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10 CFR 54

December 26, 2014 NRC-14-0082

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

References: 1) Fermi 2 NRC Docket No. 50-341 NRC License No. NPF-43

- 2) DTE Electric Company Letter to NRC, "Fermi 2 License Renewal Application," NRC-14-0028, dated April 24, 2014 (ML14121A554)
- NRC Letter, "Requests for Additional Information for the Review of the Fermi 2 License Renewal Application – Set 8 (TAC No. MF4222)," dated November 25, 2014 (ML14322A526)
- Subject:

Response to NRC Request for Additional Information for the Review of the Fermi 2 License Renewal Application – Set 8

In Reference 2, DTE Electric Company (DTE) submitted the License Renewal Application (LRA) for Fermi 2. In Reference 3, NRC staff requested additional information regarding the Fermi 2 LRA. The Enclosure to this letter provides the DTE response to the request for additional information.

One new commitment is being made in this submittal to revise plant procedures to include acceptance criteria for masonry wall inspections that ensure observed aging effects do not invalidate the wall's evaluation basis or impact its intended function. This commitment is added to the LRA as Item 34.1 in Table A.4 as indicated in the response to RAI B.1.25-1.

In addition, a clarification has been made to commitments previously identified in the LRA to specifically indicate the use of the 2002 or later version for Structures Monitoring Program enhancements that reference ACI 349.3R. These revised commitments are in Item 34 in Table A.4 as indicated in the response to RAI B.1.42-3.

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Should you have any questions or require additional information, please contact Lynne Goodman at 734-586-1205.

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

Executed on December 26, 2014

Michel A. Philippon Director Nuclear Production (Plant Manager) For Vito A. Kaminskas

Enclosure: DTE Response to NRC Request for Additional Information for the Review of the Fermi 2 License Renewal Application – Set 8

cc: NRC Project Manager
 NRC License Renewal Project Manager
 NRC Resident Office
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 Michigan Public Service Commission,
 Regulated Energy Division (kindschl@michigan.gov)

Enclosure to NRC-14-0082

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Fermi 2 NRC Docket No. 50-341 Operating License No. NPF-43

DTE Response to NRC Request for Additional Information for the Review of the Fermi 2 License Renewal Application – Set 8

# RAI B.1.25-1

## **Background**

Title 10 of the Code of Federal Regulations (10 CFR) Section 54.21(a)(3) 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 (CLB) during the period of extended operation.

License Renewal Application (LRA) Section B.1.25 states that the Masonry Wall Program is consistent, with enhancements, with GALL Report AMP XI.S5, "Masonry Walls." The "acceptance criteria" program element of GALL Report AMP XI.S5 states that "for 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, during the audit, the staff noted that the "acceptance criteria" program element of the LRA aging management program (AMP) basis document for the Masonry Wall Program states that potential non-conforming conditions identified during the course of an inspection are noted, evaluated, and corrective action taken as necessary. The staff also noted that in Section 4 of the referenced MMR14 procedure, the qualitative criteria for evaluation of inspection results are described in terms of structural function only.

#### <u>Issue</u>

It is not clear that the "acceptance criteria" program element of LRA Section B.1.25, "Masonry Wall," is consistent with the recommendations in GALL Report AMP XI.S5 because this program element does not appear to address the "invalidate evaluation basis" aspect of the acceptance criteria.

#### <u>Request</u>

- 1. Clarify how the acceptance criteria for the inspection of masonry walls are consistent with that described in GALL Report AMP XI.S5. If it is determined that a program enhancement is needed for consistency with GALL Report AMP XI.S5, provide the supporting program enhancement.
- 2. If criteria other than that described in the GALL Report are being used, provide a description of the exception that includes the acceptance criteria and technical basis for its determination.

# **Response:**

1. The Fermi 2 program procedure for masonry walls includes acceptance criteria that ensure observed conditions do not impact the wall's capability to perform its structural functions. This ensures the observed conditions do not invalidate the wall's evaluation basis or impact

its intended function. To clarify that the acceptance criteria for the inspection of masonry walls are consistent with those described in NUREG-1801 Generic Aging Lessons Learned (GALL) Report AMP XI.S5, the "acceptance criteria" for the program described in License Renewal Application (LRA) Section B.1.25, "Masonry Wall," will be revised to address the "invalidate evaluation basis" aspect. This enhancement to the Masonry Wall Program (LRA Sections A.1.25 and B.1.25) is added to the enhancements to the Structures Monitoring Program (LRA Sections A.1.42 and B.1.42). The revisions to the LRA are indicated below.

2. The acceptance criteria, with enhancements, as described in the GALL Report were used.

# LRA Revisions:

LRA Sections A.1.42, A.4, and B.1.42 are revised as shown on the following pages. Additions are shown in underline and deletions are shown in strike-through.

## A.1.42 Structures Monitoring Program

- Revise plant procedures to prescribe quantitative acceptance criteria based on the quantitative acceptance criteria of ACI 349.3R and information provided in industry codes, standards, and guidelines including ACI 318, ANSI/ASCE 11, and relevant AISC specifications. Industry and plant-specific operating experience will also be considered in the development of the acceptance criteria.
- Revise plant procedures to include acceptance criteria for masonry wall inspections that ensure observed aging effects (cracking, loss of material or gaps between the structural steel supports and masonry walls) do not invalidate the wall's evaluation basis or impact its intended function.

# A.4 LICENSE RENEWAL COMMITMENT LIST

No.	Program or Activity	Commitment	Implementation Schedule	Source
34	Structures Monitoring	Enhance Structures Monitoring Program as follows:	Prior to September	A.1.42
		<ul> <li>k. Revise plant procedures to prescribe quantitative acceptance criteria based on the quantitative acceptance criteria of ACI 349.3R and information provided in industry codes, standards, and guidelines including ACI 318, ANSI/ASCE 11, and relevant AISC specifications. Industry and plant-specific operating experience will also be considered in the development of the acceptance criteria.</li> </ul>		
		I. Revise plant procedures to include acceptance criteria for masonry wall inspections that ensure observed aging effects (cracking, loss of material or gaps between the structural steel supports and masonry walls) do not invalidate the wall's evaluation basis or impact its intended function.		

Element Affected	Enhancement assess
6. Acceptance Criteria	Revise plant procedures to prescribe quantitative acceptance criteria based on the quantitative acceptance criteria of ACI 349.3R and information provided in industry codes, standards, and guidelines including ACI 318, ANSI/ASCE 11 and relevant AISC specifications. Industry and plant- specific operating experience will also be considered in the development of the acceptance criteria.
	Revise plant procedures to include acceptance criteria for masonry wall inspections that ensure observed aging effects (cracking, loss of material or gaps between the structural steel supports and masonry walls) do not invalidate the wall's evaluation basis or impact its intended function.

# **B.1.42 STRUCTURES MONITORING**

# RAI B.1.39-1

# 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 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 Report and when evaluation of the matter in the GALL Report applies to the plant.

LRA Section B.1.39, "RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants," which is implemented as part of LRA Section B.1.42, "Structures Monitoring," states that the program is an existing program that, following enhancement, will be consistent with GALL Report AMP XI.S7. The "detection of aging effects" program element of GALL Report AMP XI.S7 states that the program should include provisions for increased inspection frequency if the extent of the degradation is such that the structure or component may not meet its design basis if allowed to continue uncorrected until the next normally scheduled inspection. However, during the AMP audit, the staff noted that the applicant's AMP does not address the provisions for more frequent inspections.

## <u>Issue:</u>

It is not clear that the "detection of aging effects" program element of the Regulatory Guide (RG) 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants Program is consistent with the recommendations in GALL Report AMP XI.S7 regarding provisions for more frequent inspections.

# <u>Request:</u>

- 1. State how the LRA RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants Program is consistent with the GALL Report provision for identifying and addressing the need to increase inspection frequency to adequately manage the effects of aging, during the period of extended operation.
- 2. Otherwise, provide the technical justification for the exception to the GALL Report recommendation.

#### **Response:**

Fermi 2 License Renewal Application (LRA) Section B.1.39, Inspection of Water-Control Structures Associated with Nuclear Power Plants, states that the program is one that requires periodic monitoring and maintenance of water-control structures so that the consequences of age-related deterioration and degradation can be prevented or mitigated in a timely manner. The program is implemented as part of the Structures Monitoring Program (LRA Section B.1.42).

As is stated in LRA Section B.1.42 "Program Description" for Structures Monitoring, inspections are performed at a frequency sufficient to ensure there is no loss of intended function between inspections, and the program will be enhanced to perform inspections at least once every five years. Also as is stated in LRA Section B.1.42, the program <u>already</u> contains provisions for increased inspection frequency and trending of structures and components in accordance with 10 CFR 50.65(a)(1), if the extent of degradation is such that the structure or component may not meet its design basis or, if degradation is allowed to continue uncorrected until the next normally scheduled assessment, the structure may not meet its design basis. This existing provision for increased inspection frequency and trending of structures and components is consistent with the NUREG-1801 Generic Aging Lessons Learned (GALL) Report recommendations for identifying and addressing the need to increase inspection frequency to adequately manage the effects of aging during the period of extended operation. Because this is a provision in the existing Structures Monitoring Program, an additional enhancement was not added to the "detection of aging effects" element in either LRA Section B.1.42 or B.1.39.

# LRA Revisions:

None.

# RAI B.1.39-2

#### Background:

LRA Section B.1.39 states that the RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants Program "performs periodic visual examinations to monitor the water-control structures and structural components, including...steel piles required for the stability of the shore barrier." LRA Table 3.5.2-2, "Water-Control Structures Summary of Aging Management Evaluation," indicates that the Structures Monitoring Program will manage the carbon steel sheet piles for the shore barrier, exposed to air – outdoor or a fluid environment, for loss of material. However, during its onsite audit, thru discussion with the applicant, the staff became aware that the applicant does not plan to perform visual inspections of the submerged steel piles at the shore barrier as described in LRA Section B.1.39.

#### Issue:

For these components identified in the LRA as within the scope of license renewal and subject to an AMR, it is not clear how either the RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants Program or the Structures Monitoring Program will manage loss of material of the "steel piles required for stability of the shore barrier" if visual inspection will not be performed.

#### <u>Request:</u>

Clarify whether the steel piles at the shore barrier will be managed for age-related degradation thru visual inspections as described in the LRA, and if not, describe how the proposed AMP(s) will adequately manage the effects of aging during the period of extended operation.

#### **Response:**

When following the Fermi 2 site surveillance procedure for the shore barrier, if deviations greater than the acceptance criteria given in the procedure are noted during the inspection of the overall shore barrier, a corrective action document is generated and an evaluation of the overall acceptability and functionality of the entire shore barrier structure is performed. Additionally, the site surveillance procedure for the shore barrier requires that steel sheet pile component alignment is visually checked while performing the surveillance if the lake level permits.

The steel sheet pile component of the shore barrier was conservatively included in the License Renewal Application (LRA) as in-scope and subject to aging management review (AMR). However, based on further evaluation and from evidence presented below, the steel sheet pile component of the Fermi 2 shore barrier does not perform a license renewal intended function.

The Fermi 2 Updated Final Safety Analysis Report (UFSAR) Figure 2.4-22 showing the shore barrier configuration in combination with the shore barrier construction specification referenced

in UFSAR Figure 2.4-22 indicate that the stone and fill component of the barrier was installed as a Quality Assurance (QA) Level I safety-related structure while the steel sheet pile was procured and installed as a QA Level III (non-Q) component. The shore barrier drawing also shows that the top of the sheet piling was cut to an elevation of 572'-0" after armor stone placement. This cut elevation is lower than the expected normal mean monthly lake level of 574.4' that is specified on the drawing. The shore barrier construction specification referenced in the UFSAR figure also specifies that the steel sheet piling was installed as a QA Level III component while the rest of the shore barrier is designated as QA Level I and the fact that the shore barrier construction specification states that the steel sheet piling was installed solely to facilitate solely to facilitate shore barrier construction specification states that the sheet piling was installed solely to facilitate solely to facilitate shore barrier construction activities demonstrates that the steel sheet pile is not credited as a structural support for the safety-related shore barrier stones and was only used as a construction aid. The fact that the sheet piling was cut off at an elevation that is below the normal lake water level also shows that the sheet piling was not credited as part of the flood barrier feature.

Fermi 2 LRA Sections A.1.39 and B.1.39 state that the steel sheet piles are required for the stability of the shore barrier. LRA Table 2.4-2 related to scoping and screening methodology for identifying structures and components subject to AMR states that the two intended functions of the steel sheet piles for the shore barrier are "Flood Barrier" and "Support for Criterion (a)(1) equipment." From the evidence presented in the above discussion, the steel sheet piles do not in fact perform either of these two specified intended functions. Therefore, the steel sheet pile component of the shore barrier is not within the scope of license renewal. The LRA will be revised as indicated below.

#### **LRA Revisions:**

LRA Tables 2.4-2, 3.5.1 (item 3.5.1-79), and 3.5.2-2 (and associated plant-specific note 502) and LRA Sections A.1.39 and B.1.39 are revised as shown on the following pages. Additions are shown in underline and deletions are shown in strike-through.

# Table 2.4-2Water-Control StructuresComponents Subject to Aging Management Review

Component	Intended Function <sup>a</sup>
Steel and Other Metals	
Fire protection fuel-oil storage tank support	Support for Criterion (a)(3) equipment
Steel components: beams, columns, plates	Enclosure, protection
	Heat sink
	Support for Criterion (a)(1) equipment
	Support for Criterion (a)(2) equipment
	Support for Criterion (a)(3) equipment
Steel components: monorails	Support for Criterion (a)(2) equipment
Steel sheet piles for shore barrier	Flood barrier
	Support for Criterion (a)(1) equipment

Table 3.5.1 Structures and Component Supports									
ltem Number	Component	Aging Effect/ Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion				
3.5.1-78	Steel components: fuel pool liner	Cracking due to stress corrosion cracking; Loss of material due to pitting and crevice corrosion	Water Chemistry and Monitoring of the spent fuel pool water level in accordance with technical specifications and leakage from the leak chase channels.	No, unless leakages have been detected through the SFP liner that cannot be accounted for from the leak chase channels	Consistent with NUREG- 1801. The Water Chemistry Control – BWR Program and monitoring of the spent fuel pool water level in accordance with technical specifications and leakage from the leak chase channels manages the listed aging effects.				
3.5.1-79	Steel components: piles	Loss of material due to corrosion	Structures Monitoring Program	No	Consistent with NUREG- 1801. The Structures Monitoring Program manages the listed aging effect. The steel piles at Fermi 2 do not perform a license renewal intended function and therefore do not require an aging management program.				
3.5.1-80	Structural bolting	Loss of material due to general, pitting and crevice corrosion	Structures Monitoring Program	No	Consistent with NUREG- 1801. The Structures Monitoring Program manages the listed aging effect.				

# Notes for Table 3.5.2-1 through 3.5.2-4

#### Generic Notes

- A. Consistent with component, material, environment, aging effect and aging management program listed for NUREG-1801 line item. AMP is consistent with NUREG-1801 AMP description.
- B. Consistent with component, material, environment, aging effect and aging management program listed for NUREG-1801 line item. AMP takes some exceptions to NUREG-1801 AMP description.
- C. Component is different, but consistent with material, environment, aging effect, and aging management program for NUREG-1801 line item. AMP is consistent with NUREG-1801 AMP description.
- D. Component is different, but consistent with material, environment, aging effect, and aging management program for NUREG-1801 line item. AMP takes some exceptions to NUREG-1801 AMP description.
- E. Consistent with NUREG-1801 material, environment, and aging effect but a different aging management program is credited or NUREG-1801 identifies a plant-specific aging management program.
- F. Material not in NUREG-1801 for this component.
- G. Environment not in NUREG-1801 for this component and material.
- H. Aging effect not in NUREG-1801 for this component, material and environment combination.
- I. Aging effect in NUREG-1801 for this component, material and environment combination is not applicable.
- J. Neither the component nor the material and environment combination is evaluated in NUREG-1801.

#### Plant-Specific Notes

- 501. The drywell support skirt is embedded in the concrete of the reactor pedestal and is similar to concrete reinforcing environment. Therefore, this component aging is addressed by the surrounding concrete aging management program.
- 502. Because steel piles driven into undisturbed soils are unaffected by corrosion and because steel piles driven into disturbed soils have experienced only minor to moderate corrosion that does not significantly affect continued safety function performance during the license renewal term, no aging management is required.

# Table 3.5.2-2Water-Control StructuresSummary of Aging Management Review

Table 3.5.2-2: Water-Control Structures									
Structure and/or Component or Commodity	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG- 1801 Item	Table 1 Item	Notes	
Steel components: monorails	SNS	Carbon steel	Air – indoor uncontrolled	Loss of material	RG 1.127	III.A6.TP- 221	3.5.1-83	С	
Steel sheet piles for shore barrier	FLB, SSR	Garbon steel	Air – outdoor	Loss of material	Structures Monitoring	HLA3.TP- 302	<del>3.5.1-77</del>	A	
Steel sheet piles for shore barrier	FLB, SSR	<del>Carbon</del> steel	Exposed-to fluid environment	Loss of material	Structures Monitoring	<del>III.A3.TP-</del> <del>219</del>	<del>3.5.1-79</del>	A	
Steel sheet piles for shore barrier	FLB, SSR	<del>Carbon</del> steel	Soil	None	None			<del>l, 502</del>	
Beams, columns and floor slabs	EN, FLB, HS, MB, SNS, SRE, SSR	Concrete	Air – indoor uncontrolled	Cracking, loss of bond, and loss of material (spalling, scaling)	RG 1.127	III.A6.TP- 38	3.5.1-59	A	

#### A.1.39 <u>RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power</u> <u>Plants Program</u>

Fermi 2 is not committed to the requirements of NRC Regulatory Guide (RG) 1.127, "Inspection of Water-Control Structures Associated with Nuclear Power Plants." However, the program at Fermi 2 was developed based on guidance provided in the NRC RG 1.127, Revision 1, and provides an inservice inspection and surveillance program for the Fermi 2 shore barrier and raw water-control structures associated with emergency cooling water systems or flood protection. The scope of the Fermi 2 program includes water-control structures within the scope of license renewal as delineated in 10 CFR 54.4. The program performs periodic visual examinations to monitor the condition of water-control structures and structural components, including structural steel and structural bolting associated with water-control structures, steel piles required for the stability of the shore-barrier, and miscellaneous steel associated with these structures. The program addresses age-related deterioration, degradation due to extreme environmental conditions, and the effects of natural phenomena that may affect water-control structures so that the consequences of age-related deterioration and degradation can be prevented or mitigated prior to loss of intended function. The program will be implemented as part of the Structures Monitoring Program (Section A.1.42).

# B.1.39 RG 1.127, INSPECTION OF WATER-CONTROL STRUCTURES ASSOCIATED WITH NUCLEAR POWER PLANTS

#### **Program Description**

Fermi 2 is not committed to the requirements of NRC RG 1.127, "Inspection of Water-Control Structures Associated with Nuclear Power Plants." However, the program at Fermi 2 was developed based on guidance provided in NRC RG 1.127, Revision 1, and provides an inservice inspection and surveillance program for the Fermi 2 slopes, channels and raw watercontrol structures associated with emergency cooling water systems or flood protection. The scope of the Fermi 2 program includes water-control structures within the scope of license renewal as delineated in 10 CFR 54.4. The program performs periodic visual examinations to monitor the condition of water-control structures and structural components, including structural steel and structural bolting associated with water-control structures, steel piles required for the stability of the shore barrier, and miscellaneous steel associated with these structures. The Fermi 2 program addresses age-related deterioration, degradation due to extreme environmental conditions, and the effects of natural phenomena that may affect water-control structures. The program requires periodic monitoring and maintenance of water-control structures so that the consequences of age-related deterioration and degradation can be prevented or mitigated in a timely manner. The program will be implemented as part of the Structures Monitoring Program (Section B.1.42).

# RAI B.1.42-1

# 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 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 Report and when evaluation of the matter in the GALL Report applies to the plant.

LRA Sections B.1.42, "Structures Monitoring," B.1.22, "Inservice Inspection-IWF," and B.1.12, "Containment Inservice Inspection-IWE," state that the programs are existing programs that, following enhancement, will be consistent with GALL Report AMPs XI.S6, XI.S3, and XI.S1. The "preventive actions," "parameters monitored or inspected," and "detection of aging effects" program elements of GALL Report AMP XI.S6, XI.S3, and XI.S1, as applicable, explicitly address the aging management of ASTM A325, ASTM F1852, and ASTM A490 structural bolting. However, during the AMP audit, the staff reviewed the LRA AMPs basis documents for the Structures Monitoring Program, Inservice Inspection-IWF, and Containment Inservice Inspection-IWE, and noted that the program elements, with enhancements, address ASTM A325 and A490 bolting, but made no mention of ASTM F1852 bolting.

#### <u>Issue:</u>

It is not clear that the "preventive actions," "parameters monitored or inspected," and "detection of aging effects" program elements of LRA Section B.1.42; "preventive actions," and "detection of aging effects" program elements of LRA Section B.1.22; and the "preventive actions" program element of LRA Section B.1.12 are consistent with the recommendations in GALL Report AMPs XI.S6, XI.S3, and XI.S1, because there was no mention of ASTM F1852 bolting.

#### <u>Request:</u>

- 1. State whether ASTM F1852 structural bolting is used in Fermi 2 structures and is within the scope of license renewal.
- 2. If ASTM F1852 structural bolting is within the scope of license renewal, state how the effects of aging will be adequately managed for the period of extended operation.

# **Response:**

ASTM F1852 bolts are twist-off type tension control structural bolt/nut/washer assemblies. The Fermi 2 plant does <u>not</u> use ASTM F1852 structural bolting. This was verified by reviewing site structural steel specifications, site bolting and torquing procedures, the site WebARMS document

search system, the site materials management system, and the site nuclear inventory system (for inventory and purchasing history of such bolts).

Additionally, plant personnel in the Material Engineering Group (MEG), Plant Support Engineering (PSE – the design authority), and Nuclear Engineering were consulted as to the use of this type of bolt in the plant. Among those consulted, there is no knowledge of the use of this type of bolt anywhere in the plant.

As demonstrated above, ASTM F1852 structural bolting is not used at the Fermi 2 plant and is therefore not included in the Structures Monitoring Program in License Renewal Application (LRA) Section B.1.42.

**LRA Revisions:** 

None.

#### RAI B.1.42-2

#### 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 will be maintained consistent with the 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 Report and when evaluation of the matter in the GALL Report applies to the plant.

GALL Report AMPs XI.S6 and XI.S7 address the detection of aging effects for inaccessible, below-grade concrete structural elements, which depends on the plant's specific ground water/soil condition. For plants with non-aggressive ground water/soil, the programs recommend: (a) evaluating the acceptability of inaccessible areas when conditions exist in accessible areas that could indicate the presence of, or result in, degradation to such inaccessible areas and (b) examining representative samples of the exposed portions of the below grade concrete, when excavated for any reason. For plants with aggressive ground water/soil (pH < 5.5, chlorides > 500 ppm, or sulfates > 1500 ppm) and/or where the concrete structural elements have experienced degradation, the GALL Report recommends a plant specific AMP to manage the concrete aging effects during the period of extended operation.

During the audit, the staff noted that the LRA AMP basis document indicates that the Fermi 2 concrete structures are subjected to an aggressive ground water/soil environment. The staff also noted that in updated final safety analysis report (UFSAR) Table 2.5-16, "Chemical Analysis of Ground Water," the ground water tested in Fermi 2 had sulfate content above the 1500 ppm limit stated in the GALL Report for aggressive groundwater.

#### Issue:

LRA Section B.1.42, Structures Monitoring," states that the program is an existing program that, following enhancement, will be consistent with GALL Report AMPs XI.S6 and XI.S7. However, the proposed enhancement to the "Structures Monitoring" does not appear to be consistent with the GALL Report recommendations for an aggressive water/soil environment. Additional information is requested to verify consistency with the GALL Report for the detection of aging effects in inaccessible, below-grade concrete structural elements exposed to an aggressive ground water/soil environment.

#### Request:

1. Clarify how the enhancement for the "detection of aging effects" program element is consistent with that described in the GALL Report AMPs XI.S6 and XI.S7 for inaccessible areas exposed to aggressive ground water/soil.

2. If criteria other than that described in the GALL Report are being used, provide the basis to justify the adequacy of the proposed exception to manage the aging effects in inaccessible areas.

#### **Response:**

 The NUREG-1801 Generic Aging Lessons Learned (GALL) Report Sections XI.S6 and XI.S7 state that for plants with aggressive groundwater/soil (pH<5.5, chlorides >500 ppm, or sulfates > 1500 ppm) and/or where the concrete structural elements have experienced degradation, a plant-specific aging management program (AMP) accounting for the extent of the degradation experienced should be implemented to manage the concrete aging during the period of extended operation for inaccessible below-grade concrete structural elements.

The Fermi 2 License Renewal Application (LRA) Section B.1.42 "Structures Monitoring" enhancement for the "Detection of Aging Effects" states (as modified in the response to RAI 3.5.2.2.1-1 in letter NRC-14-0070 dated October 24, 2014):

"If normally inaccessible areas become accessible due to plant activities, an inspection of these areas shall be conducted. Additionally, inspections will be performed of inaccessible areas in environments where observed conditions in accessible areas indicate that significant degradation may be occurring in the inaccessible areas."

Fermi 2 LRA Table 3.5.1 "Structures and Component Supports" item number 3.5.1-67 is the item that is consistent with the component type and aging effect/mechanism that are discussed in this RAI. The item 3.5.1-67 component is "concrete" and aging effect/mechanism is "Increase in porosity and permeability; cracking; loss of material (spalling, scaling) due to aggressive chemical attack."

The 3.5.2-X tables within the Fermi 2 LRA represent the "Summary of Aging Management Evaluation" for the various structures on site. Cross-referencing the 3.5.1-67 item mentioned above within these 3.5.2-X tables, it can be seen that each resulting item contains the same Material (Concrete) and the same Aging Effect Requiring Management (Increase in porosity and permeability, cracking, loss of material (spalling, scaling)). The one parameter that varies in the 3.5.2-X tables is the Environment in which the concrete is experiencing the same aging effect. It is recognized in the 3.5.2-X tables that concrete above-grade (accessible areas) exposed to an air-outdoor environment experiences the same aging effect requiring management as concrete below-grade (inaccessible areas) exposed to a soil environment. It is also recognized that Table 3.0-2 of the LRA defines air-outdoor as being an environment that may contain aggressive chemical species including chlorides, oxygen, halides, sulfates, or other aggressive corrosive substances that can influence the nature, rate, and severity of corrosion effects. The fact that the accessible concrete exposed to air-outdoor experiences the same aging effect requiring management as the inaccessible concrete exposed to a soil environment provides additional supporting evidence that performing inspections of these accessible areas provides an indication of the condition of the inaccessible structure. This is consistent with the enhancement.

DTE reviewed site operating experience (OE), including corrective action program documents and Structures Monitoring Program findings, and observations from recent site modifications (fire protection valve excavations, Emergency Diesel Generator (EDG) feeder cable mod excavations, Independent Spent Fuel Storage Installation (ISFSI) transfer pad excavations, buried pipe inspection excavations) where inaccessible below-grade concrete structural elements became accessible. No instances of structural degradation of below-grade normally inaccessible concrete structures or accessible structures exposed to the same environment/aging effect were identified that indicate that there is significant degradation of the below-grade inaccessible concrete structures exposed to soil / groundwater. This OE indicates that the Structures Monitoring Program at Fermi 2, with enhancements, is consistent with GALL Report Section XI.S6 and is adequate to manage the effects of aging on inaccessible concrete exposed to groundwater.

The Structures Monitoring Program described in LRA Section B.1.42 is appropriate to serve as the plant-specific aging management program accounting for the extent of degradation experienced on concrete structural elements exposed to groundwater at Fermi 2. This is consistent with the recommendations for detection of aging effects in the GALL Report Sections XI.S6 and XI.S7.

2. Criteria other than that described in the GALL Report are not being used.

#### LRA Revisions:

None.

# RAI B.1.42-3

## 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 will be maintained consistent with the 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 Report and when evaluation of the matter in the GALL Report applies to the plant.

LRA Section B.1.42, "Structures Monitoring," states that the program is an existing program that, following enhancement, will be consistent with GALL Report AMP XI.S6. LRA Section B.1.42 includes enhancements to the "parameters monitored or inspected," "detection of aging effects," and "acceptance criteria" program elements to revise procedures to meet the guidelines provided in American Concrete Institute Standard (ACI) 349.3R, to demonstrate consistency with the GALL Report. During the audit, the staff noted that the program basis document references the 1996 edition of ACI 349.3R. However, the staff notes that GALL Report. AMP XI.S6 is based on, and references, the 2002 edition of ACI 349.3R.

#### Issue:

Based on the deviation in edition of the referenced ACI 349.3R industry standard, it is not clear that LRA AMP B.1.41 is consistent with GALL Report AMP XI.S6. Substantive differences exist between the versions, particularly the requirements for qualifications of personnel. The staff notes that the program enhancements do not reference a specific version; however, the reference to the 1996 version of ACI 349.3R introduces potential inconsistencies with the GALL Report AMP XI.S6 recommendations.

#### Request:

- 1. Describe how inconsistencies between the ACI 349.3R version referenced in the program basis document and the GALL Report are being addressed to demonstrate consistency with the GALL Report recommendations.
- 2. Otherwise, provide technical justification for the exception to the GALL Report recommendations.

#### **Response:**

 The intent of not referencing a specific version of American Concrete Institute (ACI) 349.3R in the program basis document is to allow for the use of the latest version of ACI 349.3R during development of program implementing procedures. During review of the Fermi 2 Structures Monitoring Program against the program description in NUREG-1801 Generic Aging Lessons Learned (GALL) Report Section XI.S6, the provisions of the 2002 version of

ACI 349.3R were considered to assess consistency with the NUREG-1801 aging management program. For clarification, the Fermi 2 Structures Monitoring Program enhancements referencing ACI 349.3R will be revised to specifically indicate use of the 2002 or later version. The revisions to the License Renewal Application (LRA) are indicated below.

2. There are no exceptions being taken to the GALL Report recommendations.

#### LRA Revisions:

LRA Sections A.1.42, A.4, and B.1.42 are revised as shown on the following pages. Additions are shown in underline and deletions are shown in strike-through.

#### A.1.42 Structures Monitoring Program

- Revise plant procedures to include the following parameters to be monitored or inspected:
  - For concrete structures, base inspections on quantitative requirements of industry codes (i.e., ACI 349.3R-02 or later), standards and guidelines (i.e., ASCE 11) and consideration of industry and plant-specific operating experience.
- Revise plant procedures to include the following for detection of aging effects:
  - Personnel (Inspection Engineer and Program Administrator or Responsible Engineer) involved with the inspection and evaluation of structures and structural components, including masonry walls and water-control structures, meet the qualifications guidance identified in ACI 349.3R<u>-02 or later</u>.
- Revise plant procedures to prescribe quantitative acceptance criteria based on the quantitative acceptance criteria of ACI 349.3R-02 or later and information provided in industry codes, standards, and guidelines including ACI 318, ANSI/ASCE 11, and relevant AISC specifications. Industry and plant-specific operating experience will also be considered in the development of the acceptance criteria.

# A.4 LICENSE RENEWAL COMMITMENT LIST

No.	Program or Activity	Commitment	Implementation Schedule	Source
34	Structures Monitoring	Enhance Structures Monitoring Program as follows:	Prior to September 20, 2024	A.1.42
		g. Revise plant procedures to include the following parameters to be monitored or inspected:		
		<ul> <li>For concrete structures, base inspections on quantitative requirements of industry codes (i.e., ACI 349.3R-02 or later).</li> </ul>		
		standards and guidelines (i.e., ASCE 11) and consideration of industry and plant-specific operating experience.		
			2 	
		<ol> <li>Revise plant procedures to include the following for detection of aging effects:</li> </ol>	4.	
		• Personnel (Inspection Engineer and Program Administrator or Responsible Engineer) involved with the inspection and evaluation of structures and structural components, including masonry walls and water-control structures, meet the qualifications guidance identified in ACI 349.3R-02 or later.		
		<ul> <li>Revise plant procedures to prescribe quantitative acceptance criteria based on the quantitative acceptance criteria of ACI 340 3P 02 or later and information provided in industry acdea</li> </ul>		
		standards, and guidelines including ACI 318, ANSI/ASCE 11, and relevant AISC specifications. Industry and plant-specific operating experience will also be considered in the development of the		

#### **B.1.42 STRUCTURES MONITORING**

#### Program Description

The Structures Monitoring Program provides for aging management of structures and structural components, including structural bolting, within the scope of license renewal. The program was developed based on guidance in RG 1.160, Revision 2, "Monitoring the Effectiveness of Maintenance at Nuclear Power Plants," and NUMARC 93-01, Revision 2, "Industry Guidelines for Monitoring the Effectiveness of Maintenance at Nuclear Power Plants," to satisfy the requirement of 10 CFR 50.65, "Requirements for Monitoring the Effectiveness of Maintenance at Nuclear Power Plants." The scope of the Structures Monitoring Program includes structures within the scope of license renewal as delineated in 10 CFR 54.4. The scope of the program also includes the condition monitoring of masonry walls and water-control structures as described in the Masonry Wall Program (Section B.1.25) and in the NRC RG 1.127, "Inspection of Water-Control Structures Associated with Nuclear Power Plants," aging management program (Section B.1.39).

The structures and structural components are inspected by qualified personnel. Concrete structures are inspected for indications of deterioration and distress, using guidelines provided in ACI 201.1R, "Guide for Making a Condition Survey of Existing Buildings," and ACI 349.3R-02 or later, "Evaluation of Existing Nuclear Safety-Related Concrete Structures." Masonry walls are inspected for cracking. Elastomers will be monitored for hardening, shrinkage and loss of sealing. Rock/stone embankment structures will be inspected for loss of material and loss of form. Component supports will be inspected for loss of material and loss of capacity due to local concrete degradation. Exposed surfaces of bolting are monitored for loss of material and loss of material and loss or missing nuts and bolts. The program is augmented by plant procedures to ensure that the selection of bolting material, installation torque or tension, and the use of lubricants and sealants are appropriate for the intended purpose. These procedures will be enhanced to include the guidance of NUREG-1339 and EPRI TR-104213, NP-5067, and NP-5769 to ensure proper specification of bolting material, lubricant, and installation torque.

# **B.1.42 STRUCTURES MONITORING**

Element Affected	Enhancement
3. Parameters Monitored or Inspected	<ul> <li>Revise plant procedures to include the following parameters to be monitored or inspected:</li> <li>For concrete structures, base inspections on quantitative requirements of industry codes (i.e., ACI 349.3R-02 or later), standards and guidelines (i.e., ASCE 11) and consideration of industry and plant-specific operating experience.</li> </ul>
4. Detection of Aging Effects	<ul> <li>Revise plant procedures to include the following:         <ul> <li>Personnel (Inspection Engineer and Program Administrator or Responsible Engineer) involved with the inspection and evaluation of structures and structural components, including masonry walls and water-control structures, meet the qualifications guidance identified in ACI 349.3R-02 or later.</li> </ul> </li> </ul>
6. Acceptance Criteria	Revise plant procedures to prescribe quantitative acceptance criteria based on the quantitative acceptance criteria of ACI 349.3R <u>-02 or later</u> and information provided in industry codes, standards, and guidelines including ACI 318, ANSI/ASCE 11 and relevant AISC specifications. Industry and plant-specific operating experience will also be considered in the development of the acceptance criteria.

# RAI B.1.42-4

#### 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 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 Report and when evaluation of the matter in the GALL Report applies to the plant.

LRA Section B.1.39, "RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants," which is implemented by the applicant as part of LRA Section B.1.42, "Structures Monitoring," states that the programs are existing programs that, following enhancement, will be consistent with GALL Report AMPs XI.S6 and XI.S7. The "parameters monitored or inspected," "detection of aging effects," and "acceptance criteria" program elements of GALL Report AMPs XI.S6 and XI.S7, explicitly address the aging management of high-strength (measured yield strength  $\geq$  150 ksi) structural bolts greater than 1 inch in diameter. The GALL Report recommends that visual inspections of high-strength structural bolts be supplemented with volumetric or surface examinations to detect cracking.

Based on a review of information in the LRA and provided during the AMP audit, the staff noted that sufficient information was not provided to determine whether high-strength structural bolts (other than ASTM A325, F1852, and A490 used in civil structures) are used in the structures and how stress corrosion cracking (SCC) will be managed by the AMP(s).

#### Issue:

It is not clear if there are high strength structural bolts used in Fermi 2 structures (other than ASTM A325, F1852, and A490 used in civil structures) and, if used, whether the "preventive actions," "parameters monitored or inspected," and "detection of aging effect" program elements of LRA Sections B.1.42 and B.1.39 are consistent with the recommendations in GALL Report AMPs XI.S6 and XI.S7 regarding the provision to monitor for stress corrosion cracking in high strength structural bolts greater than 1 inch in diameter through supplemental volumetric or surface examinations to detect cracking.

#### Request:

- 1. State whether high-strength (measured yield strength  $\geq 150$  ksi) structural bolts greater than 1 inch in diameter are used in Fermi 2 structures (including those within the scope of the Structures Monitoring Program and RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants Program).
- 2. If high-strength structural bolts greater than 1 inch in diameter are used (other than ASTM A325, F1852, and A490 used in civil structures), state how the "preventive actions,"

> "parameters monitored or inspected," and "detection of aging effects" program elements are consistent with the GALL Report recommendations to monitor for SCC through supplemental volumetric or surface examinations.

#### **Response:**

High-strength (measured yield strength greater than or equal to 150 ksi) structural bolts greater than 1 inch in diameter are <u>not</u> used in Fermi 2 structures within the scope of the Structures Monitoring Program and RG 1.127 Program with the exception of identified high-strength bolting utilized in the drywell stabilizer assembly with a diameter of 1-3/8". These 1-3/8" diameter bolts are type ASTM A325 bolting. As is identified in the NUREG-1801 Generic Aging Lessons Learned (GALL) Report, bolting type ASTM A325 used in civil structures is one of the material types not prone to stress corrosion cracking (SCC) and is therefore excluded from SCC supplemental monitoring.

Therefore, DTE has identified no high-strength structural bolts greater than 1 inch in diameter (other than ASTM A325, F1852, and A490) that have been utilized in structural applications in structures within the scope of the Structures Monitoring Program and RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants Program.

LRA Revisions:

None.

# RAI 3.5.2.2.2.2-1

# 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 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 Report and when evaluation of the matter in the GALL Report applies to the plant.

SRP-LR Section 3.5.2.2.2.2 addresses reduction of strength and modulus of concrete structures due to elevated temperatures and states that the GALL Report recommends further evaluation of a plant-specific program if any portion of the safety-related and other concrete structures exceeds temperature limits of more than 150 degrees Fahrenheit (°F) for general areas and more than 200°F for local areas. The SRP-LR also states that higher temperatures may be allowed if tests and/or calculations are provided to evaluate the reduction in strength and modulus of elasticity and these reductions are applied to the design calculations.

LRA Table 3.5.1, item 48, states that reduction of strength and modulus due to elevated temperatures do not require aging management for Fermi 2 Group 1-5 concrete structures. However, the further evaluation, LRA Section 3.5.2.2.2.2, states that the Structures Monitoring Program manages this aging effect for the main steam tunnel in the turbine building since the general temperature in this area exceeds 150°F during normal operation.

#### Issue:

Based on the information provided in the LRA, it is not clear how the Structures Monitoring Program is adequate to manage the "changes in material properties" due to elevated temperatures for Fermi 2 Group 1-5 concrete structures, and/or whether a reduction in strength and modulus of elasticity where applied to the design calculations based on tests and/or calculations that evaluates these reductions due to the elevated temperatures.

#### Request:

- 1. State whether a reduction in strength and modulus of elasticity was applied in the design calculations of Fermi 2 Group 1-5 concrete structures exposed to general area temperatures above 150°F or local area temperatures above 200°F.
- 2. If a reduction in strength and modulus of elasticity was not applied in the design calculations, explain how the Structures Monitoring Program will adequately manage this aging effect.

# **Response:**

- 1. A reduction in strength and modulus of elasticity was <u>not</u> applied in the design calculations of Fermi 2 Group 1-5 concrete structures exposed to general area temperatures above 150°F or local area temperatures above 200°F.
- 2. The Structures Monitoring Program will adequately manage the aging effect of reduction of strength and modulus of elasticity due to elevated temperature. The specific aging effects addressed are loss of material, cracking and change in material properties. The parameter monitored by the Structures Monitoring Program to manage reduction of strength and modulus of elasticity is the condition of the exposed concrete surface. Acceptance criteria include the absence of spalling, cracking, and other physical damage, consistent with the parameters identified in American Concrete Institute (ACI) 349.3R-02 for concrete degradation due to thermal exposure. Failure to meet the acceptance criteria is cause for documenting the condition in DTE's corrective action program for further evaluation, which may include other examination. In order to clarify that Group 1-5 concrete structures are not exposed to temperatures that exceed the threshold, with the exception of the main steam tunnel, and that the Structures Monitoring Program will manage reduction of strength and modulus due to elevated temperature for the main steam tunnel in the turbine building, the License Renewal Application (LRA) will be revised as indicated below. Note that LRA Table 3.5.2-3 does already indicate that the Structures Monitoring Program is used to manage this aging effect for the main steam tunnel (pipe tunnel).

# LRA Revisions:

LRA Table 3.5.1 (item 3.5.1-48) is revised as shown on the following page. Additions are shown in underline and deletions are shown in strike-through.

Table 3.5.	1: Structures	and Component S	upports		
ltem Number	Component	Aging Effect/ Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.5.1-48	Group 1-5: concrete: all	Reduction of strength and modulus due to elevated temperature (>150°F general; >200°F local)	A plant-specific aging management program is to be evaluated.	Yes, if temperature limits are exceeded	Listed aging effects do not require management at Fermi 2. Fermi 2 concrete in areas for this grouping are not exposed to temperatures that exceed the thresholds, with the exception of the main steam tunnel of the turbine building. For the main steam tunnel, the Structures Monitoring Program manages this aging effect. For further evaluation, see Section 3.5.2.2.2.2.

#### RAI 3.5.1.83-1

#### 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 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 Report and when evaluation of the matter in the GALL Report applies to the plant.

LRA Table 3.5.2-4 identifies stainless steel anchor bolts exposed to a fluid environment for water-control structures as "Note A" to indicate that this item is consistent with the GALL Report item III.A6.TP-221. However, GALL Report item III.A6.TP-221 addresses steel structural bolting when exposed to several environments.

Per the material definition in GALL Report Chapter IX.C, stainless steel is considered a different category from the steel category. These two material categories exposed to certain environments may experience different aging effects/mechanism. The GALL Report states that cracking due to SCC can occur in austenitic stainless steel at ambient temperature if there is a harsh environment, at temperatures above 140°F (60 degrees Celsius), or where an environment with stagnant, oxygenated borated water systems is present. LRA Table 3.5.2-4 indicates that the stainless steel anchor bolts are exposed to a fluid environment and states that the aging effect requiring management is loss of material. However, the LRA environment description for "Exposed to Fluid Environment" corresponds to a broad list of environment types that includes environments with treated water and/or treated water with temperature above 140°F which makes a stainless steel material susceptible to SCC.

#### Issue:

Based on the information in the LRA, it is not clear if the stainless steel anchor bolts listed in LRA Table 3.5.2-4 are exposed to an environment conducive to SCC.

#### Request:

- 1. Describe the fluid environment to which these anchor bolts are exposed including temperature and water chemistry.
- 2. If the anchor bolts are in an environment conducive to SCC, state how the RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants AMP will adequately manage this aging effect.

#### **Response:**

 The fluid environment to which the stainless steel anchor bolts listed in License Renewal Application (LRA) Table 3.5.2-4 are exposed is water from Lake Erie described as raw water in LRA Table 3.0-2. The temperature of this water is < 140°F. In general, the evaluation of aging effects in the LRA assumes that Lake Erie water has similar water chemistry as the groundwater. In this case, based on a water quality study performed over a one year period from 2008 to 2009 (Table 2 of ML093380411), the following key water chemistry parameters of the Lake Erie water are utilized for the evaluation of aging effects.

pH:	7.57 to 8.88
Chlorides:	18.1 to 38.0 ppm
Sulfate:	28.3 to 32.5 ppm
Sodium:	9.75 to 20.6 ppm
Calcium:	33.5 to 41.9 ppm
Magnesium:	9.09 to 11.5 ppm

2. The stainless steel anchor bolts listed in LRA Table 3.5.2-4, exposed to fluid environment, are not in an environment conducive to stress corrosion cracking (SCC). Consistent with NUREG-1801 Generic Aging Lessons Learned (GALL) Report Chapter IX, Section D, SCC at temperatures less than 140°F (60°C) is not expected in the absence of a harsh environment (significant presence of halogens, specifically chlorides).

SCC of these stainless steel anchor bolts is not credible at temperatures below 140°F (60°C) because they are not exposed to an environment with a significant presence of contaminants, specifically chlorides. The normal operating temperature of the fluid environment to which these anchor bolts are exposed is less than the SCC threshold temperature of 140°F. Therefore, cracking due to SCC is not an aging effect requiring management for the stainless steel anchor bolts exposed to fluid environment.

# LRA Revisions:

None.

RAI 3.5.2.3.2-1

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 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 Report and when evaluation of the matter in the GALL Report applies to the plant.

LRA Table 3.5.2-2, states that asbestos cement board exposed to a fluid environment in watercontrol structures will be managed for loss of material by the RG 1.127, Inspection of Water Control Structures Associated with Nuclear Power Plants Program. LRA Table 3.0-2 describes the fluid environment for structures at Fermi 2 as either raw water or treated water with various temperatures.

GALL Report Table IX.C describes asbestos cement as a cementitious material and defines it as any material having cementing properties, which contributes to the formation of hydrated calcium silicate compounds. GALL Report Table IX.F also describes different aging mechanisms like abrasion, aggressive chemical attack, leaching of calcium hydroxide and carbonation which, depending on the type of environment and its aggressiveness, can lead to aging effects such as increase in porosity and permeability, cracking, loss of material (spalling, scaling), loss of strength, among others, for similar cementitious materials.

Issue:

Based on the information provided in the LRA, it is not clear to which type of fluid environment the asbestos cement board is exposed (e.g., raw water, treated water) and whether all applicable aging effects/mechanism for this cementitious material exposed to that fluid environment are being adequately managed.

# <u>Request:</u>

- 1. Describe the fluid environment to which the asbestos cement board is exposed (i.e., raw water, treated water), including the water chemistry.
- 2. Considering the environment to which the asbestos cement board is exposed, explain why other aging effects related to cementitious materials (e.g., increase in porosity and permeability, cracking, and loss of strength) are not considered credible aging effects.

# **Response:**

1. The fluid environment to which the asbestos cement board residual heat removal (RHR) cooling tower fill/mist eliminators listed in License Renewal Application (LRA)

Table 3.5.2-2 are exposed is described as raw water in LRA Table 3.0-2 and the source is Lake Erie water. The temperature of this water is  $< 140^{\circ}$ F. The following are key water chemistry parameters of the Lake Erie water (see response to RAI 3.5.1.83-1 for discussion of the source of these parameters).

pH:	7.57 to 8.88
Chlorides:	18.1 to 38.0 ppm
Sulfate:	28.3 to 32.5 ppm
Sodium:	9.75 to 20.6 ppm
Calcium:	33.5 to 41.9 ppm
Magnesium:	9.09 to 11.5 ppm

Although the source of water in the RHR reservoir (to which the asbestos cement board is exposed) is Lake Erie water as indicated above, the water is chemically treated for control of microbes, corrosion, and deposits. The water chemistry of this water is then monitored to be maintained within specified chemistry parameters. For example, the specification limit on chlorides in this water is 100 ppm. A water chemistry sample from 2013 indicated a pH of 8.0, chloride of 85 ppm, sulfate of 71 ppm, and sodium of 61 ppm. Although in some cases these values are above the ranges of the original Lake Erie water indicated above, the chloride and sulfate values are well below the thresholds for aggressive chemical attack discussed in the NUREG-1801 Generic Aging Lessons Learned (GALL) Report.

2. Credible aging effects for the asbestos cement board RHR cooling tower fill/mist eliminators do not include: cracking, loss of bond and loss of material (spalling, scaling) due to corrosion of embedded steel since this component does not have embedded steel; and cracking due to expansion from reaction with aggregates since this component does not have aggregate. However, credible aging effects do include: loss of material (spalling, scaling) and cracking due to freeze-thaw; and loss of material (due to abrasion). Loss of material is already included in LRA Table 3.5.2-2 as an applicable aging effect. For consistency with application of aging effects to concrete components, additional aging effects of cracking and increase in porosity and permeability and loss of strength will be included for the asbestos cement board RHR cooling tower fill/mist eliminators. The revisions to the LRA are indicated below.

#### **LRA Revisions:**

LRA Table 3.5.2-2 is revised as shown on the following page. Additions are shown in underline and deletions are shown in strike-through.

# Table 3.5.2-2Water-Control StructuresSummary of Aging Management Review

Table 3.5.2-2: Water-Control Structures								
Structure and/or Component or Commodity	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG- 1801 Item	Table 1 Item	Notes
RHR cooling tower fill/mist eliminators	SSR	Asbestos cement board	Exposed to fluid environment	Cracking, Loss of material	RG 1.127		2 2	J
RHR cooling tower fill/mist eliminators	<u>SSR</u>	<u>Asbestos</u> <u>cement</u> <u>board</u>	Exposed to fluid environment	Increase in porosity and permeability; Loss of strength	<u>RG 1.127</u>			Ţ
Barrier stone	FLB, SSR	Rock/ stone	Air – outdoor/ Exposed to fluid environment	Loss of material; Loss of form	RG 1.127	III.A6.T-22	3.5.1-58	A