Phyllis

From: Clark, Phyllis
Sent: Monday, November 07, 2016 10:52 AM
To: 'mchisum@entergy.com'
Cc: 'jjarrel@entergy.com'; 'dfrey@entergy.com'; 'lmurr91@entergy.com'; 'GYOUNG4 @entergy.com'; 'Dlach@entergy.com'; 'ataylo1@entergy.com'; 'aharris@entergy.com'; 'Milster, Leia Elizabeth'; Ramirez, Frances C; Speer, Chris; Diaz-Sanabria, Yoira K; Wittick, Brian; Morey, Dennis; RidsNrrDlr Resource; RidsNrrDlrRpb1 Resource; RidsNrrDlrRerb Resource; RidsNrrDlrRarb Resource; RidsNrrDlrRasb Resource; RidsNrrDlrRsrg Resource; RidsNrrPMWaterford Resource; 'RidsRgn4MailCenter@nrc.gov'; Folk, Kevin; Keegan, Elaine; Mitchell, Jeffrey; Buford, Angela; Prinaris, Andrew; Wong, Albert; Huynh, Alan; Akhavannik, Huda; Sweat, Tarico; Medoff, James; Gavula, James; Lopez, Juan; Cuadrado de Jesus, Samuel; Min, Seung K; Obadina, Sarah; Sadollah, Mohammad; Rogers, Billy; Brittner, Donald; Fu, Bart; Allik, Brian; Lehman, Bryce; Gardner, William; Thomas, George; Mink, Aaron; Doutt, Clifford; Holston, William; Yoo, Mark; Pulvirenti, April; McIntyre, David; Burnell, Scott; Moreno, Angel; Kennedy, Kriss; Scott, Catherine; Yoder, Matthew
Subject: REF: WATERFORD STEAM ELECTRIC STATION, UNIT 3, LICENSE RENEWAL APPLICATION – RAI SET 6 (CAC NO. MF7492)
Attachments: WATERFORD 3 LRA Set 6 Enclosure (Final 11 7 2016).docx

UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

Mr. Michael R. Chisum
Site Vice President

SUBJECT: REQUESTS FOR ADDITIONAL INFORMATION FOR THE REVIEW OF THE WATERFORD STEAM ELECTRIC STATION, UNIT 3, LICENSE RENEWAL APPLICATION – SET 6 (CAC NO. MF7492)

Dear Mr. Chisum:

By letter dated March 23, 2016, Entergy Operations, Inc. submitted an application pursuant to Title 10 of the *Code of Federal Regulations* Part 54, to renew the operating license NPF-38 for Waterford Steam Electric Station, Unit 3. The staff of the U.S. Nuclear Regulatory Commission (NRC or the staff) is reviewing the information contained in the license renewal application and has identified areas where additional information is needed to complete the review.

The enclosed requests for additional information were discussed with Mr. Alan Harris and a mutually agreeable date for the response is within 30 days from the date of this letter with the exception of RAI 4.7.4-1. RAI 4.7.4-1 has a response time of 90 days. If you have any questions, please contact me at 301-415-6447 or by e-mail at Phyllis.Clark@nrc.gov.

Sincerely,

Phyllis Clark

Phyllis Clark, Project Manager
Projects Branch 1
Division of License Renewal
Office of Nuclear Reactor Regulation

Docket No. 50-382

Enclosure:
As stated

cc: Listserv

ADAMS Accession No.: **ML16307A007** ***via email**

OFFICE	PM:RPB1:DLR	BC:RARB:DLR	BC:RASB:DLR	BC:RPB1:DLR	PM:RPB1:DLR
NAME	PClark	DMorey*	BWittick*	YDiaz-Sanabria*	PClark
DATE	10/24/2016	10/14/2016	10/6/2016	11/7/2016	11/7/2016

Phyllis Clark
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WATERFORD STEAM ELECTRIC STATION, UNIT 3
LICENSE RENEWAL APPLICATION
REQUESTS FOR ADDITIONAL INFORMATION – SET 6
(CAC NO. MF7492)

RAI 3.5.1.93-1

Background:

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-LR, an applicant may demonstrate compliance with 10 CFR 54.21(a)(3) by referencing the GALL Report and when evaluation of the matter in the GALL Report applies to the plant.

SRP-LR Table 3.5-1, item 93, recommends that galvanized steel, aluminum, or stainless steel support members, welds, bolted connections, and support anchorage exposed to an air outdoor environment be managed for loss of material due to pitting and crevice corrosion by the Structures Monitoring Program. Per the GALL Report, this item relates to supports for cable trays, conduit, HVAC (heating, ventilating, and air conditioning) ducts, tubetrack, instrument tubing, and non-ASME Code piping and components, or to supports for emergency diesel generator, HVAC system components, and other miscellaneous mechanical equipment. SRP-LR Table 3.5-1, item 91, addresses steel support members, welds, bolted connections, and support anchorage for ASME Code Class 1, 2, 3 and MC supports and recommends the ASME Code Section XI, Subsection IWF Program.

LRA Table 3.5.2-4 identifies an AMR result which states that for stainless steel structural bolting exposed to an air outdoor environment, the Inservice Inspection - IWF Program will be used to manage loss of material. This AMR line item cites generic note E, indicating that the material, environment, and aging effect is consistent with the GALL Report but a different AMP is credited.

Issue:

Based on the information provided in the LRA, it is not clear whether the AMR line item in LRA Table 3.5.2-4 addresses structural bolting for ASME Code Section XI, Subsection IWF component supports (e.g. Class 1, 2, 3, and metal containment piping and components and their associated supports) or non-ASME Code supports as indicated by the reference to GALL Report item III.B2.TP-6. The scope of the Inservice Inspection - IWF Program described in LRA Section B.1.6 appears to be limited to ASME Code Class 1, 2 and 3 piping and component supports, whereas the components associated with SRP-LR Table 3.5-1, item 93, are intended for non-ASME Code piping and components.

Request:

1. For the LRA Table 3.5.2-4 AMR line item associated with SRP-LR Table 3.5-1, item 93, which credits the Inservice Inspection - IWF Program to manage loss of material, clarify

whether the stainless steel structural bolting is associated with ASME Code Section XI, Subsection IWF components or non-ASME Code component supports.

2. If the stainless steel structural bolting is for non-ASME Code related component supports, clarify if the bolting is within the scope of the Inservice Inspection - IWF Program described in LRA Section B.1.6, and how the aging effects will be adequately managed.

RAI 3.5.1.79-1

Background:

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-LR, an applicant may demonstrate compliance with 10 CFR 54.21(a)(3) by referencing the GALL Report and when evaluation of the matter in the GALL Report applies to the plant.

SRP-LR Table 3.5-1, item 79, recommends that steel piles exposed to a groundwater/soil environment be managed for loss of material due to corrosion by the Structures Monitoring Program. Per the SRP-LR, this line item is associated with GALL Report item III.A3.TP-219 for structures and components supports.

LRA Table 2.4-3 lists the steel piles component as subject to aging management review with an intended function to support criterion (a)(3) equipment. LRA Table 3.5.1, item 3.5.1-79 states that steel piles exposed to groundwater and/or soil is not applicable because WF3 has no steel piles subject to the listed aging effects. However, LRA Table 3.5.2-3 identifies one AMR item associated with steel piles exposed to soil as having no aging effects requiring management. This AMR item cites generic note I to state that this aging effect in the GALL Report is not applicable, and plant-specific note 501, page 3.5-49, which states:

> *"Steel piles driven into undisturbed soils are unaffected by corrosion. Where steel piles are driven into disturbed soils, operating experience has shown that only minor to moderate corrosion has occurred that would not significantly affect the performance of the component intended function during the license renewal term. The steel piles are steel casings used as forms for the concrete inside the steel piles. The concrete inside the steel casing is not susceptible to degradation that could impair the ability of the concrete to perform its intended function. Therefore, no aging management is required."*

Issue:

The staff noted inconsistencies between the AMR line item associated with steel piles in LRA Table 3.5.2-3, the LRA disposition of Table 3.5.1 item 3.5.1-79, and the intended function identified in LRA Table 2.4-3. LRA Table 2.4.3 dispositions the steel piles as having an intended function of support for Criterion 10 CFR 54.4(a)(3) equipment; LRA Table 3.5.1, item 3.5.1-79 states that WF3 has no steel piles subject to the loss of material due to corrosion aging effect; and plant-specific note number 501 from LRA Table 3.5.2-3 identifies the steel piles as experiencing an aging effect of minor to moderate corrosion but dispositions them as not requiring aging management due to being steel casings that are used as forms for the concrete (which is not susceptible to degradation) inside the steel piles. The staff also noted that plant-specific note number 501 does not provide a technical basis (e.g. analysis of degradation rate and expected degradation during the period of extended operation) to support the conclusion that "no aging management is required" for steel piles with ongoing corrosion or for the concrete inside the steel casings.

Based on the information provided in the LRA, the staff is not clear (1) whether the steel piles or steel casing are within the scope of license renewal, and (2) whether the AMR line item in LRA Table 3.5.2-3 and associated line item 3.5.1-79 in LRA Table 3.5.1, are consistent with the

GALL Report recommendation from line item III.A3.TP-219 to ensure that the aging effects of loss of material due to corrosion is adequately managed for the period of extended operation.

Request:

1. Clarify if steel piles or steel casings are within the scope of license renewal and the intended function that needs to be maintained during the period of extended operation.
2. If steel piles are within the scope of license renewal, describe how the aging effects of loss of material due to corrosion in steel piles exposed to a groundwater/soil environment will be adequately managed so that the intended function will be maintained consistent with the current licensing basis for the period of extended operation. Otherwise, provide the technical justification for the exception to the GALL Report recommendation.
3. Clarify any inconsistency between LRA Table 3.5.1, item 3.5.1-79, and LRA Table 3.5.2-3 line item associated with steel piles to be consistent with the response to the above request.

RAI 3.5.1.62-1

Background:

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-LR, an applicant may demonstrate compliance with 10 CFR 54.21(a)(3) by referencing the GALL Report when evaluation of the matter in the GALL Report applies to the plant.

SRP-LR Table 3.5.1, item 62 recommends GALL Report AMP XI.S7, "RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants," to manage the aging effects of loss of material and changes in material properties for wooden piles exposed to groundwater or soil. The GALL Report AMP recommends periodic visual inspection of the accessible portions of the wooden piles. No additional recommendations are provided for inaccessible portions of wooden piles; however, the guidance assumes at least a portion of the pile is available for inspection.

Issue:

WF3 LRA Table 3.5.1, item 3.5.1-62, notes that the Structures Monitoring Program manages the listed aging effects for the wooden piles associated with the fire pump house. LRA Section 2.4.3 notes that the piles are driven into the subgrade and covered by the fire pump house concrete foundation.

The Structures Monitoring Program includes equivalent periodic visual inspections so proposing to use the Structures Monitoring Program instead of the GALL Report recommended AMP is acceptable. However, the staff is not clear how the visual inspection program will adequately manage the effects of aging for the wooden piles if none of the piles are accessible for inspection.

Request:

Explain how the Structures Monitoring program will manage the wooden piles for the aging effects of loss of material and changes in material properties so that the intended function will be maintained for the period of extended operation, or propose a new aging management approach.

RAI 3.5.1.56-1

Background:

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-LR, an applicant may demonstrate compliance with 10 CFR 54.21(a)(3) by referencing the GALL Report when evaluation of the matter in the GALL Report applies to the plant.

SRP-LR Table 3.5-1, item 56 recommends GALL Report AMP XI.S7, "RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants," to manage the aging effect of loss of material due to abrasion and cavitation for concrete exposed to flowing water.

WF3 LRA Table 3.5.1 Item 3.5.1-56, notes that the SRP line item does not apply because the item is specific to Group 6 components and WF3 has not identified components for this grouping.

Issue:

WF3 has concrete structures exposed to flowing water (e.g., structures associated with the ultimate heat sink) that could potentially experience loss of material due to abrasion or cavitation, and which may require aging management to maintain intended function. The staff is not clear regarding the technical basis for not managing the aging effect of loss of material due to abrasion and cavitation for the WF3 concrete structures exposed to flowing water.

Request:

Provide a technical justification explaining why concrete structures exposed to flowing water do not require aging management for loss of material due to abrasion or cavitation; otherwise, update the LRA to address this aging effect.

RAI 3.5.1.52-1

Background:

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-LR, an applicant may demonstrate compliance with 10 CFR 54.21(a)(3) by referencing the GALL Report and when evaluation of the matter in the GALL Report applies to the plant.

SRP-LR Table 3.5-1, item 52, recommends that steel tank liners exposed to standing water be managed for cracking due to stress corrosion cracking (SCC) and loss of material due to pitting and crevice corrosion by a plant-specific program.

Issue:

The staff needs additional information with regards to management of the loss of material due to pitting and crevice corrosion aging effect. LRA Table 3.5.2-1 AMR items associated with table 1 item 3.5.1-52 address stainless steel safety injection system (SIS) sump screens and strainers, reactor cavity seal ring and hatches, cooling tower fill/miss eliminators, condensate storage pool liner plate, refueling water storage pool liner plate, vortex breakers/screens/strainers, and reactor building liner plate exposed to fluid environment. The applicant cited note E, indicating it proposes to use a program other than the GALL Report-recommended program. For these structural components, the applicant stated it will use the Structures Monitoring Program (as opposed to the GALL Report recommendation of a plant-specific program) to manage the aging effect of loss of material for these components.

The staff reviewed the Structures Monitoring Program AMP and noted that the program uses periodic visual inspections to manage applicable aging effects for LRA Table 3.5.2-1 components. For the components that are submerged in a fluid environment, it is not clear how the visual inspections performed under the Structures Monitoring Program will be capable of managing the aging effect of loss of material if the components are submerged in a fluid environment and not accessible for visual inspection.

Request:

State how the Structural Monitoring Program will adequately manage the aging effect of loss of material due to pitting and crevice corrosion for stainless steel components associated with table 3.5.1, item 52 that are exposed to a fluid environment and not accessible for visual inspection.

RAI 3.5.2.2.2.1-1

Background:

Section 54.21(a)(3) of the10 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-LR, an applicant may demonstrate compliance with 10 CFR 54.21(a)(3) by referencing the GALL Report and when evaluation of the matter in the GALL Report applies to the plant.

LRA Section 3.5.2.2.2.1, item 4, associated with LRA Table 3.5.1, item 3.5.1-47, addresses "Concrete (inaccessible areas): exterior above- and below-grade; foundation" of Groups 1- 5 and 7-9 structures exposed to groundwater for aging effects increase in porosity and permeability, and loss of strength due to leaching of calcium hydroxide and carbonation. This LRA section states that WF3 Groups 1-5 and 7-9 concrete structures are designed and constructed in accordance with ACI 318 (1963 and/or 1971 editions) using materials conforming to ACI and ASTM standards (e.g., ASTM C150, Type II for cement, ASTM C33 for aggregate) to produce dense well-cured durable concrete having low permeability consistent with the guidance and recommendations in ACI 201.2R-77. The LRA section further states that below-grade inaccessible concrete areas of Groups 1-5 and 7-9 concrete structures are exposed to groundwater, which is considered equivalent to a flowing water environment, and therefore, increase in porosity and permeability, and loss of strength due to leaching of calcium hydroxide and carbonation is an applicable aging effect for the below-grade inaccessible concrete areas at WF3 that will be managed by the Structures Monitoring Program.

The criteria in SRP-LR Section 3.5.2.2.2.1, item 4, provides that increase in porosity and permeability, and loss of strength due to leaching of calcium hydroxide and carbonation could occur in below-grade inaccessible areas of Group 1-5, and 7-9 concrete structures exposed to "water–flowing" environment. The SRP-LR also states that further evaluation is required if leaching is observed in accessible areas that impact intended functions. The related review procedure in SRP-LR 3.5.3.2.2.1, item 4, and the GALL Report AMR line items associated with SRP-LR Table 3.5.1, item 3.5.1-47, also note that further evaluation is required to determine if a plant-specific aging management program is needed to manage increase in porosity and permeability due to leaching of calcium hydroxide and carbonation of inaccessible concrete areas, and that a plant-specific aging management program is not required if (1) there is evidence in the accessible areas that the flowing water has not caused leaching and carbonation, or (2) evaluation determined that the observed leaching of calcium hydroxide and carbonation in accessible areas has no impact on the intended function of the concrete structure.

GALL Report Table IX.D defines "water-flowing" environment as "Water that is refreshed; thus, it has a greater impact on leaching and can include rainwater, raw water, ground water, or water flowing under a foundation." LRA Table 3.0-2 "Service Environments for Structural Aging Management Reviews" defines "exposed to fluid environment" for structures at WF3 as raw water or treated water, and states that it includes corresponding NUREG-1801 environments: ground water, treated water, treat water > 140^{o}F, water-flowing, and water-standing.

Issue:

In its review of LRA AMP B.1.38 “Structures Monitoring,” the staff noted that the program does not include any plant-specific enhancement to specifically address the aging effects of increase in porosity and permeability, and loss of strength due to leaching of calcium hydroxide and carbonation for inaccessible areas, so it appears that a plant-specific AMP was deemed not necessary. In addition, the further evaluation in LRA Section 3.5.2.2.2.1, item 4, is silent related to the WF3 operating experience with regard to the aging effects of leaching and carbonation at WF3. Contrary to the criteria in the SRP-LR, the applicant did not state it would be using a plant-specific program or a Structures Monitoring Program enhancement and there is no discussion of (1) an evaluation to determine whether there is evidence in the accessible areas that the flowing water has not caused leaching and carbonation; or (2) an evaluation that determined that the observed leaching of calcium hydroxide and carbonation in accessible areas has no impact on the intended function of the concrete structure. Therefore, the staff finds that sufficient information is not provided in the further evaluation in LRA Section 3.5.2.2.2.1, item 4, for the staff to determine if the applicant has met the further evaluation criteria of SRP-LR stated above with regard to whether a plant-specific program is needed to manage the aging effects.

Additionally, in its review of components associated with item 3.5.1-47, the staff also finds that there are no Table 2 aging management review (AMR) line items identified in LRA Tables 3.5.2-1 through 3.5.2-4 for LRA Table 3.5.1, item 3.5.1-47 (and corresponding GALL Report line items) that would indicate that the aging effects will be appropriately managed for the applicable components.

Request:

(1) Address the further evaluation criteria in SRP-LR Section 3.5.2.2.2.1, item 4, described in the “Background Section” and justify whether or not a plant-specific program is necessary to manage the aging effects related to SRP-LR Table 3.5.1, item 47. Provide information describing whether or not WF3 has observed leaching of calcium hydroxide and carbonation in accessible concrete areas subject to a “exposed to fluid environment,” which by definition in LRA Table 3.0-2 includes the applicable GALL Report “water-flowing” environment, its evaluation for impact on intended functions, and demonstrate how it would be adequately managed in inaccessible concrete areas.

(2) Provide justification for not including Table 2 AMR line items in LRA Tables 3.5.2-1 through 3.5.2-4 for LRA Table 3.5.1, item 3.5.1-47 (and corresponding GALL Report line items), which the applicant claimed to be applicable.

RAI 3.5.1.74-1

Background:

Section 54.21 (a)(3) of Title 10 of the Code of Federal Regulations (10 CFR) requires applicants to demonstrate that the effects of aging will be adequately managed so that intended function(s) will be maintained consistent with the current licensing basis (CLB) for the period of extended operation.

For aging management review (AMR) item 3.5.1-74 the Generic Aging Lessons Learned (GALL) Report recommends GALL Report aging management program (AMP) XI.S6, "Structures Monitoring," to manage the aging effect of loss of mechanical function due to corrosion, distortion, dirt, debris, overload and wear for sliding support bearings and surfaces. The GALL Report states that components addressed under AMR item 3.5.1-74 include supports and anchorage for cable trays, conduit, heating, ventilation, and air-conditioning (HVAC) ducts, TubeTrack®, instrument tubing, and non-ASME piping and components; and supports for emergency diesel generator, HVAC system components, and other miscellaneous mechanical equipment.

Issue:

For AMR item 3.5.1-74 in LRA Table 3.5.1, "Containment, Structures and Component Supports, NUREG-1801," the applicant stated that GALL Report AMRs referencing item 3.5.1-74 are associated with Lubrite® plates and "Lubrite® plates are not subject to aging management because the listed aging mechanisms are event driven and typically can be avoided through proper design." Therefore, the applicant stated that the aging effects for these components were not applicable.

The staff disagrees that the aging mechanisms are solely event driven. Even though Lubrite® bearings are characterized as maintenance-free, they can still be subject to the aging effects of loss of material due to wear or corrosion, debris, or dirt that could lead to a loss of intended function if the aging effects are not detected and adequately managed during the period of extended operation (PEO). GALL Report AMP XI.S6 recommends that the potential aging effects for Lubrite® be managed by performing periodic examination under the Structures Monitoring Program. Absent an inspection of Lubrite® plates, it is not clear how the potential aging effects will be identified and adequately managed so that intended function(s) will be maintained consistent with the CLB during the PEO.

Request:

1) Provide additional basis to support the determination that the aging effects of loss of material due to wear or corrosion, debris, or dirt that could lead to a loss of intended function are not applicable to Lubrite® plates and justification for not performing periodic inspections to identify aging effects during the period of extended operation.
2) If it is determined that the components will be inspected, state whether the inspections will be consistent with the GALL Report recommendation for periodic inspection under the Structures Monitoring Program.

RAI 4.6-1

Background:

Section 54.21 (c)(1) of 10 CFR requires the evaluation of time-limited aging analyses (TLAA) to demonstrate that: (i) the analyses remain valid for the period of extended operation, (ii) the analyses have been projected to the end of the period of extended operation; or (iii) the effects of aging on the intended function will be adequately managed for the period of extended operation. Section 4.6 of the SRP-LR states that if a plant's code of record requires a fatigue analysis, then this analysis may be a TLAA and must be evaluated in accordance with 10 CFR 54.21(c)(1) to ensure that the effects of aging on the intended functions are adequately managed for the period of extended operation. SRP-LR acceptance criteria in Section 4.6.2.1.1.1 states that a TLAA is acceptable under 10 CFR 54.21(c)(1)(i) when the existing CUF calculations remains valid because the number of assumed cyclic loads will not be exceeded during the period of extended operation [when compared to the extrapolation to 60 years of operation of the operating transients experienced to date].

License renewal application (LRA) Section 4.6, "Containment Liner Plate, Metal Containments, and Penetrations Fatigue Analysis," states that, as described in FSAR Section 3.6.2.4, penetration bellows are designed for a minimum of 7,000 thermal cycles and 200 design seismic movement (cycles). The LRA Section 4.6 dispositioned the analysis of the penetration bellows in accordance with 10 CFR 54.21(c)(1)(i) by stating that these cycles are "more than what these expansion joints will experience through the period of extended operation."

Issue:

Contrary to the SRP-LR acceptance criteria in Section 4.6.2.1.1.1, LRA Section 4.6 does not include the number of operating transient cycles experienced by the penetrations bellows to date, and their extrapolation to 60 years of operation, to demonstrate that the TLAA analyses meets 10 CFR 54.21(c)(1)(i). The staff requires this information to verify that the number of transients in the existing analyses will not be exceeded during the period of extended operation.

Request:

1. Provide information of the number of transient cycles experienced by the penetration bellows to date, and their extrapolation through the period of extended operation that would demonstrate that the TLAA analyses for the penetration bellows meets the criteria of 10 CFR 54.21(c)(1)(i).

RAI 3.5.2.2.1.5-1

Background:

Section 54.21 (a)(3) of 10 CFR requires applicants to demonstrate that the effects of aging will be adequately managed so that intended functions will be maintained consistent with the current licensing basis for each structure and component subject to aging management review. As described in SRP-LR, an applicant may demonstrate compliance with 10 CFR 54.21(a)(3) by referencing the GALL Report and when evaluation of the matter in the GALL Report applies to the plant.

GALL Report item II.A3.C-13, associated with SRP-LR Table 3.5.1 item 9, addresses cumulative fatigue damage due to fatigue (only if current licensing basis (CLB) fatigue analysis exists) in penetration sleeves and penetration bellows (steel; stainless steel; dissimilar metal welds) exposed to an uncontrolled air-indoor or air-outdoor environment. GALL Report item II.A3.CP-37, associated with SRP-LR Table 3.5.1 item 27, addresses cracking due to cyclic loading (CLB fatigue analysis does not exist) in penetrations sleeves and penetration bellows (steel; stainless steel; dissimilar metal welds) exposed to an uncontrolled air-indoor or air-outdoor environment.

License renewal application (LRA) Table 3.5.1, item 3.5.1-9, states that Waterford 3 is consistent with the GALL Report for containment penetrations that experience significant cyclic loading. LRA Section 3.5.2.2.1.5, associated with Table 3.5.1 item 3.5.1-9, states that the evaluation of fatigue as a TLAA for the penetration bellows is addressed in LRA Section 4.6. The LRA also states that other containment mechanical penetration bellows located outside the containment building have been screened out of scope since they do not perform a pressure boundary function. LRA Table 3.5.1, item 3.5.1-27, also states that Waterford 3 does have a CLB fatigue analysis for penetration bellows, which is evaluated in Section 4.6.

FSAR section 3.8.2.1 describes the different types of containment penetrations (i.e. Type I – VI) and their design characteristics in order to maintain the desired containment integrity. The staff notes that, as described in FSAR section 3.8.2.1, each type of penetration relies on different components (e.g. bellows, flued heads, sleeves) to maintain their intended function.

Issue:

The staff finds that there are no Table 2 AMR line items identified in LRA Tables 3.5.2-1 "Reactor Building – Summary of Aging Management Evaluation" for LRA Table 3.5.1, item 3.5.1-27, that would indicate that the aging effect of cracking due to cyclic loading for penetration sleeves and bellows (CLB fatigue analysis does not exist) will be appropriately managed for the applicable components. Considering the different types of penetrations described in FSAR section 3.8.2.1 and that there are no Table 2 items corresponding to SRP-LR item 3.5.1-27, the staff is not clear why the LRA Table 3.5.2-1 AMR results line item corresponding to Table 1, item 3.5.1-9, does not address penetrations sleeves, and how this component will be adequately managed for cumulative fatigue damage or cracking due to cyclic loading for the period of extended operation.

Request:

1. Clarify how the penetration sleeves will be adequately managed for cumulative fatigue damage through the period of extended operation. Otherwise, provide the technical basis

for not addressing these component(s) in LRA Table 3.5.2-1 AMR results line items corresponding to Table 1, item 3.5.1-9.

2. Provide justification for not including Table 2 AMR line items in LRA Table 3.5.2-1 for SRP-LR Table 3.5.1, item 3.5.1-27, for penetration sleeves to manage cracking due to cyclic loading if CLB fatigue analysis does not exist for the component.

RAI 3.5.1.92-1

Background:

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-LR, an applicant may demonstrate compliance with 10 CFR 54.21(a)(3) by referencing the GALL Report and when evaluation of the matter in the GALL Report applies to the plant.

SRP-LR Table 3.5-1, item 92, recommends that steel support members; welds; bolted connections; support anchorage to building structure exposed to air – indoor, uncontrolled or air – outdoor environment be managed for loss of material due to general and pitting corrosion by the Structures Monitoring program.

Issue:

In LRA Table 3.5.2-4, the applicant used GALL Report identifier III.B2.TP-43 to indicate how it will manage steel fire hose reels exposed to air-indoor, uncontrolled, or air-outdoor environment. The applicant cited generic Note E, to note that it would manage these components using a different program than recommended by the GALL Report. For these structural components, the applicant stated it will use the Fire Water System Program (as opposed to the GALL Report recommendation of the Structures Monitoring Program) to manage the aging effect of loss of material for these components.

The staff noted that the Structures Monitoring Program, which is recommended by the GALL Report, includes periodic visual examinations of these components for loss of material. The staff reviewed the applicant's Fire Water System program and did not identify fire hose reels as components to be managed under that program. It was also not clear what inspection methods will be used and at what periodicity fire hose reels would be inspected to ensure these components are adequately managed for loss of material.

Request:

State how the Fire Water System Program will adequately manage the aging effect of loss of material due to general and pitting corrosion for steel fire hose reels associated with table 3.5.1, item 92 that are exposed to an air-indoor or air-outdoor environment.

RAI 3.5.2.2.2.1-2

Background:

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-LR, an applicant may demonstrate compliance with 10 CFR 54.21(a)(3) by referencing the GALL Report and when evaluation of the matter in the GALL Report applies to the plant.

SRP-LR Table 3.5-1, item 44, recommends that concrete exposed to soil for structures from all groups be managed for cracking and distortion due to increased stress levels from settlement using the Structures Monitoring Program. This line item is associated with several GALL Report items that address this material, environment and aging effect, including GALL Report item III.A1.TP-30 for Group 1 structures. The GALL Report identifies the PWR shield building as a Group 1 structure.

Issue:

In LRA Table 3.5-1, item 3.5.1-44, the applicant stated that all concrete will be managed for the aging effect of cracking and distortion due to increased stress levels from settlement, consistent with GALL Report recommendations. The LRA also states that this item is associated with further evaluation section 3.5.2.2.2.1 item 3, which states that Group 1-3 and 5-9 below-grade inaccessible concrete structures will be managed by the Structures Monitoring Program. LRA Section 3.5.2.2.1.1, associated with LRA Table 3.5.1-1, also credits inspections of the shield building concrete foundation to manage this aging effect for the primary containment foundation (which is integral with the shield building foundation). However, the LRA does not include any "table 2" AMR line items associated with GALL Report item III.A1.TP-30 to manage cracking and distortion due to increased stress levels from settlement for concrete exposed to soil. Since there is no line item for the Group 1 shield building associated with GALL Report item III.A1.TP-30, it is unclear whether the shield building will be managed for this aging effect in accordance with the GALL Report recommendations.

Request:

State whether the concrete shield building foundation exposed to soil will be managed for cracking and distortion due to increased stress levels from settlement and provide any necessary associated "table 2" information. If not, provide supporting justification.

RAI 3.6.2.2.2-1

Background:

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-LR, an applicant may demonstrate compliance with 10 CFR 54.21(a)(3) by referencing the GALL Report, and when evaluation of the matter in the GALL Report applies to the plant.

Section 3.6.2.2.2 of SRP-LR, "Reduced Insulation Resistance due to Presence of Any Salt Deposits and Surface Contamination, and Loss of Material due to Mechanical Wear Caused by Wind Blowing on Transmission Conductors" states that: "Loss of material due to mechanical wear caused by wind blowing on transmission conductors could occur in high-voltage insulators. The GALL Report recommends further evaluation of a plant-specific AMP to ensure that this aging effect is adequately managed."

In LRA 3.6.2.2.2, the applicant references SRP-LR for further evaluation of the above aging mechanisms and effects for high-voltage insulators. Table 3.6.1, line item numbers 3.6.1-2 and 3.6.1-3 identify the component as "High voltage insulators composed of porcelain, malleable iron, aluminum, galvanized steel and cement." The corresponding table 3.6.2 of the LRA for these two items identify the material as "Porcelain, galvanized metal and cement."

Issue:

The staff noted an apparent discrepancy between LRA table 3.6.1 and table 3.6.2 in describing the material used for high-voltage insulators. Table 3.6.2 of the LRA is inconsistent with table 3.6.1 in that it has omitted malleable iron and aluminum from the list of materials that constitute high-voltage insulators. It is not clear whether this apparent discrepancy is based on a plant-specific evaluation that has determined a lack of such material for high-voltage insulators at Waterford 3 or is a result of inadvertent omission.

Request:

Clarify the apparent discrepancy between LRA table 3.6.1 items 3.6.1-2 and 3.6.1-3 and the two corresponding table 3.6.2 items that omitted malleable iron and aluminum from the materials listed for high-voltage insulators.

RAI 3.6.2.2.3-1

Background:

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-LR, an applicant may demonstrate compliance with 10 CFR 54.21(a)(3) by referencing the GALL Report, and when evaluation of the matter in the GALL Report applies to the plant.

Section 3.6.2.2.3 of SRP-LR, "Loss of Material due to Wind Induced Abrasion and Fatigue, Loss of Conductor Strength due to Corrosion, and Increased Resistance of Connections due to Oxidation or Loss of Pre-Load" states that: "Loss of material due to wind induced abrasion and fatigue, loss of conductor strength due to corrosion, and increased resistance of connections due to oxidation or loss of pre-load could occur in transmission conductors and connection, and in switchyard bus and connections. The GALL Report recommends further evaluation of a plant-specific AMP to ensure that this aging effect is adequately managed."

In LRA 3.6.2.2.3, the applicant references SRP-LR for further evaluation of the above aging mechanisms and effects for transmission conductors. Items from Table 3.6-1 of NUREG-1800, incorporated into LRA Table 3.6.1, line items 3.6.1-4 and 3.6.1-7 identify "Transmission conductors composed of aluminum, steel." The corresponding transmission conductor items in table 3.6.2 of the LRA identify the material as "aluminum."

Similarly, LRA table 3.6.1, line item 3.6.1-6, identifies the component as: "Switchyard bus and connections composed of aluminum, copper, bronze, stainless steel, galvanized steel." The corresponding item in table 3.6.2 of the LRA, identifies the material as: "aluminum, steel, steel alloy."

Issue:

The staff noted an apparent discrepancy between LRA table 3.6.1 and table 3.6.2 in describing the material used for transmission conductors. Table 3.6.2 of the LRA is inconsistent with table 3.6.1 in that it has omitted steel from the list of materials that constitute transmission conductors for items corresponding to 3.6.1-4 and 3.6.1-7. It is not clear whether this discrepancy is based on a plant-specific evaluation that determined a lack of such material for transmission conductors at Waterford 3 or is a result of inadvertent omission.

There is also an inconsistency between LRA table 3.6.1 and table 3.6.2 in that copper, bronze and galvanized steel have been omitted from LRA table 3.6.2 for the switchyard bus and connections line item corresponding to 3.6.1-6. It is not clear whether this discrepancy is based on a plant-specific evaluation that determined a lack of such material for switchyard connections at Waterford 3 or is a result of inadvertent omission.

Request:

1. Clarify the apparent discrepancy between LRA tables 3.6.1 and 3.6.2 regarding transmission conductor material.

2. Clarify the discrepancy between LRA tables 3.6.1 and 3.6.2 regarding switchyard bus and connections material.

RAI 3.1.1.88-1

Background:

In the License Renewal Application (LRA) for Waterford, Unit 3, Table 3.1.1, item 3.1.1-88, addresses loss of material due to pitting and crevice corrosion for stainless steel, steel with nickel-alloy or stainless steel cladding, and nickel alloy reactor coolant pressure boundary components exposed to reactor coolant. It is indicated in LRA item 3.1.1-88 that the aging effect is managed by using the Water Chemistry Control – Primary and Secondary Program and the One-Time Inspection Program. The One-Time Inspection Program will verify the effectiveness of the water chemistry program. In addition, LRA Table 3.1.2-4 indicates that LRA item 3.1.1-88 is used to manage loss of material due to pitting and crevice corrosion for steam generator (SG) channel heads and tubesheets.

In relation to its review of LRA item 3.1.1-88, the staff notes that U.S. Nuclear Regulatory Commission (NRC) Information Notice (IN) 2013-20, "Steam Generator Channel Head and Tubesheet Degradation" (Agencywide Documents Access Management System Accession No. ML13204A143), indicates that loss of material due to boric acid corrosion could occur in the steel base material of SG channel heads and tubesheets if the SG cladding is compromised (e.g., due to cracking, manufacturing defects, maintenance, or foreign material impingement damage). Furthermore, NRC IN 2013-20 highlights the importance of performing visual inspections to ensure integrity of the SG channel head, tubesheet, and associated cladding.

The staff is currently finalizing License Renewal Interim Staff Guidance 2016-01, "Changes to Aging Management Guidance for Various Steam Generator Components." This guidance highlights the importance of doing general visual inspections of the SG channel head. These visual inspections offer the opportunity not only to detect loss of material of the SG channel head and tubesheet, but also to detect gross distortion of components such as the divider plate assemblies and potential cracking/degradation of the tube-to-tubesheet welds. Current industry recommendations for performing SG channel head visual inspections are to perform such inspections each time the SG manway is opened for performing tube inspections (which, for Waterford, Unit 3, could be every 72 effective full power months or every third refueling outage, whichever results in more frequent inspections).

Issue:

The LRA does not clearly address which aging management review (AMR) items are used to manage loss of material due to boric acid corrosion for SG channel heads and tubesheets.

Request:

1. Describe the AMR items that are used to manage loss of material due to boric acid corrosion for SG channel heads and tubesheets, including aging management programs. Please discuss whether periodic visual inspections will be performed to ensure integrity of the SG channel heads and tubesheets.

2. Please discuss whether these visual inspections will also be used as part of the management of the possible degradation of the SG tube-to-tubesheet welds and divider plate assemblies (e.g., cracking associated with rust stains or gross distortion of primary side components). If so, please revise the AMR items for SG tube-to-tubesheet welds and

divider plate assemblies associated with LRA item 3.1.1-25 in LRA Table 3.1.2-4, as needed, to reflect these visual inspections.

RAI B.1.37-1

Background:

In the LRA for Waterford, Unit 3, Table 3.1.2-4, it is stated that cracking of the Steam Generator (SG) tubesheet, which is made of carbon steel clad with Alloy 690 and is exposed to treated borated water on the primary side, is managed by the Inservice Inspection Program and Water Chemistry Control – Primary and Secondary Program. LRA Table 3.1.2-4 also indicates that this AMR item is associated with LRA item 3.1.1-45. The primary side of a SG tubesheet is typically inspected by visual inspections as part of the Steam Generator Integrity Program in conjunction with plug visual inspections and possibly through the tube inspections (e.g., the general condition of the tubesheet may be able to be assessed through cameras used to monitor probe insertion into a tube).

Issue:

It is not clear to the staff how cracking of the SG tubesheet is managed by the Inservice Inspection Program rather than by the Steam Generator Integrity Program.

Request:

1. Discuss how degradation (aging) of the SG tubesheet is managed by the Inservice Inspection Program (i.e., list which sections of American Society of Mechanical Engineers Boiler and Pressure Vessel Code, Section XI, “Rules for Inservice Inspection,” are used).

2. If a program other than the Inservice Inspection Program is credited to manage cracking for the SG tubesheet, please revise the AMR items for the component accordingly.

RAI B.1.10-4

Background

1. GALL Report AMP XI.M36, "External Surfaces Monitoring of Mechanical Components," recommends inspections for leakage to identify cracking of stainless steel external surfaces exposed to air environments containing halides.

   LRA Section B.1.10 states that inspection parameters include leakage for detection of cracks on the external surfaces of stainless steel components exposed to an air environment containing halides. LRA Tables 3.3.2-4, 3.3.2-11, 3.3.2-12, 3.3.2-14, 3.3.2-15-6, and 3.4.2-4 contain AMR items for stainless steel components exposed to an outdoor air or condensation external environment and a gaseous, condensation, or indoor air internal environment. Cracking is managed for these components with the External Surfaces Monitoring program.

2. LRA Tables 3.3.2-3 and 3.3.2-13 contain AMR items for aluminum components exposed to an outdoor air or condensation environment that will be managed for cracking using the External Surfaces Monitoring program.

Issue

1. For stainless steel components that have a gaseous, condensation, or indoor air internal environment, it is not clear to the staff how inspections of external surfaces will effectively use leakage as an indicator of cracking.
2. Methods for detecting cracking in aluminum components are not specified in the External Surfaces Monitoring program.

Request

1. State the parameters monitored and the inspection methods that will be used to determine whether cracking is present in the stainless steel components in LRA Tables 3.3.2-4, 3.3.2-11, 3.3.2-12, 3.3.2-14, 3.3.2-15-6, and 3.4.2-4 with a gaseous, condensation, or indoor air internal environment.
2. State the inspection parameters monitored and the inspection methods that will be used to determine whether cracking is present in the aluminum components in LRA Tables 3.3.2-3 and 3.3.2-13.

RAI 4.7.4-1

Background:

LRA Section 4.7.4 provides the applicant TLAA for the aging evaluation of reactor vessel internals (RVI), other than those associated with applicant's metal fatigue TLAA for these components. The applicant identifies that the aging evaluations of irradiation-assisted stress corrosion cracking and loss of fracture toughness due to thermal aging and neutron irradiation embrittlement in its 2003 extended power uprate (EPU) license amendment request are analyses that conform to the definition of a TLAA in 10 CFR 54.3(a). The applicant stated that the implementation of LRA AMP B.1.33, Reactor Vessel Internals Program, will ensure that these TLAAs are acceptable in accordance with 10 CFR 54.21(c)(1))(iii).

The license amendment request for the EPU was submitted on November 3, 2003, and approved in an NRC-issued safety evaluation (SE) dated April 15, 2005 (ML051030068). Section 2.1.4 of the SE identifies that the projected neutron fluences for RVI components in the vicinity of the reactor core will range from 3.0 – 5.0 X 10^{22} n/cm^2 (E > 0.1 MeV) through 40 years of licensed operations.

Issue:

EPRI Report MRP-191 estimates that RVI components in the core shroud would generally have neutron fluences ranging from 1.0 – 5.0 X 10^{22} n/cm^2 through 60 years of licensed operations. The staff needs additional demonstration that the neutron fluence values for these types of RVI components through 60 years of licensed operation will not exceed the fluence estimates for the components in Table 4-7 of the MRP-191 report. Otherwise, the staff will need further assessment of the inspection bases for core shroud assembly components if the 60-year projected fluences for these components will exceed those specified for the components in MRP-191.

Request:

Justify (with a technical explanation) why the projected neutron fluences for RVI core shroud components through 60 years of operations are considered bounded by the fluence estimates for these components in Table 4-7 of the MRP-191 report. Otherwise, clarify what the impact will be on the FMECA assessment for these components and the inspection plan for RVI components if the 60-year neutron fluence value for any RVI core shroud component will exceed the neutron fluence estimate for the component in Table 4-7 of the MRP-191 report.