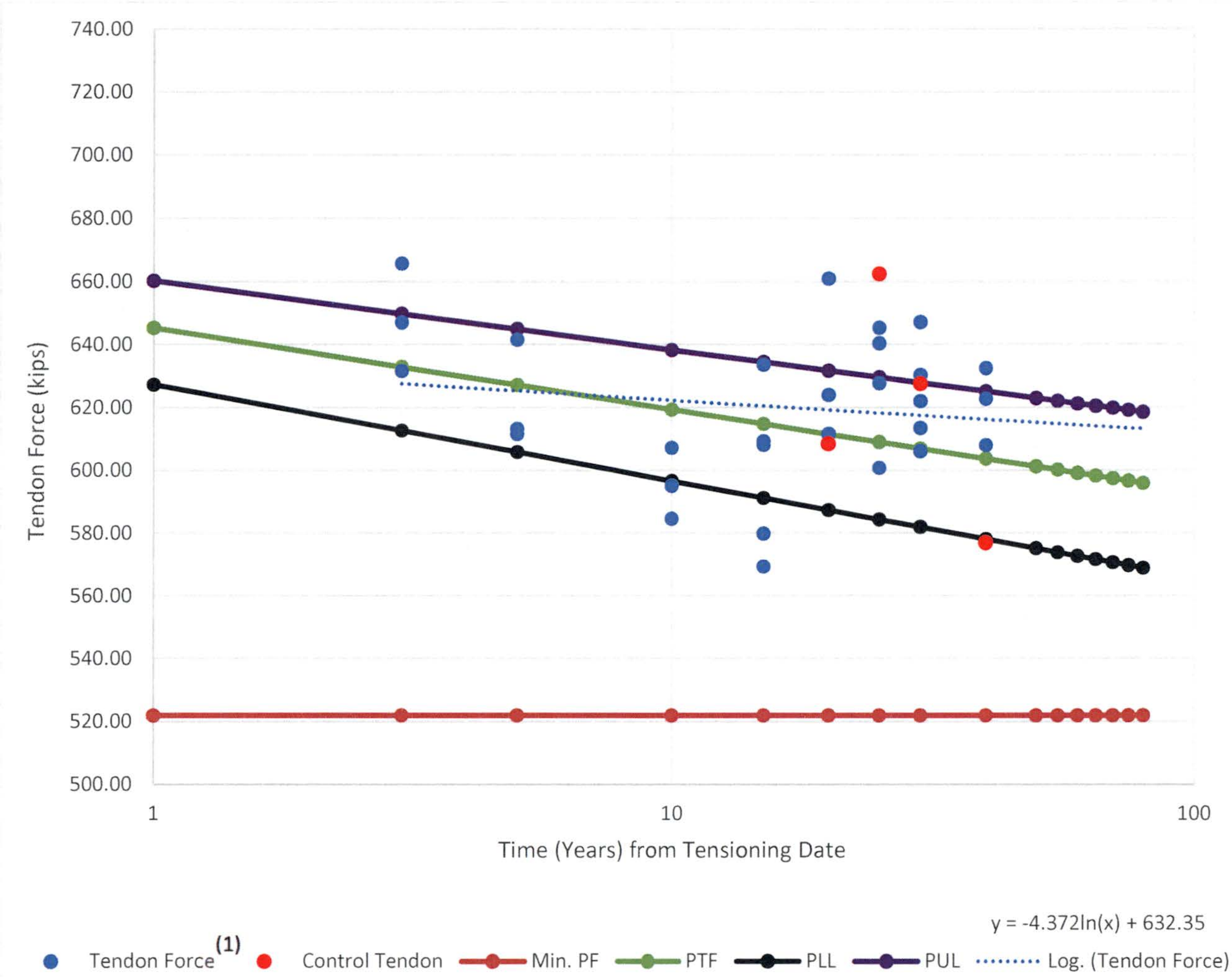

Notes:

(1) After the 30th surveillance year, the Tendon Force is only represented for the 30th and 40th year since Turkey Point meets the criteria of Section IWL-2421, which allows the two units alternate between "physical" and "visual" inspections at each surveillance period. Unit 4 underwent a "physical" inspection 35th and 45th surveillance years and will continue every ten years throughout the SPEO.

**Figure 4.5-5**

**Unit 3 Vertical Tendons**

**3rd Through 45th Year Tendon Surveillance**



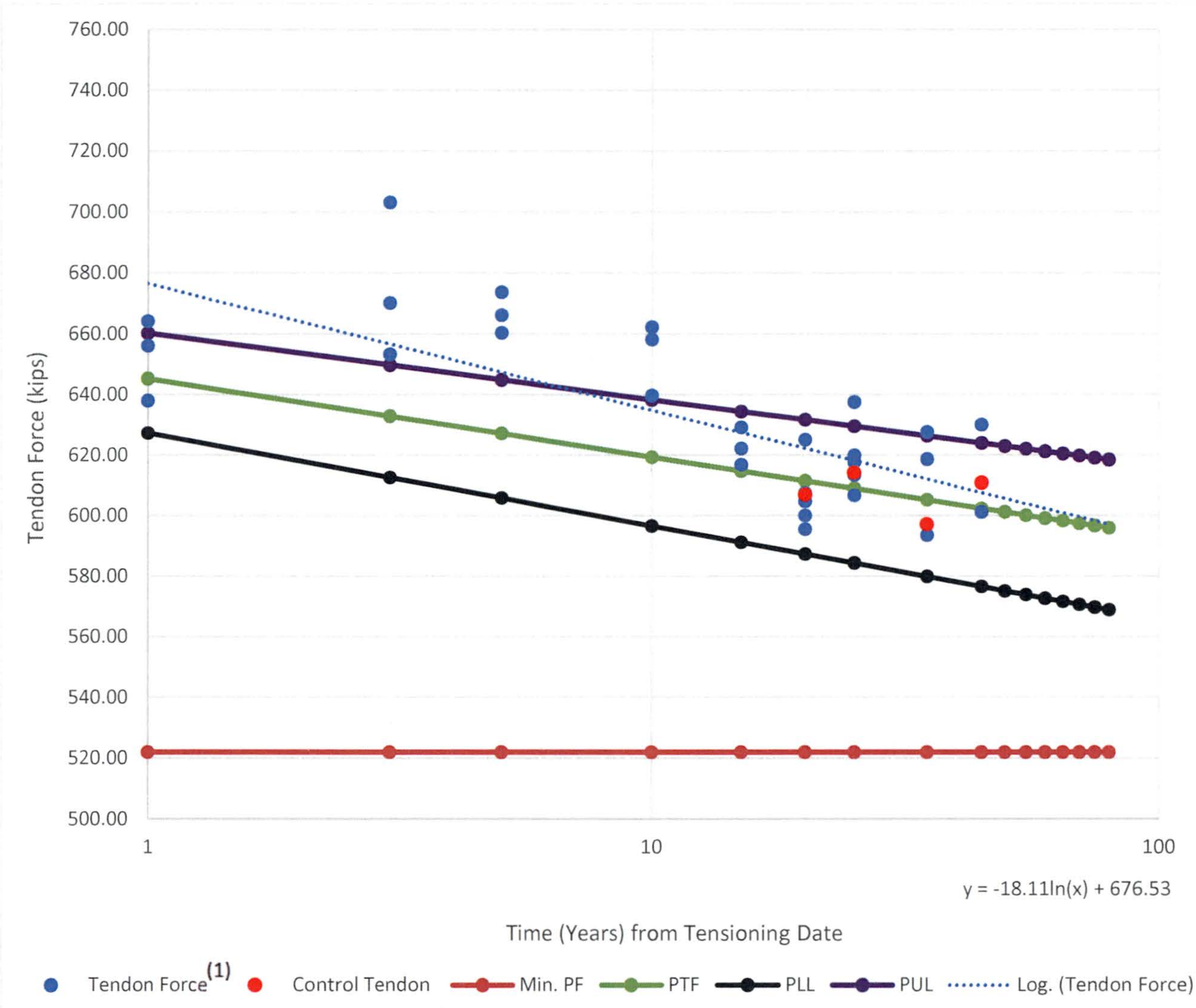

Notes:

(1) After the 30th surveillance year, the Tendon Force is only represented for the 30th and 40th year since Turkey Point meets the criteria of Section IWL-2421, which allows the two units alternate between "physical" and "visual" inspections at each surveillance period. Unit 3 underwent a "physical" inspection 30th and 40th surveillance years and will continue every ten years throughout the SPEO.

**Figure 4.5-6**

**Unit 4 Vertical Tendons**

**1st Through 45th Year Tendon Surveillance**




Notes:

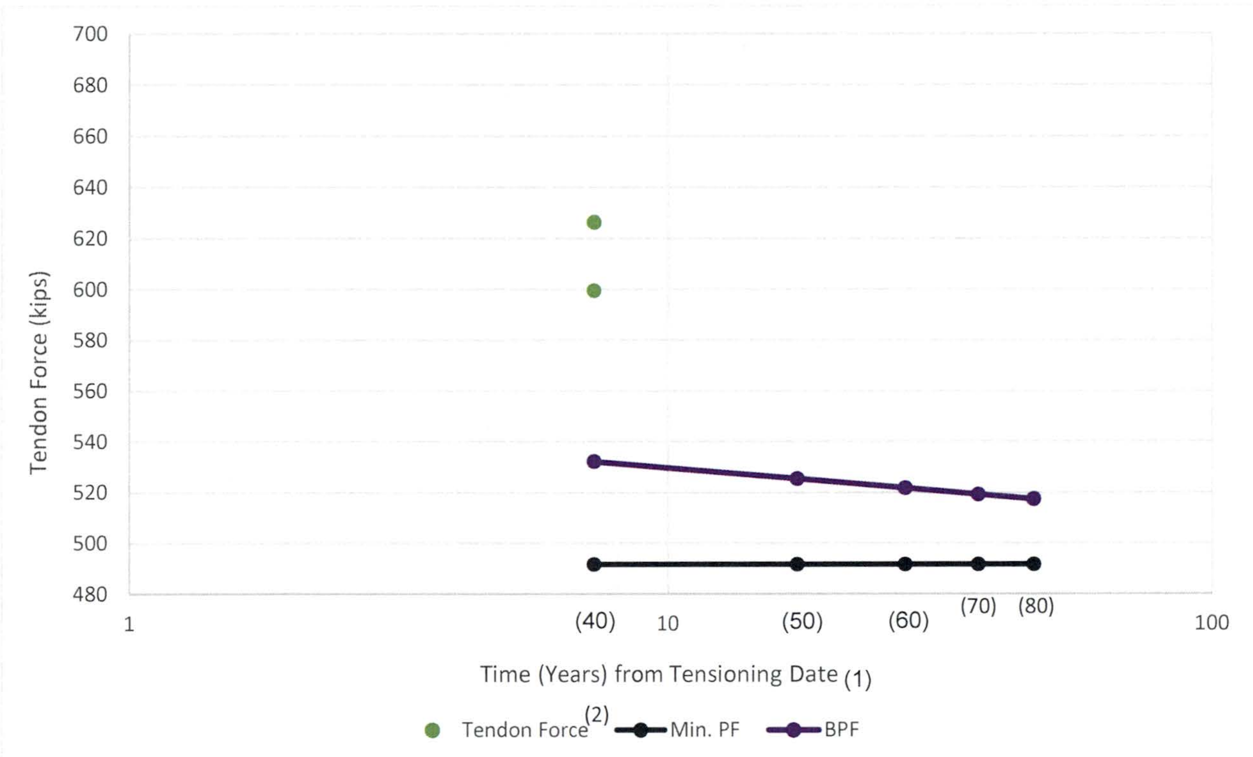
(1) After the 30th surveillance year, the Tendon Force is only represented for the 30th and 40th year since Turkey Point meets the criteria of Section IWL-2421, which allows the two units alternate between "physical" and "visual" inspections at each surveillance period. Unit 4 underwent a "physical" inspection 35th and 45th surveillance years and will continue every ten years throughout the SPEO.

Revise Figures 4.5-7, 8, 9, 10 as follows:

**Figure 4.5-7**

**Unit 3 RVCH Hoop Tendons**

**40th Year Tendon Surveillance**




Notes:

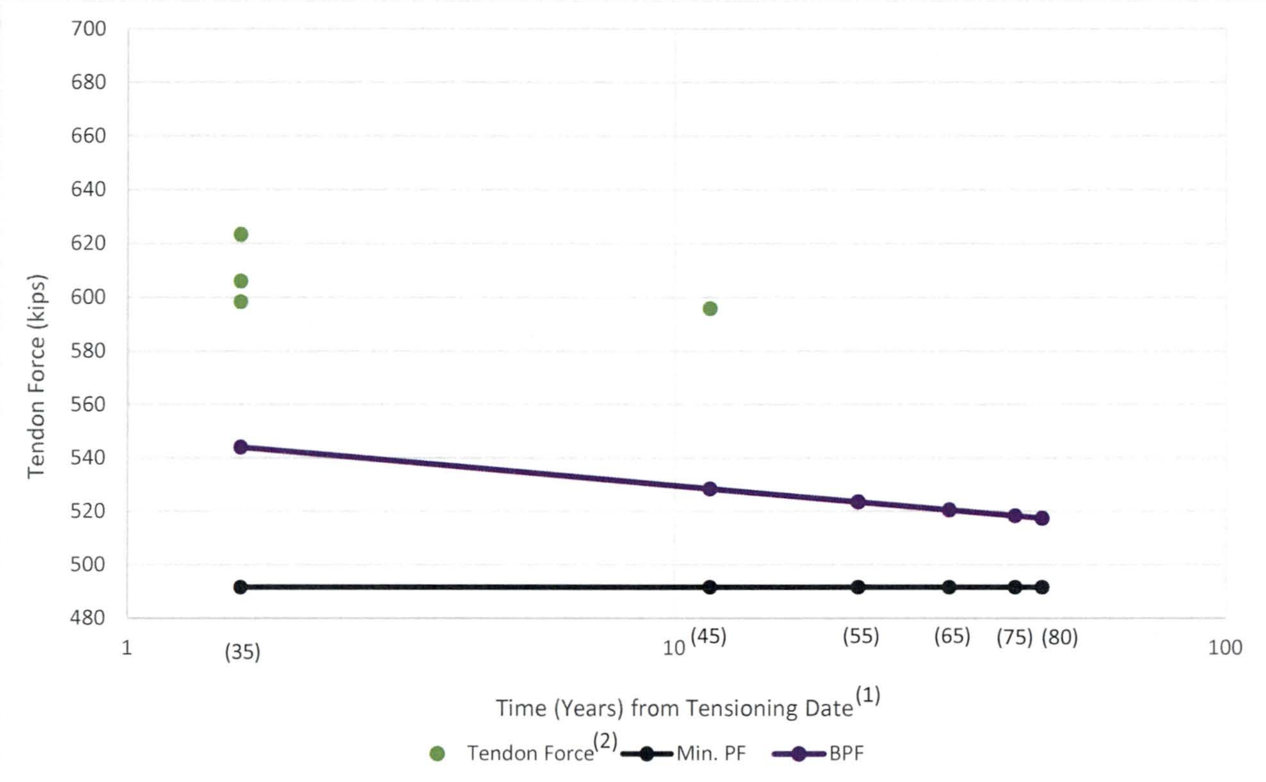
(1) Years in the parenthetical represent the IWL tendon surveillance year.

(2) After the 30th surveillance year, the Tendon Force is only represented for the 30th and 40th year since Turkey Point meets the criteria of Section IWL-2421, which allows the two units alternate between "physical" and "visual" inspections at each surveillance period. The Unit 3 RVCH tendons underwent a "physical" inspection the 40th surveillance year and will continue every ten years throughout the SPEO.

## Figure 4.5-8

## Unit 4 RVCH Hoop Tendons

## 35th Through 45th Year Tendon Surveillance




Notes:

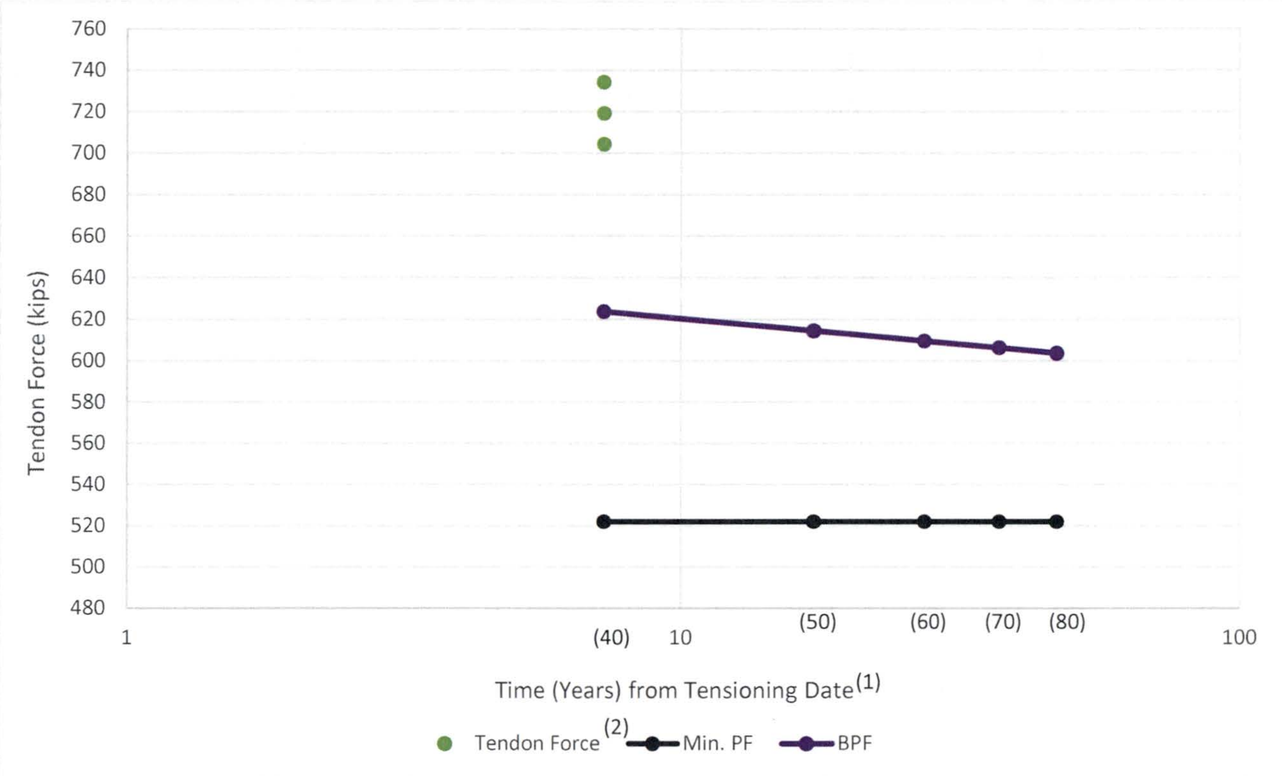
(1) Years in the parenthetical represent the IWL tendon surveillance year.

(2) After the 30th surveillance year, the Tendon Force is only represented for the 30th and 40th year since Turkey Point meets the criteria of Section IWL-2421, which allows the two units alternate between "physical" and "visual" inspections at each surveillance period. The Unit 4 RVCH tendons underwent a "physical" inspection the 35th and 45th surveillance years and will continue every ten years throughout the SPEO.

**Figure 4.5-9**

**Unit 3 RVCH Vertical Tendons**

**40th Year Tendon Surveillance**




Notes:

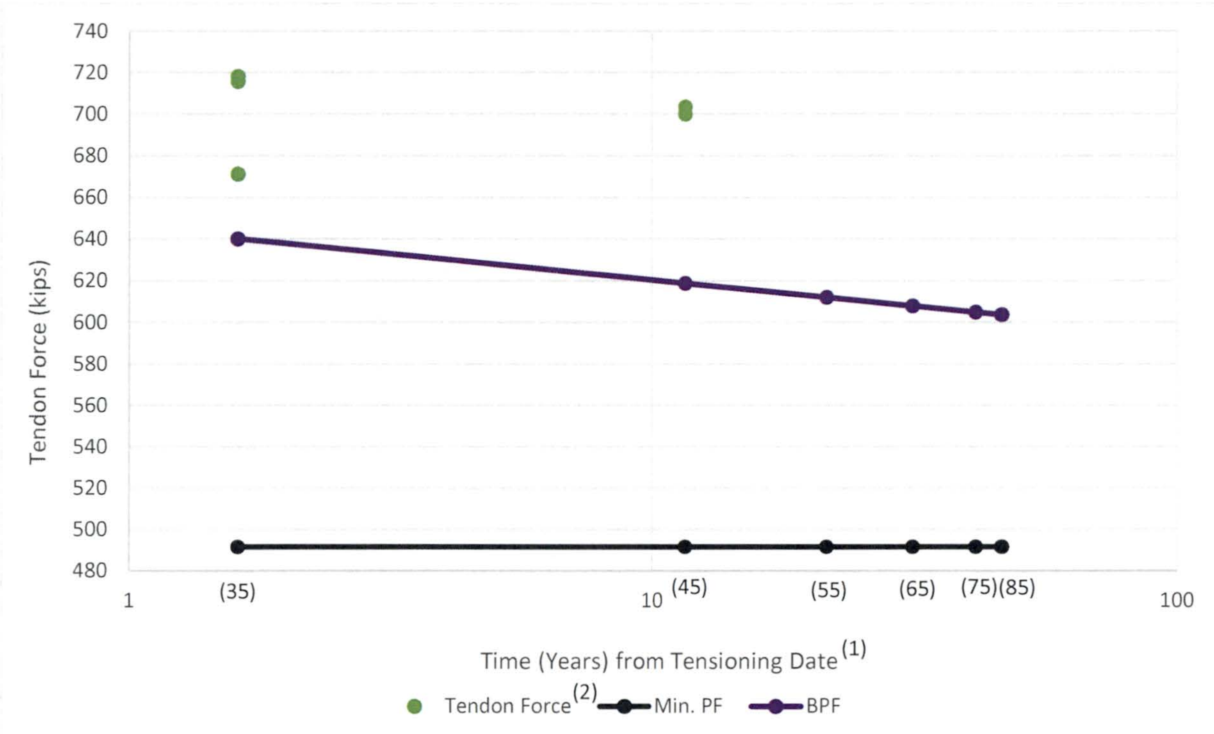
(1) Years in the parenthetical represent the IWL tendon surveillance year.

(2) After the 30th surveillance year, the Tendon Force is only represented for the 30th and 40th year since Turkey Point meets the criteria of Section IWL-2421, which allows the two units alternate between "physical" and "visual" inspections at each surveillance period. The Unit 3 RVCH tendons underwent a "physical" inspection the 40th surveillance year and will continue every ten years throughout the SPEO.

**Figure 4.5-10**

**Unit 4 RVCH Vertical Tendons**

**35th Through 45th Year Tendon Surveillance**




Notes:

(1) Years in the parenthetical represent the IWL tendon surveillance year.

(2) After the 30th surveillance year, the Tendon Force is only represented for the 30th and 40th year since Turkey Point meets the criteria of Section IWL-2421, which allows the two units alternate between "physical" and "visual" inspections at each surveillance period. The Unit 4 RVCH tendons underwent a "physical" inspection the 35th and 45th surveillance years and will continue every ten years throughout the SPEO.

**Associated Enclosures:**

None

**On-Site Regulatory Audit Regarding the Turkey Point Nuclear Generating Unit Nos. 3 and 4 – Subsequent License Renewal Application, August 27-31, 2018**

**Concrete Containment Tendon Prestress (X.S1) and ASME Section XI, Subsection IWL (XI.S2) AMPs**

During the NRC site audit at Turkey Point from August 30, 2018, questions were raised regarding the subject aging management programs (AMPs) in relation to the questions raised on the TLAA calculation. These include clarification of:

- Whether and how the guidance of Regulatory Guide (RG) 1.35.1 was followed during the 45$^{th}$ year of IWL inspections and is part of the CLB?
- How the tendon prestress force history was developed and how past observed data correlates with those to be obtained from future inspections?
- Whether alterations made to the concrete containments and tendon prestressing system(s) affected the use of the twin containment stipulation for alternating the frequency of tendon lift-off force measurements?
- What actions have been taken, relative to grease leakage from tendons, for IWL AMP to ensure that tendon degradation does not cause a loss of containment prestress during the SPEO?

**FPL Supplemental Response:**

This response supplements FPL's October 17, 2018 response (Attachment 3 of Reference 1; Concrete Containment Tendon Prestress TLAA and Concrete Containment Tendon Prestress (X.S1) and ASME Section XI, Subsection IWL (XI.S2) AMPs) with additional clarifications discussed during the November 15, 2018 NRC public meeting with FPL (Reference 2). This supplemental response includes clarifications regarding the Technical Specification amendments allowing the 10 year inspection frequency for each Unit as well as clarification on the definition of "visual" and "physical" inspections.

The requested clarifications are summarized as:

- Tendon surveillance interval requirements related to the "twin" unit designation current licensing basis are discussed in Attachment 8 above.

  Alterations made to the containments and their tendon prestressing systems did not affect the use of twin containment stipulation. The alterations were temporary in relation to reactor vessel closure head (RVCH) replacements. The alterations affected the same tendons for each unit plus 3 additional tendons for Unit 4. All of the affected tendons, whether replaced or retensioned, were removed from the sample population and included in a separate augmented scope population. A baseline predicted force (BPF) has been determined and projected for these tendons. A tendon is selected from this augmented scope population per IWL-2521-2 and the force measured.

- Turkey Point Unit 3 and Unit 4 meet the criteria of Section IWL-2421, which allows for the condition that one unit undergo a physical surveillance and the other unit only undergo a "visual" inspection. The two units alternate between "physical" and "visual" inspections at each surveillance period. A "visual" tendon surveillance consists of sheathing filler inspection and testing, inspection for free water, anchorage inspection, concrete inspection around tendon bearing plates, and replacement of grease caps and grease after completion of all inspections. A "physical" tendon surveillance consists of a visual inspection, plus force monitoring and inspection, as well as tensile testing of removed wire samples.

**References:**

1. FPL Letter L-2018-176 to NRC Dated October 17, 2018, Turkey Point Units 3 and 4 Subsequent License Renewal Application, Response to NRC On-Site Regulatory Audit Follow Up Items (ADAMS Accession Number ML18292A641)
2. NRC Public Meeting Agenda dated November 5, 2018, Telecon Between NRC and FPL to Discuss Items Associated with the Safety Review of the Turkey Point Subsequent License Renewal Application (ADAMS Accession No. ML18315A004)
3. FPL Letter L-2018-191 to NRC Dated November 28, 2018, Turkey Point Units 3 and 4 Subsequent License Renewal Application Safety Review Request for Additional Information (RAI) Set 7 Responses (ADAMS Accession No. ML18334A182)

**Associated SLRA Revisions:**

SLRA Section B.2.3.31 is amended as indicated by the following text deletion (strikethrough) and text addition (red underline font) revisions. These SLRA revisions supplement the SLRA revisions indicated in L-2018-176 Attachment 3 (Reference 1). Subsequent to the issuance of L-2018-176 Attachment 3, unrelated changes were also made to SLRA section B.2.3.31 by L-2018-191 Attachment 12 (Reference 3).

Revise the ASME Section XI, Subsection IWL AMP in Section B.2.3.31 on page B-236 as follows:

The primary inspection method is a visual examination, supplemented by testing. **A visual tendon surveillance consists of sheathing filler inspection and testing, inspection for free water, anchorage inspection, concrete inspection around tendon bearing plates, and replacement of grease caps and grease after completion of all inspections. A physical tendon surveillance consists of a visual inspection, plus force monitoring and inspection, as well as tensile testing of**

**removed wire samples. The inspections associated with this AMP assess the quality and structural performance of the containment structures and associated post-tensioning systems.** Accessible concrete surfaces are subject to periodic visual inspections to detect deterioration and distress, including loss of material (spalling, scaling), cracking, increase in porosity and permeability, and loss of bond in the air-outdoor (uncontrolled) environments.

**Associated Enclosures:**

None

**NRC RAI Letter Nos. ML18243A006 and ML18243A007 dated September 17, 2018**

**RAI B.2.3.27-2**

Background:

The Turkey Point UFSAR, Section 16.2.17, "Metamic Insert Surveillance Program," Revision 28, contains a description of the Metamic Insert Surveillance Program. This description includes items such as: criteria for the surveillance testing; test requirements; test frequency; acceptance criteria; and corrective actions, documentation and reporting based on test results. In addition, procedure 0-OSP-034.3, "Metamic Insert Surveillance," Revision 1, contains a similar description of requirements for the program, and also references UFSAR Section 16.2.17 for these requirements. Surveillance Requirement (SR) 4.9.14.2 in Technical Specification (TS) 3/4.9.14, "Spent Fuel Storage," also references UFSAR Section 16.2 for the surveillance program requirements.

Issue:

The staff reviewed the proposed UFSAR supplement, and it appeared that significant details of the program would be removed from the UFSAR. It is unclear whether these changes will impact the implementing procedure for the Metamic insert surveillance program.

Request:

Clarify whether the Metamic insert surveillance program, TS 3/4.9.14, or SR 4.9.14.2, will be impacted by the proposed changes to the UFSAR.

**FPL Supplemental Response:**

This response supplements FPL's October 16, 2018 RAI response (Attachment 36 of Reference 1; NRC RAI No. B.2.3.27-2) with additional clarifications discussed during the November 15, 2018 NRC public meeting with FPL (Reference 2). This information addresses the concerns regarding PTN technical specification changes.

The proposed changes to the SLRA UFSAR supplement Section 17.2.2.27 do not impact TS 3/4.9.14. However, a license amendment will be required to revise SR 4.9.14.2 to reference UFSAR Section 17.2.2.27 prior to entering the SPEO. Accordingly, Commitment 31 in Table 17-3 of the SLRA is revised to include submittal of a license amendment to revise SR 4.9.14.2 prior to entry into the SPEO.

**References:**

1. FPL Letter L-2018-166 to NRC dated October 16, 2018, Turkey Point Units 3 and 4 Subsequent License Renewal Application Safety Review Requests for Additional Information (RAI) Set 3 Responses (ADAMS Accession Number ML18296A024)

2. NRC Public Meeting Agenda dated November 5, 2018, Telecon Between NRC and FPL to Discuss Items Associated with the Safety Review of the Turkey Point Subsequent License Renewal Application (ADAMS Accession No. ML18315A004)

**Associated SLRA Revisions:**

SLRA Appendix A, Table 17-3 is amended as indicated by the following text deletion (strikethrough) and text addition (red underlined font) revisions.

SLRA Table 17-3 is revised as follows:

| No. | Aging Management Program or Activity (Section) | NUREG-2191 Section | Commitment | Implementation Schedule |
|---|---|---|---|---|
| 31 | Monitoring of Neutron-Absorbing Materials other than Boraflex (17.2.2.27) | XI.M40 | **e) Submit a license amendment to revise SR 4.9.14.2 to reference UFSAR Section 17.2.2.27.** | Complete the initial Boral® testing and inspections**, and submit the license amendment** no later than 18 months prior to the SPEO, i.e.:<br>PTN3: 1/19/2032<br>PTN4: 10/10/2032 |

**Associated Enclosures:**

None

**NRC RAI Letter Nos. ML18243A006 and ML18243A007 dated September 17, 2018**

**RAI B.2.3.20-2**

Background:

SLRA Table 3.2.2-2, states that carbon steel piping exposed internally to treated borated water will be managed for loss of material by the Water Chemistry and One - Time Inspection programs.

The "scope of program" program element of GALL-SLR AMP XI.M32 states the following:

1. The program cannot be used for structures or components with known age-related degradation mechanisms as determined based on a review of plant-specific and industry OE for the prior operating period.

Periodic inspections are proposed in these cases for structures or components with known age- related degradation.

During the audit, the staff reviewed AR 01638881, which states, "[t]here is a long history of Containment Spray carbon steel piping corrosion at PTN [Turkey Point]." Additionally, the AR states that the Containment Spray System Piping Inspection program was developed to perform ultrasonic testing (UT) with a 54 month frequency. The staff also noted that the AR states "corrosion product buildup can occur within the Containment Spray headers have been documented in several AR..." the AR goes on to state that most of the corrosion is considered to be general boric acid corrosion and there is also a buildup of bimetallic weld transition from carbon to stainless steel.

Issue:

It is not clear to the staff how the One-Time Inspection program will be sufficient for managing age-related degradation of carbon steel piping in the containment spray system, when a history of loss of material is apparent. The One-Time Inspection program states that the program cannot be used for structures or components with known age-related degradation mechanisms as determined based on a review of plant-specific and industry OE for the prior operating period. The program states that periodic inspections are proposed in these cases.

Request:

State the basis for using the One-Time Inspection program for carbon steel piping in the containment spray system. Alternatively, provide the following:

1. Provide a periodic inspection program that will be used to monitor the loss of material for carbon steel.

2. Provide the inspection frequency that will be used to monitor wall thinning for carbon steel piping in the containment spray system.
3. Provide how bimetallic corrosion (galvanic corrosion) will be managed for the weld transition from carbon to stainless steel.

**FPL Revised Response:**

This revised RAI response supersedes in its entirety the RAI response provided in Attachment 5 of Reference 1 as discussed during the November 15, 2018 NRC public meeting with FPL (Reference 2). The revised response addresses Items 1 through 3 above and provides a description of the locations where containment spray piping volumetric examinations will be performed prior to and during the subsequent period of extended operation (SPEO) and evaluates if flow blockage of the containment spray nozzles is an aging effect requiring management.

The PTN containment spray system (CSS) for each PTN unit consists of two motor-driven, horizontal centrifugal pumps that each discharge through motor-operated valves, two spray headers and a series of spray nozzles located near the top of the containment structure. The CSS piping material is a combination of both stainless steel and carbon steel. The stainless steel portion of the CSS piping for each unit is located outside containment and enters the containment through two (2) containment penetrations (one per header) at plant elevation 26 feet. Once inside containment, the stainless steel piping is connected to carbon steel piping at a bimetallic weld. The routing of the CSS piping inside containment for each of the two headers is different. Both the 3A and 4A headers have a short horizontal section of stainless to carbon steel piping at the penetrations and then transition vertically to the approximate 54 foot elevation. The piping then runs horizontally in an approximate 90 foot arc and then turns vertical up to the spray nozzle laterals located at plant elevation 154 feet. The 3B and 4B headers have the same short horizontal section of stainless to carbon steel piping at the penetrations and then transition vertically to the spray nozzle laterals at plant elevation 154 feet.

The carbon steel piping inside containment is sometimes partially filled with stagnant borated water due to leakage through the containment spray pump discharge motor-operated valves (MOV-3/4-880A/B), potentially up to a maximum elevation of 65 feet corresponding to the water level of the refueling water storage tank. Therefore, CSS horizontal piping at the penetration, the bimetallic welds, approximately 40 feet of vertical piping per header, and an approximate 90 foot arc of horizontal piping for the 3A and 4A headers are assumed to be exposed to an internal environment of treated borated water.

The most susceptible locations to loss of material due to general, pitting, crevice, galvanic, or boric acid corrosion are currently inspected using ultrasonic thickness (UT) measurements in accordance with the existing license renewal Containment Spray Piping Inspection AMP. The inspections currently consider the most susceptible locations due to the galvanic couplings at the bimetallic welds between the stainless steel and carbon steel piping components. The existing program calculates loss of material rates based on the UT measurements and future inspection frequencies are based on these calculated material loss rates. Piping components that do not pass the UT examinations are either repaired or replaced, as necessary, to meet applicable code requirements. The frequency of the UT examinations was initially set to occur every refueling outage, but the current inspection frequency is every five refueling outages based on an evaluation of the observed loss of material rates and past replacement of limiting piping components.

These program activities will continue throughout the SPEO under the Internal Surfaces in Miscellaneous Piping and Ducting Components AMP. This AMP was chosen to subsume these inspections so that the related program elements will govern performing the inspections, monitoring and trending the results, and the implementation of appropriate corrective actions if inspection results dictate. In addition, opportunistic inspections will be performed if the CSS piping inside containment is opened for other reasons. The PTN Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components AMP includes additional requirements beyond those described in NUREG-2191 XI.M38 by specifying volumetric (UT) examination of the CSS piping inside containment. The AMP will also ensure that the sample population for each 10-year period includes UT examination of all stainless-to-carbon steel bimetallic welds, a representative sample (minimum of five (5) inspections of each header) of the approximate 90 foot arc of horizontal piping in each of the 3A and 4A headers, and the air-to-borated water interface in the vertical runs of piping at the approximate 65 foot plant elevation. The PTN SLRA is updated to reflect that the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components AMP will manage loss of material for the carbon steel CSS piping.

Both plant specific and industry operating experience (OE) has been reviewed to determine if flow blockage of the containment spray nozzles is an aging effect requiring management for the SPEO. As indicated in the background information of this RAI, PTN has experienced corrosion of the CSS carbon steel piping and UT examinations have led to the replacement of several CSS piping components. During the replacement of a piping elbow downstream of the containment penetration for the 3A CSS header in 2012, debris was discovered in the bottom of the stainless steel CSS piping. The debris was removed from the piping and was determined to be corrosion (scaling) from the carbon steel piping. The debris was composed of iron oxide particles less than 1/32" that would loosely bond together to form clumps ≤ 1/4". Applying finger pressure to the clumps immediately broke them up into individual particles. A detailed evaluation of the potential that these corrosion products could block the CSS spray nozzles was performed by engineering. The evaluation concluded that based on the composition and size of the known corrosion products, nozzle discharge water velocity and homogeneous mixing of the corrosion products throughout the entire CSS piping during CSS operation, and the large (3/8") diameter of the spray nozzles, the corrosion products would pass through the spray nozzles as designed. The condition does not represent an operability concern for either unit.

The engineering evaluation also identified that in accordance with PTN Technical Specification Surveillance Requirement 4.6.2.1.e, an air or smoke flow test is performed through each CSS spray header every 10 years to verify each spray nozzle is unobstructed. A review of the past two tests for each of the four CSS spray headers has been performed. The 3A and 3B CSS spray headers were flow tested in 2001 and 2012 and each test confirmed that all Unit 3 spray nozzles (85 on the 3A header and 86 on the 3B header) were unobstructed. The 4A and 4B CSS spray headers were flow tested in 2002 and 2013. The 2002 test confirmed all Unit 4 spray nozzles (86 for both the 4A and 4B headers) were unobstructed. However, the 2013 test identified that one spray nozzle on the 4B header exhibited diminished flow. A wire was used to dislodge a piece of debris and the nozzle subsequently passed the flow test. An engineering evaluation concluded that the partial flow blockage of the one spray nozzle on the 4B header had no impact on the operability of the header.

A review of industry OE identified that Palo Verde Nuclear Generating Station (PVNGS) Unit 3 experienced flow blockage of seven CSS spray nozzles during performance of an air flow test in 2010 (Reference 3). Reference 3 determined that the root cause of the nozzle blockage was boric acid solution that was not removed from low points that entrapped water in the CSS headers after the headers were filled with borated water. The boric acid deposits were friable and easily removed from the nozzles using a pipe cleaner during the inspections. The PVNGS evaluation concluded that the CSS header water and associated header pressure would dissolve or easily remove the boric acid deposits out of the spray nozzles if an actual CSS actuation occurred and therefore, the event did not adversely affect the safe operation of the plant or health and safety of the public.

Based on the review of site-specific and industry OE above, flow blockage of the PTN CSS spray nozzles is not an aging effect requiring management during the SPEO. Accumulation of corrosion products and dried boric acid in the PTN CSS headers would not prevent the PTN CSS from performing its SLR intended function.

**References:**

1. FPL Letter L-2018-166 to NRC dated October 16, 2018, Turkey Point Units 3 and 4 Subsequent License Renewal Application Safety Review Requests for Additional Information (RAI) Set 3 Responses (ADAMS Accession Number ML18296A024)
2. NRC Public Meeting Agenda dated November 5, 2018, Telecon Between NRC and FPL to Discuss Items Associated with the Safety Review of the Turkey Point Subsequent License Renewal Application (ADAMS Accession No. ML18315A004)
3. Palo Verde Nuclear Generating Station (PVNGS) Unit 3 Licensee Event Report (LER) 2010-002-01 dated June 27, 2012, Condition Prohibited by Technical Specification Resulting from Containment Spray Nozzle Obstruction (ADAMS Accession No. ML12193A560)

**Associated SLRA Revisions:**

SLRA Table 3.2-1, Table 3.2.2-2, Section 17.2.2.25, Table 17.3 and Section B.2.3.25 are amended as indicated by the following text deletion (strikethrough) and text addition (red underlined font).

Revise SLRA Table 3.2-1 Item 90 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, 090 | Steel components exposed to treated water, treated borated water, raw water | Long-term loss of material due to general corrosion | AMP XI.M32, "One-Time Inspection" | No | Consistent with NUREG-2191. The One-Time Inspection AMP will be used to manage long-term loss of material in the ~~steel containment spray piping and the~~ pressurizer relief tank exposed to treated borated water. The pressurizer relief tank is coated~~ and the containment spray piping is normally empty~~. |

Revise SLRA Table 3.2.2-2 as follows:

| Table 3.2.2-2: Containment Spray – 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** |
| Piping | Pressure Boundary | Carbon steel | Treated borated water (int) | Long-term loss of material | ~~One-Time Inspection~~ **Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components** | ~~V.A.E-434~~ – | ~~3.2-1, 090~~ – | ~~A~~ **H, 1** |

| Component Type | Intended Function | Material | Environment | Aging Effect Requiring Management | Aging Management Program | NUREG-2191 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| Piping | Pressure Boundary | Carbon steel | Treated borated water (int) | Loss of material | ~~Water Chemistry One-Time Inspection~~<br>**Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components** | - | - | H, 1 |

Revise SLRA Table 3.2.2-2 plant specific notes as follows:

**Plant-Specific Notes for Table 3.2.2-2**

1. Aging effect for this component, material, and environment combination is not in NUREG-2191. This line item is specific to the carbon steel piping header for containment spray. ~~This portion of piping is normally drained but is flooded during system testing.~~ The ~~Water Chemistry and One-Time Inspection~~ **of Internal Surfaces in Miscellaneous Piping and Ducting Components** AMP~~s are~~ **is** used to manage **loss of material and long-term loss of material.** ~~this aging effect as these AMPs are used to manage loss of material in other portions of the treated borated water s~~

Revise the current commitment for the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components AMP in Table 17-3, item 29, as follows:

| No. | Aging Management Program or Activity (Section) | NUREG-2191 Section | Commitment | Implementation Schedule |
|---|---|---|---|---|
| 29 | Inspection of Internal Surfaces<br>in Miscellaneous Piping and<br>Ducting Components<br>(17.2.2.25) | XI.M38 | Implement the new PTN Inspection of Internal Surfaces in<br>Miscellaneous Piping and Ducting Components AMP.<br><br>**Perform periodic ultrasonic thickness measurements of the carbon steel containment spray piping inside containment including all stainless-to-carbon steel bimetallic welds, a representative sample (a minimum of five (5) inspections of each header) of the approximate 90 foot arc of horizontal piping in each of the 3A and 4A headers, and the air-to-borated water interface in the vertical runs of piping at the approximate 65 foot plant elevation every 10 years.** | No later than 6 months prior<br>to the SPEO, i.e.:<br>PTN3: 1/19/2032<br>PTN4: 10/10/2032<br><br>**The first ultrasonic thickness measurements of the piping will occur within 10 years prior to the SPEO.** |

Add the following paragraph to the end of SLRA Section 17.2.2.25 on page A-32 as follows:

**This AMP is also used to manage loss of material and long-term loss of material for the carbon steel containment spray headers that are exposed to treated borated water. This AMP periodically uses ultrasonic thickness measurements to determine which portions of carbon steel piping should be inspected more frequently or replaced to ensure the containment spray system is capable of performing its intended function.**

Add the following text after the second paragraph of SLRA Section B.2.3.25 on page B-205 as follows:

**This AMP is also used to manage loss of material and long-term loss of material for the carbon steel containment spray headers that are exposed to treated borated water. This AMP periodically uses ultrasonic thickness measurements to determine which portions of carbon steel piping should be inspected more frequently or replaced to ensure the containment spray system is capable of performing its intended function.**

**The PTN Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components AMP includes additional requirements to program elements 3 "Parameters Monitored or Inspected" and 4 "Detection of Aging Effects" beyond those described in NUREG-2191 XI.M38 to ensure adequate wall thickness of the carbon steel containment spray system (CSS) piping inside containment throughout the SPEO by performing periodic ultrasonic thickness measurements. The AMP will also ensure that the sample population for each 10-year period includes UT examination of all stainless-to-carbon steel bimetallic welds, a representative sample (minimum of five (5) inspections of each header) of the approximate 90 foot arc of horizonal piping in each of the 3A and 4A headers, and the air-to-borated water interface in the vertical runs of piping at the approximate 65 foot plant elevation. The initial inspection will take place within 10 years prior to the SPEO and will continue throughout the SPEO.**

**Associated Enclosures:**

None

**NRC RAI Letter Nos. ML18243A006 and ML18243A007 dated September 17, 2018**

**Open Cycle Cooling Water System, GALL AMP XI.M20**

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 B.2.3.11-1**

Background:

The recommendations in Aging Management Program XI.M20, "Open-Cycle Cooling Water System" (OCCW) in Generic Aging Lessons Learned for Subsequent License Renewal (GALL- SLR) Report state that the scope of program addresses piping and piping components exposed to raw water in the OCCW system. Enercon Report FPLCORP020-REPT-082, Aging Management Program Basis Document – Open-Cycle Cooling Water System," Revision 1 shows that the only implementing document associated with piping inspections is SPEC-M-086, "Intake Cooling Water System Piping Inspection."

Issue:

The staff noted that SPEC-M-086 describes the scope of the inspection procedure to include selected piping with nominal diameters of 24 inches or larger and did not specify inspection requirements for piping with diameters less than 24 inches. Drawing 5614-M-3019, Revision 28, "Intake Cooling Water System," appears to include in-scope OCCW piping with diameters less than 24 inches.

Request:

Discuss how the applicable aging effects (e.g., loss of material, flow blockage) for in-scope OCCW piping with diameters less than 24 inches are managed by the OCCW program. Describe the inspections that are performed on in-scope OCCW piping with diameters less than 24 inches and cite any relevant procedures that address inspections of this piping.

**FPL Supplemental Response:**

This response supplements the response provided in Attachment 34 of Reference 1 with additional clarification discussed during the November 15, 2018 NRC public meeting with FPL (Reference 2).

Consistent with Element 4, "Detection of Aging Effects", of NUREG-2191 AMP XI.M20, the inspection scope, methods, and frequencies of the PTN OCCW System program are in accordance with PTN's docketed response to NRC Generic Letter (GL) 89-13. The scope of the PTN GL 89-13 program is described in the PTN license renewal application (LRA) that was submitted to the NRC via Reference 3. Table 3.4-1 of the PTN LRA identifies that the Component/Commodity Group of cast iron "Valves Piping/fittings (main lines upstream of basket strainers)" exposed to an internal environment of raw water is susceptible to the aging effect of loss of material and is managed by the Intake Cooling Water System Inspection Program. Section 3.2.10 of the PTN LRA describes the attributes of the Intake Cooling Water System Inspection Program and states that the program was developed in response to NRC GL 89-13 and addresses the aging effects of loss of material due to various corrosion mechanisms, stress corrosion cracking, and fouling due to macro-organisms for those components subject to raw water (i.e., salt water) conditions.

The staff review of the PTN LRA is contained in Reference 4 below. Section 3.9.10.2 of Reference 4 is the staff evaluation of the PTN Intake Cooling Water System Inspection Program. On page 3-243, the staff states that the program scope was in conformance with NRC GL 89-13, and is therefore acceptable.

A review of PTN SLR boundary drawings 5613-M-3019 Sheets 1 and 2 and 5614-M-3019 Sheets 1 and 2 indicate that all portions of the main ICW piping upstream of the component cooling water (CCW) and turbine plant cooling water (TPCW) baskets strainers are greater than or equal to 24 inches in diameter. Therefore, the scope of the PTN SLR OCCW System aging management program is limited to piping ≥ 24 inches in diameter.

For ICW piping outside the boundaries of the current inspection scope included in the scope of GL 89-13 and exposed to an internal environment of raw water, the aging effects are managed by the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting

Components AMP and the Internal Coatings/Linings for In-Scope Piping, Piping Components, Heat Exchangers, and Tanks AMP if the component is coated.

**References:**

1. FPL Letter L-2018-166 to NRC dated October 16, 2018, Turkey Point Units 3 and 4 Subsequent License Renewal Application, Safety Review Requests for Additional Information (RAI) Set 3 Responses (ADAMS Accession No. ML18296A024)
2. NRC Public Meeting Agenda dated November 5, 2018, Telecon Between NRC and FPL to Discuss Items Associated with the Safety Review of the Turkey Point Subsequent License Renewal Application (ADAMS Accession No. ML18315A004)
3. FPL Letter L-2000-177 to NRC dated September 8, 2000, Turkey Point Units 3 and 4 Application for Renewed Operating Licenses (ADAMS Accession No. ML003749538)
4. NRC Letter to J. A. Stall (FPL), License Renewal Safety Evaluation Report for Turkey Point Nuclear Plant, Units 3 and 4, dated February 27, 2002 (ADAMS Accession No. ML020580582)

**Associated SLRA Revisions:**

None

**Associated Enclosures:**

None

**Emergency Containment Cooler Tube Wear, GALL TLAA 4.7**

Regulatory Basis:

For time-limited aging analyses, 10 CFR 54.21(c)(1)(iii) requires an applicant to demonstrate that the effects of aging on the intended function(s) will be adequately managed for the period of extended operation. As provided in 10 CFR 54.29(a), a renewed license may be issued if the staff finds that actions have been identified, which either have been or will be taken, with respect to time limited aging analyses identified to require review under 10 CFR 54.21(c). In order to complete its review and to enable formulation of a finding under 10 CFR 54.29(a), the staff requires additional information as described below.

**RAI 4.7.2-1**

Background:

SLRA Section 4.7.2, Emergency Containment Cooler [ECC] Tube Wear includes a discussion about conducting an inspection for minimum tube wall thickness in 2011. The measured wall thickness was found to be 0.039 inches and based on an initial tube wall thickness of 0.049 inches, the calculated wear rate was 0.000263 inches per year using 38 years of operation. The ultrasonic testing (UT) wall thickness values for the 1.125-inch diameter tubes are listed in the "UT Matrix" and show wall thickness values between 0.054 inches and 0.039 inches. Although these results concluded that the calculated wear rates would be acceptable for the subsequent period of extended operation, the SLRA states that a one-time inspection will be performed to confirm the acceptability of the projected wear rates because tube wall loss has been observed.

PTN-ENG-LRAM-00-00065, "Emergency Containment Cooler Inspection – License Renewal Basis Document," includes a sketch as part of Attachment 9.1, "Unit 4 ECC Tubes Inspection Report dated 04/04/11," showing that inspection locations A through E, on both the North Side and South Side headers, are either on 90° elbows or 180° returns on the cooler. The staff notes that based on information in Vendor Manual V000060, "Installation, Operation, & Maintenance Instructions Emergency Containment Filter Equipment and Cooling," the 8-inch schedule 40 "North Side" header appears to be the supply side of the water to the tubes and the "South Side" header appears to be the return side of the water from the tubes. In its discussion of erosion, EPRI 1007820, Closed Cooling Water Chemistry Guideline," April 2004, Section B.1.2 "Localized Corrosion," states, "Copper alloy heat exchanger tubes are often subject to erosion conditions, especially at the inlet end where turbulence is greatest."

The "Ultrasonic Thickness Calibration Data Sheet" in Attachment 9.1, includes the statement (in regards to the UT measurement of the calibration block) that, "the instrument shall read ±0.005 inches from the actual thickness measured."

The staff also notes that the "acceptance criteria" discussion in PTN-ENG-LRAM-00-0065 states the minimum allowable wall thickness value of 0.011 inches "includes a 10% margin typically used in wear applications (such as the Flow Accelerated Corrosion program)."

Issue:

The staff identified the following potential nonconservatisms with the initial methodology used to show that the projected wear rates for the ECC heat exchanger tubes are acceptable:

1) Sample Location. Wall thickness measurements were only taken at 90° or 180° fittings. Based on the information from EPRI 1007820, it is not clear to the staff how the sample selection criteria determined that the inlet portion of the tubing coming off of the supply header was not one of the most susceptible locations. The flow in the supply header past the first sets of tubing take-offs will induce significantly more turbulence in the inlet portion of the tubing than the last sets of tubing take-offs. The outlet portion of the tubing in the return header would not be susceptible to this aspect.

2) Wear Rate Calculation Methodology. The UT measurements show that some of the locations have thicknesses greater than the nominal 0.049 inch tubing wall thickness. Consequently, basing the wear rate on the difference between the nominal value and measured value potentially, significantly underestimates the wear rate. It was not clear to the staff why the wear rate calculation did not use initial wall thicknesses values greater than the nominal value based on the actual measurements.

3) Wear Rate Projection Methodology. The wear rate is calculated based on an assumed amount of yearly operation during surveillance testing. The calculation for the initial license renewal appropriately determined the remaining wall thickness at year 60, assuming the amount of system surveillance testing done during the initial 38 years of operation will be comparable to the amount of surveillance testing to be done in the remaining 22 years. However, it was not clear to the staff how the calculation accounted for the additional wear that would occur due to high flow rates during design basis accident conditions.

4) Wall Thickness Measurement Uncertainty. Based on the small tube diameter, thin wall, unique configuration of the tubes, and the statement on the UT calibration sheet, it is not clear to the staff whether some measurement uncertainty should be considered in the wear rate calculation.

5) Safety Factor Application. The acceptance criteria states that it includes a 10 percent margin typically used in wear applications such as the Flow-

Accelerated Corrosion program. (The allowable wall thickness of 0.011 inches, includes the calculated minimum wall thickness of 0.010 inches plus an additional 10 percent.) As stated in GALL-SLR Report AMP XI.M17, "Flow-Accelerated Corrosion, a conservative safety factor is applied to the predicted wear rate determination to account for uncertainties in the wear rate calculations and UT measurements. Applying a safety factor to the calculated minimum wall thickness instead of the calculated wear rate potentially underestimates the applied margin, depending on the magnitudes of the minimum wall thicknesses and the wear rates. For the specific situation of the ECC tubes, the applied margin of 0.001 inch would only be conservative as long as the calculated wear rate is determined to be less than 0.000319 inches per year (neglecting the wear rate projection methodology question above). Using the worst case wear rate based on the thickest and the thinnest readings, the calculated wear rate is 0.000395 inches per year. Consequently, it is not clear to the staff that applying the 10 percent margin to the acceptance criteria, instead of to the wear rate, is consistent with typical wear applications such as for the Flow-Accelerated Corrosion program.

Request:

In order to determine whether the same approach used for the initial license renewal can be used for the subsequent license renewal activities:

1) Provide information to show that the wall thickness measurements were taken at the most susceptible locations. Include a discussion explaining how the inlet portions tubes that are subjected to significant turbulence were determined to be less susceptible than the locations on the outlet side of the heat exchanger.

2) Provide information to show that the use of nominal wall thickness values in the wear rate calculation bounds the potential wear rates of the heat exchanger components.

3) Provide information to show that the projection of the tube wall thinning only needs to account for material lost during periodic surveillances and testing through the end of the extended period of operation and that no additional consideration needs to be included for wall thinning that will occur during high flow conditions as part of an accident response.

4) Provide information to show that wall thickness data consider UT measurement uncertainty or that consideration of UT measurement uncertainty is not needed in order provide reasonable assurance that wall thinning due to tube erosion is acceptable.

5) Provide information to show that the application of a 10 percent margin to the acceptance criteria instead of the wear rate is consistent with other wear applications such as flow-accelerated corrosion.

**FPL Revised Response:**

This response revises the response provided in Attachment 29 of Reference 1 in its entirety per discussion during the November 15, 2018 NRC public meeting with FPL (Reference 2).

FPL reviewed the inspection data relative to emergency containment cooler (ECC) tube thickness and wear and a condition report was entered into the PTN corrective action program to evaluate the ECC ultrasonic test (UT) tube thickness measurement data. FPL determined that although there is a potential data duplication error, the acceptance criteria and projected acceptability of the results to the end the period of extended operation are unaffected. Based on the current calculation of the wear rate, the screening criteria thickness of 0.035" may be reached in 2024. Therefore, an ultrasonic thickness measurement inspection is currently scheduled prior to 2024.

Even though the tubes are not expected to wear below the screening criteria (0.035") or the minimum wall thickness without margin (0.010") prior to 2024, a work order was written to re-perform the ultrasonic thickness measurements of the limiting locations of the 4B emergency containment cooler during the next refueling outage in 2019. The 4B emergency containment cooler has been determined to be the most limiting cooler with respect to loss of material. Ultrasonic thickness measurements will be taken for both the inlet and outlet bends. Due to the data duplication error in the previous (2011) results and potential to reach the screening criteria thickness prior to the end of the PEO, the performance of these measurements and evaluation of the data will serve as a baseline for future inspections in the SPEO and will consider the following:

1) Based on an engineering evaluation of the specific geometry of the emergency containment coolers and the way the tube bends were formed and statements made in the EPRI1007820 guidance document, the inlet bends were determined to be the most limiting locations in terms of wear rate. Sufficient inspection data will be taken to confirm that the inlet bends are the most limiting locations.

2) The wear rate will be calculated based on either the highest measured wall thickness from the 2011 data or the nominal thickness of 0.049", whichever is higher. Going forward, the wear rate will be calculated based on which location is experiencing the highest wear rate.

3) The wear rate calculated will consider past operating history and the effects of any parameter change (i.e., flow rate or increased operation time) that may affect future wear rate calculations. The safety factors added to the wear rate will be established to bound any off-normal or DBA condition to ensure that the ECCs will perform their SLR intended function. Sufficient ECC tube thickness data points will be acquired to establish the projected wear rate.

4) The calculated wear rate will consider instrument uncertainty.

5) A margin of 10% will be applied to the wear rate consistent with the PTN FAC program.

To ensure that the intended function of the ECCs will be maintained throughout the SPEO, FPL commits to performing ECC tube thickness ultrasonic thickness measurements at a frequency of no greater than every 10 years to ensure that measured and projected wear rates remain acceptable. The wear rate will be recalculated and adjusted as necessary after each ultrasonic thickness measurement to ensure that the emergency containment coolers can perform their SLR intended function. The SLRA is revised to remove the calculation of the wear rate based on the 2011 data as compared to the nominal thickness and add the requirement for performing periodic ultrasonic thickness measurements. The PTN Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components AMP includes additional requirements beyond those described in NUREG-2191 XI.M38 to reflect follow-up ultrasonic thickness measurements and the recalculation of the tube wear rate for the ECCs.

**References:**

1. FPL Letter L-2018-166 to NRC dated October 16, 2018, Turkey Point Units 3 and 4 Subsequent License Renewal Application, Safety Review Requests for Additional Information (RAI) Set 3 Responses (ADAMS Accession No. ML18296A024)
2. NRC Public Meeting agenda dated November 5, 2018, Telecon Between NRC and FPL to Discuss Items Associated with the Safety Review of the Turkey Point Subsequent License Renewal Application (ADAMS Accession No. ML18315A004)

**Associated SLRA Revisions:**

SLRA Table 3.2-1, Table 3.2.2-1, Section 4.7.2, Section 17.3.7.2, Section 17.2.2.25, Table 17-3, Table B-4, and Section B.2.3.25 are amended as indicated by the following text deletion (strikethrough) and text addition (red underlined font) revisions. These revisions supersede the revisions provided in L-2018-166 Attachment 29.

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, 032 | Copper alloy heat exchanger components, piping, piping components exposed to closed-cycle cooling water | Loss of material due to pitting, crevice corrosion, MIC | AMP XI.M21A, "Closed Treated Water Systems" | No | Consistent with NUREG-2191 with exception. The Closed Treated Water Systems AMP will be used to manage loss of material in copper alloy heat exchanger components exposed to treated water.<br><br>**In addition, the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components AMP will be used to manage loss of material due to wear for the emergency containment cooler heat exchanger tubes.** |

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 | Treated water (int) | Loss of material | Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components | V.A.EP-94 | 3.2-1, 032 | E |

Revise the "TLAA Evaluation" section contained in SLRA Section 4.7.2 as follows:

To ensure ECC cooler coil reliability, an inspection for minimum tube wall thickness was conducted in 2011 prior to the initial period of extended operation.

~~The actual measured all was 0.039". Therefore, based on an initial tube wall thickness of 0.049", the calculated wear rate is (0.049-0.039)/ 38 years = 0.000263 in/yr. The expected material loss is calculated by multiplying the erosion rate (0.000263 in/yr) by the remaining years of service from the one time inspection activity (4/04/2011) to the end of the SPEO (42 years). The expected material loss value is then added to the minimum allowable wall thickness value of 0.011 inches which includes a 10% margin typically used in wear applications. Based on the above, the acceptance criterion for SLR was determined to be 0.022 inches. The results concluded that the calculated tube wear rates would be acceptable for the SPEO. However, since~~

**Since** tube wall loss has been observed, **periodic ultrasonic thickness measurements** ~~a one-time inspection~~ to confirm the projected tube wear rates are acceptable for the SPEO will be performed. **During each inspection, tube wall loss rate will be measured and the evaluation will ensure that the tube wall thickness will meet the acceptance criteria until at least the next scheduled inspection.**

**TLAA Disposition: 10 CFR 54.21(c)(1)(iii)**

The ~~One-Time~~ Inspection **of Internal Surfaces in Miscellaneous Piping and Ducting Components** program described in Section B.2.3.~~20~~**25** will ensure that the aging effect of emergency containment cooler tube wear will be adequately managed for the SPEO.

Revise SLRA Section 17.3.7.2 paragraphs 4 and 5 as follows:

To ensure emergency containment cooler coil reliability, an inspection for minimum tube wall thickness was conducted in 2011 prior to the initial PEO. Results concluded that the calculated tube wear rates would be acceptable for the PEO. However, since cooler tube wall loss has been observed, ~~an~~ **periodic ultrasonic thickness measurements** of the emergency containment cooler coils to confirm updated tube wear rates would be acceptable for the revised 80-year plant life will be performed.

The PTN ~~One-Time~~ Inspection **of Internal Surfaces in Miscellaneous Piping and Ducting Components** AMP will ensure that the aging effect of emergency containment cooler tube wear will be adequately managed for the SPEO. Therefore, this TLAA is dispositioned in accordance with 10 CFR 54.21(c)(1)(iii).

Add the following paragraph before the last paragraph in Section 17.2.2.25 on page A-32:

**The PTN Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components AMP will also perform periodic ultrasonic thickness measurements**

**of the limiting emergency containment cooler tube locations every 10 years or as determined by the calculated wear rate, whichever is more frequent. Based on the data collected during the inspections, the wear rates will be used to ensure the coolers can perform their intended function throughout the SPEO.**

Revise the current commitment for the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components AMP in Table 17-3, item 29, as follows:

| No. | Aging Management Program or Activity (Section) | NUREG-2191 Section | Commitment | Implementation Schedule |
|---|---|---|---|---|
| 29 | Inspection of Internal Surfaces<br>in Miscellaneous Piping and<br>Ducting Components<br>(17.2.2.25) | XI.M38 | Implement the new PTN Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components AMP.<br><br>**Perform periodic ultrasonic thickness measurements of the limiting emergency containment cooler tube locations every 10 years or as determined by the calculated wear rate, whichever is more frequent.** | No later than 6 months prior to the SPEO, i.e.:<br>PTN3: 1/19/2032<br>PTN4: 10/10/2032<br><br>**The first ultrasonic thickness measurement of the limiting emergency containment cooler tube locations will occur within 10 years prior to the SPEO.** |

Revise the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components AMP row in SLRA Table B-4 and add a note to the end of the table as follows:

**Table B-4**

**PTN Aging Management Program Consistency with NUREG-2191**

| | | | **NUREG-2191 Comparison** | | |
|---|---|---|---|---|---|
| | | | **NUREG-2191 Section** | | |
| Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components | B.2.3.25 | No | XI.M38 | New[1] | No |

**Notes:**

1. **The PTN Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components AMP is a new program and includes additional requirements beyond those described in NUREG-2191 XI.M38 to ensure adequate wall thickness of the emergency containment cooler tubes.**

Add the following information below the last paragraph in the Program Description portion of SLRA Section B.2.3.25 on page B-205 as follows:

**Based on the evaluation in Section 4.7.2, the PTN Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components AMP includes additional requirements beyond those described in NUREG-2191 XI.M38 as follows to ensure adequate wall thickness of the emergency containment cooler tubes throughout the SPEO by performing periodic ultrasonic thickness measurements of the limiting emergency containment cooler tube locations. The initial inspection will take place within 10 years prior to the SPEO and will continue throughout the SPEO.**

| **Element Affected** | **Additional Requirement** |
|---|---|
| **3. Parameters Monitored or Inspected** | **Wall thickness of the emergency containment cooler tubes will be monitored for loss of material due to wear.** |

| Element Affected | Additional Requirement |
|---|---|
| 4. Detection of Aging effects | Periodic ultrasonic thickness measurements of the limiting emergency containment cooler tube locations will be performed every 10 years or as determined by the calculated wear rate, whichever is more frequent. |
| 5. Monitoring and Trending | The calculation of the emergency containment cooler tube wear rate will consider the following:<br>The wear rate will be calculated based on the previous data collected and will be applied to the limiting locations.<br>The wear rate calculated will consider past operating history and consider the effects of any additional thinning that may have occurred during increased usage during off-normal conditions.<br>The calculated wear rate will consider instrument uncertainty.<br>The calculated wear rate will include a 10% safety factor.<br>The wear rate will be projected until the next 10 year inspection and periodic ultrasonic thickness measurements frequencies will be adjusted as necessary to ensure adequate the emergency containment coolers can perform their intended function. The AMP will be updated to reflect the latest wear rate. |
| 6. Acceptance Criteria | The minimum allowed wall thickness of the emergency containment cooler tubes is 0.010 inches. |

## Associated Enclosures:

None

**NRC RAI Letter No. ML18260A242 and ML18260A243 dated September 17, 2018**

**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 Supplemental Response:**

This response supplements the response provided in Attachment 7 of Reference 1 with respect to the flow-accelerated corrosion software classification topic discussed during the November 15, 2018 NRC public meeting with FPL (Reference 2).

To facilitate the NRC review, the software classification determination (SCD) forms for CHECWORKS™ Steam/Feedwater Application (SFA) and FAC Manager Web Edition (FMWE) have been made available for Staff review. These forms each have a completed checklist for screening in Software Quality Levels A, B, and C, and if all of the questions are answered "NO", then the software is classified as Level D. Both forms answered all of the Level A and Level B screening questions as "NO" but did answer some of the Level C screening questions as "YES". Section 5.3 of the software quality assurance program procedure states that, in all cases, the SCD process from Section 5.2 of the software quality assurance process procedure shall be performed to identify the appropriate classification level. This process was followed and resulted in the completed and signed SCD forms. Therefore, both CHECWORKS™ SFA and FMWE are classified as SQA Level C.

The SCD form questions justify that, even though the FAC CHECWORKS™ software is mentioned within the UFSAR, the software does not have to be classified as Level B. Question 2.2.4 of the SCD form is the only screening question that mentions the UFSAR. The answer to the question is "NO" because if the software were to fail, none of the Technical Specifications' safety limits would be exceeded, no UFSAR Design Basis Accident would be initiated, and the reactor coolant boundary would still be controlled. The CHECWORKS™ SFA and FMWE programs are used as tools to assist the FAC engineer in predicting wall thinning rates and locations, but it is the wall thickness inspections and associated trending that ultimately ensure that the safety function of the systems is maintained.

Table 2 of the software quality assurance program procedure states that SQA Level C software programs are required to have some form of error reporting and corrective action, and the table states that the regular work control process is an acceptable form of error reporting. Therefore, when software errors occur, an Action Request (AR) is created in accordance with the site Corrective Action Program to document and track the resolution of the errors.

**References:**

1. FPL Letter L-2018-175 to NRC dated October 17, 2018, Turkey Point Units 3 and 4 Subsequent License Renewal Application, Safety Review Requests for Additional Information (RAI) Set 5 Responses (ADAMS Accession No. ML18292A642)
2. NRC Public Meeting Agenda dated November 5, 2018, Telecon Between NRC and FPL to Discuss Items Associated with the Safety Review of the Turkey Point Subsequent License Renewal Application (ADAMS Accession No. ML18315A004)

**Associated SLRA Revisions:**

None

**Associated Enclosures:**

None