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DTE Energy

~~Proprietary Information – Withhold Under 10 CFR 2.390~~

~~10 CFR~~ 54

February 12, 2015
NRC-15-0011

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)

3) NRC Letter, "Requests for Additional Information for the Review of the Fermi 2 License Renewal Application – Set 17 (TAC No. MF4222)," dated January 14, 2015 (ML14356A212)

Subject: Response to NRC Request for Additional Information for the Review of the Fermi 2 License Renewal Application – Set 17

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. Enclosures 1, 2, and 5 to this letter provide the response to the request for additional information (RAI). Enclosure 1 provides the responses to all RAIs except for RAI 4.7.3-1. Enclosures 2 and 5 provide the response to RAI 4.7.3-1.

Enclosures 2 and 5 contain proprietary information as defined by 10 CFR 2.390. General Electric – Hitachi (GEH), as the owner of the proprietary information, has executed the affidavits in Enclosures 4 and 7, which identifies that the enclosed proprietary information has been handled and classified as proprietary, is customarily held in confidence, and has been withheld from public disclosure. The proprietary information was provided to DTE in a GEH transmittal that is referenced by the

~~Enclosures 2 and 5 contain Proprietary Information – Withhold Under 10 CFR 2.390. When separated from Enclosures 2 and 5, this document is decontrolled.~~

affidavit. The proprietary information has been faithfully reproduced in the enclosed documentation such that the affidavit remains applicable. GEH herein requests as set forth in the enclosed affidavits of Lisa K. Schichlein that the enclosed proprietary information be withheld from public disclosure in accordance with the provisions of 10 CFR 2.390. Non-proprietary versions of the documentation in Enclosures 2 and 5 are provided in Enclosures 3 and 6.

Two new commitments are being made in this submittal. The new commitments are enhancements in Item 4, Bolting Integrity, in LRA Table A.4 as indicated in the response to RAI 3.3.2.9-1. In addition, revisions have been made to a commitment previously identified in the LRA. The revised commitment is in Item 12, Fatigue Monitoring, in LRA Table A.4 as indicated in the response to RAI 4.3.3-1.

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 February 12, 2015

Vito A. Kaminskas
Site Vice President
Nuclear Generation

Enclosures:
1) DTE Response to NRC Request for Additional Information for the Review of the Fermi 2 License Renewal Application – Set 17
2) Enclosure 1 to GEH Letter 318178-8, "GEH Responses to RAIs 4.2.2-1, 4.2.6-1, and 4.7.3-1" – PROPRIETARY
3) Enclosure 2 to GEH Letter 318178-8, "GEH Responses to RAIs 4.2.2-1, 4.2.6-1, and 4.7.3-1" – NON-PROPRIETARY
4) GE-Hitachi Nuclear Energy Americas LLC Affidavit for Enclosure 1 of 318178-8
5) Enclosure 1 to GEH Letter 318178-12, "Revised GEH Response to RAI 4.7.3-1 Parts 1 and 4" – PROPRIETARY
6) Enclosure 2 to GEH Letter 318178-12, "Revised GEH Response to RAI 4.7.3-1 Parts 1 and 4" – NON-PROPRIETARY
7) GE-Hitachi Nuclear Energy Americas LLC Affidavit for Enclosure 1 of 318178-12

cc w/ all Enclosures:
- NRC Project Manager
- NRC License Renewal Project Manager
- NRC Resident Office
- Reactor Projects Chief, Branch 5, Region III
- Regional Administrator, Region III

cc w/o Enclosures 2 and 5:
- Michigan Public Service Commission,
  - Regulated Energy Division (kindschl@michigan.gov)

Enclosure 1 to
NRC-15-0011

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 17

RAI 3.3.2.9-1

Background

License Renewal Application (LRA) Tables 3.3.2-9 and 3.3.2-12 address carbon steel bolting in a lube oil (exterior) environment. The LRA states that the aging effects of loss of material and loss of preload will be managed through the Bolting Integrity Program. The LRA states that for items that cite a generic Note G, the environment is not in the Generic Aging Lessons Learned (GALL) Report for the component and material combination. LRA Section B.1.2 states that the Bolting Integrity Program is an existing program, with enhancements, that will be consistent with GALL Report Aging Management Program (AMP) XI.M18, "Bolting Integrity."

GALL Report AMP XI.M18 includes preventive measures to minimize loss of preload, such as proper torqueing of bolts and checking for uniformity of gasket compression. GALL Report AMP XI.M18 also recommends periodic inspections (at least once per refueling cycle) of closure bolting for signs of leakage to ensure the detection of age-related degradation due to loss of material and loss of preload.

Issue

It is not clear whether the referenced bolts in a lube oil (exterior) environment are submerged in lube oil. If the bolts are in a submerged environment it is not clear how the program will be able to detect leakage of submerged bolted connections; therefore, it is not clear how the program will detect loss of material and loss of preload for submerged bolted connections prior to loss of intended function.

Request

For the aging management review (AMR) items in LRA Tables 3.3.2-9 and 3.3.2-12 that address carbon steel bolting in a lube oil (exterior) environment through the Bolting Integrity Program state whether the bolts are submerged in lube oil. If the bolts are in a submerged environment, describe how the program will be capable of detecting both loss of material and loss of preload, and also describe how the proposed bolting inspections will be capable of detecting loss of material in crevice locations (e.g., threaded regions or the shank below the bolt heads) that are not readily visible.

Response:

License Renewal Application (LRA) Table 3.3.2-9 addresses the nonsafety-related Combustion Turbine Generator system and LRA Table 3.3.2-12 addresses the safety-related Control Center HVAC system. Both systems have bolting with an external environment of lubricating oil. In both systems, the bolting is associated with a lube oil pump that is located internal to the machine in a lube oil sump. These pumps are inaccessible during normal operation.

As described in LRA Section B.1.2, the Bolting Integrity Program preventive measures include material selection, lubricant selection, applying the appropriate preload (torque), and checking for uniformity of gasket compression, where appropriate. These preventive measures are consistent with NUREG-1801, Section XI.M18, and minimize the potential for both loss of material and loss of preload.

Bolting on these lube oil pumps and other related pressure-retaining submerged bolting will be inspected in accordance with the recommendations of NUREG-1801 Section XI.M18, "Bolting Integrity," with the exception of the inspection frequency.

For the safety-related Control Center HVAC system an exception to the inspection frequency recommended by NUREG-1801 will be taken. NUREG-1801 Section XI.M18, "Bolting Integrity" recommends an inspection at least once every refueling cycle. Inspection of these pumps (two divisions) and related submerged bolting on a once per refueling cycle frequency is not practical as these pumps are located internal to their respective machines. Rather, direct inspection of the Control Center HVAC lube oil pump and related submerged bolting will occur during a scheduled disassembly and inspection Preventive Maintenance (PM) event. The PM frequency for this event is every 8 years (plus up to 25% grace period). Note that per EPRI Technical Report 1010639, "Non-Class 1 Mechanical Implementation Guideline and Mechanical Tools, Revision 4," Appendix C, lubricating oil systems generally do not suffer appreciable degradation by cracking or loss of material since the environment is not conducive to corrosion mechanisms. Nevertheless, lube oil pressure is monitored during system operation. Degradation of lube oil pump performance, which could indirectly indicate a bolting issue, would be identified and entered into the Corrective Action Program. As part of the Corrective Action Program, pump repair or refurbishment would be performed as necessary. During this maintenance, the associated bolting is inspected, including the bolting threads. To ensure that loss of material in crevice locations that are not readily visible can be detected, the LRA will be revised to include opportunistic inspections of the submerged bolting threads as part of the Bolting Integrity Program.

For the nonsafety-related Combustion Turbine Generator lube oil pump an exception will also be taken to the inspection frequency recommended by NUREG-1801. NUREG-1801 Section XI.M18, "Bolting Integrity" recommends an inspection at least once every refueling cycle. Inspection of this lube oil pump and other pressure retaining submerged bolts that may be in the lube oil sump will be conducted on an opportunistic basis, for example, whenever the lube oil sump is drained. This lube oil pump has a good performance record and there is no PM event in place for inspection. Per EPRI Technical Report 1010639, "Non-Class 1 Mechanical Implementation Guideline and Mechanical Tools, Revision 4," Appendix C, lubricating oil systems generally do not suffer appreciable degradation by cracking or loss of material since the environment is not conducive to corrosion mechanisms. Nevertheless, lube oil pressure is monitored during system operation. Degradation of lube oil pump performance, which could indirectly indicate a bolting issue, would be identified and entered into the Corrective Action Program. As part of the Corrective Action Program, pump repair or refurbishment would be performed as necessary.

LRA Revisions:

LRA Sections A.1.2, A.4, and B.1.2 are revised as shown on the following pages. Additions are shown in underline and deletions are shown in strike-through.

A.1.2 Bolting Integrity Program

The Bolting Integrity Program will be enhanced as follows.

- Revise Bolting Integrity Program procedures to perform opportunistic inspections for Control Center HVAC system safety-related pressure-retaining bolting in a lube oil external environment, including the bolting threads to ensure that loss of material in crevice locations that are not readily visible can be detected.
- Revise Bolting Integrity Program procedures to perform opportunistic inspections for CTG system nonsafety-related pressure-retaining bolting in a lube oil external environment.

A.4 LICENSE RENEWAL COMMITMENT LIST

No.	Program or Activity	Commitment	Implementation Schedule	Source
4	Bolting Integrity	Enhance Bolting Integrity Program as follows: g. Revise Bolting Integrity Program procedures to perform opportunistic inspections for Control Center HVAC system safety-related pressure-retaining bolting in a lube oil external environment, including the bolting threads to ensure that loss of material in crevice locations that are not readily visible can be detected. h. Revise Bolting Integrity Program procedures to perform opportunistic inspections for CTG system nonsafety-related pressure-retaining bolting in a lube oil external environment.	Prior to September 20, 2024.	A.1.2

B.1.2 BOLTING INTEGRITY

NUREG-1801 Consistency

The Bolting Integrity Program, with enhancements, is consistent with the program described in NUREG-1801, Section XI.M18, Bolting Integrity, with the following exceptions.

Exceptions to NUREG-1801

The Bolting Integrity Program has the following exceptions.

Element Affected	Exception
4. Detection of Aging Effects	NUREG-1801 recommends periodic inspections of the bolting at least once per refueling cycle. For the safety-related CCHVAC system, inspection of the lube oil pump bolting and other submerged bolting with an external environment of lube oil will be performed during scheduled disassembly and inspection preventive maintenance activities.[2]

Exception Notes

2. Inspection of these pumps (two divisions) and related submerged bolting on a refueling cycle frequency is not practical as these pumps are located internal to their respective machines. Rather, direct inspection of the Control Center HVAC system lube oil pump and related submerged bolting will occur during a scheduled disassembly and inspection Preventive Maintenance (PM) event. The PM frequency for this event is every 8 years (plus up to 25% grace period). Per EPRI Technical Report 1010639, "Non-Class 1 Mechanical Implementation Guideline and Mechanical Tools, Revision 4," Appendix C, lubricating oil systems generally do not suffer appreciable degradation by cracking or loss of material since the environment is not conducive to corrosion mechanisms. Nevertheless, lube oil pressure is monitored during system operation. Degradation of the lube oil pump performance, which could indirectly indicate a bolting issue, would be identified and entered into the Corrective Action Program.

Element Affected	Exception
4. Detection of Aging Effects	NUREG-1801 recommends periodic inspections of the bolting at least once per refueling cycle. For the nonsafety-related CTG system, inspection of the lube oil pump bolting and other pressure-retaining bolts that may be in the lube oil sump will be conducted on an opportunistic basis.[3]

Exception Notes

3. Inspection of CTG system lube oil pump and other pressure-retaining submerged bolts that may be in the lube oil sump will be conducted on an opportunistic basis, for example, whenever the lube oil sump is drained. This lube oil pump has a good performance record and there is no PM event in place for inspection. Per EPRI Technical Report 1010639, "Non-Class 1 Mechanical Implementation Guideline and Mechanical Tools, Revision 4," Appendix C, lubricating oil systems generally do not suffer appreciable degradation by cracking or loss of material since the environment is not conducive to corrosion mechanisms. Nevertheless, lube oil pressure is monitored during system operation. Degradation of the lube oil pump performance, which could indirectly indicate a bolting issue, would be identified and entered into the Corrective Action Program.

Enhancements

Element Affected	Enhancement
4. Detection of Aging Effects	Revise Bolting Integrity Program procedures to perform opportunistic inspections for Control Center HVAC system safety-related pressure-retaining bolting in a lube oil external environment, including the bolting threads to ensure that loss of material in crevice locations that are not readily visible can be detected.
4. Detection of Aging Effects	Revise Bolting Integrity Program procedures to perform opportunistic inspections for CTG system nonsafety-related pressure-retaining bolting in a lube oil external environment.

RAI 3.3.2.3.17.10-1

Background

LRA Table 3.3.2-17-10 contains AMR items for plastic piping and valve bodies internally exposed to treated water in the potable water system. No aging effect is cited and no AMP is proposed for these items. No detail was provided on the type of plastic used or the nature of the treated water environment (the treated water in other AMR items in Table 3.3.2-17-10 was specifically identified as equivalent to raw potable water).

Regulatory Issue Summary 2012-02, "Insights into Recent License Renewal Application Consistency with the Generic Aging Lessons Learned Report," states that, when an applicant states that there is no aging effect requiring management (AERM) and no proposed AMP, the application should state the specific material type and grade of polymeric materials and greater detail on the specific environment (e.g., high temperatures, chemicals).

Issue

The staff does not have sufficient information to evaluate the determination that the subject plastic piping has no aging effects. The staff noted that some polymeric materials may be susceptible to degradation in water environments. For example, the GALL Report states that high density polyethylene (HDPE) materials exposed to raw water are susceptible to cracking, blistering, and change in color due to water absorption.

Request

For the subject plastic piping and valve bodies:

1. *State the specific material type or grade.*
2. *Clarify whether the treated water environment is raw potable water and identify any environmental considerations that may cause the plastic components to age, such as exposure to high temperatures or chemicals.*
3. *Provide the basis for why there is no AERM, or otherwise, propose an AMP to manage the AERM.*

Response:

The potable water system plastic piping and valve bodies listed in License Renewal Application (LRA) Table 3.3.2-17-10 with internal environment of treated water are associated with a turbine building ventilation evaporative cooler. Further investigation identified that the nonsafety-related piping and valve bodies are located on the turbine building roof, an area that includes no safety-related components. This potable water system plastic piping and valve bodies perform

no license renewal intended functions identified in 10 CFR 54.4(a). Therefore, the subject components are not in the scope of license renewal and are not subject to aging management review. The LRA will be revised to remove these plastic component types from Table 3.3.2-17-10 and to remove the material from Section 3.3.2.1.17.

LRA Revisions:

LRA Section 3.3.2.1.17 and LRA Table 3.3.2-17-10 are revised as shown on the following pages. Additions are shown in underline and deletions are shown in strike-through.

3.3.2.1.17 Miscellaneous Auxiliary Systems in Scope for 10 CFR 54.4(a)(2)

The following lists encompass materials, environments, aging effects requiring management, and aging management programs for the series 3.3.2-17-xx tables.

Materials

Nonsafety-related components affecting safety-related systems are constructed of the following materials.

- Aluminum
- Carbon steel
- Copper alloy
- Copper alloy > 15% zinc or > 8% aluminum
- Elastomer
- Glass
- ~~Plastic~~
- Stainless steel

Table 3.2.2-17-10: Potable Water System, Nonsafety-Related Components Affecting Safety-Related Systems								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
~~Piping~~	~~Pressure boundary~~	~~Plastic~~	~~Air – indoor (ext)~~	~~Change in material properties~~	~~External Surfaces Monitoring~~	–	–	~~F~~
~~Piping~~	~~Pressure boundary~~	~~Plastic~~	~~Treated water (int)~~	~~None~~	~~None~~	–	–	~~F~~
~~Valve body~~	~~Pressure boundary~~	~~Plastic~~	~~Air – indoor (ext)~~	~~Change in material properties~~	~~External Surfaces Monitoring~~	–	–	~~F~~
~~Valve body~~	~~Pressure boundary~~	~~Plastic~~	~~Treated water (int)~~	~~None~~	~~None~~	–	–	~~F~~

RAI 3.5.1.90-1

Background

Section 54.21(a)(3) of Title 10 of the Code of Federal Regulations (10 CFR) Part 54 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 (CLB) for the period of extended operation. As described in NUREG-1800, "Standard Review Plan for Review of License Renewal Applications for Nuclear Power Plants" (SRP-LR), an applicant may demonstrate compliance with 10 CFR 54.21(a)(3) by referencing the GALL Report when evaluation of that matter in the GALL Report applies to the applicant's plant.

LRA Table 3.5.1, item 90, discusses aging management of support members; welds; bolted connections; support anchorage to building structure which will be managed for loss of material due to general (steel only), pitting, and crevice corrosion by the Water Chemistry Control-BWR and Inservice Inspection-IWF programs. The "discussion" column on LRA Table 3.5.1, item 90, states that this item is consistent with the GALL Report. The SRP-LR states that item 3.5.1-90 corresponds to GALL Report item III.B1.1.TP-10. LRA Tables 3.5.2-1 and 3.5.2-4, which reference GALL Report item III.B1.1.TP-10, state that carbon steel vent header supports and anchorage/embedments (respectively) "exposed to fluid environment" will be managed for the aging effect of loss of material by the Water Chemistry Control-BWR and Inservice Inspection-IWF programs. For the carbon steel vent header supports the LRA cites a Note A indicating that the AMR item is consistent with component, material, environment, aging effect and AMP recommended in the GALL Report. For the anchorage/embedments the LRA cites a Note C indicating that the AMR item component is different, but consistent with material, environment, aging effect, and AMP recommended in the GALL Report.

Issue

1. *LRA Table 3.0-2, "Service Environments for Structural Aging Management Reviews," states, in part, that the "exposed to fluid environment" used in the application corresponds to the GALL Report environment "treated water >140 °F." However, GALL Report AMR item III.B1.1.TP-10 addresses steel and stainless steel components exposed to an environment of treated water less than 140 °F. It is not clear how the LRA description of an "exposed to fluid environment" is consistent with an environment of treated water less than 140 °F in GALL Report AMR item III.B1.1.TP-10.*

2. *For stainless steel components exposed to treated water greater than 140 °F, the GALL Report lists cracking as an aging effect/mechanism for which age management is recommended. It is not clear whether stainless steel anchorage/embedment components exposed to treated water greater than 140 °F will be managed for cracking.*

Request

1. *Clarify how the "exposed to fluid environment" defined in the LRA is consistent with an environment of treated water less than 140 °F in GALL Report AMR item III.B1.1.TP-10.*

2. *State how the aging effects of cracking for anchorage/embedments stainless steel components exposed to treated water greater than 140 °F will be adequately managed during the period of extended operation. If cracking is not an aging effect to be managed at Fermi 2 for this component, material, and environment provide the technical justification.*

Response:

1. The "exposed to fluid environment" environment in License Renewal Application (LRA) Table 3.0-2 is a general category that encompasses a number of specific raw water and treated water environments. "Treated water > 140°F" is just one of the specific treated water environments encompassed in the general category of "exposed to fluid environment." Treated water less than 140°F is also included in the same general category. The components exposed to fluid environment listed in LRA Tables 3.5.2-1 and 3.5.2-4 with a reference to NUREG-1801 AMR item III.B.1.1.TP-10 are in treated water less than 140°F.

2. As discussed in response 1 above, the stainless steel anchorage / embedments listed in LRA Table 3.5.2-4, exposed to fluid environment, are in treated water less than 140°F. This environment is not conducive to stress corrosion cracking; therefore, cracking is not an aging effect requiring management. This is consistent with aging management review results in NUREG-1801 for AMR item III.B.1.1.TP-10.

LRA Revisions:

None.

RAI B.1.28-1

Background

The applicant states that LRA AMPs B.1.26, "Metal Enclosed Bus Inspection," and B.1.28, "Non-EQ Cable Connections," are new programs that are consistent with GALL Report AMP XI.E6, "Electrical Cable Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements," and GALL Report AMP XI.E4, "Metal Enclosed Bus."

During its onsite audit, the staff reviewed plant maintenance procedures that included procedures for verifying the torque of bolted electrical connections. The staff found that the applicant's procedures were inconsistent with the guidelines set forth by Electric Power Research Institute (EPRI) TR-104213, "Bolted Joint Maintenance & Applications Guide," concerning verifying proper torque of bolted electrical connections.

EPRI TR-104213, "Bolted Joint Maintenance & Applications Guide," states:

> *Inspect bolted joints for evidence of overheating, signs of burning or discoloration, and indications of loose bolts. The bolts should not be re-torqued unless the joint requires service or the bolts are clearly loose. Verifying the torque is not recommended. The torque required to turn the fastener in the tightening direction (restart torque) is not a good indicator of the preload once the fastener is in service. Due to relaxation of the parts of the joint, the final loads are likely to be lower than the installed loads. However, this load reduction has little effect on electrical conductivity or joint performance. Check the joint resistance of bolted joints using a low range ohm meter.*

GALL Report AMP XI.E4 recommends checking bus connections for increased resistance by using thermography or by measuring connection resistance using a micro-ohmmeter.

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 when evaluation of that matter in the GALL Report applies to the applicant's plant.

Issue

The re-torqueing of bolted electrical connections is not recommended per industry guidance (i.e., EPRI TR-104213) and is inconsistent with GALL Report AMPs XI.E4 and XI.E6. Therefore, Fermi 2 maintenance practices of re-torqueing within scope bolted electrical connections may not support the applicant's conclusion that LRA AMPs B.1.26 and B.1.28 are consistent with the GALL Report or that LRA AMPs B.1.26.and B.1.28 will be effective in managing aging mechanisms and effects for the period of extended operation.

Request

Explain why plant procedures specify re-torqueing of bolted electrical connections versus the recommended practice referenced in EPRI TR-104213, "Bolted Joint Maintenance & Applications Guide," not to re-torque bolted electrical connections once the fastener is in service.

Response:

Plant procedures have specified re-torquing bolted electrical connectors to confirm torque values as part of a preventive maintenance strategy. DTE will revise applicable procedures to eliminate this practice consistent with the recommendations of EPRI 1003471 "Electrical Connector Application Guidelines." Therefore, re-torquing will not be used as an alternative to thermography or resistance checks for the detection of aging effects on bolted electrical connections. The procedure revisions will be addressed through the Fermi 2 Corrective Action Program. LRA Sections A.1.26, A.1.28, B.1.26, and B.1.28 will be revised to clarify that torque checking will not be used as an alternative method to thermography or resistance checks.

LRA Revisions:

LRA Sections A.1.26, A.1.28, B.1.26, and B.1.28 are revised as shown on the following pages. Additions are shown in underline and deletions are shown in strike-through.

A.1.26 Metal Enclosed Bus Inspection Program

The Metal Enclosed Bus Inspection Program is a new condition monitoring program that provides for the inspection of the internal and external portions of metal enclosed bus (MEB) to identify age-related degradation of the bus and bus connections, the bus enclosure assemblies, the bus insulation and the bus insulators. This program will inspect the MEB between combustion turbine generator (CTG) transformer CTG 11-1 and peaker bus 1-2B located in the 120-kV switchyard. The MEB associated with CTG 11-1 is utilized as the alternate AC source for a station blackout (SBO) event and to support response by the Dedicated Shutdown Panel to an Appendix R fire.

The program calls for the visual inspection of MEB internal surface (bus enclosure assemblies) to detect age-related degradation, including cracks, corrosion, foreign debris, excessive dust buildup, and evidence of moisture intrusion. MEB insulating material is visually inspected for signs of reduced insulation resistance due to thermal/thermoxidative degradation of organics/ thermoplastics, radiation-induced oxidation, moisture/debris intrusion, or ohmic heating, as indicated by embrittlement, cracking, chipping, melting, swelling, discoloration, or surface contamination, which may indicate overheating or aging degradation. The internal bus insulating supports or insulators will be inspected for structural integrity and signs of cracks. MEB external surfaces are visually inspected for loss of material due to general, pitting, and crevice corrosion. Accessible elastomers (e.g., gaskets, boots, and sealants) are inspected for degradation, including surface cracking, crazing, scuffing, and changes in dimensions (e.g., "ballooning" and "necking"), shrinkage, discoloration, hardening, and loss of strength. A sample of accessible bolted connections will be inspected for increased resistance of connection by using thermography or by measuring connection resistance using a micro-ohmmeter. Torque checking will not be used as an alternative test method. Twenty percent of the population with a maximum sample of 25 will constitute a representative sample size. Otherwise, a technical justification of the methodology and sample size used for selecting components should be included as part of the program's site documentation. These inspections are performed at least once every ten years.

A.1.28 Non-EQ Cable Connections Program

The Non-EQ Cable Connections Program is a new one-time inspection program that consists of a representative sample of electrical connections within the scope of license renewal, which is inspected or tested at least once prior to the period of extended operation to confirm that there are no aging effects requiring management during that period. Cable connections included in this program are those connections susceptible to age-related degradation resulting in increased resistance of connection due to thermal cycling, ohmic heating, electrical transients, vibration, chemical contamination, corrosion, or oxidation that are not subject to the environmental qualification requirements of 10 CFR 50.49. Inspection methods may include thermography, contact resistance testing, or other appropriate testing methods without removing the connection insulation, such as heat shrink tape, sleeving, insulating boots, etc. Torque checking will not be used as an alternative test method. The one-time inspection provides additional confirmation to support industry operating experience that shows that electrical connections have not experienced a high degree of failures and that existing installation and maintenance practices are effective.

B.1.26 METAL ENCLOSED BUS INSPECTION

Program Description

The Metal Enclosed Bus Inspection Program is a new condition monitoring program that provides for the inspection of the internal and external portions of metal enclosed bus (MEB) to identify age-related degradation of the bus and bus connections, the bus enclosure assemblies, the bus insulation and the bus insulators. This program will inspect the MEB between combustion turbine generator (CTG) transformer CTG 11-1 and peaker bus 1-2B located in the 120-kV switchyard. The MEB associated with CTG 11-1 is utilized as the alternate AC source for a station blackout (SBO) event and to support response by the Dedicated Shutdown Panel to an Appendix R fire.

Internal portions (bus enclosure assemblies) of the MEB will be inspected for cracks, corrosion, foreign debris, excessive dust buildup, and evidence of water intrusion. The bus insulation or insulators will be inspected for signs of reduced insulation resistance due to thermal/ thermoxidative degradation of organics/thermoplastics, radiation-induced oxidation, moisture/ debris intrusion, or ohmic heating, as indicated by embrittlement, cracking, chipping, melting, discoloration, or swelling, which may indicate overheating or aging degradation. The internal bus insulating supports or insulators will be inspected for structural integrity and signs of cracks. A sample of accessible bolted connections will be inspected for increased resistance of connection by using thermography or by measuring connection resistance using a microohmmeter. Torque checking will not be used as an alternative test method. Twenty percent of the population with a maximum sample of 25 will constitute a representative sample size. Otherwise, a technical justification of the methodology and sample size used for selecting components should be included as part of the program's site documentation. Alternatively, for accessible bolted connections covered with heat shrink tape, sleeving, insulating boots, etc., the sample may be visually inspected for insulation material surface anomalies. The external portions of the MEB, including accessible gaskets, boots, and sealants, will be inspected for hardening and loss of strength due to elastomer degradation that could permit water or foreign debris to enter the bus. MEB external surfaces will be inspected for loss of material due to general, pitting, and crevice corrosion. This program will be used instead of the Structures Monitoring Program for external surfaces of the bus enclosure assemblies.

B.1.28 NON-EQ CABLE CONNECTIONS

Program Description

The Non-EQ Cable Connections Program is a new one-time inspection program that provides reasonable assurance that the intended functions of the metallic parts of electrical cable connections are maintained consistent with the current licensing basis through the period of extended operation. Cable connections included in this program are those connections susceptible to age-related degradation resulting in increased resistance of connection due to thermal cycling, ohmic heating, electrical transients, vibration, chemical contamination, corrosion, or oxidation that are not subject to the environmental qualification requirements of 10 CFR 50.49.

This program will provide for one-time inspections on a sample of connections that will be completed prior to the period of extended operations. Inspection methods may include thermography, contact resistance testing, or other appropriate testing methods without removing the connection insulation, such as heat shrink tape, sleeving, insulating boots, etc. Torque checking will not be used as an alternative test method. The factors considered for sample selection will be application (medium and low voltage, defined as < 35 kV), circuit loading (high loading), connection type, and location (high temperature, high humidity, vibration, etc.). The representative sample size will be based on 20 percent of the connection population with a maximum sample of 25. The technical basis for the sample selections will be documented. If an unacceptable condition or situation is identified in the selected sample, the Corrective Action Program will be used to evaluate the condition and determine appropriate corrective action.

RAI B.1.28-2

Background

The applicant states that LRA AMP B.1.28, "Non-EQ Cable Connections," is a new program that is consistent with GALL Report AMP XI.E6, "Electrical Cable Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements."

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 when evaluation of that matter in the GALL Report applies to the applicant's plant.

The AC (alternating current) power recovery path at Fermi 2 includes a 3000 amp and a 1200 amp tap box located in the Division 2 4160 V switchgear room as well as three similar tap boxes in the Division 1 switchgear room. There are electrical bolted connections inside these boxes that are subject to ohmic heating and electrical transients aging mechanisms which can contribute to increased resistance of these connections as stated in the "parameters monitored/inspected" program element of GALL Report AMP XI.E6. These connections are within the scope of license renewal according to 10 CFR 54.4(3).

The "detection of aging effects" program element of the LRA AMP basis document states that "the technical basis for the sample selected will be documented." Sample selection methodology and the technical basis have not been developed by the applicant and were not available for the staff to review at the time of its onsite audit. Factors listed for consideration for sampling per GALL Report AMP XI.E6, "Electrical Cable Connections not Subject to 10 CFR 50.49 Environmental Qualification Requirements," include voltage level (medium and low voltage); circuit loading (high load); and connection type and location (high temperature, high humidity, vibration). The technical basis for sample selection should be documented according to this AMP.

During its onsite audit, the staff requested the operating experience associated with these devices and records of any maintenance activities performed. The applicant stated that no such documents were found and that there has been no reported operating experience regarding these cable connections since these tap boxes are not in the applicant's preventive maintenance program.

Issue

GALL Report AMP XI.E6 "detection of aging effects" program element allows the applicant to take credit for the existing maintenance practices. It states, "The one-time test provides additional confirmation to support industry operating experience that shows that electrical

connections have not experienced a high degree of failures, and that existing installation and maintenance practices are effective." Given that these particular devices have not been inspected or maintained, it is not clear that a one-time test under LRA AMP B.1.28 performed on a sampling basis, is adequate to ensure that aging of these cable connections will be addressed. Depending on the sampling methodology adopted by the applicant, these devices may never be tested or inspected for aging effects. Sample selection methodology and the technical basis have not been developed by the applicant and were not available for the staff to review at the time of the audit.

Request

Justify that a one-time test, on a sampling basis, per LRA AMP B.1.28, is adequate to ensure that aging of these in-scope cable connections is properly managed, given that they have never been inspected nor maintained. Explain if a representative number of these cable connections will be included in the overall population of the tested devices according to the applicant's sampling methodology.

Response:

As stated in License Renewal Application (LRA) Section B.1.28, Non-EQ Cable Connections is a new program. The "detection of aging effects" element will be consistent with NUREG-1801, Section XI.E6, "Electrical Cable Connections not Subject to 10 CFR 50.49 Environmental Qualification Requirements." As stated in NUREG-1801, Section XI.E6, "The one-time test provides additional confirmation to support industry operating experience that shows that electrical connections have not experienced a high degree of failures, and that existing installation and maintenance practices are effective." The one-time test will confirm that the design and the installation practice of the initial assembly of the electrical cable connection, and the maintenance practice of disassembly and reassembly of the electrical cable connection are effective. Some electrical cable connections will be routinely disassembled to facilitate maintenance of electrical components. Electrical cable connections that are not part of electrical components, as in this example, will not require routine or periodic maintenance and a one-time test will confirm the effectiveness of the design and installation practices for the cable connections.

Although inspection of these tap boxes at Fermi 2 has not been performed, in response to Operating Experience INPO event report Level 2-14-46, "Multiple Electrical Faults Resulting in Explosion of Unit auxiliary Transformer and Automatic Scram," preventive maintenance events (PMs) were created and scheduled at Fermi 2. The PMs specify inspection of the Calvert cable bus tap boxes for signs of heating, corona effects, and insulation damage. The scheduling of these PMs is coordinated to align with the switchgear and transformer preventive maintenance schedule, or once every 12 years (plus up to 25% grace period).

In addition, the "corrective actions" element of NUREG-1801 Section XI.E6 states "If acceptance criteria are not met, the corrective action program is used to perform an evaluation

that considers the extent of the condition, the indications of aging effect, and changes to the one-time testing program or alternative inspection program. Corrective actions may include, but are not limited to, sample expansion, increased inspection frequency, and replacement or repair of the affected cable connection components."

The one-time test and sampling bases are consistent with NUREG-1801 and provide confirmation of the effectiveness of the installation and maintenance practices. The one-time test that is augmented with PM inspections and the corrective action element of the AMP provides reasonable assurance that this program will be effective in managing aging effects for electrical connections.

The sampling selection, consistent with NUREG-1801, is based on voltage level, circuit loading, connection type and location. The tap boxes are uniquely designed and will be grouped as a specific connection type for the purpose of sample selection. Therefore, the tap boxes will be included in the sample population based on the sample selection criteria. LRA Sections A.1.28 and B.1.28 will be revised to identify types of connections considered in sample selection.

LRA Revisions:

LRA Sections A.1.28 and B.1.28 are revised as shown on the following pages. Additions are shown in underline and deletions are shown in strike-through.

A.1.28 Non-EQ Cable Connections Program

The Non-EQ Cable Connections Program is a new one-time inspection program that consists of a representative sample of electrical connections within the scope of license renewal, which is inspected or tested at least once prior to the period of extended operation to confirm that there are no aging effects requiring management during that period. Cable connections included in this program are those connections susceptible to age-related degradation resulting in increased resistance of connection due to thermal cycling, ohmic heating, electrical transients, vibration, chemical contamination, corrosion, or oxidation that are not subject to the environmental qualification requirements of 10 CFR 50.49. Inspection methods may include thermography, contact resistance testing, or other appropriate testing methods without removing the connection insulation, such as heat shrink tape, sleeving, insulating boots, etc. The one-time inspection provides additional confirmation to support industry operating experience that shows that electrical connections have not experienced a high degree of failures and that existing installation and maintenance practices are effective.

The factors considered for sample selection will be application (medium and low voltage, defined as < 35 kV), circuit loading (high loading), connection type (crimped, bolted, and tap box), and location (high temperature, high humidity, vibration, etc.). The representative sample size will be based on 20 percent of the connection population with a maximum sample of 25. The technical basis for the sample selections will be documented. If an unacceptable condition or situation is identified in the selected sample, the corrective action program will be used to evaluate the condition and determine appropriate corrective action.

B.1.28 NON-EQ CABLE CONNECTIONS

Program Description

The Non-EQ Cable Connections Program is a new one-time inspection program that provides reasonable assurance that the intended functions of the metallic parts of electrical cable connections are maintained consistent with the current licensing basis through the period of extended operation. Cable connections included in this program are those connections susceptible to age-related degradation resulting in increased resistance of connection due to thermal cycling, ohmic heating, electrical transients, vibration, chemical contamination, corrosion, or oxidation that are not subject to the environmental qualification requirements of 10 CFR 50.49.

This program will provide for one-time inspections on a sample of connections that will be completed prior to the period of extended operations. The factors considered for sample selection will be application (medium and low voltage, defined as < 35 kV), circuit loading (high loading), connection type (crimped, bolted, and tap box), and location (high temperature, high humidity, vibration, etc.). The representative sample size will be based on 20 percent of the connection population with a maximum sample of 25. The technical basis for the sample selections will be documented. If an unacceptable condition or situation is identified in the selected sample, the Corrective Action Program will be used to evaluate the condition and determine appropriate corrective action.

RAI 4.3.1-1

Background

Pursuant to 10 CFR 54.21(c)(1)(iii), an applicant must demonstrate that the effects of aging on the intended function(s) of a component will be adequately managed for the period of extended operation. LRA Sections 4.3.1.1, 4.3.1.4, 4.3.1.5, and 4.3.1.6 state that the effects of fatigue will be managed by the Fatigue Monitoring Program (LRA Section B.1.17) in accordance with 10 CFR 54.21(c)(1)(iii). LRA Table 4.3-1, "Analyzed Transients with Projections," contains the transient cycles that require tracking for the time-limited aging analyses (TLAAs) in LRA Section 4.3.1. LRA Table 4.3-1 also contains events which are not design transient cycles. LRA Section 4.3.1.2 discusses the applicant's TLAA to manage the effects of fatigue on the reactor pressure vessel feedwater nozzle in accordance with 10 CFR 54.21(c)(1)(iii).

Issue

1. *It is unclear to the staff which events in LRA Table 4.3-1 are being used to calculate the cumulative usage factors (CUFs) for the TLAAs in LRA Sections 4.3.1.1, 4.3.1.2, 4.3.1.4, 4.3.1.5, and 4.3.1.6. The staff cannot determine if events other than design transients are being used to determine CUF values for these sections.*

2. *LRA Section 4.3.1.2 does not identify the program being used to manage the effects of fatigue on the feedwater nozzle for the period of extended operation.*

Request

1. *State which events are being used to calculate the CUFs for the TLAAs in LRA Sections 4.3.1.1, 4.3.1.2, 4.3.1.4, 4.3.1.5, and 4.3.1.6. Provide a clear distinction between events which are design transients and those that are not design transients. Justify the use of the Fatigue Monitoring Program to track any events which are not design transients.*

2. *State what program is being used to manage the effects of fatigue on the feedwater nozzle for the period of extended operation, in accordance with 10 CFR 54.21(c)(1)(iii), in LRA Section 4.3.1.2.*

Response:

1. All events listed in License Renewal Application (LRA) Table 4.3-1 are plant design transients except the "Main steam bypass line time of operation at 30% – 45% open (days)" event, which is used in a vibration service life evaluation. See the response to RAI B.1.17-2 (DTE letter NRC-15-0005 dated January 20, 2015) for additional discussion of the main steam bypass lines. The Fatigue Monitoring Program includes the necessary monitoring and reporting infrastructure to track and report the time of main steam bypass line operation at 30% – 45% open.

In general, the following transients from LRA Table 4.3-1 apply to specific components (the number in parentheses following the event description refers to the event number in LRA Table 4.3-1):

Boltup (1) / Unbolt (19) – RPV closure region and studs
Turbine roll (4) – Feedwater system components
Control rod drive isolation (12a) / Single control rod drive SCRAM (12b) – CRD system components
Hot Standby (injections) (14a-d) – Feedwater system components and a few reactor internal components
Loss of bottom head / RWCU drain flow (102) – RWCU and a few feedwater components
Core spray injection (103) – Core spray components
SRV actuations (104, 105) – Main steam, SRV and suppression pool components
Recirculation pump injection on-off-on – RRS pump cooler, bolts and heater
Recirculation pump A, B hot standby hours – RRS pump shaft (hours reflect thermal striping cycles)
Main steam bypass operation @ 30%-45% valve open position – Main steam bypass piping
RRS single loop operation – RRS components
All other transients (2, 3, 6, 8, 9, 10, 11, 13, 15-17, 18, 21, 22 and OBE) involve bulk RCS temperature/pressure/load changes that affect a wider range of RCPB components.

The RPV components discussed in LRA Section 4.3.1.1 are generally analyzed for the startup (3), shutdown (15-17), SCRAMs (10, 11, 22), pressure tests (2, 18), pre-op blowdown (21) and seismic OBE events. Specific nozzles are also affected by injection or relief flows (12, 14, 102, 103, 104, 105) or changes to feedwater temperature (4, 6, 8, 9, 13).

The fatigue analysis of the feedwater nozzle components discussed in LRA Section 4.3.1.2 includes fatigue from transient events (system cycling contribution) and fatigue from potential rapid cycling behind the thermal sleeves (rapid cycling contribution). Applicable transient events for the feedwater nozzles include startup (3), shutdown (15-17), SCRAMs (10, 11, 22), pressure tests (2, 18), injections (14), changes to feedwater temperature (4, 6, 8, 9, 13), pre-op blowdown (21) and seismic OBE events. The feedwater nozzle also has fatigue usage contribution from rapid cycling that is part of the total fatigue usage for that location. The rapid cycle usage is calculated based on the amount of time spent at particular feedwater and reactor temperatures. Operation at power levels above 20% does not contribute to rapid cycling usage. Only operation with the majority of feedwater heaters out of service contributes to rapid cycling usage. (A crack growth analysis described in LRA Section 4.3.1.2 is also performed for the feedwater nozzles conservatively assuming that rapid cycling thermal skin stresses have caused a ¼" deep crack in the nozzle. Crack growth is limited to 1" in 60 years.)

Depending on the specific internal component under consideration, the reactor internals described in LRA Section 4.3.1.4 are generally analyzed for a subset of the following events: startup (3), shutdown (15-17), SCRAMs (10, 11, 22), injections (14), changes to feedwater temperature (4, 8), core spray injection (103), SRV actuations (105) and seismic OBE events.

The RRS pump cooler, bolts and heater described in LRA Section 4.3.1.5 are generally analyzed for the startup (3), shutdown (13, 15-17), SCRAMs (10, 11) and RRS pump injection on-off-on events.

The piping systems discussed in LRA Section 4.3.1.6 are generally analyzed for the startup (3), shutdown (15-17), SCRAMs (10, 11), loss of feedwater pumps (22), pressure tests (2, 18) and seismic OBE events. Specific piping systems are also affected by sudden flow changes (12, 14, 21, 102, 103, 104, 105) or changes to feedwater temperature (4, 6, 8, 9, 13). Valves have generally been analyzed for generic transients representing startup (3), shutdown (15-17), pre-op blowdown (21), loss of feedwater pumps (22), pressure tests (2, 18), valve tests and seismic OBE events. GE supplied valves are analyzed for a subset of the following events, as applicable: startup (3), shutdown (15-17), loss of feedwater pumps (22), pressure tests (2, 18), small RRS step temperature changes and seismic OBE events.

2. The Fatigue Monitoring Program is being used to manage the effects of fatigue on the feedwater nozzle by tracking the number of occurrences of each transient event listed in LRA Table 4.3-1.

LRA Revisions:

None.

RAI 4.3.2-1

Background

Pursuant to 10 CFR 54.21(c)(1)(i), an applicant must demonstrate that the analyses for a component remain valid for the period of extended operation. LRA Section 4.3.2.1, "Piping and In-Line Components," states that non-Class 1 piping calculations are valid for the period of extended operation in accordance with 10 CFR 54.21(c)(1)(i). The LRA also states that none of the TLAAs associated with non-Class 1 piping within the scope of license renewal will exceed the thermal cycle limit of 7000 cycles during the period of extended operation. The LRA further states that for some plant systems the number of thermal cycles coincides with the number of plant heatups and cooldowns, although the number of thermal cycles is independent of plant heatups and cooldowns for other systems. LRA Section 4.3.2.1 provides examples of plant systems for which the number of thermal cycles is independent of plant heatups and cooldowns.

Issue

1. *The LRA does not provide the transients (or cycles) being used to determine that the thermal cycle limit of 7000 will not be exceeded during the period of extended operation.*

2. *The LRA does not provide the current or projected number of full thermal cycles for the TLAAs being evaluated.*

Request

1. *State the transients (or cycles) being counted for the non-Class 1 piping that are used to determine that the stress calculations are valid for the period of extended operation.*

2. *State the current and, if applicable, projected number of full thermal cycles for the non-Class 1 piping TLAAs being evaluated.*

Response:

The current/projected number of cycles for most components is estimated by adding the current/projected counts of the cited transient events listed in LRA Table 4.3-1. Other systems consider system-specific operations involving transients that are not reflected in LRA Table 4.3-1, for example, the sampling system. Thermal cycles for the non-Class 1 systems have been projected for 60 years of plant operation as described in the individual system evaluations below. These projections indicate that 7000 thermal cycles will not be exceeded for 60 years of operation. Therefore, the pipe stress calculations are valid for the period of extended operation in accordance with 10 CFR 54.21(c)(1)(i).

Reactor Coolant System Pressure Boundary
There are non-Class 1 components that are attached to the Class 1 components. Significant cycles of the these components are coincident with plant heatups and cooldowns, which are limited to well below 7000 cycles per LRA Table 4.3-1.

Residual Heat Removal System
Residual heat removal (RHR) is used during plant shutdowns to cold conditions. Even though cycling of the RHR system may occur during outages, significant thermal transients occur only early in the shutdown when reactor coolant is still at temperatures above 220 °F. Thus, significant cycles of the RHR system are coincident with plant cooldowns, which are limited to well below 7000 cycles per LRA Table 4.3-1.

High Pressure Coolant Injection System
The high pressure coolant injection (HPCI) system includes piping and valves that are exposed to elevated temperature in the steam supply to the turbine and the turbine exhaust. The plant heatups (~300 projected), approximately quarterly testing (~ 240 cycles in 60 years), and infrequent automatic operation together will not exceed 7000 cycles.

Nuclear Pressure Relief System
The nuclear pressure relief system consists of safety/relief valves located on the main steam lines between the reactor vessel and the first isolation valve within the drywell. The plant heatups and SRV actuations (<300 + ~1450) will be significantly below 7,000 equivalent full temperature cycles for the piping constructed per ASME III Class 2 or ANSI B31.1 during the period of extended operation.

Reactor Core Isolation Cooling System
The reactor core isolation cooling (RCIC) system steam supply to the RCIC pump turbine and turbine exhaust are exercised during testing and to mitigate design basis events. The plant heatups (~300 projected), pump routine testing approximately quarterly (~ 240 cycles in 60 years), and the infrequent system starting for actual plant operation together will remain significantly below 7,000 equivalent full temperature cycles during the period of extended operation.

Emergency Diesel Generator System
The diesels are routinely tested approximately monthly (~ 720 full temperature cycles in 60 years). EDG actuations and special testing are expected to occur infrequently; therefore the total equivalent full-temperature cycles in 60 years will not exceed 7000.

Fire Protection: Water System
The fire protection diesel is routinely tested approximately weekly (~3120 full temperature cycles in 60 years). Automatic actuations and special testing are expected to occur infrequently; therefore the total equivalent full-temperature cycles in 60 years will not exceed 7000.

HVAC Systems
A secondary containment penetration (as shown on drawing LRA-M-2271) provides auxiliary steam supply for heating inside the reactor and auxiliary building. This penetration will be at elevated temperatures when the heating steam is in service. The number of cycles is expected to be seasonal and well below 7000 cycles.

Compressed Air System
There is a small section of piping at the non-interruptible air supply (NIAS) compressor discharge that can be exposed to temperatures above the fatigue threshold from the heat of compression when the compressors are run for an extended time period. The compressors are normally in standby (air is normally supplied from the station air compressors) and therefore the expected thermal cycles from operation and quarterly testing will remain below 7000 cycles on these components.

Control Rod Drive System
The portion of the control rod drive (CRD) hydraulic components that are in the discharge flow path from the control rod during a system scram are exposed to elevated temperatures that make them subject to thermal fatigue. Following a reactor trip, this header fills with hot reactor coolant and thus experiences a thermal cycle. The plant is restricted in the number of scrams and the CRD system will not exceed 7,000 equivalent full temperature cycles during the period of extended operation.

Feedwater and Standby Feedwater System
The feedwater system is heated up during plant startup and is maintained at elevated temperature during normal plant operation. The system will not exceed 7,000 equivalent full temperature cycles during the period of extended operation since the plant is restricted in startup/shutdowns, scrams, loss of heaters, turbine rolls, standby feedwater injections and substantial power reductions as shown in LRA Table 4.3-1.

Primary Containment Monitoring & Leakage Detection System
These components are connected to systems that are heated up during plant startup and maintained at elevated temperature during normal plant operation. The piping systems will not exceed 7,000 equivalent full temperature cycles during the period of extended operation since the plant is restricted in startups per LRA Table 4.3-1.

Non-safety-Related Systems and Components Affecting Safety- Related Systems
Non-safety-related systems and components whose failure could affect safety-related systems that are exposed to temperatures above the threshold for fatigue, as described in LRA Section 3.0, include those in the steam/feedwater cycle, the reactor system, and the plant sampling system which interfaces with the steam/feedwater and RCS systems.

Steam/Feedwater Cycle
The following systems are in the steam/feedwater cycle:
Main and Reheat Steam (N11)

Condensate System (N20)
Main Turbine Generator and Auxiliaries (N30)
Condenser and Auxiliaries (N61)
Off-Gas Process and Vacuum (N62)
Condensate Storage and Transfer (P11)
Drips, Drains, and vents (P95)
None of these systems will exceed 7,000 equivalent full temperature cycles during the period of extended operation since the plant is restricted in startup/shutdowns, scrams, loss of heaters, turbine rolls and substantial power reductions as shown in LRA Table 4.3-1.

Reactor System
The following systems are associated with the reactor system:
Nuclear Boiler System (B21)
Reactor Recirculation System (B31)
Core Spray System (E21)
High Pressure Coolant Injection System (E41)
Residual Heat Removal (El1/E61)
Reactor Water Cleanup (G33)
Post-Accident Sampling (P34)
These systems will not exceed 7,000 equivalent full temperature cycles during the period of extended operation since the plant is restricted in startup/shutdowns, scrams and RWCU out of service cycles per LRA Table 4.3-1.

Process Sampling (P33)
The process sampling lines were identified as experiencing temperatures over the fatigue thresholds and therefore require further evaluation to determine the temperature cycles that they experience. Fermi 2 primarily uses samples that utilize a continuous flow sample point that is not isolated between samples. Thus, each sample does not constitute a thermal cycle, only the startup and shutdown of the continuous flow process constitutes a thermal cycle. Continuous flow samples are interrupted only when plant transients or shutdowns necessitate isolating the sample flows. The cycling frequency of the sampling system is projected to be well below the once every 3 days that would be required to reach the 7000 cycle limit in 60 years. Special samples may be drawn through isolated lines and result in a thermal cycle. However, use of these special samples is infrequent and will not exceed 7000 cycles prior to 60 years of operation. Fermi 2 sample lines will not exceed 7000 cycles through the period of extended operation.

Plant Heating (Reactor/Auxiliary Building HVAC – T41, Turbine Building HVAC – U41)
A number of components provide auxiliary steam supply for heating. The number of cycles is expected to be seasonal and well below 7000 cycles.

LRA Revisions:

None.

RAI 4.3.2-2

Background

Pursuant to 10 CFR 54.21(c)(1)(i), an applicant must demonstrate that the analyses for a component remain valid for the period of extended operation. LRA Section 4.3.2.2, "Components Other than Piping," states that non-Class 1 expansion joint fatigue analysis calculations are valid for the period of extended operation in accordance with 10 CFR 54.21(c)(1)(i). The LRA also states that the expansion joint fatigue analysis is a TLAA that assumed a bounding number of cycles. The LRA further states that it has been determined that the number of analyzed cycles is adequate for the period of extended operation.

Issue

The staff lacks sufficient information to evaluate the expansion joint fatigue analysis TLAA (LRA Section 4.3.2.2) for the period of extended operation. The LRA does not include the following information that the staff needs for its evaluation: (a) methodology used to analyze the expansion joints, (b) transients (or cycles) being counted for the fatigue analysis, (c) current number of cycles experienced by the expansion joints, and (d) number of additional cycles projected to the end of the period of extended operation.

Request

Provide a summary of the fatigue analysis used to evaluate the non-Class 1 expansion joints for the period of extended operation. The summary should include:

- *methodology or Code used in the analysis*
- *transients (or cycles) being counted for the fatigue analysis*
- *current number of cycles experienced by the expansion joints*
- *number of cycles projected to the end of the period of extended operation*
- *assumed number of bounding cycles*
- *basis used to establish the assumed number of bounding cycles*
- *basis used to disposition this TLAA as remaining valid for the period of extended operation,10 CFR 54.21(c)(1)(i)*

Response:

The summary for each of the seven bulleted items in the request are provided in the corresponding seven paragraphs below. This response includes information in a table (Table 4.3.2-2a) on subsequent pages to facilitate the review.

1. The expansion joints and flexible hoses are designed for fatigue using the Standards of the Expansion Joint Manufacturers Association, Inc. (EJMA) or testing per NC-3649.4(e)(2)(b) is used to establish an allowable number of cycles. The expansion joints (and flexible hoses)

are designed to withstand movements from plant operation (e.g. pipe thermal movement) and earthquake cycles as appropriate for the expansion joint seismic classification.

2. The vent line bellows, refueling and drywell seal bellows, TIP penetration bellows, and Type I containment penetration bellows are described in LRA Section 4.6. Table 4.3.2-2a on the following pages identifies the other expansion joints with TLAAs, the expansion joint application in the plant, and the applicable transient events from LRA Table 4.3-1. LRA Table 4.3-1 already identifies the current and projected cycle counts for these overall plant transients and that cycle information is therefore not repeated in Table 4.3.2-2a of this response. For expansion joints that are cycled by other than the overall plant transients identified in LRA Table 4.3-1, specific transient information is provided.

3. LRA Table 4.3-1 contains the current transient event cycles for fatigue analysis. The current OBE event count is zero for all expansion joints.

4. The last column of Table 4.3.2-2a of this response gives the applicable transient events (cycles) from LRA Table 4.3-1 (or the cycles from anticipated equipment operation and testing) projected to the end of the period of extended operation.

5. The phrase "assumed number of bounding cycles" refers to the allowable number of thermal cycles from the expansion joint fatigue evaluation. These values are given in Table 4.3.2-2a of this response under the column "Allowable Thermal Cycles."

6. The expected joint displacements are determined based on the connected piping/equipment thermal and seismic movements and the calculated expansion joint seismic inertial displacements. The stresses due to the joint displacements and the cyclic life are determined using the EJMA standard. (As noted above, in a few cases, the allowable number of cycles is based on test.) The expansion joint design is chosen to assure that the allowable number of cycles is well in excess of the anticipated number of cycles due to plant operation.

7. The basis for concluding that the TLAAs remain valid in accordance with 10 CFR 54.21(c)(1)(i) is that the expected number of cycles for 60 years of plant operation remains less than the number of allowable cycles assumed in the analyses.

Table 4.3.2-2a: Expansion Joints with TLAAs

LRA Drawing/System	Joint/Hose and Associated Piping Function	Allowable Thermal Cycles	Justification for Period of Extended Operation
LRA-M-2089 Nuclear Boiler	B2102G001 through 015 Instrument lines from pressure taps downstream of SRVs	1.8E6	Component transient cycles are due to SRV lifts (~1450 cycles) and plant heatups (246 cycles) and scrams (12 + 33 + 13 cycles). The total number of cycles is less than the allowable cycles.
LRA-M-2089 Nuclear Boiler	B2103G001 Main Steam Drain Line test tap	2,300	Component transient cycles are due to plant heatups & scrams (304 cycles). The total number of cycles is less than the allowable cycles.
LRA-M-2833 Reactor Recirculation	B3101G001A,B RRS Pump seal injection outlet controlled bleed-off to drain	154,000	Component transient cycles are due to plant heatups & scrams (304 cycles), RRS pump injection (37 cycles), and RRS SLO (15 cycles). The total number of cycles is less than the allowable cycles.
LRA-M-2833 Reactor Recirculation	B3101G002A RRS pump seal leakage drain	9,500	Component transient cycles are due to plant heatups & scrams (304 cycles), RRS pump injection (37 cycles), and RRS SLO (15 cycles). The total number of cycles is less than the allowable cycles.
LRA-M-2833 Reactor Recirculation	B3101G002B RRS pump seal leakage drain	Infinite	Component transient cycles are due to plant heatups & scrams (304 cycles), RRS pump injection (37 cycles), and RRS SLO (15 cycles). The total number of cycles is less than the allowable cycles.

LRA Drawing/System	Joint/Hose and Associated Piping Function	Allowable Thermal Cycles	Justification for Period of Extended Operation
LRA-M-2833 Reactor Recirculation	B3101G003A,B RRS Pump seal injection inlet	124,000	Component transient cycles are due to plant heatups & scrams (304 cycles), RRS pump injection (37 cycles), and RRS SLO (15 cycles). The total number of cycles is less than the allowable cycles.
LRA-M-2833 Reactor Recirculation	B3101G004A RRS pump seal flange cover drain	154,000	Component transient cycles are due to plant heatups & scrams (304 cycles), RRS pump injection (37 cycles), and RRS SLO (15 cycles). The total number of cycles is less than the allowable cycles.
LRA-M-2833 Reactor Recirculation	B3101G004B RRS pump seal flange cover drain	Infinite	Component transient cycles are due to plant heatups & scrams (304 cycles), RRS pump injection (37 cycles), and RRS SLO (15 cycles). The total number of cycles is less than the allowable cycles.
LRA-M-2833 Reactor Recirculation	B3101G005A,B RRS pump driver mount drain	14,700	Component transient cycles are due to plant heatups & scrams (304 cycles), RRS pump injection (37 cycles), and RRS SLO (15 cycles). The total number of cycles is less than the allowable cycles.
LRA-M-2833 Reactor Recirculation	B3101G006A RRS pump cover vent	154,000	Component transient cycles are due to plant heatups & scrams (304 cycles), RRS pump injection (37 cycles), and RRS SLO (15 cycles). The total number of cycles is less than the allowable cycles.

LRA Drawing/System	Joint/Hose and Associated Piping Function	Allowable Thermal Cycles	Justification for Period of Extended Operation
LRA-M-2833 Reactor Recirculation	B3101G006B, B3100G007A,B RRS pump cover vent and RRS pump seal pressure taps	975,000	Component transient cycles are due to plant heatups & scrams (304 cycles), RRS pump injection (37 cycles), and RRS SLO (15 cycles). The total number of cycles is less than the allowable cycles.
LRA-M-2034 Core Spray	E2150D003, D004 Core spray pump suction piping	Infinite	The allowable number of transient cycles is unlimited due to the low CS normal operating temperature of < 150°F.
LRA-M-2044 Reactor Core Isolation Cooling	E5150G001 RCIC Steam Line test tap	2,300	Component transient cycles are due to plant heatups & scrams (304 cycles). The total number of cycles is less than the allowable cycles.
LRA-M-2002 Main and Reheat Steam	N1100G001, N1100G002 Piping / tubing from main steam piping taps to sample cooler	2,000	Component transient cycles are due to plant heatups & scrams (304 cycles). The total number of cycles is less than the allowable cycles.
LRA-M-2002 Main and Reheat Steam	N3011G001A thru G001H Steam stop / throttle valves and loop pipe pressure taps (NSR)	2,000	Component transient cycles are due to plant heatups, scrams and turbine rolls (505 cycles). The total number of cycles is less than the allowable cycles.
LRA-M-2002 Main and Reheat Steam	N3018G078A-D, N3018G079A-D (Replaced in 2006) Moisture Separator Reheater cold reheat piping at MSR inlet nozzles (NSR)	7,000	Component transient cycles are due to plant heatups, scrams and turbine rolls (505 cycles). The total number of cycles is less than the allowable cycles.
LRA-M-2002 Main and Reheat Steam	Six unnumbered pressure balanced expansion joints in the MSR hot reheat piping at the MSR outlet nozzles (NSR)	4,600	Component transient cycles are due to plant heatups, scrams and turbine rolls (505 cycles). The total number of cycles is less than the allowable cycles.

LRA Drawing/System	Joint/Hose and Associated Piping Function	Allowable Thermal Cycles	Justification for Period of Extended Operation
LRA-M-2003 Main Turbine Extraction Steam	N6100D001A North Reactor Feed Pump Turbine (NRFPT) exhaust duct (NSR)	15,000	Component transient cycles are due to plant heatups & scrams (304 cycles) and power reductions below 50% (29 cycles). The total number of cycles is less than the allowable cycles.
LRA-M-2003 Main Turbine Extraction Steam	N6100D002A (Replaced in 2013) SRFPT exhaust duct @ turbine (NSR)	65,000	Component transient cycles are due to plant heatups & scrams (304 cycles) and power reductions below 50% (29 cycles). The total number of cycles is less than the allowable cycles.
LRA-M-2003 Main Turbine Extraction Steam	N6100D001B, N6100D002B RFPT exhaust ducts @ wall (NSR)	15,000	Component transient cycles are due to plant heatups & scrams (304 cycles) and power reductions below 50% (29 cycles). The total number of cycles is less than the allowable cycles.
LRA-M-2006 Condensate Storage and Transfer	P1100D007B, P1100D007K HPCI / RCIC pump suction piping in the Condensate Storage Tank (CST) pit	2,700	CST normal operating temperature is < 150°F. Only significant cycles are caused by emptying the CST (which seldom occurs).
LRA-M-5444, LRA-M-5357 Emergency Equipment Cooling Water (EECW)	P4400G003A RRS pump seal cooling water outlet	14,700	Component transient cycles are due to plant heatups & scrams (304 cycles), RRS pump injection (37 cycles), and RRS SLO (15 cycles). The total number of cycles is less than the allowable cycles.
LRA-M-5444, LRA-M-5357 EECW	P4400G003B, P4400G004B RRS pump seal cooling water outlet and inlet	1.8E6	Component transient cycles are due to plant heatups & scrams (304 cycles), RRS pump injection (37 cycles), and RRS SLO (15 cycles). The total number of cycles is less than the allowable cycles.

LRA Drawing/System	Joint/Hose and Associated Piping Function	Allowable Thermal Cycles	Justification for Period of Extended Operation
LRA-M-5444, LRA-M-5357 EECW	P4400G004A RRS pump seal cooling water inlet	8.8E6	Component transient cycles are due to plant heatups & scrams (304 cycles), RRS pump injection (37 cycles), and RRS SLO (15 cycles). The total number of cycles is less than the allowable cycles.
LRA-M-5444, LRA-M-5357 EECW	P4400G005A,B RRS pump motor upper end oil cooler EECW inlet	154,000	Component transient cycles are due to plant heatups & scrams (304 cycles), RRS pump injection (37 cycles), and RRS SLO (15 cycles). The total number of cycles is less than the allowable cycles.
LRA-M-5444, LRA-M-5357 EECW	P4400G006A RRS pump motor upper end oil cooler EECW outlet	6,000	Component transient cycles are due to plant heatups & scrams (304 cycles), RRS pump injection (37 cycles), and RRS SLO (15 cycles). The total number of cycles is less than the allowable cycles.
LRA-M-5444, LRA-M-5357 EECW	P4400G006B RRS pump motor upper end oil cooler EECW outlet	154,000	Component transient cycles are due to plant heatups & scrams (304 cycles), RRS pump injection (37 cycles), and RRS SLO (15 cycles). The total number of cycles is less than the allowable cycles.
LRA-M-5444, LRA-M-5357 EECW	P4400G007A RRS pump motor lower end oil cooler EECW inlet	154,000	Component transient cycles are due to plant heatups & scrams (304 cycles), RRS pump injection (37 cycles), and RRS SLO (15 cycles). The total number of cycles is less than the allowable cycles.

LRA Drawing/System	Joint/Hose and Associated Piping Function	Allowable Thermal Cycles	Justification for Period of Extended Operation
LRA-M-5444, LRA-M-5357 EECW	P4400G007B RRS pump motor lower end oil cooler EECW inlet	Infinite	Component transient cycles are due to plant heatups & scrams (304 cycles), RRS pump injection (37 cycles), and RRS SLO (15 cycles). The total number of cycles is less than the allowable cycles.
LRA-M-5444, LRA-M-5357 EECW	P4400G008A,B RRS pump motor lower end oil cooler EECW outlet	154,000	Component transient cycles are due to plant heatups & scrams (304 cycles), RRS pump injection (37 cycles), and RRS SLO (15 cycles). The total number of cycles is less than the allowable cycles.
LRA-M-4615 Interruptible & Non-Interruptible Control Air	P4400G011A,B; G012A, B Control air supply to the EECW temperature control valves F400A,B	48,000	The hoses are provided to isolate the tubing from the temperature control valve. They have no significant thermal displacements since EECW and NIAS are < 150°F.
LRA-M-5007 Primary Containment Pneumatic Supply	T4901G001 thru G013 & G015 Pneumatic N2 supply to SRVs	600	Component transient cycles are due to plant heatups (246 cycles) & scrams (12 + 33 + 13 cycles). The total number of cycles is less than the allowable cycles.
LRA-M-5007 Primary Containment Pneumatic Supply	T4901G016, G017 Supply air to RRS pump CRD seal purge line inboard isolation valves	600	Component transient cycles are due to plant heatups & scrams (304 cycles), RRS pump injection (37 cycles), and RRS SLO (15 cycles). The total number of cycles is less than the allowable cycles.
LRA-M-5007 Primary Containment Pneumatic Supply	T4901G014 Pneumatic N2 supply to SRVs	6,900	Component transient cycles are due to plant heatups (246 cycles) & scrams (12 + 33 + 13 cycles). The total number of cycles is less than the allowable cycles.

LRA Revisions:

None.

RAI 4.3.3-1

Background

LRA Section 4.3.3, "Effects of Reactor Water Environment on Fatigue Life," states that a screening evaluation has been conducted on the six locations identified in NUREG/CR-6260, "Application of NUREG/CR-5999 Interim Fatigue Curves to Selected Nuclear Power Plant Components," to assess the impact of environmentally assisted fatigue (EAF) for the period of extended operation. The results of the screening evaluation are provided in LRA Table 4.3-8, "EAF Screening of Fermi 2 Locations," with multiple locations having projected CUF values exceeding the limit of 1.0 when accounting for environmental effects. The LRA also states that the fatigue usage calculations will be updated using refined fatigue analysis to determine valid CUFs of less than 1.0 for the locations in Table 4.3-8. The LRA further states that "DTE will review design basis ASME Class 1 component fatigue evaluations to ensure the Fermi 2 locations evaluated for the effects of the reactor coolant environment on fatigue include the most limiting components within the reactor coolant pressure boundary."

Issue

The staff lacks sufficient information to evaluate the effects of the reactor coolant environment on component fatigue life during the period of extended operation. It is unclear what methodologies are being used to identify the plant-specific limiting locations. It is also unclear what corrective actions and/or refined fatigue analysis will be used to ensure that the CUF values projected to exceed 1.0, when accounting for environmental effects, will remain within the ASME Code limit.

Request

1. *Provide the methodology being used to identify plant-specific component locations in the reactor coolant pressure boundary that are more limiting than the components identified in NUREG/CR-6260.*

2. *Explain the technical basis for how this methodology identifies the plant-specific, bounding component locations.*

3. *Provide the corrective actions being used and/or the methodology to refine the fatigue analysis to ensure that the CUF values projected to exceed 1.0, when accounting for environmental effects, will remain within the ASME Code limit. Justify the use of the Fatigue Monitoring Program to ensure that the CUF ASME Code limit of 1.0 is not exceeded.*

Response:

1. The methodology in EPRI Technical Report 1024995, "Environmentally Assisted Fatigue Screening, Process and Technical Basis for Identifying EAF Limiting Locations", dated August 2012, will be used to identify the plant specific components in the reactor coolant pressure boundary, if any, that are more limiting than the components identified in NUREG/CR-6260.

2. Section 3 of the cited EPRI Technical Report provides the technical basis for the screening method. The process involves:
   - Reviewing plant components susceptible to fatigue
   - Categorizing them into groups
   - Estimating environmentally adjusted CUF (U_{en}) by multiplying the CUF by the estimated environmental fatigue correction factor (F_{en}). Locations within each group with the highest estimated U_{en} are reviewed to determine one or more Sentinel Locations to be analyzed and monitored for EAF usage.

   Consideration is given to components with multiple materials to account for the different fatigue life correction factors associated with different materials. Therefore, components with multiple materials, in multiple locations will be evaluated.

   The process provides a consistent technical basis to identify Sentinel Locations using available design data and stress or fatigue analysis. The methodology in the EPRI report has been used by other license renewal applicants. The approach is valid for both BWRs and PWRs.

   Sentinel Locations include NUREG/CR-6260 locations and will be managed for the period of extended operation.

3. For CUF values projected to exceed 1.0 when accounting for environmental effects, several options may be used to ensure that the ASME Code limit continues to be met. The options, consistent with NUREG-1801 Section X.M1, are:

   a) Performing a more refined ASME Code and environmentally assisted fatigue calculation.
   b) Implementing Cycle-Based Fatigue (CBF) and/or Stress-Based Fatigue (SBF) monitoring method. CBF monitoring conservatively estimates fatigue usage based on accumulated cycles and their contribution to fatigue usage. SBF monitoring computes stress history for a given component from transient pressure and temperature data collected from plant instruments, and the corresponding stress history at the critical location in the component. The stress history is analyzed to identify stress cycles and then a CUF is computed. The recommendations of RIS 2008-30 will be applied for any use of SBF. Use of either CBF or SBF monitoring will appropriately account for environmental effects on fatigue usage.

c) Repair
d) Replacement

The option selected may be different for different components and will be addressed in the Corrective Action Program as analysis results are obtained.

The Fatigue Monitoring Program is the appropriate program to use because it includes tracking transients, counting cycles, performing fatigue calculations, and ensuring the cumulative fatigue is maintained below the ASME code limit. Also, per NUREG-1801, Section X.M1, Fatigue Monitoring, the program monitors occurrences of transients and, alternatively, more detailed monitoring of local pressure and thermal conditions may be performed to allow the actual fatigue usage for the specified critical locations to be calculated. Acceptable corrective actions include more rigorous analysis, repair or replacement of the component.

The Fatigue Monitoring Program will be revised to add the option to use CBF or SBF monitoring methods (including environmental effects) if a component's CUF value is projected to exceed 1.0 after EAF calculations are completed.

LRA Revisions:

LRA Sections A.1.17, A.4, and B.1.17 are revised as shown on the following pages. Additions are shown in underline and deletions are shown in strike-through.

A.1.17 Fatigue Monitoring Program

The Fatigue Monitoring Program will be enhanced as follows.

- After the EAF calculations are completed, revise the Fatigue Monitoring Program procedures to state that the program counting of the cycle limits maintains the cumulative fatigue usage below the design limit through the period of extended operation, with consideration of the reactor water environmental fatigue effects. Revise Fatigue Monitoring Program procedures to allow for use of cycle-based fatigue (CBF) or stress-based fatigue (SBF) monitoring methods (including environmental effects) if a component's CUF value is projected to exceed 1.0 after EAF calculations are completed.

A.4 LICENSE RENEWAL COMMITMENT LIST

No.	Program or Activity	Commitment	Implementation Schedule	Source
12	Fatigue Monitoring	Enhance Fatigue Monitoring Program as follows: d. After the EAF calculations are completed, revise the Fatigue Monitoring Program procedures to state that the program counting of the cycle limits maintains the cumulative fatigue usage below the design limit through the period of extended operation, with consideration of the reactor water environmental fatigue effects. Revise Fatigue Monitoring Program procedures to allow for use of cycle-based fatigue (CBF) or stress-based fatigue (SBF) monitoring methods (including environmental effects) if a component's CUF value is projected to exceed 1.0 after EAF calculations are completed.	Part (b): At least two years prior to March 20, 2025. Remainder: Prior to September 20, 2024.	A.1.17

B.1.17 FATIGURE MONITORING

Enhancements

Element Affected	Enhancement
6. Acceptance Criteria	After the EAF calculations are completed, revise the Fatigue Monitoring Program procedures to state that the program counting of the cycle limits maintains the cumulative fatigue usage below the design limit through the period of extended operation, with consideration of the reactor water environmental fatigue effects. Revise Fatigue Monitoring Program procedures to allow for use of cycle-based fatigue (CBF) or stress-based fatigue (SBF) monitoring methods (including environmental effects) if a component's CUF value is projected to exceed 1.0 after EAF calculations are completed.

RAI 4.6.1-1

Background

LRA Table 3.5.2-1 includes, on LRA page 3.5-64, an item for component type "Steel elements (accessible areas): drywell shell; drywell head; drywell shell in sand pocket region," which credits "TLAA - metal fatigue" as the AMP. LRA Table 3.5.2-1 also includes, on LRA page 3.5-65, an item for component type "Steel elements: torus; vent line; vent header; vent line bellows; downcomers." These LRA Table 3.5.2-1 items correspond to Item 3.5.1-9 in LRA Table 3.5.1, which refers to the further evaluation in LRA Section 3.5.2.2.1.5. LRA Section 3.5.2.2.1.5, "Cumulative Fatigue Damage," states that the evaluation of fatigue as a TLAA for the Fermi 2 primary containment, including its drywell shell, torus, vent line bellows, downcomers, etc., is addressed in [LRA] Section 4.6. Further, the discussion for Item 3.5.1-27 in LRA Table 3.5.1 states: "Fermi 2 does have a CLB fatigue analysis associated with penetration sleeves and downcomers, and therefore this aging effect and mechanism is addressed under Item 3.5.1-9." Also, the discussion for Item 3.5.1-40 in LRA Table 3.5.1 states: "Fermi 2 does have a CLB fatigue analysis associated with vent header and downcomers, and therefore this aging effect and mechanism is addressed under Item 3.5.1-9."

Fermi 2 Updated Final Safety Analyses Report (UFSAR) Sections 3.8.2.1.2.1 and 3.8.2.1.2.2 state that the design, fabrication, inspection, and testing of the drywell and the suppression chamber comply with the requirements of Section III, Subsection B, of the ASME Boiler and Pressure Vessel (B&PV) Code, 1968 edition (ASME Code). Further, UFSAR Section 3.8.2.5.b states that the primary containment design details conform to the rules specified in Subarticle N-414 - Basic Stress Intensity Limits of the ASME Code. With regard to analysis for cyclic operation, N-1314(e) of Subsection B, "Requirements for Class B Vessels," of Fermi 2 code of record (i.e., the ASME Code) requires that any portion of the containment structure which does not satisfy the provisions of N-415.1 - Vessels Not Requiring Analysis for Cyclic Operation (i.e., fatigue waiver analysis) shall be evaluated by and satisfy the provisions of N-415.2 - Design for Cyclic Loading and N-416. If the plant's code of record requires a fatigue analysis or a fatigue waiver analysis, then this analysis may be a TLAA to be evaluated in accordance with 10 CFR 54.21(c)(1).

Issue

LRA Section 4.6 and LRA Subsection 4.6.1, "Primary Containment," do not include the fatigue analyses or fatigue waiver analyses of the Fermi 2 primary containment drywell and the downcomers required by Section N-415 of the ASME Code (code of record) as a TLAA that is credited to manage fatigue cracking for the corresponding line items in LRA Table 3.5.2-1 and LRA Table 3.5.1 mentioned under the "Background" section above.

Request

1. *State whether or not the fatigue analysis or fatigue waiver analysis of (a) the drywell, and (b) the downcomers required by the ASME Code (code of record) is a TLAA under the CLB.*

2. *If it is a TLAA, provide an evaluation of the analysis for (a) the drywell components, and (b) the downcomers in the LRA in accordance with 10 CFR 54.21(c)(1).*

3. *If it is not a TLAA, provide information on how aging effects of cumulative fatigue damage of (a) the drywell components, and (b) the downcomers will be managed for the corresponding items in LRA Table 3.5.2-1, included on LRA pages 3.5-64 and 3.5-65, which credit "TLAA – metal fatigue" in the AMP column.*

4. *Update the applicable tables and UFSAR supplement, as appropriate, to be consistent with the responses to the above requests.*

Response:

1. (a) The Code analysis is completed in accordance with the requirements of the design specification. Fatigue analysis or fatigue waiver for the drywell shell and head is not required since no cyclic loads were identified for these components in the applicable design specification per the current licensing basis. The drywell shell/head stress analyses are not TLAAs.

   (b) Fatigue analysis of the vent system components inside the torus was completed as described in the plant unique analysis report and the bounding results are presented in LRA Table 4.6-1. The maximum cumulative usage for a vent system component occurs in the vent header at the downcomer-vent header intersection. The maximum cumulative usage for a vent system weld occurs at the SRV piping-vent line penetration. The downcomers are included as part of the vent system fatigue analysis which is identified as a TLAA.

2. (a) Not applicable since there is no TLAA.

   (b) The fatigue analysis results for the vent system components described in LRA Table 4.6-1 bound the results for the downcomers and the reported result for the governing vent system component is the vent header at the downcomer-vent header intersection. As stated in LRA Section 4.6.1, Fermi 2 will manage the aging effects due to fatigue using the Fatigue Monitoring Program (LRA Section B.1.17) in accordance with 10 CFR 54.21(c)(1)(iii).

3. (a) As indicated in response to item 1 above, cumulative fatigue damage is not an aging effect requiring management for the Fermi 2 drywell. In LRA Table 3.5.2-1, on page

3.5-64, the line item for component type "Steel elements (accessible areas): drywell shell; drywell head; drywell shell in sand pocket region" with the aging effect "cracking" will be deleted as described in the response to item 4 below.

(b) Not applicable since it is a TLAA.

4. LRA Table 3.5.2-1, on page 3.5-64, will be revised to delete the line item for component type "Steel elements (accessible areas): drywell shell; drywell head; drywell shell in sand pocket region" with the aging effect "cracking" and AMP "TLAA – metal fatigue." The cited NUREG-1801 Item II.B1.1.C-21 only refers to "steel elements: torus; vent line; vent header; vent line bellows; downcomers," which are already included as line items on page 3.5-65. The Table 1 item listed also does not mention the drywell shell or head. NUREG-1801 does not include a different line item for Mark I steel components for cracking due to fatigue or cyclic loading. Therefore, the line item on page 3.5-64 is not needed. Additionally, LRA Section 3.5.2.2.1.5, "Cumulative Fatigue Damage," will be revised to remove "drywell shell" as indicated below.

LRA Revisions:

LRA Section 3.5.2.2.1.5 and LRA Table 3.5.2-1 are revised as shown on the following page. Additions are shown in underline and deletions are shown in strike-through.

3.5.2.2.1.5 Cumulative Fatigue Damage

TLAAs are evaluated in accordance with 10 CFR 54.21(c) as documented in Section 4. The evaluation of fatigue as a TLAA for the Fermi 2 containment, including its ~~drywell shell,~~ torus, vent line bellows, downcomers, etc., is addressed in Section 4.6.

Table 3.5.2-1: Reactor/Auxiliary Building and Primary Containment

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Item	Table 1 Item	Notes
~~Steel elements (accessible areas): drywell shell; drywell head; drywell shell in sand pocket region~~	~~EN, MB, PB, SSR~~	~~Carbon steel~~	~~Air – indoor uncontrolled~~	~~Cracking~~	~~TLAA – metal fatigue~~	~~II.B1.1.C-21~~	~~3.5.1-9~~	~~C~~

RAI 4.6.1-2

Background

The TLAA evaluations for primary containment components in LRA Section 4.6.1 and containment penetrations in LRA Section 4.6.5 appear to include load cycles from seismic operating basis earthquake (OBE) and/or safe shutdown earthquake (SSE) events. The disposition of these TLAA evaluations is that Fermi 2 will manage the aging effects due to fatigue using the Fatigue Monitoring Program, described in LRA Sections B.1.17 and A.1.17, in accordance with 10 CFR 54.21(c)(1)(iii). LRA Section B.1.17 states that the Fatigue Monitoring Program, with enhancements, is consistent with program X.M1, "Fatigue Monitoring," in the GALL Report.

Issue

The program descriptions in LRA Section B.1.17, "Fatigue Monitoring," LRA Section A.1.17, "Fatigue Monitoring," and GALL Report Section X.M1, "Fatigue Monitoring," appear focused on monitoring and tracking critical thermal and pressure transients for selected components. It is not clear to the staff whether the LRA Section B.1.17, "Fatigue Monitoring," credited in the disposition of the TLAAs in LRA Sections 4.6.1 and 4.6.5, in accordance with 10 CFR 54.21(c)(1)(iii), include under its scope load cycles from OBE and SSE events as parameters monitored and tracked.

Further, it is not clear as to the number of specific load cycles considered in the fatigue evaluation for each OBE event and/or SSE event that defines the total bounding limit of seismic load cycles monitored against by the credited Fatigue Monitoring Program in LRA Sections B.1.17 and A.1.17.

Request

1. *Clarify whether LRA Section B.1.17, "Fatigue Monitoring," credited in the disposition of the TLAA in LRA Sections 4.6.1 and 4.6.5, in accordance with 10 CFR 54.21(c)(1)(iii), includes under its scope load cycles from OBE and SSE events as parameters monitored and tracked.*

2. *State the number of specific load cycles considered in the fatigue evaluations in LRA Sections 4.6.1 and 4.6.5 for each OBE event and/or SSE event, as applicable. Also, clarify why seismic SSE is not listed as an analyzed transient in LRA Table 4.3-1.*

Response:

1. The Fatigue Monitoring Program includes all normal, upset and testing condition events that are included in the TLAAs discussed in LRA Sections 4.6.1 and 4.6.5. The SSE is an emergency condition event that requires plant shutdown in accordance with the technical

specifications. Fatigue considerations would need to be addressed as part of the activities required for plant restart. Fatigue evaluation of emergency and faulted condition events is not required by the ASME Code Section III. If emergency or faulted events occur during plant operation, they must be evaluated. Fatigue considerations would need to be addressed as part of the activities required for plant restart.

The OBE is an upset condition event that is included (as required) in the fatigue analysis and counted in the Fatigue Monitoring Program. The Fatigue Monitoring Program counts OBE events. The number of cycles experienced by each component per OBE event (two OBEs are considered as indicated in LRA Table 4.3-1) varies from 5 to 250 cycles as described in Updated Final Safety Analysis Report (UFSAR) Section 3.7.3.1. The total number of cycles considered in the analysis of some components may be greater than this, as indicated in the response to item 2 below.

2. The fatigue analysis of the suppression chamber components described in LRA Table 4.6.1 is discussed in the response to RAI 4.6.1-3. For the containment vent locations, 1000 total OBE cycles were considered. For the suppression chamber locations, 600 total OBE cycles were considered in the analysis.

   For the containment penetration flued heads listed in LRA Table 4.6-2, 508 seismic OBE load cycles were considered for penetrations X-7A-D, X-8, X-11, X-12, X-13A / B, X-16A / B, X-42, and X-43. 530 seismic OBE cycles were considered for penetrations X-9A / B. For penetration X-10, the critical location was the pipe to head weld and the OBE cycles were calculated using the piping system fundamental frequency. The analysis considered 90 total OBE cycles.

   UFSAR Section 3.7.3.1 states, "Fatigue evaluation due to the SSE was not necessary since it is an emergency condition and thus not required by ASME B&PV Code Section III." If SSE occurs during plant operation, it will be addressed as described in the response to request 1 above.

LRA Revisions:

None.

RAI 4.6.1-3

Background

With regard to the fatigue evaluations of the primary containment suppression chamber and containment vent, LRA Section 4.6.1 states, in part, "The usage factors are identified in Table 4.6-1. The safety relief valve actuations and seismic cycles are tracked and will be maintained below the cycle value used in the fatigue evaluation, or reanalysis will be completed. Fermi 2 will manage the aging effects due to fatigue using the Fatigue Monitoring Program (Section B.1.17) in accordance with 10 CFR 54.21(c)(1)(iii)."

Issue

It is not clear to the staff which specific transient events and the corresponding analysis (cycle) input values were used in calculating the cumulative usage factors documented in LRA Table 4.6-1 for containment suppression chamber and containment vent that will be monitored against by LRA Section B.1.17, "Fatigue Monitoring."

Request

1. *State, with the basis, the specific applicable transients and corresponding analysis (cycle) input limits that were used in the design fatigue analysis for calculating the CUF values documented in LRA Table 4.6-1 for containment suppression chamber and containment vent, and that will be monitored by the Fatigue Monitoring Program.*

2. *Clarify whether the applicable transients identified in the response to Item 1 of the request are included in LRA Table 4.3-1.*

Response:

1. The containment vent system fatigue usage factors shown in LRA Table 4.6-1 are computed for the controlling event, which is normal operating plus small break accident (SBA). The governing vent system component for fatigue is the vent header at the downcomer-vent header intersection. The magnitudes and numbers of cycles of downcomer lateral loads are the primary contributors to fatigue at this location. The governing vent system weld for fatigue is the nozzle to gusset weld at the SRV penetration to the vent line. SRV temperature and thrust loads and the number of SRV actuations are the major contributors to fatigue at this location. Cycles from LRA Table 4.3-1 considered in these analyses include individual SRV actuation and 1000 seismic cycles. The governing load combination also includes SBA condensation oscillation and chugging load cycles.

   The largest contributor to suppression chamber fatigue effects are SRV discharge loads which occur during normal operating conditions. The largest total fatigue usage occurs for the normal operating plus SBA event with usage factors for the critical suppression chamber

shell and associated welds given in LRA Table 4.6-1. Cycles from LRA Table 4.3-1 considered in these analyses include individual and multiple SRV actuation and 600 seismic cycles. The governing load combination also includes SBA chugging load cycles.

2. SRV actuations and OBE events are included in LRA Table 4.3-1. Drywell pipe break events are not included in LRA Table 4.3-1. ASME Code Section III does not require fatigue evaluation of emergency and faulted condition events. If an emergency or faulted condition event occurs during plant operation, it must be evaluated.

LRA Revisions:

None.

RAI 4.6.5-1

Background

LRA Section 4.6.5 states, in part, that "The usage factors are shown in Table 4.6-2 for these flued head penetrations based on the number of cycles shown in the analysis input value column in Table 4.3-1." Further, LRA Section 4.6.5 also states that "Fermi 2 will manage the aging effects due to fatigue of these penetrations using the Fatigue Monitoring Program (Section B.1.17) in accordance with 10 CFR 54.21(c)(1)(iii). The Fatigue Monitoring Program monitors the plant transients that contribute to fatigue usage."

LRA Table 4.3-1, "Analyzed Transients with Projections," included two OBE events.

Issue

It is not clear to the staff which specific transient events in LRA Table 4.3-1 and corresponding analysis (cycle) input values were used in calculating the CUFs documented in LRA Table 4.6-2 for flued head penetrations and that will be monitored against by the Fatigue Monitoring Program in LRA Section B.1.17.

Request

State, with the basis, the specific applicable transients in LRA Table 4.3-1, or other, and corresponding analysis (cycle) input values that were used in the design fatigue analysis for calculating the CUF values documented in LRA Table 4.6-2 for flued head penetrations and that will be monitored using the Fatigue Monitoring Program.

Response:

The containment penetrations were originally analyzed (n_{design}) for 250 cycles (300 cycles for X-9A/B) of bounding transient events and attached piping loads. For purposes of projecting the number of cycles (n_{60}), the bounding events were categorized in the tables on the following page. Note that the numbers in parentheses following the event descriptions correspond to the event number in LRA Table 4.3-1.

Events for Penetrations X-7A/B/C/D, X-8, X-11, X-12, X-13A/B, X-16A/B, X-42, X-43	Plant Condition	n_{design}	n_{60}
Startup (3)	normal/upset	120	246
Shutdown (15-17)	normal/upset	111	246
Pre-Op Blowdown (21)	normal/upset	10	3
Loss of FW Pumps (22)	normal/upset	5	13
Reactor Overpressure-Delayed SCRAM-FW On-Isolation Valves Open	emergency	1	0
Single Relief or Safety Valve Blowdown	emergency	1	0
Automatic Blowdown	emergency	1	0
Pipe Rupture and Blowdown	faulted	1	0
(OBE cycles were assumed to act concurrently with other transients)			

Events for Penetrations X-9A/B	Plant Condition	n_{design}	n_{60}
Startup (3)	normal/upset	120	246
Shutdown (15-17)	normal/upset	111	246
Pre-Op Blowdown (21)	normal/upset	10	3
Loss of FW Pumps (22)	normal/upset	5	13
SCRAM-Turbine Generator Trip (10)	normal/upset	40	12
Loss of FW Heaters-Turbine Trip with 100% Bypass (8)	normal/upset	10	10
Reactor Overpressure-Delayed SCRAM-FW On-Isolation Valves Open	emergency	1	0
Single Relief or Safety Valve Blowdown	emergency	1	0
Automatic Blowdown	emergency	1	0
Pipe Rupture and Blowdown	faulted	1	0
(OBE cycles were assumed to act concurrently with other transients)			

For penetration X-10, a more detailed analysis for the pipe to flued head weld location was performed to obtain the results described in the LRA, using the interfacing piping transients.

Events for Penetrations X-10 Weld Location	Plant Condition	n_{design}	n_{60}
Startup (3)	normal/upset	120	246
Shutdown (15-17)	normal/upset	111	246
SCRAM – All Others (11)	normal/upset	140	33
Loss of FW Pumps(22)	normal/upset	5	13
SCRAM-Turbine Generator Trip (10)	normal/upset	40	12
(2 OBE events were considered in the analysis)			

LRA Revisions:

None.

RAI 4.6.5-2

Background

With regard to the fatigue evaluations of containment penetration bellows, LRA Section 4.6.5 states, in part, that:

> *The analysis for these bellows determined they were capable of handling the movement from many more normal operation or faulted cycles than were specified. The bellows are qualified for more than the projected number of startups and shutdowns, and therefore, the bellows analysis remains valid for the period of extended operation in accordance with 10 CFR 54.21(c)(1)(i).*

Issue

The number of normal operation or faulted transient cycles that the containment penetration bellows were determined to be capable of handling is not included in LRA Section 4.6.5. The staff needs this information to verify if the bellows' analysis remains valid for the period of extended operation.

Request

State, with the basis, the number of normal operation and/or faulted transient cycles that the containment penetration bellows were determined to be capable of handling by the bellows' design fatigue analysis.

Response:

The containment penetration bellows are installed to accommodate the differential movement between the drywell nozzle pipe and the flued head anchor. The containment penetration bellows were originally designed for 200 cycles of cold to normal operating thermal movement and 10 cycles of cold to faulted thermal movement. In addition, most penetration bellows were also analyzed for 4 cycles of compression/extension during installation. For the most limiting containment penetration bellows, more than 3000 cycles of cold to normal operating thermal movement would be required to achieve a cumulative usage factor of 1.0. Therefore, the permissible number of cycles is an order of magnitude greater than the number of startup and shutdown cycles expected through the period of extended operation.

LRA Revisions:

None.

RAI 4.7.3-1

Background

LRA Section 4.7.3 describes a TLAA for auxiliary spring wedge assemblies installed on certain jet pumps. The LRA states that the auxiliary spring wedge assemblies are subject to loss of preload and were designed for a 40-year life based on a fluence of $1.2x10^{20}$ n/cm^2. The LRA also states that a fluence analysis was performed through the end of the period of extended operation and it was determined for the most limiting case that the projected fluence exceeds the design fluence by 4 percent. The LRA states that this increase in fluence results in a slight increase in the loss of spring preload. The LRA further states that this increased loss of preload has no impact on the most limiting stresses and has no adverse impact on the structural integrity and functional performance of the components. As a result, the LRA concludes that the analysis has been projected to the end of the period of extended operation in accordance with 10 CFR 54.21(c)(1)(ii).

Issue

For demonstrations made pursuant to 10 CFR 54.21(c)(1)(ii), SRP-LR Section 4.7.3.1.2 states that, "The applicant shall provide a sufficient description of the analysis and documents the results of the reanalysis to show that it is satisfactory for the 60-year period." However, LRA Section 4.7.3 does not sufficiently describe the analysis or the results of the re-analysis. Therefore, it is not clear as to how the increased loss of preload will have no adverse impact on the intended function of the auxiliary spring wedge assemblies.

Request

Address the following items to support the conclusion that an increased loss of preload due to a 4 percent increase in projected fluence will have no adverse impact on the intended function of the auxiliary spring wedge assemblies.

1. *Describe how preload ensures the functional performance of the auxiliary spring wedge assemblies and indicate how much preload is needed to ensure this functional performance.*

2. *Describe the methodology that was used to calculate neutron fluence through the end of the period of extended operation and provide justification for using this methodology to determine the neutron fluence received by the auxiliary spring wedge assemblies.*

3. *Describe the methodology that was used to calculate loss of preload in the re-analysis. Indicate whether this methodology is different from the methodology used in the original analysis. Provide justification if the methodology is different.*

4. *Quantify the amount of preload loss that was calculated through the end of the period of extended operation and compare that value to the amount of preload loss that is needed to ensure the functional performance of the auxiliary spring wedge assemblies.*

Response:

The response contains proprietary information. The responses to requests 2 and 3 are provided in Enclosures 2 (proprietary version) and 3 (non-proprietary version) of this letter. The responses to requests 1 and 4 are provided in Enclosures 5 (proprietary version) and 6 (non-proprietary version) of this letter.

LRA Revisions:

None.

RAI 4.7.3-2

Background

LRA Section A.2.5.3 provides the UFSAR supplement summary description of the TLAA for auxiliary spring wedge assemblies installed on certain jet pumps. It states that an evaluation of the increased fluence on the jet pump auxiliary spring wedge assemblies was evaluated and has no impact on the most limiting stresses.

Issue

LRA Section A.2.5.3 does not provide a sufficient summary description of this TLAA. This section does not properly identify the auxiliary spring wedge assemblies addressed in the analysis, or which of these assemblies represents the most limiting case. Also, the UFSAR supplement does not provide the acceptance criteria used to determine how functionality of the spring wedge is ensured, or quantify the results of the analysis in terms of the amount of preload loss and compare those results against the acceptance criteria.

Request

Justify why the information above is not included in the UFSAR supplement. Otherwise, revise LRA Section A.2.5.3, as appropriate, to address each of the issues identified.

Response:

License Renewal Application (LRA) Section A.2.5.3 will be revised as indicated below to add information to the summary of the TLAA evaluation. However, the quantitative values for preload loss and acceptance criteria are considered proprietary to GEH and therefore will not be added to the Updated Final Safety Analysis Report (UFSAR) supplement. The proprietary response to RAI 4.7.3-1 provides that information for NRC review.

LRA Revisions:

LRA Section A.2.5.3 is revised as shown on the following page. Additions are shown in underline and deletions are shown in strike-through.

A.2.5.3 Jet Pump Auxiliary Spring Wedge Assembly

Auxiliary spring wedges have been installed on ~~selected~~ jet pumps 1, 2, and 15 at Fermi 2 to maintain continuous three point contact for the inlet mixer to the restrainer bracket. A calculation evaluates relaxation of the spring preload for the jet pump auxiliary spring wedge assemblies. The evaluation considers a neutron fluence of 1.2E+20 n/cm^2 (E > 1 MeV) for a 40-year design life. The relaxation of the spring preload in the spring wedge assembly is a TLAA.

To disposition the TLAA, a fluence analysis was performed to determine the fluence values at the three currently installed wedges on the jet pumps and at the bounding location for possible future installation of wedge assemblies through the period of extended operation. The analysis determined that wedge 1 is the limiting case with the projected neutron fluence for wedge 1 slightly ~~exceeds~~exceeding the design fluence prior to the end of the period of extended operation. An evaluation of the slightly higher fluence for wedge 1 determined that it has no impact on the most limiting stresses that were reported in the original stress report. The slightly higher fluence for wedge 1 has no adverse impact on the structural integrity and functional performance.

The results of the analysis demonstrated that the available preload at the end of period of extended operation is considerably greater than the required preload. Additionally, the auxiliary spring wedge assembly is designed to function independent of the spring preload, i.e. the spring wedge function works at any preload. There will be contact between the belly band, auxiliary spring wedge assembly and the restrainer bracket.

This TLAA has been projected to the end of the period of extended operation in accordance with 10 CFR 54.21(c)(1)(ii).

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 CLB for the period of extended operation.

LRA Table 3.6.1, items 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. LRA Table 3.6.2 identifies the material as porcelain, galvanized metal, and cement for these two items.

Issue

The staff found an apparent discrepancy between LRA Table 3.6.1, items 3.6.1-2 and 3.6.1-3, and the corresponding items on LRA Table 3.6.2 in describing the material used for high-voltage insulators. Table 3.6.2 is inconsistent with Table 3.6.1 in that it has omitted malleable iron and aluminum in the list of material that make up this component. LRA Table 3.6.1 is consistent with SRP-LR Table 3.6.1.

Request

Clarify the discrepancy between LRA Tables 3.6.1 and 3.6.2 regarding high-voltage insulator material as noted above.

Response:

License Renewal Application (LRA) Table 3.6.2, "Electrical Components," will be revised to include the material "aluminum" for high voltage insulators. However, it is not necessary to explicitly add the material "malleable iron" to LRA Table 3.6.2. This is because LRA Table 3.6.2 includes the material "galvanized metal" and EPRI 1013475, "Plant Support Engineering: License Renewal Electrical Handbook" indicates that galvanized metal includes malleable iron, ductile iron, and drop-forged steel. Therefore, malleable iron is implicitly included in LRA Table 3.6.2 under "galvanized metal."

The high-voltage insulator materials in LRA Table 3.6.2, as revised, are consistent with LRA Table 3.6.1.

In addition, LRA Table 3.6.2 will be revised to indicate that high-voltage insulators and switchyard bus and connections have an intended function of SBO and SBO recovery, consistent with the response to RAI 2.5-1 (DTE letter NRC-15-0006 dated January 20, 2015).

LRA Revisions:

LRA Table 3.6.2 is revised as shown on the following page. Additions are shown in underline and deletions are shown in strike-through.

Table 3.6.2: Electrical Components								
Component Type	**Component Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
High voltage insulators (high voltage insulators for SBO and SBO recovery)	IN	Porcelain, galvanized metal, cement, aluminum	Air – outdoor	None	None	VI.A.LP-32 VI.A-10 (LP-11)	3.6.1-2	I
High voltage insulators (high voltage insulators for SBO and SBO recovery)	IN	Porcelain, galvanized metal, cement, aluminum	Air – outdoor	None	None	VI.A.LP-28 VI.A-9 (LP-07)	3.6.1-3	I
Switchyard bus and connections (switchyard bus for SBO and SBO recovery)	CE	Aluminum, steel, steel alloy	Air – outdoor	None	None	VI.A.LP-39 VI.A-15 (LP-9)	3.6.1-6	I

Enclosure 3 to
NRC-15-0011

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

Enclosure 2 to GEH Letter 318178-8, "GEH Responses to RAIs 4.2.2-1, 4.2.6-1, and 4.7.3-1" – NON-PROPRIETARY

(contains response to Parts 2 and 3 of RAI 4.7.3-1 only, responses to RAIs 4.2.2-1 and 4.2.6-1 were submitted previously by letter NRC-15-0022 dated 1/30/15)

ENCLOSURE 2

318178-8

GEH Responses to RAIs 4.2.2-1, 4.2.6-1, and 4.7.3-1

Non-Proprietary Information – Class I (Public)

INFORMATION NOTICE

This is a non-proprietary version of Enclosure 1 of 318178-8, which has the proprietary information removed. Portions of the document that have been removed are indicated by white space inside open and closed bracket as shown here [[ ]].

RAI 4.7.3-1

Background:

LRA Section 4.7.3 describes a TLAA for auxiliary spring wedge assemblies installed on certain jet pumps. The LRA states that the auxiliary spring wedge assemblies are subject to loss of preload and were designed for a 40-year life based on a fluence of $1.2x10^{20}$ n/cm^2. The LRA also states that a fluence analysis was performed through the end of the period of extended operation and it was determined for the most limiting case that the projected fluence exceeds the design fluence by 4 percent. The LRA states that this increase in fluence results in a slight increase in the loss of spring preload. The LRA further states that this increased loss of preload has no impact on the most limiting stresses and no adverse impact on the structural integrity and functional performance of the components. As a result, the LRA concludes that the analysis has been projected to the end of the period of extended operation in accordance with 10 CFR 54.21(c)(1)(ii).

Issue:

For demonstrations made pursuant to 10 CFR 54.21(c)(1)(ii), SRP-LR Section 4.7.3.1.2 states that, "The applicant shall provide a sufficient description of the analysis and documents the results of the reanalysis to show that it is satisfactory for a 60-year period." However, LRA Section 4.7.3 does not sufficiently describe the analysis or the results of the re-analysis. Therefore, it is not clear as to how the increased loss of preload will have no adverse impact on the intended function of the auxiliary spring wedge assemblies.

Request:

Address the following items to support the conclusion that an increased loss of preload will have no adverse impact on the intended function of the auxiliary spring wedge assemblies.

1. *Describe how preload ensures the functional performance of the auxiliary spring wedge assemblies and indicate how much preload is needed to ensure this functional performance.*
2. *Describe the methodology that was used to calculate neutron fluence through the end of the period of extended operation and provide justification for using this methodology to determine the neutron fluence received by the auxiliary spring wedge assemblies.*
3. *Describe the methodology that was used to calculate loss of preload in the re analysis. Indicate whether this methodology is different from the methodology used in the original analysis. Provide justification if the methodology is different.*
4. *Quantify the amount of preload loss that was calculated through the end of the period of extended operation and compare that value to the amount of preload loss that is needed to ensure the functional performance of the auxiliary spring wedge assemblies.*

GEH Response:

1. The response to Part 1 is now provided in GEH Letter 318178-12 (see Enclosures 5 and 6 to NRC-15-0011).

2. The fast neutron fluence to the auxiliary spring wedge is calculated using the GE Hitachi (GEH) methodology described in the Licensing Topical Report (LTR) NEDC-32983P-A (Reference 4.7.3-1-1). This methodology is approved by the Nuclear Regulatory Commission (NRC) via MFN-05-143 (Reference 4.7.3-1-2) and MFN 01-050 (Reference 4.7.3-1-3), and is adherent to Regulatory Guide 1.190. The NRC staff finds that the methodology is acceptable for referencing in licensing actions as it provides a best-estimate prediction of the fast neutron flux for boiling water reactor pressure vessel (RPV) and its internal components.

   The GEH methodology uses the discrete ordinates transport code DORT and the 80-group MATXS cross-section library. Two calculations are performed in (r,θ) and (r,z) geometries. [[

   ]]

   The flux analysis supporting Section 4.7.3 of the license renewal application (LRA) for Fermi 2 uses a P_3 Legendre polynomial expansion of the scattering cross sections and S_{12} angular quadrature set (96 angles), and models [[

   ]] the maximum flux is used to calculate the fluence. For future installations the bounding flux is the maximum azimuthal flux at the specific radius and axial range of interest. For additional assurance that a conservative flux is used, [[

   ]]

   The end-of-life (EOL) fluence for the installed wedges is calculated using the peak flux for each wedge and the operating history that includes the historical and projected reactor power level and the associated time (i.e. effective full power years (EFPY)) at that power level. [[

   ]] For future installations the bounding flux and a conservative projected operation of 32.2 EFPY at the TPO power level is used, which is based on installation during Refuel Outage 16. For additional assurance that a conservative fluence is used, a capacity factor of 100% is assumed for the TPO power level. The EOL fluence is for 52 EFPY.

Using an NRC approved methodology to calculate the fast neutron flux, and applying conservative assumptions, a conservative fluence is calculated for the installed wedges and a bounding fluence is calculated for future installations. Therefore the fluence values adequately support the evaluation of the auxiliary spring wedge as a time-limited aging analysis (TLAA) item in Section 4.7.3 of the LRA.

3. The original analysis and re-analysis, due to increased fluence, of the auxiliary wedge loss of preload are both based upon the same analysis methodology. Wedge preload loss is attributed to: (1) the wedge material stress relaxation properties with respect to the neutron fluence at the reactor operating temperature; and 2) potential plastic deformation during installation as the wedge arms are temporarily expanded past the installed angle.

4. The response to Part 4 is now provided in GEH Letter 318178-12 (see Enclosures 5 and 6 to NRC-15-0011).

References:

4.7.3-1-1 GE Nuclear Energy, "General Electric Methodology for Reactor Pressure Vessel Fast Neutron Flux Evaluations," NEDC-32983P-A, Revision 2, January 2006.

4.7.3-1-2 Herbert N. Berkow (NRC) to George B. Stramback (GE), "Final Safety Evaluation Regarding Removal of Methodology Limitations for NEDC-32983P-A, 'General Electric Methodology for Reactor Pressure Vessel Fast Neutron Flux Evaluation' (TAC No. MC3788)," MFN-05-143, November 17, 2005.

4.7.3-1-3 Stuart A. Richards (NRC) to James F. Klapproth, "Safety Evaluation for NEDC-32983P, 'General Electric Methodology for Reactor Pressure Vessel Fast Neutron Flux Evaluation' (TAC No. MA9891)," MFN 01-050, September 14, 2001.

Enclosure 4 to
NRC-15-0011

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

GE-Hitachi Nuclear Energy Americas LLC
Affidavit for Enclosure 1 of 318178-8

ENCLOSURE 3

318178-8

Affidavit for Enclosure 1

GE-Hitachi Nuclear Energy Americas LLC

AFFIDAVIT

I, Lisa K. Schichlein, state as follows:

(1) I am a Senior Project Manager, NPP/Services Licensing, Regulatory Affairs, GE-Hitachi Nuclear Energy Americas LLC (GEH), and have been delegated the function of reviewing the information described in paragraph (2) which is sought to be withheld, and have been authorized to apply for its withholding.

(2) The information sought to be withheld is contained in Enclosure 1 of GEH letter 318178-8, "GEH Response to Fermi 2 License Renewal Application RAIs 4.2.2-1, 4.2.6-1, and 4.7.3-1," dated January 16, 2015. The GEH proprietary information in Enclosure 1, which is entitled "GEH Responses to RAIs 4.2.2-1, 4.2.6-1, and 4.7.3-1," is identified by a dotted underline inside double square brackets. [[This sentence is an example.{3}]] In each case, the superscript notation {3} refers to Paragraph (3) of this affidavit, which provides the basis for the proprietary determination.

(3) In making this application for withholding of proprietary information of which it is the owner or licensee, GEH relies upon the exemption from disclosure set forth in the *Freedom of Information Act* ("FOIA"), 5 U.S.C. Sec. 552(b)(4), and the *Trade Secrets Act*, 18 U.S.C. Sec. 1905, and NRC regulations 10 CFR 9.17(a)(4), and 2.390(a)(4) for trade secrets (Exemption 4). The material for which exemption from disclosure is here sought also qualifies under the narrower definition of trade secret, within the meanings assigned to those terms for purposes of FOIA Exemption 4 in, respectively, Critical Mass Energy Project v. Nuclear Regulatory Commission, 975 F.2d 871 (D.C. Cir. 1992), and Public Citizen Health Research Group v. FDA, 704 F.2d 1280 (D.C. Cir. 1983).

(4) The information sought to be withheld is considered to be proprietary for the reasons set forth in paragraphs (4)a. and (4)b. Some examples of categories of information that fit into the definition of proprietary information are:

a. Information that discloses a process, method, or apparatus, including supporting data and analyses, where prevention of its use by GEH's competitors without license from GEH constitutes a competitive economic advantage over other companies;

b. Information that, if used by a competitor, would reduce their expenditure of resources or improve their competitive position in the design, manufacture, shipment, installation, assurance of quality, or licensing of a similar product;

c. Information that reveals aspects of past, present, or future GEH customer-funded development plans and programs, resulting in potential products to GEH;

d. Information that discloses trade secret or potentially patentable subject matter for which it may be desirable to obtain patent protection.

(5) To address 10 CFR 2.390(b)(4), the information sought to be withheld is being submitted to NRC in confidence. The information is of a sort customarily held in confidence by GEH,

and is in fact so held. The information sought to be withheld has, to the best of my knowledge and belief, consistently been held in confidence by GEH, not been disclosed publicly, and not been made available in public sources. All disclosures to third parties, including any required transmittals to the NRC, have been made, or must be made, pursuant to regulatory provisions or proprietary or confidentiality agreements that provide for maintaining the information in confidence. The initial designation of this information as proprietary information, and the subsequent steps taken to prevent its unauthorized disclosure, are as set forth in the following paragraphs (6) and (7).

(6) Initial approval of proprietary treatment of a document is made by the manager of the originating component, who is the person most likely to be acquainted with the value and sensitivity of the information in relation to industry knowledge, or who is the person most likely to be subject to the terms under which it was licensed to GEH.

(7) The procedure for approval of external release of such a document typically requires review by the staff manager, project manager, principal scientist, or other equivalent authority for technical content, competitive effect, and determination of the accuracy of the proprietary designation. Disclosures outside GEH are limited to regulatory bodies, customers, and potential customers, and their agents, suppliers, and licensees, and others with a legitimate need for the information, and then only in accordance with appropriate regulatory provisions or proprietary or confidentiality agreements.

(8) The information identified in paragraph (2), above, is classified as proprietary because it contains details on the GEH fluence methodology for boiling water reactors (BWRs). Development of these methods, techniques, and information and their application for the design, modification, and analyses methodologies and processes was achieved at a significant cost to GEH.

The development of the evaluation processes along with the interpretation and application of the analytical results is derived from the extensive experience databases that constitute a major GEH asset.

(9) Public disclosure of the information sought to be withheld is likely to cause substantial harm to GEH's competitive position and foreclose or reduce the availability of profit-making opportunities. The information is part of GEH's comprehensive BWR safety and technology base, and its commercial value extends beyond the original development cost. The value of the technology base goes beyond the extensive physical database and analytical methodology and includes development of the expertise to determine and apply the appropriate evaluation process. In addition, the technology base includes the value derived from providing analyses done with NRC-approved methods.

The research, development, engineering, analytical and NRC review costs comprise a substantial investment of time and money by GEH. The precise value of the expertise to devise an evaluation process and apply the correct analytical methodology is difficult to quantify, but it clearly is substantial. GEH's competitive advantage will be lost if its competitors are able to use the results of the GEH experience to normalize or verify their

own process or if they are able to claim an equivalent understanding by demonstrating that they can arrive at the same or similar conclusions.

The value of this information to GEH would be lost if the information were disclosed to the public. Making such information available to competitors without their having been required to undertake a similar expenditure of resources would unfairly provide competitors with a windfall, and deprive GEH of the opportunity to exercise its competitive advantage to seek an adequate return on its large investment in developing and obtaining these very valuable analytical tools.

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

Executed on this 16th day of January 2015.

Lisa K. Schichlein

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Enclosure 6 to
NRC-15-0011

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

Enclosure 2 to GEH Letter 318178-12, "Revised GEH Response to RAI 4.7.3-1 Parts 1 and 4" – NON-PROPRIETARY

(although the title of the GEH letter states "Revised", these responses are the first DTE response being provided to the NRC for RAI 4.7.3-1 Parts 1 and 4)

ENCLOSURE 2

318178-12

Revised GEH Response to RAI 4.7.3-1 Parts 1 and 4

Non-Proprietary Information – Class I (Public)

INFORMATION NOTICE

This is a non-proprietary version of Enclosure 1 of 318178-12, which has the proprietary information removed. Portions of the document that have been removed are indicated by white space inside open and closed bracket as shown here [[ ]].

RAI 4.7.3-1

Background:

LRA Section 4.7.3 describes a TLAA for auxiliary spring wedge assemblies installed on certain jet pumps. The LRA states that the auxiliary spring wedge assemblies are subject to loss of preload and were designed for a 40-year life based on a fluence of $1.2x10^{20}$ n/cm^2. The LRA also states that a fluence analysis was performed through the end of the period of extended operation and it was determined for the most limiting case that the projected fluence exceeds the design fluence by 4 percent. The LRA states that this increase in fluence results in a slight increase in the loss of spring preload. The LRA further states that this increased loss of preload has no impact on the most limiting stresses and no adverse impact on the structural integrity and functional performance of the components. As a result, the LRA concludes that the analysis has been projected to the end of the period of extended operation in accordance with 10 CFR 54.21(c)(1)(ii).

Issue:

For demonstrations made pursuant to 10 CFR 54.21(c)(1)(ii), SRP-LR Section 4.7.3.1.2 states that, "The applicant shall provide a sufficient description of the analysis and documents the results of the reanalysis to show that it is satisfactory for a 60-year period." However, LRA Section 4.7.3 does not sufficiently describe the analysis or the results of the re-analysis. Therefore, it is not clear as to how the increased loss of preload will have no adverse impact on the intended function of the auxiliary spring wedge assemblies.

Request:

Address the following items to support the conclusion that an increased loss of preload will have no adverse impact on the intended function of the auxiliary spring wedge assemblies.

1. *Describe how preload ensures the functional performance of the auxiliary spring wedge assemblies and indicate how much preload is needed to ensure this functional performance.*
4. *Quantify the amount of preload loss that was calculated through the end of the period of extended operation and compare that value to the amount of preload loss that is needed to ensure the functional performance of the auxiliary spring wedge assemblies.*

GEH Response to Parts 1 and 4:

1. The original jet pump design has a three point contact support for the inlet mixer to the restrainer bracket with one gravity wedge and two setscrews. The auxiliary spring wedge assemblies are designed to replace the setscrew function by maintaining continuous three point contact in case of setscrew wear.

   The first wedge arm utilizes a monolithic torsional spring, which when fastened to the second wedge arm forms the auxiliary spring wedge assembly (Reference 4.7.3-1-1). The auxiliary spring wedge assembly contact pad is machined to fit based on the measured gap between the restrainer bracket and inlet mixer belly band. The torsional spring acts to continually force the two wedge arms to cross over the shallow angled wedge surface, which in turn increases the stacked thickness of the wedges to maintain constant contact between the belly band and restrainer bracket.

Thus the auxiliary spring wedge assembly functions analogous to the gravity wedge, self-adjusting and constantly maintaining contact with the belly band. This auxiliary spring wedge assembly is designed to function independent of the magnitude of the spring preload (i.e., the spring/wedge function works at any preload).

4. For all three GEH auxiliary spring wedge assemblies installed at the Fermi 2 nuclear plant (Reference 4.7.3-1-2), the bounding preload loss attributed to neutron fluence and potential plastic deformation during installation was calculated as [[ ]] and [[ ]], respectively. The resultant total auxiliary spring wedge assembly preload loss through the end of the extended operation is [[ ]] versus the total preload loss of [[ ]] from the original analysis.

   There is still preload remaining in the auxiliary spring wedge assembly. As the auxiliary spring wedge assembly function is independent of the magnitude of the preload (see RAI 4.7.3-1.1) then there will be contact between the belly band, auxiliary spring wedge assembly bearing surfaces, and the restrainer bracket. However, the previous Fermi 2 auxiliary spring wedge assembly evaluations applied a conservative approach in defining the required preload.

   The installed auxiliary spring wedge assembly is constrained between the belly band, restrainer bracket, setscrew, and restrainer bracket guide ear. Therefore, the auxiliary spring wedge assembly will stay in the installed configuration and perform its function regardless of the preload level. Nevertheless, the conservative Fermi 2 auxiliary spring wedge assembly preload evaluations defined the required minimum preload as that necessary to prevent any slipping of the auxiliary spring wedge assembly between belly band and restrainer bracket during normal and upset operating conditions.

   In this conservative case, the friction forces between the wedge-to-restrainer bracket and wedge-to-belly band must be greater than the maximum Level A/B (Normal/Upset) combined loads applicable to the auxiliary spring wedge assembly. To satisfy this condition, the conservative approach required preload is [[ ]] versus the available preload of [[ ]] with the preload losses considered.

Reference:

4.7.3-1-1 J. G. Erbes, "Jet Pump Spring Wedge," US Patent 6,490,331 B2, December 3, 2002.

4.7.3-1-2 GE Hitachi Nuclear Energy, "Fermi Unit 2 Slip Joint Clamp and Auxiliary Wedge Relaxation Evaluation," 0000-0158-7986 R1, Revision 1, September 2013.

Enclosure 7 to
NRC-15-0011

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

GE-Hitachi Nuclear Energy Americas LLC
Affidavit for Enclosure 1 of 318178-12

ENCLOSURE 3

318178-12

Affidavit for Enclosure 1

GE-Hitachi Nuclear Energy Americas LLC

AFFIDAVIT

I, Lisa K. Schichlein, state as follows:

(1) I am a Senior Project Manager, NPP/Services Licensing, Regulatory Affairs, GE-Hitachi Nuclear Energy Americas LLC (GEH), and have been delegated the function of reviewing the information described in paragraph (2) which is sought to be withheld, and have been authorized to apply for its withholding.

(2) The information sought to be withheld is contained in Enclosure 1 of GEH letter 318178-12, "Revised GEH Response to Fermi 2 License Renewal Application RAI 4.7.3-1 Parts 1 and 4," dated January 30, 2015. The GEH proprietary information in Enclosure 1, which is entitled "Revised GEH Response to RAI 4.7.3-1 Parts 1 and 4," is identified by a dotted underline inside double square brackets. [[This sentence is an example.{3}]] In each case, the superscript notation {3} refers to Paragraph (3) of this affidavit, which provides the basis for the proprietary determination.

(3) In making this application for withholding of proprietary information of which it is the owner or licensee, GEH relies upon the exemption from disclosure set forth in the *Freedom of Information Act* ("FOIA"), 5 U.S.C. Sec. 552(b)(4), and the *Trade Secrets Act*, 18 U.S.C. Sec. 1905, and NRC regulations 10 CFR 9.17(a)(4), and 2.390(a)(4) for trade secrets (Exemption 4). The material for which exemption from disclosure is here sought also qualifies under the narrower definition of trade secret, within the meanings assigned to those terms for purposes of FOIA Exemption 4 in, respectively, Critical Mass Energy Project v. Nuclear Regulatory Commission, 975 F.2d 871 (D.C. Cir. 1992), and Public Citizen Health Research Group v. FDA, 704 F.2d 1280 (D.C. Cir. 1983).

(4) The information sought to be withheld is considered to be proprietary for the reasons set forth in paragraphs (4)a. and (4)b. Some examples of categories of information that fit into the definition of proprietary information are:

a. Information that discloses a process, method, or apparatus, including supporting data and analyses, where prevention of its use by GEH's competitors without license from GEH constitutes a competitive economic advantage over other companies;

b. Information that, if used by a competitor, would reduce their expenditure of resources or improve their competitive position in the design, manufacture, shipment, installation, assurance of quality, or licensing of a similar product;

c. Information that reveals aspects of past, present, or future GEH customer-funded development plans and programs, resulting in potential products to GEH;

d. Information that discloses trade secret or potentially patentable subject matter for which it may be desirable to obtain patent protection.

(5) To address 10 CFR 2.390(b)(4), the information sought to be withheld is being submitted to NRC in confidence. The information is of a sort customarily held in confidence by GEH,

and is in fact so held. The information sought to be withheld has, to the best of my knowledge and belief, consistently been held in confidence by GEH, not been disclosed publicly, and not been made available in public sources. All disclosures to third parties, including any required transmittals to the NRC, have been made, or must be made, pursuant to regulatory provisions or proprietary or confidentiality agreements that provide for maintaining the information in confidence. The initial designation of this information as proprietary information, and the subsequent steps taken to prevent its unauthorized disclosure, are as set forth in the following paragraphs (6) and (7).

(6) Initial approval of proprietary treatment of a document is made by the manager of the originating component, who is the person most likely to be acquainted with the value and sensitivity of the information in relation to industry knowledge, or who is the person most likely to be subject to the terms under which it was licensed to GEH.

(7) The procedure for approval of external release of such a document typically requires review by the staff manager, project manager, principal scientist, or other equivalent authority for technical content, competitive effect, and determination of the accuracy of the proprietary designation. Disclosures outside GEH are limited to regulatory bodies, customers, and potential customers, and their agents, suppliers, and licensees, and others with a legitimate need for the information, and then only in accordance with appropriate regulatory provisions or proprietary or confidentiality agreements.

(8) The information identified in paragraph (2), above, is classified as proprietary because it contains details on the GEH fluence methodology for boiling water reactors (BWRs). Development of these methods, techniques, and information and their application for the design, modification, and analyses methodologies and processes was achieved at a significant cost to GEH.

The development of the evaluation processes along with the interpretation and application of the analytical results is derived from the extensive experience databases that constitute a major GEH asset.

(9) Public disclosure of the information sought to be withheld is likely to cause substantial harm to GEH's competitive position and foreclose or reduce the availability of profit-making opportunities. The information is part of GEH's comprehensive BWR safety and technology base, and its commercial value extends beyond the original development cost. The value of the technology base goes beyond the extensive physical database and analytical methodology and includes development of the expertise to determine and apply the appropriate evaluation process. In addition, the technology base includes the value derived from providing analyses done with NRC-approved methods.

The research, development, engineering, analytical and NRC review costs comprise a substantial investment of time and money by GEH. The precise value of the expertise to devise an evaluation process and apply the correct analytical methodology is difficult to quantify, but it clearly is substantial. GEH's competitive advantage will be lost if its competitors are able to use the results of the GEH experience to normalize or verify their

own process or if they are able to claim an equivalent understanding by demonstrating that they can arrive at the same or similar conclusions.

The value of this information to GEH would be lost if the information were disclosed to the public. Making such information available to competitors without their having been required to undertake a similar expenditure of resources would unfairly provide competitors with a windfall, and deprive GEH of the opportunity to exercise its competitive advantage to seek an adequate return on its large investment in developing and obtaining these very valuable analytical tools.

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

Executed on this 30th day of January 2015.

Lisa K. Schichlein

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