REQUEST FOR ADDITIONAL INFORMATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION PERRY UNIT 1 LICENSE RENEWAL APPLICATION REVIEW (SAFETY) ENERGY HARBOR NUCLEAR GENERATION LLC PERRY, UNIT 1 DOCKET NO. 05000440 ISSUE DATE: 10/02/2024

ESEB RAI-10308-R1

Question 1

Regulatory Basis

Title 10 of the Code of Federal Regulations Section 54.21(a)(3) 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 (CLB) for the period of extended operation. As described in SRP-LR, an applicant may demonstrate compliance with 10 CFR 54.21(a)(3) by referencing the GALL-LR Report when evaluation of the matter in the GALL-LR Report applies to the plant.

Background

SRP-LR Item 3.5-1, 019 addresses the aging effects of cracking due to expansion from reaction with aggregates in accessible areas of containment concrete including basemat and concrete fill-in annulus. SRP-LR lists AMP XI.S2, ASME Section XI, Subsection IWL to manage the aging effects.

LRA Section 3.5.2.2.1.8 states, for PNPP containment concrete: "[a]ccessible concrete surfaces of the containment fill in annulus are monitored for cracking due to expansion from reaction with aggregates by the ASME Section XI, Subsection IWL program and are addressed under Item Number 3.5.1-19." Its associate LRA Item Number 3.5.1-12 also indicates that the accessible concrete of PNPP containment is managed by ASME Section XI, Subsection IWL for cracking due to expansion from reaction with aggregates, and its condition is used as an indicator of the condition of the inaccessible components.

LRA Item Number 3.5.1-19, as modified by Supplement 3 (ML24206A150), states that this item is not applicable because "PNPP containment is a free-standing SCV, and its concrete foundation is integral to the reactor building basemat. The reactor building basemat is not considered to be accessible. The top surface of the annulus concrete is accessible. Aging of annulus concrete will be managed by the ASME Section XI, Subsection IWL." LRA Table 3.5.2-1 does not provide any items related to Item Number 3.5.1-19.

lssue

It appears to the staff that the "not applicable" claim of LRA Item Number 3.5.1-19 is inconsistent with the guidance in SRP Item 3.5-1, 019. SRP Item 3.5-1, 019 provide guidance

to staff to review the aging effects of cracking due to expansion from reaction with aggregates on components such as accessible areas of concrete fill-in annulus that require aging management. For LRA Item Number 3.5.1-19, the applicant stated that the top surface of the annulus concrete is accessible, while at the same time claiming that Item 3.5.1-19 is not applicable.

LRA Item Number 3.5.1-19 also contradicts LRA Section 3.5.2.2.1.8 and LRA Item Number 3.5.1-12. In LRA Section 3.5.2.2.1.8 and LRA Item Number 3.5.1-12, the applicant states that aging effects on accessible concrete surfaces of the containment fill in annulus are addressed under Item Number 3.5.1-19, whereas in LRA Item Number 3.5.1-19, the applicant claims Item 3.5.1-19 is not applicable.

Request

- 1. Provide justification on non-applicability claim for LRA Item Number 3.5.1-19.
- 2. If LRA Item Number 3.5.1-19 is deemed applicable, provide Table 2 item(s) in Table 3.5.2-1 accordingly.
- 3. Update the LRA accordingly based on the responses.

Question 2

Regulatory Basis

Title 10 of the Code of Federal Regulations Section 54.21(a)(3) 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 (CLB) for the period of extended operation. As described in SRP-LR, an applicant may demonstrate compliance with 10 CFR 54.21(a)(3) by referencing the GALL-LR Report when evaluation of the matter in the GALL-LR Report applies to the plant.

Background

SRP-LR AMR Item 3.5-1,049 addresses the aging effects of loss of material (spalling, scaling) and cracking due to freeze-thaw in inaccessible concrete areas of Groups 6 Structures (Water-Control Structures) including "exterior above- and below-grade; foundation; interior slab". SRP-LR requires further evaluation for plants located in moderate to severe weathering conditions (weathering index >100 day-inch/yr). NRC's interim staff guidance of Updated Aging Management Criteria for Structures Portions (SLR-ISG-2021-03-STRUCTURES, ML20181A381) lists plant-specific aging management program or AMP XI.S6, "Structures Monitoring," enhanced as necessary, as aging management program for Item 3.5-1,049. SRP-LR Subsection 3.5.3.2.2.3, Aging Management of Inaccessible Areas for Group 6 Structures, Item 1 states that a plant-specific program is not required if documented evidence confirms that where the existing concrete had air content of 3% to 8% and subsequent inspection of accessible areas did not exhibit degradation related to freeze-thaw. LRA Section 2.4.3, Water Control Structures, describes the structures and structural components within the scope of license renewal. LRA Table 2.4.3-1 lists component types subject to aging management review.

PNPP is located in a "severe" weathering region per Figure 1 of American Society for Testing of Materials (ASTM) C33, Location of Weathering Regions. LRA Item Number 3.5.1-49, as modified by Supplement 3 (ML24206A150), states that this item is not applicable because: "[t]he below grade inaccessible concrete areas of PNPP Group 6 structures were constructed in a manner that minimizes the potential for any freeze-thaw aging effects. The loss of material (spalling, scaling) and cracking due to freeze-thaw are not aging effects requiring management for PNPP Groups 6 structures. The air content percentages for concrete are less than 8%. The absence of this concrete aging effects is confirmed by the Structures Monitoring Program and also based on 35 years of operating experience. The foundation levels of all groups of structures are well below the frost line which would preclude this aging effects requiring management for PNPP Groups 6 structures." LRA Table 3.5.2-3, Water Control Structures, does not provide any items related to Item Number 3.5.1-49.

Issue

Cracking, spalling and disintegration of concrete due to freeze-thaw cycling are concrete aging effects requiring management in the environment with moderate to severe weathering conditions. Although, as stated in SRP-LR, a plant-specific program is not required if the existing concrete was constructed with air content of 3% to 8% and subsequent inspection of accessible areas shows no freeze-thaw related degradation, this does not mean that aging effects are not applicable. The potential aging effects of loss of material (spalling, scaling) and cracking due to freeze-thaw on the applicable components (i.e., Group 6 concrete inaccessible areas: exterior above- and below-grade; foundation; interior slab) still need to be adequately managed during the period of extended operation through an appropriate aging management program (e.g., Structural Monitoring Program).

All relevant components required by SRP-LR Item 3.5-1, 049 should be included into the aging management review. SRP-LR Item 3.5-1, 049 requires managing the aging effects in inaccessible concrete areas of Groups 6 structures including "exterior above- and below-grade; foundation; interior slab", while the applicant's statement of non-applicability appears to apply only to the concrete inaccessible areas well below the frost line, seemingly excluding other inaccessible concrete areas where aging may occur from the scope of its aging management review. For example, in addition to the foundation, the emergency service water pumphouse as shown in PNPP USFAR Figure 9A-34 (DWG. E-023-0034-00000) contains exterior above-ground and below-ground concrete walls that may be inaccessible but require aging management review.

<u>Request</u>

- With reference to the structures and structural components within the scope of license renewal as described in LRA Section 2.4.3, clarify whether all applicable inaccessible concrete components required by SRP-LR Item 3.5-1, 049 (i.e. external above- and belowgrade; foundation; internal slab) are included in the aging management review and, accordingly, reevaluate whether the statement of non-applicability for LRA Item No. 3.5.1-49 is appropriate.
- 2. If LRA Item Number 3.5.1-49 is deemed applicable, identify an AMP to manage the aging effects, explain how the designated AMP will adequately manage freeze-thaw related aging effects in the inaccessible area of Group 6 concrete if they occur during the period of extended operation, and provide associate Table 2 item(s) in Table 3.5.2-3, Water Control

Structures, accordingly. If LRA Item Number 3.5.1-49 is considered not applicable, provide a rationale for how inaccessible concrete areas that may be at risk for freeze-thaw cycles (e.g., portions of underground concrete walls located above or around the frost line) are excluded from aging management review.

3. Update LRA accordingly based on the responses.

ESEB RAI-10327-R1

Regulatory Basis

Title 10 of the *Code of Federal Regulations* Section 54.21(a)(3) 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 (CLB) for the period of extended operation. As described in the SRP-LR, an applicant may demonstrate compliance with 10 CFR 54.21(a)(3) by referencing the GALL-LR Report when evaluation of the matter in the GALL-LR Report applies to the plant.

Question 1 - TRP 46 AMP

Background

LRA Section B.2.43, as modified by LRA Supplement 3 (ML24206A150), provides an enhancement to the "scope of program" program element to include in-scope masonry walls for loss of material (spalling, scaling), change in material properties, and cracking due to freeze-thaw. The staff finds that this enhancement to the Structures Monitoring program contains both the "scope of program" and the "parameters monitored or inspected" program elements but lacks aging effect of cracking due to restraint shrinkage, creep, and aggressive environment. AMR 3.5.1-70 in LRA Table 3.5.1 claims to be consistent with NUREG-1801 and contains aging effect of cracking due to restraint shrinkage, creep, and aggressive environment, which will be managed by the Structures Monitoring program.

AMR 3.5.1-71 in LRA Table 3.5.1 claims to be consistent with NUREG-1801 with aging effect of loss of material (spalling, scaling) and cracking due to freeze-thaw, which will be managed by the Structures Monitoring program.

Additionally, LRA Section B.2.43 states that the Masonry Walls program will be implemented under the Structures Monitoring program but lacks acceptance criteria for masonry walls. The acceptance criteria in G ALL-LR XI.S5 AMP states, "[f]or each masonry wall, the extent of observed shrinkage and/or separation and cracking of masonry may not invalidate the evaluation basis or impact the wall's intended function. However, further evaluation is conducted if the extent of cracking and loss of material is sufficient to impact the intended function of the wall or invalidate its evaluation basis."

lssue

1. The LRA lacks the enhancement to the "parameters monitored or inspected" and "acceptance criteria" program elements for in-scope masonry walls.

- 2. The LRA does not make clear whether cracking due to restraint shrinkage, creep, and aggressive environment needs to be included in the enhancement to the Structures Monitoring program.
- 3. The LRA lacks Table 2 items associated with AMR 3.5.1-71 for cracking.

<u>Request</u>

- 1. Clarify whether this enhancement to the Structures Monitoring program is for both the "scope of program" and the "parameters monitored or inspected" program elements.
- 2. Clarify whether this enhancement to the Structures Monitoring will include cracking due to restraint shrinkage, creep, and aggressive environment. If not, provide justification for why it is not applicable.
- 3. Provide Table 2 AMR items associated with AMR 3.5.1-71 for cracking.
- 4. Provide the enhancement to the "acceptance criteria" program element for masonry walls.
- 5. Revise the LRA accordingly based on the responses above.

Question 2 - TRP 46 AMP

Background

LRA Section B.2.43, as modified by LRA Supplement 3 (ML24206A150), provides an enhancement to the "parameters monitored or inspected" program element to monitor the porous sub-foundation for loss of material and change in material properties.

Table 2 AMR items in LRA Table 3.5.2-1 (items 23 and 26), as modified by LRA Supplement 3 (ML24206A150), adds additional aging effect of increase in porosity and permeability, and loss of strength for porous concrete foundation. Additionally, based on the staff's assessment, cracking due to erosion of porous concrete sub-foundation may be an applicable aging effect. Table 2 AMR item in LRA Table 3.5.2-1 (item 25), as modified by LRA Supplement 3 (ML24206A150), lists porous concrete sub-foundation for change in material properties, which is managed by the Structures Monitoring program, citing Note G with GALL-LR item II.B3.1.C-07 and AMR 3.5.1-2.

<u>Issues</u>

- 1. The LRA has inconsistent aging effects between the enhancement to the Structures Monitoring program and Table 2 AMR items.
- 2. The LRA lacks the "detection of aging effects" and the "acceptance criteria" program elements for the porous concrete sub-foundation and porous concrete pipe associated with the plant underdrain system.
- 3. Table 2 AMR item in LRA Table 3.5.2-1 (item 25), citing Note G, should not have any GALL-LR item II.B3.1.C-07 and AMR 3.5.1-2 associated with this line item.

<u>Request</u>

- 1. Evaluate and clarify aging effects of the porous concrete sub-foundation and porous concrete pipe associated with the plant underdrain system.
- 2. Clarify whether GALL-LR item B3.1.C-07 and AMR 3.5.1-2 in LRA Table 3.5.2-1 (item 25) can be deleted.

- 3. Revise the enhancement to the Structures Monitoring program and Table 2 AMR items for the porous concrete sub-foundation accordingly to ensure each Table 2 AMR item has the corresponding aging effect for the porous sub-foundation.
- 4. Provide the enhancement to the Structures Monitoring program and the corresponding Table 2 AMR items for the porous concrete pipe.
- 5. Evaluate whether the enhancements to the "detection of aging effects" and "acceptance criteria" program elements are needed for the porous concrete sub-foundation and porous concrete pipe associated with the plant underdrain system. If not, provide the justification for why they are not needed.
- 6. Revise the LRA accordingly based on the responses above.

Question 3 - TRP 46 AMP

Background

LRA Section B.2.43, as modified by LRA Supplement 3 (ML24206A150), provides an enhancement to the "parameters monitored or inspected" program element to monitor the plant drain piping for unacceptable flow blockage, change in internal geometry, or other internal degradation irrespective of piping material.

Table 2 AMR items in LRA Table 3.5.2-4 list steel and concrete storm drain (items 322 to 324, items 327 to 328) for loss of material and flow blockage, polymer storm drain (item 325) for flow blockage, which will be managed by the Structures Monitoring.

<u>Issues</u>

- 1. The aging effects of the plant storm drain in the enhancement to the Structures Monitoring program are inconsistent with ones for Table 2 AMR items.
- 2. The LRA lacks Table 2 AMR item for loss of material of the polymer storm drain.

<u>Request</u>

- 1. Clarify the aging effects of the plant drain piping and ensure all aging effects are identified.
- 2. Revise the enhancement to the Structures Monitoring program and Table 2 AMR items accordingly to ensure each Table 2 AMR item has the corresponding aging effect for the plant drain piping based on the responses above.

Question 4 - TRP 46 AMP

Background

GALL-LR XI.S6 AMP states that the scope of this program includes periodic sampling and testing of ground water. LRA Section B.2.43, as modified by LRA Supplement 3 (ML24206A150), provides an enhancement to the "parameters monitored or inspected" program element to monitor ground water chemistry.

<u>Issue</u>

The LRA lacks an enhancement to the "scope of program" program element for the periodic sampling and testing of ground water.

Request

Clarify whether an enhancement to the "scope of program" program element is needed for the periodic sampling and testing of ground water. If not, provide the justification for why it is not needed.

Question 5 - TRP 46 AMP

Background

LRA Section B.2.43, as modified by LRA Supplement 3 (ML24206A150), provides a new enhancement to the "acceptance criteria" program element to monitor unimpregnated and impregnated (with elastomer) fiberglass fabric for loss of material, cracking/delamination, change in material properties and visual deterioration. In addition, LRA Section 2.4.4 "Structural bulk commodities" does not include unimpregnated and impregnated (with elastomer) fiberglass fabric.

There is only one Table 2 AMR item in LRA Table 3.5.2-4 (item 314), which addresses the change in material properties and cracking for unimpregnated fiberglass fabric; fiberglass fabric impregnated with elastomer, which are managed by the Structures Monitoring program, citing Note J.

Additionally, it is noted that the aging effects of the other related Table 2 AMR items in LRA Table 3.5.2-4 (items 318 and 319) that have the same combination of material, aging effect and environment are managed by the Fire Protection program citing Note H instead of the Structures Monitoring program.

Issues

- 1. It appears that this enhancement to the Structures Monitoring program does not belong to the "acceptance criteria" program element. In addition, LRA Section 2.4.4 "Structural bulk commodities" does not include unimpregnated and impregnated (with elastomer) fiberglass fabric.
- 2. The LRA does not make clear why different Notes J and H (for the Structures Monitoring and the Fire Protection programs, respectively) are used for the same combination of material, aging effect and environment.
- 3. The LRA lacks Table 2 AMR item for loss of material of unimpregnated fiberglass fabric; fiberglass fabric impregnated with elastomer managed by the Structures Monitoring program.

Request

1. Clarify whether this enhancement to the Structures Monitoring program is applicable to both the "scope of program" and the "parameters monitored or inspected" program elements.

- 2. Explain why both Note J and Note H (for the Structures Monitoring and the Fire Protection programs, respectively) are used for the same combination of material, aging effect, and environment, and correct them if necessary.
- 3. Evaluate the aging effects in the enhancement to the Structures Monitoring and ensure all applicable aging effects are identified and are consistent with aging effects in the Table 2 AMR items.
- 4. Revise the enhancement to the Structures Monitoring program and Table 2 AMR items accordingly to ensure each Table 2 AMR item has the corresponding aging effect for the plant drain piping based on the responses above.

ESEB RAI-10328-R1

Regulatory Basis

Title 10 of the *Code of Federal Regulations* Section 54.21(a)(3) 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 (CLB) for the period of extended operation. As described in the SRP-LR, an applicant may demonstrate compliance with 10 CFR 54.21(a)(3) by referencing the GALL-LR Report when evaluation of the matter in the GALL-LR Report applies to the plant.

Question 1 -TRP 46 AMR

Background

Table 2 AMR item in LRA Table 3.5.2-4 (item 77), as modified by Supplement (ML24206A150), addresses loss of strength for polymer conduit caps exposed to air-indoor environment, which will be managed by the Structures Monitoring program. This Table 2 AMR item cites plant-specific notes 518, which states in part, "[t]he function of the conduit cap is an external flood barrier...as long as the conduit cap is in place and shows minimal signs of deterioration, it is capable of performing its intended function of providing an adequate seal for flooding." Based on the staff assessment, it appears that loss of material, loss of seal, and cracking are applicable aging effects of the polymer conduit caps.

<u>Issue</u>

The LRA does not make clear whether all applicable aging effects such as loss of material, loss of sealing, and cracking are identified.

Request

Clarify whether loss of material, loss of sealing, and cracking are applicable aging effects for the polymer conduit caps. If not, provide the justification for why they are not applicable. Otherwise, provide Table 2 AMR items associated with their aging effects along with aging mechanisms.

Question 2 TRP 46 AMR

Background

Table 2 AMR item in LRA Table 3.5.2-4 (item 284), as modified by LRA Supplement 3 (ML24206A150), appears to list an incorrect Table 1 AMR item 3.5.1-33 (GALL-LR item II.B4.CP-41) for the elastomer roof membranes. AMR 3.5.1-33 (GALL-LR item II.B4.CP-41) is for component in containment structures, which is managed by the 10 CFR Appendix J program.

Table 2 AMR items in LRA Table 3.5.2-4 (items 353, 354 355), as modified by LRA Supplement 3 (ML24206A150), lists cracking for the elastomer waterproofing & membranes, which are managed by the Structures Monitoring program.

GALL-LR item III.A6.TP-7 addresses loss of sealing due to deterioration of seals, gaskets, and moisture barriers (caulking, flashing, and other sealants), which is managed by the Structures Monitoring program. Loss of sealing is an applicable aging effect for elastomer roof membranes and waterproofing & membranes.

lssue

The LRA does not address loss of sealing for elastomer roof membranes and waterproofing & membranes.

Request

- 1. Clarify whether loss of sealing is an applicable aging effect, if not, provide the justification for why it is not applicable. Otherwise, provide Table 2 AMR items for the elastomer roof membranes and waterproofing & membranes.
- 2. Clarify whether 5.1-33/II.B4.CP-41 is the appropriate Table 2 AMR item in LRA Table 3.5.2-4 (item 284) and revise Note E accordingly.

Question 3 TRP 46 AMR

Background

AMR 3.5.1-63 in LRA Table 3.5.1 claims to be consistent with NUREG-1801. However, Table 2 AMR items associated with Table 1 AMR item 3.5.1-63 in LRA Tables 3.5.2-1 (items 50 and 147) and 3.5.2-2 (items 25 37, 56, and 169), as modified by LRA Supplement 3 (ML24206A150), list raw water and soil environments, which will be managed by the Structures Monitoring program. However, their corresponding GALL-LR items III.A1.TP-24 and III.A3.TP-24 list water-flowing environments.

<u>Issue</u>

Table 2 AMR items in LRA Tables 3.5.2-1 (items 50 and 147) and 3.5.2-2 (items 25 37, 56, and 169), as modified by LRA Supplement 3 (ML24206A150), are inconsistent with GALL-LR items III.A1.TP-24 and III.A3.TP-24 in the environment.

<u>Request</u>

Address the discrepancy in the environment and revise Table 2 AMR items with the correct Note accordingly.

NCSG RAI-10332-R1

Regulatory Basis

Section 54.21(a)(3) of Title 10 of the *Code of Federal Regulations* (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 U.S. Nuclear Regulatory Commission (NRC) 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. 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 in the requests for information.

Question 1 Coolant Heat Exchanger Tube Bundle Replacement Frequency

Background :

Supplement 2 of the License Renewal Application (LRA) dated June 27, 2024 (ML24180A010), revised LRA Section A.1.21, LRA Table A.3, and LRA Section B.2.21 to include an enhancement to the Fire Water System program to periodically replace the coolant heat exchanger tube bundle on the diesel driven fire pump engine during the period of extended operation. The enhancement included a periodic replacement frequency of every 14 years. Supplement 2 also revised LRA Table 3.3.2-24 to manage loss of material of the diesel fire pump heat exchanger shell, and loss of material and reduction of heat transfer of the diesel fire pump heat exchanger tubes exposed to closed-cycle cooling water by the Fire Water System program in lieu of the Closed Treated Water Systems program.

During the audit of the Fire Water System program, several procedures were discussed. Specifically, PAP-1910, "Fire Protection Program," that requires the diesel driven fire pump be operated every 31 days, including inspection for leaks and condition of all piping and component types containing coolant, and leakage checks every 3 months; and PMI-0072, "Diesel Fire Service Pump Preventive Maintenance," that requires the coolant to be drained and replaced annually, and components to be inspected for mineral buildup, scale, rust, or oil, and cleaned as needed. It was also noted that coolant temperature is monitored to confirm heat transfer performance while the engine is running.

<u>lssue</u> :

Supplement 2 of the LRA did not provide a technical basis for the periodic replacement frequency of every 14 years. It is unclear whether the diesel driven fire pump engine monitoring and maintenance activities in PAP-1910 and PMI-0072 will continue during the period of extended operation, and whether the activities are equivalent to the activities that would be performed under the Closed Treated Water Systems program. For example, depending on the specific water chemistry treatment program, the Closed Treated Water Systems program includes quarterly chemistry testing.

Request :

- 1. Please provide the technical basis supporting the periodic replacement frequency of every 14 years for the coolant heat exchanger tube bundle on the diesel driven fire pump engine.
- 2. Please discuss whether the diesel driven fire pump engine monitoring and maintenance activities in PAP-1910 and PMI-0072 will continue during the period of extended operation, including before and after replacement of the coolant heat exchanger tube bundle.
- 3. Please provide sufficient information to demonstrate that the diesel driven fire pump engine monitoring and maintenance activities that will be performed by the Fire Water System program are or will be (i.e., require program enhancement(s)) equivalent to the monitoring and maintenance activities that would be performed by the Closed Treated Water Systems program.

Question 2 Fire Water System Program Enhancements and Exceptions

Background :

As stated in 10 CFR 54.29(a), one of the findings that NRC staff must make to issue a renewed license is that <u>actions have been identified and have been or will be taken</u> 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. Supplement 2 of the LRA dated June 27, 2024 (ML24180A010), stated that reconciliation of Perry's Fire Protection program with the 2011 Edition of National Fire Protection Association (NFPA) Standard 25 is underway and exceptions are expected and will be submitted in a future supplement. Supplement 2 revised the Discussion of several aging management review items in LRA Table 3.3.1 to refer to LRA Section B.2.21 for exceptions to the program; revised Table 3.3.2-24 to include plant-specific note 342 related to an exception to the inlet screens, however, there is no exception included in LRA Section B.2.21; and revised LRA Table B.1-2 to indicate that there are exceptions to the Fire Water System program.

In addition, during the breakout audit of the Fire Water System program, Perry noted that enhancements identified from the reconciliation process would be provided in a future LRA supplement.

<u>lssue</u> :

Supplement 2 of the LRA did not describe or justify an exception to the Fire Water System program related to the inlet screens. In addition, Supplement 2 of the LRA did not discuss whether additional enhancements are expected.

Request :

In accordance with 10 CFR 54.29(a), please identify actions that will be taken with respect to managing the effects of aging during the period of extended operation (i.e., enhancements and exceptions to the Fire Water System program) for NRC staff review.

NCSG RAI-10337-R1

Regulatory Basis

Section 54.21(a)(3) of Title 10 of the *Code of Federal Regulations* (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 U.S. Nuclear Regulatory Commission (NRC) 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. 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 in the requests for information.

Question 1 (Drywell Mechanical Penetrations – Aging Management Programs)

Background :

License Renewal Application (LRA) Supplement 3 (ML24206A150) updated the discussion of Aging Management Review (AMR) item 3.5.1-10 in LRA Table 3.5.1 to state, in part, "SCC [stress corrosion cracking] is managed by ASME [American Society of Mechanical Engineers] Section XI, Subsection IWE and Structures Monitoring and Fire Protection programs for Drywell mechanical penetrations. See Further evaluation section 3.5.2.2.1.6." LRA Supplement 3 also revised LRA Section 3.5.2.2.1.6 to state, "[a]Ithough an aggressive chemical environment doesn't exist, the potential for SCC is assumed for these components, and the aging effect is managed by the ASME Section XI, Subsection IWE and 10 CFR 50, Appendix J programs for containment penetrations, and by the ASME Section XI, Subsection IWE, Fire Protection and Structures Monitoring programs for drywell mechanical penetrations."

<u>lssue</u> :

LRA Supplement 3 revised LRA Table 3.5.2-1 to cite AMR item 3.5.1-10 for managing cracking of stainless steel drywell mechanical penetrations by deleting the Structures Monitoring program and adding the 10 CFR 50, Appendix J program. This change is inconsistent with the

statements made for both AMR item 3.5.1-10 in LRA Table 3.5.1 and LRA Section 3.5.2.2.1.6, where the Structures Monitoring program and not the 10 CFR 50, Appendix J program is credited for managing SCC of stainless steel drywell mechanical penetrations.

Request :

Please reconcile the discrepancies in the programs credited for managing cracking of stainless steel drywell mechanical penetrations in AMR item 3.5.1-10 of LRA Table 3.5.1, LRA Section 3.5.2.2.1.6, and LRA Table 3.5.2-1.

Question 2 (Pyrocrete)

Background :

LRA Supplement 2 (ML24180A010) revised LRA Sections A.1.20 and B.2.20 to state that the Fire Protection program manages loss of material, cracking/<u>delamination</u>, and separation of Pyrocrete fireproofing. LRA Supplement 3 (ML24206A150) revised LRA Table 3.5.2-4 to credit the Fire Protection program with managing separation of Pyrocrete fireproofing (cracking and loss of material originally included). Delamination was not added to LRA Table 3.5.2-4. During the audit of the Fire Protection program, the NRC staff noted that Revision 6 of LRPY-CAMR-001, "Structural Material/Environment/Aging Effect Bases Report," states that change in material properties due to chemical exposure is not applicable for Pyrocrete because if it were exposed to corrosive chemicals, it would be event-driven and not age related. In addition, the report states that change in material properties due to gamma irradiation exposure is not applicable for Pyrocrete because "Pyrocrete is a cementitious material and not an organic polymer, such that it is less susceptible to irradiation aging effects."

<u>lssue</u> :

Delamination was identified as an applicable aging effect for Pyrocrete in LRA Supplement 2 (LRA Sections A.1.20 and B.2.20), however, it was not added to LRA Table 3.5.2-4 in subsequent LRA supplements. Therefore, based on the LRA supplements and Revision 6 of LRPY-CAMR-001, it is unclear whether the applicant considers delamination applicable or not applicable for Pyrocrete.

Section 6.3.3.2 of EPRI 3002013084, "Long-Term Operations: Subsequent License Renewal Aging Affects for Structures and Structural Components (Structural Tools)," November 2018, states that 10⁶ rads, which is the organic polymer radiation damage threshold, is conservative for fire wraps and fire stops, and if the radiation dose is below 10⁶ rads, then change in material properties is not expected. Table 6-3 of EPRI 3002013084 includes change in material properties due to gamma irradiation exposure for cementitious fireproofing as being applicable for exposures exceeding 10⁶ rads. Given that Revision 6 of LRPY-CAMR-001 only states Pyrocrete is "less susceptible to irradiation aging effects," it is unclear why change in material properties due to gamma irradiation exposure was not identified as applicable.

Request :

1. Please discuss whether delamination is an applicable aging effect for Pyrocrete.

2. Please provide additional justification for why change in material properties due to gamma irradiation exposure is not an applicable aging effect for Pyrocrete (e.g., not located in areas where the radiation dose would exceed 10⁶ rads).

Question 3 (Fiberglass/Alumina Silicate/Calcium Silicate/Mineral Fiber)

Background :

LRA Supplement 3 (ML24206A150) revised LRA Table 3.5.2-1 to credit the Fire Protection program with managing cracking/delamination and loss of material of fiberglass/alumina silicate/calcium silicate/mineral fiber drywell mechanical penetrations (fiberglass). LRA Supplement 3 revised LRA Table 3.5.2-4 to credit the Fire Protection program with managing cracking delamination and loss of material of fiberglass/alumina silicate/calcium silicate/mineral fiber fire wrap. Also, LRA Supplement 3 revised LRA Table 3.5.2-4 to credit the Fire Protection program with managing cracking/delamination, loss of material, and separation of fiberglass/alumina silicate/calcium silicate/calcium silicate/mineral fiber glass/alumina silicate/calcium silicate/mineral fiber glass/alumina silicate/calcium silicate/mineral fiber glass/alumina silicate/calcium silicate/calcium silicate/mineral fiber glass/alumina silicate/calcium silicate/mineral fiber glass/alumina silicate/calcium silicate/calcium silicate/mineral fiber glass/alumina silicate/calcium silicate/calcium silicate/mineral fiber glass/alumina silicate/calcium silicat

Table 3.5.2-4 in the initial LRA cited no aging effects requiring management and no aging manage program for fiberglass/alumina silicate/calcium silicate/mineral fiber insulation and penetration sealant (flood, radiation) exposed externally to uncontrolled indoor air, and insulation exposed externally to outdoor air. Plant-specific note 503 was cited and states, "Operating experience review did not identify aging effects that affect intended function for these material/environment combinations." These components do not have a fire barrier intended function.

Issue :

It is unclear why separation was cited as an applicable aging effect for the fiberglass/alumina silicate/calcium silicate/mineral fiber penetration sealant (fire) but not cited for the fiberglass/alumina silicate/calcium silicate/mineral fiber drywell mechanical penetrations (fiberglass). Penetrations would appear to be associated with the separation of fire zones. In addition, it is unclear why change in material properties was not cited as an applicable aging effect for fiberglass/alumina silicate/calcium silicate/mineral fiber drywell mechanical penetrations (fiberglass/alumina silicate/calcium silicate/mineral fiber drywell mechanical penetrations (fiberglass), fire wrap, and penetration sealant (fire).

For fiberglass/alumina silicate/calcium silicate/mineral fiber, Revision 6 of LRPY-CAMR-001 appears to only evaluate a loss of insulation function and not a fire barrier intended function, and references Table 10-7 of EPRI 3002013084. The staff notes that Section 10.3.1 of EPRI 3002013084 states that "[i]nsulating materials associated with fire barriers are addressed in Section 6 of this report." Therefore, based on Table 6-2 of EPRI 3002013084, separation due to vibration, movement, and shrinkage may be applicable to fire stops, and change in material properties due to gamma irradiation exposure may be applicable to fire wraps and fire stops.

While LRA Supplement 2 (ML24180A010) added "separation in elastomer and pyrocrete," to LRA Sections A.1.20 or B.2.20, subsequent LRA supplements have not revised LRA Sections A.1.20 or B.2.20 to state that the Fire Protection program will manage separation of fiberglass/alumina silicate/calcium silicate/mineral fiber as indicated in LRA Table 3.5.2-4 for fiberglass/alumina silicate/calcium silicate/mineral fiber penetration sealant (fire).

EPRI 3002013084 notes that insulation systems typically consist of the insulating material and a barrier or covering that provides protection for the specific application. It is unclear if all the fiberglass/alumina silicate/calcium silicate/mineral fiber component types (fire barriers and non-fire barriers) installed at Perry have a protective barrier or covering. In addition, during the audit of the Fire Protection program it was stated that insulation material in high gamma radiation areas is limited by design to metallic insulation. It is unclear whether the non-fire barrier fiberglass/alumina silicate/calcium silicate/mineral fiber component types installed at Perry are located in areas of high gamma radiation.

Request :

- 1. Please discuss why separation was cited as an applicable aging effect for the fiberglass/alumina silicate/calcium silicate/mineral fiber penetration sealant (fire) but not cited for the fiberglass/alumina silicate/calcium silicate/mineral fiber drywell mechanical penetrations (fiberglass).
- 2. Please discuss why change in material properties was not cited as an applicable aging effect for fiberglass/alumina silicate/calcium silicate/mineral fiber drywell mechanical penetrations (fiberglass), fire wrap, and penetration sealant (fire) (e.g., not located in areas where the radiation dose would exceed 10 ⁶ rads).
- 3. Please discuss why LRA Sections A.1.20 and B.2.20 have not been revised to state that the Fire Protection program will manage separation of fiberglass/alumina silicate/calcium silicate/mineral fiber.
- 4. Please discuss whether all the fiberglass/alumina silicate/calcium silicate/mineral fiber component types (fire barriers and non-fire barriers) installed at Perry have a protective barrier or covering as described in EPRI 3002013084.
- 5. Please discuss whether any of the non-fire barrier fiberglass/alumina silicate/calcium silicate/mineral fiber component types installed at Perry are located in areas of high gamma radiation. If they are, then discuss whether change in material properties is an applicable aging effect.

Question 4 (Unimpregnated Fiberglass Fabric; Fiberglass Fabric Impregnated With Elastomer)

Background :

LRA Tables 3.5.2-1 and 3.5.2-4 cite change in material properties and cracking for unimpregnated fiberglass fabric; fiberglass fabric impregnated with elastomer drywell mechanical penetration (fiberglass fabric), penetration sealant (fire), and safety relief valve (SRV) tailpipe penetration boot seals. LRA Supplement 3 (ML24206A150) revised LRA Tables 3.5.2-1 and 3.5.2-4 to also cite loss of material for these components.

LRA Supplement 3 (ML24206A150) revised LRA Table 3.5.2-4 to remove the Structures Monitoring program as one of the credited programs for managing change in material properties and cracking of unimpregnated fiberglass fabric; fiberglass fabric impregnated with elastomer SRV tailpipe penetration boot seals.

<u>lssue</u> :

It is unclear why separation and delamination were not cited as applicable aging effects for unimpregnated fiberglass fabric; fiberglass fabric impregnated with elastomer drywell mechanical penetration (fiberglass fabric), penetration sealant (fire), and SRV tailpipe penetration boot seals.

Revision 6 of LRPY-CAMR-001 appears to only evaluate change in material properties and cracking and references Table 7-5 of EPRI 3002013084. The staff notes that Section 7 of EPRI 3002013084 states that "[t]his section covers elastomers used in structural applications within the scope of LR, except for those associated with fire stops and penetration seals, which are addressed in Section 6." Therefore, based on Table 6-2 of EPRI 3002013084, separation due to vibration, movement, and shrinkage may be applicable to fire stops, and delamination may be applicable to elastomer fire stops.

Request :

- 1. Please discuss why separation was not cited as an applicable aging effect for unimpregnated fiberglass fabric; fiberglass fabric impregnated with elastomer drywell mechanical penetration (fiberglass fabric), penetration sealant (fire), and SRV tailpipe penetration boot seals (e.g., does not interact with vibrating components, is not affected by differential movement between structures, etc.).
- 2. Please discuss why delamination was not cited as an applicable aging effect for unimpregnated fiberglass fabric; fiberglass fabric impregnated with elastomer drywell mechanical penetration (fiberglass fabric), penetration sealant (fire), and SRV tailpipe penetration boot seals.

Question 5 (Gypsum Board/Drywall)

Background :

LRA Supplement 3 (ML24206A150) revised LRA Table 3.5.2-4 to identify gypsum board drywall as a fire barrier used at Perry. However, no aging effects were cited, and plant-specific note 532 was added, which states, "[n]o mechanism for degradation of drywall was identified due to aging."

<u>lssue</u> :

Based on Table 6-2 of EPRI 3002013084, loss of material due to abrasion may be an applicable aging effect for fire stops; cracking due to vibration, movement, and shrinkage may be an applicable aging effect for fire stops; change in materials due to gamma irradiation exposure may be an applicable aging effect for fire stops; and separation due to vibration, movement, and shrinkage may be an applicable aging effect for fire stops; and separation due to vibration, movement, and shrinkage may be an applicable aging effect for fire stops; and separation due to vibration, movement, and shrinkage may be an applicable aging effect for fire stops.

Revision 6 of LRPY-CAMR-001 appears to have only evaluated loss of material and change in material properties for gypsum board and did not address cracking or separation. LRPY-CAMR-001 states that loss of material due to abrasion is not applicable because it is due to design problems or human interaction and change in material properties due to gamma irradiation exposure is not applicable because it is not an organic polymer.

The staff notes that if gypsum board is experiencing loss of material due to design problems or human interaction, and corrective actions have not been taken to correct the design problems

and human interaction, then loss of material is a known degradation that could impact the gypsum board from performing its intended fire barrier function if not managed.

Section 6.3.3.2 of EPRI 3002013084 states that 10⁶ rads, which is the organic polymer radiation damage threshold, is conservative for fire wraps and fire stops and if the radiation dose is below 10⁶ rads, then change in material properties is not expected. Table 6-3 of EPRI 3002013084 includes change in material properties due to gamma irradiation exposure for fire stops as being applicable for exposures exceeding 10⁶ rads. Therefore, no explanation is provided for why change in material properties due to gamma radiation exposure is not applicable.

Request :

Please discuss why loss of material (e.g., not in vicinities of other vibrating components, design problems have been corrected, and human interaction problems have been corrected), change in material properties due to gamma irradiation (e.g., not located in areas where the gamma irradiation exposure would exceed 10 ⁶ rads), cracking (e.g., not in vicinities of other vibrating components), and separation (e.g., not in vicinities of other vibrating components) are not applicable aging effects for gypsum board.

Question 6 (Loss of Sealing)

Background :

LRA Supplement 3 (ML24206A150) revised LRA Table 3.5.2-4 to delete loss of sealing of elastomer fire stops managed by the Structures Monitoring program. Only the Fire Protection program is credited for managing loss of sealing of the elastomer fire stops. In addition, LRA Table 3.5.2-4 credits only the Fire Protection program for managing loss of sealing of the elastomer seismic isolation joints. Plant-specific note 522 is cited and states, "Structures Monitoring Program is aligned with Fire Protection Program in detecting the loss of sealing aging effect for this material/environment combination." This plant-specific note appears to indicate that the Structures Monitoring and Fire Protection programs work together to manage loss of sealing of the elastomer fire stops and seismic isolation joints.

The staff notes that LRA Table 3.5.2-4 does credit both the Fire Protection and Structures Monitoring programs for managing loss of sealing of elastomer penetration sealant (fire), also citing plant-specific note 522. This approach is consistent with the approach for elastomer shield building electrical penetration seals and sealant in LRA Table 3.5.2-1, which credits both the 10 CFR 50, Appendix J, and Fire Protection programs with managing loss of sealing. The approach of crediting two programs seems appropriate given the components have intended functions, in addition to the fire barrier intended function.

<u>lssue</u> :

It is unclear why, consistent with what appears to be the intent of plant-specific note 522, both the Fire Protection and Structures Monitoring programs are credited to manage loss of sealing of the elastomer penetration sealant (fire), but both programs are not credited to manage loss of sealing of the elastomer fire stops and seismic isolation joints, which also cite plant-specific note 522.

Request :

Please discuss why both the Fire Protection and Structures Monitoring programs are credited to manage loss of sealing of the elastomer penetration sealant (fire), but both programs are not credited to manage loss of sealing of the elastomer fire stops and seismic isolation joints.

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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. 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.

Question 1 - RAI B.2.45-1

Introduction :

As added by letter dated September 5, 2024 (ML24249A123), LRA Section B.2.45 describes the new Plant-Specific Periodic Inspections for Selective Leaching Program as plant-specific. The applicant and staff identified three populations (i.e., materials and environment combinations) where selective leaching is occurring, and the applicant provided the Plant-Specific Periodic Inspections for Selective Leaching Program to manage loss of material due to selective leaching for these populations. The three populations being managed using this plant-specific AMP are: (a) gray cast iron components exposed to raw water; (b) gray cast iron components exposed to soil; and (c) ductile iron components exposed to soil. With the issuance of GALL-SLR Report AMP XI.M33, "Selective Leaching," the staff provided a framework to manage loss of material due to selective leaching through periodic inspections, as opposed to the GALL-LR Report AMP XI.M33 framework which recommends one-time inspections to demonstrate that this aging effect is not occurring. In addition, the staff noted the applicant developed the Plant-Specific Periodic Inspections for Selective Leaching Program based on the guidance provided in GALL-SLR Report AMP XI.M33. Therefore, the staff compared the program elements included in LRA Section B.2.45 to the corresponding program elements of GALL-SLR Report AMP XI.M33.

Background :

The "detection of aging effects" program element in LRA Section B.2.45 states the following (in part):

- "[m]echanical examination techniques, such as chipping and scraping, augmented visual inspections for gray cast iron components."
- "[t]he Fire Protection System contains one gray cast iron (ductile iron) piping component with a soil environment. For populations with less than 35 components, PNPP will perform one destructive examination for this population during each inspection period..."

The "acceptance criteria" program element in LRA Section B.2.45 states the following (in part):
"b) the presence of no more than a superficial layer of dealloying, as determined by removal of the dealloyed material by mechanical removal, and
c) the components meet system design requirements such as minimum wall thickness, when projected to the end of the period of extended operation. When evaluating a component in relation to *criterion (b)* [emphasis added by staff], no credit is taken for the material properties of the dealloyed portion of the component."

GALL-SLR Report AMP XI.M33 recommends the following:

- Mechanical examination techniques, such as chipping and scraping, augment visual inspections for gray cast iron and *ductile iron* [emphasis added by staff] components.
- Two destructive examinations for sample populations with greater than 35 susceptible components. When inspections are conducted on piping, a 1-foot axial length section is considered as one inspection.

<u>lssue</u> :

- 1. The staff seeks clarification with respect to why mechanical examination techniques, such as chipping and scraping, augment visual inspections for gray cast iron components but not ductile iron components.
- 2. It is the staff's understanding that there is greater than 35 feet of in-scope ductile iron piping exposed to soil. Based on this, the staff seeks clarification with respect to why two destructive examinations will not be performed for this population.
- 3. The staff seeks clarification with respect to why "criterion (b)" (highlighted and italicized by the staff in the background section above) does not refer to "criterion (c)". Criterion (b) refers to a superficial dealloyed layer which would not involve an evaluation, whereas criterion (c) would involve an evaluation to show that system design requirements would be met.

Request :

- 1. State the basis for why mechanical examination techniques will not augment visual inspections for ductile iron components. Alternatively, revise the LRA to reflect that mechanical examination techniques will augment visual inspections for ductile iron components.
- 2. Clarify if there is greater than 35 feet of in-scope ductile iron piping exposed to soil. If there is, state the basis for performing only one destructive examination for this population during each inspection period. Alternatively, revise the LRA to reflect that two destructive examinations will be performed for this population during each inspection period.
- 3. State the basis for why "criterion (b)" (highlighted and italicized by the staff in the background section above) does not refer to "criterion (c)". Alternatively, revise the LRA to reference "criterion (c)" instead of "criterion (b)".

Question 2 - RAI A.1.45-1

Introduction :

As added by letter dated September 5, 2024, LRA Section A.1.45 provides the UFSAR supplement for the Plant-Specific Periodic Inspections for Selective Leaching Program. The applicant and staff identified three populations (i.e., materials and environment combinations) where selective leaching is occurring, and the applicant provided the Plant-Specific Periodic Inspections for Selective Leaching Program to manage loss of material due to selective leaching for these populations. The three populations being managed using this plant-specific AMP are: (a) gray cast iron components exposed to raw water; (b) gray cast iron components exposed to soil; and (c) ductile iron components exposed to soil. With the issuance of GALL-SLR Report AMP XI.M33, "Selective Leaching," the staff provided a framework to manage loss of material due to selective leaching through periodic inspections, as opposed to the GALL-LR Report AMP XI.M33 framework which recommends one-time inspections to demonstrate that this aging effect is not occurring. In addition, the staff noted the applicant developed the Plant-Specific Periodic Inspections for Selective Leaching Program based on the guidance provided in GALL-SLR Report AMP XI.M33. Therefore, the staff compared LRA Section A.1.45 against the recommended description for AMP XI.M33 as described in GALL-SLR Report Table XI-01, "FSAR Supplement Summaries for GALL-SLR Report Chapter XI Aging Management Programs."

Background :

The recommended description for AMP XI.M33 as described in GALL-SLR Report Table XI-01 states "[w]hen the acceptance criteria are not met such that it is determined that the affected component should be replaced prior to the end of the subsequent [deleted by staff since this is an initial LRA] period of extended operation, additional inspections are performed."

Issue :

The staff seeks clarification with respect to why the statement from GALL-SLR Report Table XI-01 (described in the background section above) is not included in LRA Section A.1.45.

Request :

State the basis for why the statement from GALL-SLR Report Table XI-01 (described in the background section above) is not included in LRA Section A.1.45. Alternatively, revise LRA Section A.1.45 to include this statement.