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DTE Energy

10 CFR 54

May 9, 2016
NRC-16-0033

U. S. Nuclear Regulatory Commission
Attention: Document Control Desk
Washington, DC 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) DTE Electric Company Letter to NRC, "Fermi 2 License Renewal Application 2015 Annual Update," NRC-15-0068, dated June 26, 2015 (ML15180A327)

Subject: Fermi 2 License Renewal Application 2016 Annual Update

In Reference 2, DTE Electric Company (DTE) submitted the License Renewal Application (LRA) for Fermi 2. The purpose of this letter is to provide the NRC an update to the Fermi 2 LRA in accordance with 10 CFR 54.21(b). During NRC review of the Fermi 2 LRA, DTE is required by 10 CFR 54.21(b) to provide an amendment to the Fermi 2 LRA that identifies changes to the Fermi 2 current licensing basis (CLB) that materially affects the contents of the Fermi 2 LRA each year and at least three months before scheduled completion of the NRC review. DTE has completed the annual CLB review and is providing the changes to the LRA required by this review in Enclosure 1. In addition, Enclosure 1 of this letter includes additional LRA revisions that have been identified but are not related to changes to the Fermi 2 CLB. This is the annual update for 2016; an annual update for 2015 was previously provided in Reference 3.

No new commitments are being made in this submittal.

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 May 9, 2016

Keith J. Polson
Site Vice President
Nuclear Generation

Enclosures: 1. Fermi 2 License Renewal Application Revisions for 2016 Annual Update

cc: NRC Project Manager
NRC License Renewal Project Manager
NRC Resident Office
Reactor Projects Chief, Branch 5, Region III
Regional Administrator, Region III
Michigan Public Service Commission,
Regulated Energy Division (kindschl@michigan.gov)

Enclosure 1 to
NRC-16-0033

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

Fermi 2 License Renewal Application Revisions for 2016 Annual Update

Current Licensing Basis Changes

In accordance with 10 CFR 54.21(b), DTE has reviewed changes to the Fermi 2 current licensing basis (CLB) to determine if changes impact the Fermi 2 License Renewal Application (LRA). The results of this review that impact the LRA are discussed below.

A. Two new nonsafety-related structures were installed on site. The two structures are the FLEX Storage Facility #1 and #2. These structures provide storage for beyond-design-basis external event mitigation equipment and were constructed as part of the Fermi 2 response to Fukushima. The structures are nonsafety-related and do not contain any safety-related equipment; therefore, they are not within the scope of license renewal. LRA Table 2.2-5 is revised to add an entry for the new structures.

B. As part of the Fermi 2 response to NRC Order EA-12-049 regarding the events at Fukushima, a new system (K11) was installed. The components associated with this system are for responding to beyond-design-basis external events and are therefore nonsafety-related. The new system contains cross-connections into existing plant systems such as the residual heat removal (RHR) and high pressure coolant injection (HPCI) systems. Due to these connections, some components have a license renewal intended function per 10 CFR 54.4(a)(2). LRA Sections 2.3.3.17 and 3.3.2 are revised, LRA Tables 2.2-1 and 3.3.1 (only the footnote at the end of the table) are revised, and new LRA Tables 2.3.3-17-37 and 3.3.2-17-37 are added to address this new system.

C. In the response to request for additional information (RAI) 3.1.2.1-1 in DTE letter NRC-15-0008, dated January 26, 2015, DTE revised LRA Table 3.1.2-1 to add line items for the welds associated with the CRD return line nozzle and cap. In the RAI response, it was indicated that both the nozzle to vessel and nozzle to cap welds are nickel alloy. A more detailed review of these welds has indicated that the nozzle to cap weld is nickel alloy but the nozzle to vessel weld is carbon steel. LRA Tables 3.1.1 (Item 3.1.1-96) and 3.1.2-1 are revised to clarify that the two welds are different materials by using separate line items. The carbon steel weld will use the same line item (3.1.1-96) as the carbon steel nozzle while the nickel alloy weld will use the same line item (3.1.1-97) as the nickel alloy cap.

D. Rotameters in the nonsafety-related portion of the reactor recirculation system (B31) were replaced. The new material is stainless steel. Nonsafety-related components in the B31 system are reviewed in LRA Table 3.1.2-4-2. There are existing line items for stainless steel piping in LRA Table 3.1.2-4-2. However, during the review of the change it was determined that the piping may be exposed to temperatures >140°F. The existing line items do not specify >140°F. LRA Table 3.1.2-4-2 is revised to add line items for stainless steel piping in a treated water >140°F environment.

E. Skid-mounted pumps in the emergency diesel generator system (R30) were replaced. The pump casing material was previously carbon steel. The new material is gray cast

iron. Components in the R30 system are reviewed in LRA Table 3.3.2-10. There are existing line items for carbon steel pump casing, but not for gray cast iron pump casing. LRA Table 3.3.2-10 is revised to add line items for gray cast iron pump casing and the corresponding text in LRA Section 3.3.2.1.10 is revised to add gray cast iron to the list of materials.

F. A pump in the nonsafety-related portion of the control rod drive (CRD) hydraulic system (C11) was replaced. The materials of the replacement pump are the same as the original except for the pump casing. The pump casing was previously carbon steel. The new pump casing is stainless steel. Nonsafety-related components in the B31 system are reviewed in LRA Table 3.3.2-17-1. There are existing line items for carbon steel pump casing in LRA Table 3.3.2-17-1, but not for stainless steel pump casing. LRA Table 3.3.2-17-1 is revised to add line items for stainless steel pump casing.

G. Tubing in the nonsafety-related off-gas process and vacuum system (N62) was added. The tubing material is stainless steel. Nonsafety-related components in the N62 system are reviewed in LRA Table 3.3.2-17-9. There are existing line items for stainless steel tubing in LRA Table 3.3.2-17-9. However, during the review of the change it was determined that the added tubing is exposed to internal condensation. The existing line items do not include condensation as an internal environment. LRA Table 3.3.2-17-9 is revised to add a line item for stainless steel tubing with a condensation internal environment.

H. Valves in the nonsafety-related waste oil system (P70) were replaced. The material was previously carbon steel. The new material is gray cast iron. Nonsafety-related components in the P70 system are reviewed in LRA Table 3.3.2-17-21. There are existing line items for carbon steel valve bodies, but not for gray cast iron valve bodies. LRA Table 3.3.2-17-21 is revised to add line items for gray cast iron valve bodies and the corresponding text in LRA Section 3.3.2.1.17 is revised to add gray cast iron to the list of materials.

I. Several updates were made related to metal fatigue:
   - In the response to RAI 4.3.3-3 in DTE letter NRC-15-0089, dated September 24, 2015, DTE stated that the design fatigue calculation for the condensing chambers may be over-predicting the calculated usage and that a new stress and fatigue analysis was planned. The revised calculations have been performed. As expected, the environmentally assisted fatigue (EAF) cumulative usage factor (CUF_{en}) has decreased. LRA Section 4.3.3 is revised to refer to the new calculation and LRA Table 4.3-8 is revised to update the values for the condensing chambers. The response to RAI 4.3.3-3 also stated that the condensing chambers would be retained as a sentinel location if the CUF_{en} was greater than 0.115. Since the updated CUF_{en} is much less than 0.115, the condensing chambers are not required to be a sentinel location and LRA

Table 4.3-8 is also revised to remove the footnote that had indicated they were a sentinel location.

- In the response to RAI 4.3.3-3a in DTE letter NRC-16-0003, dated January 22, 2016, DTE stated that the standby liquid control (SLC) piping inside containment is not a sentinel location. Subsequent to the RAI response, DTE has decided to conservatively identify the SLC piping inside containment as a sentinel location. LRA Table 4.3-8 is revised to add a footnote to the SLC piping to indicate that it is a sentinel location.
- In the response to RAI 4.3.3-3a regarding EAF in DTE letter NRC-16-0003, dated January 22, 2016, DTE stated that the reactor recirculation (RR) pump cooler calculation was revised to appropriately account for the cooler being replaced in 1998. Although the CUF_{en} for the RR pump cooler in LRA Table 4.3-8 was updated in the January 22, 2016 letter, other sections of the LRA were not updated at that time since they were planned to be included in this annual update. LRA Section 4.3.1.5 and LRA Tables 4.3-1 and 4.3-4 are revised to add details for the RR pump cooler for consistency with the response to RAI 4.3.3-3a.
- The cumulative usage factor (CUF) calculation for the recirculation outlet nozzles was revised to correct an error identified by the Fermi 2 Corrective Action Program. LRA Section 4.3.1.1 is revised to reference the revised calculation and LRA Table 4.3-2 is revised to provide the updated CUF. Note that the CUF value previously provided was conservative (i.e. over-predicted the CUF).
- LRA Section 4.8 (References) is revised to update the references associated with the metal fatigue changes discussed above.

J. In DTE letter NRC-14-0065 dated September 16, 2014, DTE submitted a license amendment request to relocate specific Technical Specification (TS) surveillance frequencies to a licensee-controlled program in accordance with NEI 04-10. This license amendment request was approved by the NRC by letter dated July 14, 2015 (ML15155B416). The program description of the Diesel Fuel Monitoring Program in LRA Sections A.1.14 and B.1.14 referred to the inspection frequency being specified in the Fermi 2 TS. LRA Sections A.1.14 and B.1.14 are revised to refer instead to the Surveillance Frequency Control Program for consistency with the NRC-approved change to the Fermi 2 TS.

K. In an NRC letter dated February 22, 2016 (ML16011A190), the NRC documented the final safety evaluation of BWRVIP-18 Revision 2. The letter indicated that BWRVIP-18 Revision 2 is approved for use. DTE plans to incorporate all conditions in the BWRVIP-18 Revision 2 final safety evaluation without exception. LRA Appendix C references BWRVIP-18 Revision 1 in multiple places. LRA Appendix C is revised to change the revision number of BWRVIP-18 from “1” to “2” in all instances for consistency with the February 22, 2016 NRC letter. Since the approved version (i.e. the -A version) is not yet available, LRA Appendix C is also revised to remove the “-A” from BWRVIP-18.

Administrative Changes

In addition to the CLB changes, DTE has also identified some other non-material changes to the LRA. These changes are administrative changes to make editorial corrections or ensure consistency between the LRA and previously submitted RAI responses. These additional items that impact the LRA are discussed below.

L. In the response to RAI B.1.41-1 in DTE letter NRC-15-0007, dated January 28, 2015, DTE revised LRA Table 3.3.2-3 to add a line item for fouling of copper alloy nozzles in the service water systems. However, the aging effect of fouling was not added to the corresponding text in LRA Section 3.3.2.1.3 which lists the applicable aging effects for the service water systems. LRA Section 3.3.2.1.3 is revised to add "fouling" to the bulleted list of aging effects for consistency with the change previously made in the response to RAI B.1.41-1. In addition, the line item that was previously added to LRA Table 3.3.2-3 referenced LRA Table 3.3.1 Item 3.3.1-36. The aging effect/mechanism column for Item 3.3.1-36 includes fouling; however, the discussion column does not. LRA Table 3.3.1 Item 3.3.1-36 is revised to include "fouling" in the discussion column for consistency with the change previously made in the response to RAI B.1.41-1.

M. In the response to RAI 3.5.2.2.2.1-3a in DTE letter NRC-15-0056, dated May 19, 2015, DTE revised LRA Tables 3.5.2-1 and 3.5.2-3 to add line items for loss of strength of concrete in the Structures Monitoring Program. However, the aging effect of loss of strength was not added to the corresponding text in LRA Sections 3.5.2.1.1 and 3.5.2.1.3 which lists the applicable aging effects. LRA Sections 3.5.2.1.1 and 3.5.2.1.3 are revised to add "loss of strength" to the bulleted list of aging effects requiring management for consistency with the change previously made in the response to RAI 3.5.2.2.2.1-3a.

N. In the response to RAI B.1.16-2 in DTE letter NRC-15-0007, dated January 28, 2015, DTE revised LRA Table 3.5.2-4 to add an aging effect of degradation due to moisture intrusion for insulation to be managed by the External Surfaces Monitoring Program. In the response to the follow-up RAI B.1.16-2a in DTE letter NRC-15-0067, dated June 18, 2015, DTE further revised Table 3.5.2-4 to indicate that this aging effect for insulation will also be managed by the Periodic Surveillance and Periodic Maintenance Program. However, this information was not added to the corresponding text in LRA Section 3.5.2.1.4 which lists the applicable aging effects and aging management programs. LRA Section 3.5.2.1.4 is revised to add "degradation due to moisture intrusion" to the bulleted list of aging effects requiring management and to add both "External Surfaces Monitoring" and "Periodic Surveillance and Periodic Maintenance" to the bulleted list of aging management programs for consistency with the changes previously made in the responses to RAIs B.1.16-2 and B.1.16-2a.

O. In DTE letter NRC-16-0027, dated April 12, 2016, DTE revised the Buried and Underground Piping Program in LRA Sections A.1.4 and B.1.4 based on LR-ISG-2015-01, "Changes to Buried and Underground Piping and Tank

Recommendations." Although the LRA was revised to indicate consistency with LR-ISG-2015-01, the program description in LRA Section A.1.4 did not explicitly include some statements that were included in the corresponding program description in LR-ISG-2015-01. LRA Section A.1.4 is revised to add some additional details to the Buried and Underground Piping Program description for consistency with the changes recommended in LR-ISG-2015-01.

P. LRA Section A.3 is a list of references for Appendix A of the LRA. In the original LRA submittal, the second reference (A.3-2) was a placeholder for the Safety Evaluation Report (SER) for the LRA. LRA Section A.3 is revised to replace the placeholder reference with the actual reference to the SER with Open Items.

Q. In an NRC letter dated December 28, 2015 (ML15307A468), the NRC accepted the approved version of BWRVIP-76 Revision 1 (i.e. the -A version). The letter indicated that BWRVIP-76 Revision 1-A is approved for use. LRA Appendix C references BWRVIP-76 Revision 1 in multiple places. LRA Appendix C is revised to add the "-A" to all instances of BWRVIP-76 Revision 1 for consistency with the December 28, 2015 NRC letter.

R. The tables in LRA Section 3.0 include a "Notes" column and generic notes A and B are identical except that note A is used for programs that are consistent with NUREG-1801 and note B is used for programs that have exceptions to NUREG-1801. The same is true for generic notes C and D. DTE letter NRC-16-0027 dated April 12, 2016 revised the Buried and Underground Piping Program (LRA Section B.1.4) to add an exception to NUREG-1801. For Section 3.0 table line items that reference this program, all use of generic note A associated with this program is revised to note B and all use of generic note C is revised to note D. Since these changes affect multiple line items in multiple tables in LRA Section 3.0 and the changes are administrative in nature, actual markups to the existing LRA tables are not provided in this letter.

LRA Revisions

The LRA revisions associated with the changes discussed above (both the CLB-related and administrative changes) are shown on the following pages. Additions are shown in underline and deletions are shown in strike-through. Note that changes to these same LRA sections made in previous letters are not shown in underline or strike-through such that only the new changes due to the items above are shown as revisions. Since a single change may result in an impact to multiple locations in the LRA, the LRA revisions are labeled with a letter in the right margin that cross-references the change to the list above. The LRA revisions are provided in the order that they would appear in the LRA. Note that the LRA revisions for Items A and B above include references to the Updated Final Safety Analysis Report (UFSAR). Those UFSAR references are based on revisions to the UFSAR that have been approved by DTE, but have not yet been provided to the NRC. UFSAR revisions are periodically provided to the NRC pursuant to 10 CFR 50.71(e) and 10 CFR 50.4(b)(6); the next submittal is scheduled for May 2016.

Table 2.2-1
Mechanical Systems Within the Scope of License Renewal

System Code	System Name	LRA Section Describing System
J11	Fuel and Reloads	Section 2.3.1.6, Fuel and Reloads
K11	Beyond Design Basis External Event Mitigation (Fukushima)	Section 2.3.3.17, Miscellaneous Auxiliary Systems in Scope for 10 CFR 54.4(a)(2)
N11	Main and Reheat Steam	Section 2.3.4.3, Miscellaneous Steam and Power Conversion Systems in Scope for 10 CFR 54.4(a)(2)

B

Table 2.2-5
Structures Not Within the Scope of License Renewal

Structure Name	UFSAR Reference or Structure Function
Fermi 1 structures	Support Fermi 2 by providing laboratory space, office and storage space, and support equipment for the potable water system and sewer system. The sanitary sewer system (Y44) is not within the scope of license renewal, and the potable water system (P21) has no components subject to aging management review in Fermi 1 structures since the system's only intended function for license renewal meets the criterion of 10 CFR 54.4(a)(2).
FLEX Storage Facility #1 & #2	Section 1.2.2.4; Table 3.2-1
Hydrogen Storage Facility	Section 9A.4.7.6

A

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

The following auxiliary systems, described in the referenced sections, are within the scope of license renewal based on the criterion of 10 CFR 54.4(a)(2) for physical interactions.

System Code	System Name	Section Describing System
H21	Local Panels and Racks	Section 2.3.3.17, Miscellaneous Auxiliary Systems in Scope for 10 CFR 54.4(a)(2)
K11	Beyond Design Basis External Event Mitigation (Fukushima)	Section 2.3.3.17, Miscellaneous Auxiliary Systems in Scope for 10 CFR 54.4(a)(2)
N62	Off-Gas Process and Vacuum	Section 2.3.3.17, Miscellaneous Auxiliary Systems in Scope for 10 CFR 54.4(a)(2)

B

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

System Description

Local Panels and Racks

Beyond Design Basis External Event Mitigation (Fukushima)

The purpose of the beyond design basis external event mitigation (Fukushima) system (system code K11) is to maintain or restore core cooling, containment and spent fuel pool cooling capabilities following a beyond-design-basis external event (BDBEE). This system is part of an overall response to NRC issued Order EA-12-049, "Issuance of Order to Modify Licenses with Regard to Requirements for Mitigation Strategies for Beyond-Design-Basis External Events." The Order was the result of lessons learned from the earthquake/tsunami event at Fukushima Dai-ichi on March 11, 2011.

The elements of this system in conjunction with modifications made to several other existing systems are capable of mitigating a simultaneous loss of all alternating current (ac) power and loss of normal access to the ultimate heat sink. This system also includes reasonable protection for the associated equipment from external events. B

The system includes pumps, generators, piping, fittings, strainers, valves, hoses, instrumentation, couplings, cables, connections, and equipment to deploy the mitigation equipment. The system has two FLEX storage buildings which are capable of protecting equipment stored within. There is one structure inside the protected area and one located outside the protected area.

Those portions of the K11 system that are connected to or are located in the general vicinity of systems, structures and components that have an intended function under 10 CFR 54.4(a)(1) are considered to have an intended function under 10 CFR 54.4(a)(2).

UFSAR References: Sections 1.2.2.4, 6.3.2.2.1, 9.2.1.2, and 9.2.1.3

Off-Gas Process and Vacuum

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

UFSAR References

The following table lists the UFSAR references for systems described in this section.

System Code	System Name	UFSAR Reference
H21	Local Panels and Racks	Table 3.10-3
K11	Beyond Design Basis External Event Mitigation (Fukushima)	Sections 1.2.2.4, 6.3.2.2.1, 9.2.1.2, and 9.2.1.3
N62	Off-Gas Process and Vacuum	Section 11.3.2.7

B

Components Subject to Aging Management Review

System Code	System Name	Component Types	AMR Results
H21	Local Panels and Racks	Table 2.3.3-17-8	Table 3.3.2-17-8
K11	Beyond Design Basis External Event Mitigation (Fukushima)	Table 2.3.3-17-37	Table 3.3.2-17-37
N62	Off-Gas Process and Vacuum	Table 2.3.3-17-9	Table 3.3.2-17-9

B

Table 2.3.3-17-37
Beyond Design Basis External Event Mitigation (Fukushima) System
Nonsafety-Related Components Affecting Safety-Related Systems
Components Subject to Aging Management Review

Component Type	Intended Function[a]
Flex connection	Pressure boundary
Piping	Pressure boundary
Tubing	Pressure boundary
Valve body	Pressure boundary

a. For component types included under 10 CFR 54.4(a)(2), the intended function of pressure boundary includes providing structural/seismic support for components that are included for nonsafety-related SSCs directly connected to safety-related SSCs.

B

Table 3.1.1
Summary of Aging Management Programs for the Reactor Coolant System
Evaluated in Chapter IV of NUREG-1801

Table 3.1.1: Reactor Coolant System						
Item Number	**Component**	**Aging Effect/ Mechanism**	**Aging Management Programs**	**Further Evaluation Recommended**	**Discussion**	
3.1.1-96	Steel (with or without stainless steel cladding) control rod drive return line nozzles exposed to reactor coolant	Cracking due to cyclic loading	Chapter XI.M6, "BWR Control Rod Drive Return Line Nozzle"	No	The Fermi 2 control rod drive return line was cut and capped before initial plant operation. The nozzles have not been exposed to thermal cyclic loading from operation of the return line. However, the BWR CRD Return Line Nozzle Program manages cracking for the control rod drive return line nozzle, ~~and nickel alloy~~ cap, and nozzle welds. This item is used for the nozzle and nozzle to vessel weld. See Item 3.1.1-97 for the nickel alloy cap and nozzle to cap weld~~s~~.	C

Table 3.1.2-1
Reactor Vessel
Summary of Aging Management Evaluation

Table 3.1.2-1: Reactor Vessel									
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**	
Welds (nozzle to vessel) • CRD return line (N9)	Pressure boundary	Carbon steel	Air – indoor (ext)	None	None	--	--	G, 102	
Welds (nozzle to vessel) • CRD return line (N9)	Pressure boundary	Carbon steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	IV.A1.RP-50	3.1.1-84	D, 101	C
Welds (nozzle to vessel) • CRD return line (N9)	Pressure boundary	Carbon steel	Treated water (int)	Cracking	BWR CRD Return Line Nozzle	IV.A1.R-66	3.1.1-96	I	
Welds (~~nozzle to vessel and~~ nozzle to cap) • CRD return line (N9)	Pressure boundary	Nickel alloy	Air – indoor (ext)	None	None	IV.E.RP-03	3.1.1-106	A	
Welds (~~nozzle to vessel and~~ nozzle to cap) • CRD return line (N9)	Pressure boundary	Nickel alloy	Treated water (int)	Loss of material	Water Chemistry Control – BWR	IV.A1.RP-157	3.1.1-85	B, 101	C

Table 3.1.2-1: Reactor Vessel								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
Welds (~~nozzle to vessel and~~ nozzle to cap) • CRD return line (N9)	Pressure boundary	Nickel alloy	Treated water (int)	Cracking	BWR CRD Return Line Nozzle Water Chemistry Control – BWR	IV.A1.R-68	3.1.1-97	E

C

Table 3.1.2-4-2
Reactor Recirculation System
Nonsafety-Related Components Affecting Safety-Related Systems
Summary of Aging Management Evaluation

Table 3.1.2-4-2: Reactor Recirculation 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	Stainless steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	V.D2.EP-73	3.2.1-17	D, 101	
Piping	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Cracking	Water Chemistry Control – BWR	VIII.C.SP-88	3.4.1-11	D, 101	D
Piping	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Loss of material	Water Chemistry Control – BWR	IV.C1.RP-158	3.1.1-79	B, 101	
Pump casing	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	V.E.E-44	3.2.1-40	C	

3.3.2 **Results**

The following system tables summarize the results of aging management reviews and the NUREG-1801 comparison for auxiliary systems.

- Table 3.3.2-17-36 RHR Complex Drains and OSB Potable Water System, Nonsafety-Related Components Affecting Safety-Related Systems–Summary of Aging Management Evaluation
- Table 3.3.2-17-37 Beyond Design Basis External Event Mitigation (Fukushima) System, Nonsafety-Related Components Affecting Safety-Related Systems–Summary of Aging Management Evaluation

B

3.3.2.1.3 Service Water Systems

Aging Effects Requiring Management

The following aging effects associated with the service water systems require management.

- Change in material properties
- Cracking
- Fouling
- Loss of coating integrity
- Loss of material
- Loss of material – recurring internal corrosion
- Loss of material – wear
- Loss of preload

L

3.3.2.1.10 Emergency Diesel Generator System

Materials

Emergency diesel generator system components are constructed of the following materials.

- Aluminum
- Carbon steel
- Coppery alloy
- Copper alloy > 15% zinc (inhibited)
- Copper alloy > 15% zinc or > 8% aluminum
- Glass
- Gray cast iron | E
- Stainless steel

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

Materials

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

- Aluminum
- Carbon steel
- Coppery alloy
- Copper alloy > 15% zinc or > 8% aluminum
- Elastomer
- Glass
- Gray cast iron | H
- Stainless steel

Table 3.3.1
Summary of Aging Management Programs for the Auxiliary Systems
Evaluated in Chapter VII of NUREG-1801

Table 3.3.1: Auxiliary Systems					
Item Number	**Component**	**Aging Effect/ Mechanism**	**Aging Management Programs**	**Further Evaluation Recommended**	**Discussion**
3.3.1-36	Copper alloy piping, piping components, and piping elements exposed to raw water	Loss of material due to general, pitting, crevice, and microbiologically influenced corrosion; fouling that leads to corrosion	Chapter XI.M20, "Open-Cycle Cooling Water System"	No	Consistent with NUREG-1801. Loss of material and fouling for copper alloy components exposed to raw water is managed by the Service Water Integrity Program.

L

Notes for Tables 3.3.2-1 through ~~3.3.2-17-36~~ 3.3.2-17-37

B

Generic Notes

Plant-Specific Notes

Table 3.3.2-10
Emergency Diesel Generator System
Summary of Aging Management Evaluation

Table 3.3.2-10: Emergency Diesel Generator System								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
Pump casing	Pressure boundary	Carbon steel	Treated water (int)	Loss of material	Water Chemistry Control – Closed Treated Water Systems	VII.H2.AP-202	3.3.1-45	B
Pump casing	Pressure boundary	Gray cast iron	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VII.I.A-77	3.3.1-78	A
Pump casing	Pressure boundary	Gray cast iron	Treated water (int)	Loss of material	Selective Leaching	VII.G.AP-31	3.3.1-72	A
Sight glass	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VII.I.A-77	3.3.1-78	A

E

Table 3.3.2-17-1
CRD Hydraulic System
Nonsafety-Related Components Affecting Safety-Related Systems
Summary of Aging Management Evaluation

Table 3.3.2-17-1: CRD Hydraulic 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**
Pump casing	Pressure boundary	Carbon steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	VII.E3.AP-106	3.3.1-21	D, 301
Pump casing	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VII.J.AP-123	3.3.1-120	A
Pump casing	Pressure boundary	Stainless steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	VIII.D2.SP-87	3.4.1-16	D, 401
Strainer housing	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VII.I.A-77	3.3.1-78	A

F

Table 3.3.2-17-9
Off-Gas Process and Vacuum System
Nonsafety-Related Components Affecting Safety-Related Systems
Summary of Aging Management Evaluation

Table 3.3.2-17-9: Off-Gas Process and Vacuum 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**
Tubing	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VII.J.AP-123	3.3.1-120	A
Tubing	Pressure boundary	Stainless steel	Condensation (int)	Loss of material	Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.E5.AP-273	3.3.1-95	C
Tubing	Pressure boundary	Stainless steel	Treated water (int)	Loss of material	Water Chemistry Control – Closed Treated Water Systems	VII.C2.A-52	3.3.1-49	D

G

Table 3.3.2-17-21
Waste Oil System
Nonsafety-Related Components Affecting Safety-Related Systems
Summary of Aging Management Evaluation

Table 3.3.2-17-21: Waste Oil 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**	
Valve body	Pressure boundary	Carbon steel	Waste water (int)	Loss of material	Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.E5.AP-281	3.3.1-91	C	
Valve body	Pressure boundary	Gray cast iron	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VII.I.A-77	3.3.1-78	A	H
Valve body	Pressure boundary	Gray cast iron	Waste water (int)	Loss of material	Selective Leaching	VII.G.A-51	3.3.1-72	A, 305	
Valve body	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VII.J.AP-123	3.3.1-120	A	

Table 3.3.2-17-37
Beyond Design Basis External Event Mitigation (Fukushima) System
Nonsafety-Related Components Affecting Safety-Related Systems
Summary of Aging Management Evaluation

Table 3.3.2-17-37: Beyond Design Basis External Event Mitigation (Fukushima) 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
Flex connection	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VII.J.AP-123	3.3.1-120	A
Flex connection	Pressure boundary	Stainless steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	VII.E3.AP-110	3.3.1-25	B, 301
Piping	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VII.I.A-77	3.3.1-78	A
Piping	Pressure boundary	Carbon steel	Air – indoor (int)	Loss of material	External Surfaces Monitoring	V.D2.E-29	3.2.1-44	E
Piping	Pressure boundary	Carbon steel	Treated water (int)	Cracking – fatigue	TLAA – metal fatigue	V.D2.E-10	3.2.1-1	C
Piping	Pressure boundary	Carbon steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	VII.E3.AP-106	3.3.1-21	B, 301

B

Table 3.3.2-17-37: Beyond Design Basis External Event Mitigation (Fukushima) 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
Tubing	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VII.J.AP-123	3.3.1-120	A
Tubing	Pressure boundary	Stainless steel	Air – indoor (int)	None	None	VII.J.AP-123	3.3.1-120	A
Valve body	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VII.I.A-77	3.3.1-78	A
Valve body	Pressure boundary	Carbon steel	Air – indoor (int)	Loss of material	External Surfaces Monitoring	V.D2.E-29	3.2.1-44	E
Valve body	Pressure boundary	Carbon steel	Treated water (int)	Cracking – fatigue	TLAA – metal fatigue	V.D2.E-10	3.2.1-1	C
Valve body	Pressure boundary	Carbon steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	VII.E3.AP-106	3.3.1-21	B, 301

B

3.5.2.1.1 Reactor/Auxiliary Building and Primary Containment

Aging Effects Requiring Management

The following aging effects associated with the reactor/auxiliary building and primary containment require management.

- Cracking
- Increase in porosity and permeability
- Loss of bond
- Loss of coating integrity
- Loss of leak tightness
- Loss of material
- Loss of preload
- Loss of sealing
- Loss of strength | M

3.5.2.1.3 Turbine Building, Process Facilities, and Yard Structures

Aging Effects Requiring Management

The following aging effects associated with the turbine building, process facilities, and yard structures require management.

- Cracking
- Cracks and distortion
- Increase in porosity and permeability
- Loss of bond
- Loss of material
- Loss of strength | M

3.5.2.1.4 Bulk Commodities

Aging Effects Requiring Management

The following aging effects associated with bulk commodities require management.

- Change in material properties
- Cracking
- Cracking/delamination, separation
- Degradation due to moisture intrusion | N
- Increase in porosity and permeability
- Increased hardness, shrinkage, loss of strength
- Loss of bond
- Loss of material
- Loss of mechanical function
- Loss of preload
- Loss of sealing
- Reduction in concrete anchor capacity
- Reduction or loss of isolation function

Aging Management Programs

The following aging management programs manage the effects of aging on the bulk commodity components.

- External Surfaces Monitoring | N
- Fire Protection
- Fire Water System
- Inservice Inspection – IWF
- Periodic Surveillance and Preventive Maintenance | N
- RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants
- Structures Monitoring
- Water Chemistry Control – BWR

Table 4.3-1
Analyzed Transients with Projections

Event Number		Event Description	Current Count	Projected Value	Analysis Input Value	
		Recirculation pump injection on-off-on[i]	21	34	37	I

h. The current count of OBE events is zero. This results in zero projected events. For conservatism, two events were included in the analysis input value.

i. The recirculation pump coolers were replaced in 1998. Through December 2012, 3 cycles had been experienced. The analysis input value for the coolers was 12 cycles (Ref. 4-18). I

4.3.1.1 Reactor Pressure Vessel

As described in UFSAR Section 5.4.6.3.1 and shown in UFSAR Figure 5.4-1, the RPV is a vertical, cylindrical pressure vessel with hemispherical heads of welded construction. The vessel design data are listed in UFSAR Table 5.4-1. The RPV thermal cycles are listed in Table 4.3-1. The RPV is designed, fabricated, tested, inspected, and stamped in accordance with the ASME B&PV Code Section III, 1968, Class 1, up to and including summer 1969 Addenda.

Sections 4.3.1.2 and 4.3.1.3 provide additional details on the review of feedwater nozzle and underclad cracking. Table 4.3-2 lists the CUFs for the reactor vessel (Ref. 4-16 and 4-18). I

Fermi 2 will monitor transient cycles using the Fatigue Monitoring Program (Section B.1.17) and assure that action is taken if any of the actual cycles approach their analyzed numbers. As such, the Fatigue Monitoring Program will manage the effects of aging due to fatigue on the reactor pressure vessel in accordance with 10 CFR 54.21(c)(1)(iii).

Table 4.3-2
Reactor Pressure Vessel Cumulative Usage Factors

General Location	Location/Node	CUF
Recirculation outlet nozzles	Nozzle-vessel intersection	0.258
	Safe end	~~0.103~~ 0.008 I
	Nozzle	0.116

4.3.1.5 Reactor Pressure Vessel Internals

NPVC 1 (NPVC - 1, 2, 3 Draft ASME Code for Pumps and Valves for Nuclear Power, Class I, II, III). As identified in Note z of UFSAR Table 3.2-1 and UFSAR Table 3.2-4 Note j, the reactor recirculation pumps were upgraded to the 4th generation design, and the modified components were designed and manufactured to ASME III, 1989. Representative analyses of recirculation pumps are summarized in UFSAR Table 3.9-20. The transients that require tracking are included in Table 4.3-1. Table 4.3-4 provides the CUFs for the reactor recirculation pumps (Ref. ~~4-16~~ 4.18). The number of transients and calculations for the cooler (lower inner cylinder) were projected to account for the cooler being replaced in 1998 and cycles experienced from replacement through December 2012 (Ref. 4-19). I

Table 4.3-4
Reactor Recirculation Pumps Cumulative Usage Factors

General Location	Location/Node	CUF
GE RRS pumps	Cooler (lower inner cylinder)	~~0.236~~ 0.056 I
	Bolts	0.642
	Heater (non-RCPB)	~~0.467~~ 0.738 I

4.3.3 Effects of Reactor Water Environment on Fatigue Life

The screening calculations determined that some components have a calculated CUF_{en} greater than 1.0. Where this occurred, the locations were re-evaluated with reduced F_{en} multipliers using average transient temperatures (based on NUREG/CR-6909 guidance) or average load pair temperatures where available. The results of the EAF screening are shown in Table 4.3-8. Sentinel locations are noted in Table 4.3-8.

As shown in Table 4.3-8, this screening has determined that there are locations that, when accounting for environmental effects, have projected usage factors greater than 1.0. Additional action will be needed, e.g. more detailed analysis or stress-based or cycle-based fatigue monitoring, as part of the Fatigue Monitoring Program (Section B.1.17) for these locations. DTE will update the fatigue usage calculations using refined fatigue analyses to determine CUFs less than 1.0 when accounting for the effects of reactor water environment prior to the period of extended operation or institute stress-based fatigue (SBF) or cycle-based fatigue (CBF) monitoring to demonstrate CUFs remain less than 1.0. For some locations, Table 4.3-8 has been updated based on more detailed analyses (Ref. 4-17 and 4-20). I

Fermi 2 manages the effects of fatigue, including environmentally assisted fatigue, under the Fatigue Monitoring Program (Section B.1.17) for the period of extended operation in accordance with 10 CFR 54.21(c)(1)(iii).

Table 4.3-8
EAF Screening of Fermi 2 Locations

NUREG/CR-6260 Generic Location		Fermi 2 Location	Material[1]	CUF	F_{en}	EAF CUF	
--	--	SLCS piping[2]	SS	0.108	4.50 - 9.73[3]	0.658	I
--	--	Condensing chamber[2]	SS	~~0.385~~ 0.0026	9.73	~~3.75~~[4] 0.025	I

1. CS: carbon steel. LAS: low alloy steel. NBA: nickel-based alloy. SS: stainless steel.
2. This component is a sentinel location.
3. F_{en} was calculated for each transient or load pair based on average temperature or maximum service temperature at uprate conditions.
4. CUF_{en} is above 1, so additional action will be needed, e.g. more detailed analysis or stress based monitoring.
5. Not part of reactor coolant pressure boundary, so no EAF evaluation is needed.

4.8 REFERENCES

4-15 NUREG/CR-6909 (ANL-06/08), *Effect of LWR Coolant Environments on the Fatigue Life of Reactor Materials*, February 2007.

4-16 Design Calculation DC-6222, "ASME Operating Plant Fatigue Assessment for License Renewal – RCPB Components", Revision A, March 2015.

4-17 Structural Integrity Associates Calculation 1400966.301, "Fermi 2 Environmental Assisted Fatigue (EAF) Screening", ~~Revision 2, May 2015~~ Revision 3, January 2016. I

4-18 Structural Integrity Associates Calculation 1300837.301, "ASME Operating Plant Fatigue Assessment for License Renewal – RCPB Components," Revision 3, January 2016.

4-19 DTE letter to NRC, NRC-16-0003, "Response to NRC Request for Additional Information for the Review of the Fermi 2 License Renewal Application – Set 38," dated January 22, 2016. I

4-20 Structural Integrity Associates Calculation 1500488.304, "Environmentally Assisted Fatigue Usage Analysis of Fermi 2 Condensing Chamber," February 2016.

A.1.4 Buried and Underground Piping Program

The Buried and Underground Piping Program is a new program that will manage the effects of aging on the external surfaces of buried and underground piping components within the scope of license renewal. The program will manage aging effects of loss of material and cracking for the external surfaces of buried and underground piping fabricated of aluminum, carbon steel, gray cast iron, and stainless steel through preventive and mitigative measures (e.g., coatings, backfill quality, and cathodic protection) and periodic inspection activities during opportunistic or directed excavations. There are no underground or buried tanks for which aging effects would be managed by the Buried and Underground Piping Program. Fermi 2 utilizes a cathodic protection system. Fermi 2 has performed preliminary laboratory soil composition analyses on samples removed from the site to evaluate the potential corrosivity of the soil for use in life cycle management.

Inspections are conducted by qualified individuals. Where the coatings, backfill or the condition of exposed piping does not meet acceptance criteria such that the depth or extent of degradation of the base metal could have resulted in a loss of pressure boundary function when the loss of material rate is extrapolated to the end of the period of extended operation, an increase in the sample size is conducted. Soil testing will be conducted once in each ten-year period starting ten years prior to the period of extended operation, if a reduction in the number of inspections recommended in Table XI.M41-2 of NUREG-1801 is taken based on a lack of soil corrosivity. O

When using the 100 mV, -750 mV or -650 mV polarization criteria as an alternative to the -850 mV criterion, for steel piping, electric resistance probes (ERPs) will be installed in select locations as determined by a Cathodic Protection Specialist. The ERPs will be made of the most anodic metal in the system to ensure adequate protection of the most anodic system metal. Concurrent with the ERPs, permanent reference cells and reference metal will be installed. Installation of the permanent reference cells at pipe depth and near the piping of interest will allow for an accurate measurement of pipe-to-soil potential, minimizing the influence of mixed metals. Where used, the electrical resistance probes will be uncoated and placed in the immediate vicinity of the buried piping it is representing. For each installation application, two probes will be installed; one connected to the cathodic protection system and one left unprotected. The test probe left unprotected (not connected to the pipe) will be free of the mixed metals influence.

This program will be implemented prior to the period of extended operation.

A.1.14 Diesel Fuel Monitoring Program

The Diesel Fuel Monitoring Program manages loss of material in piping, tanks, and other components exposed to an environment of diesel fuel oil by verifying the quality of the fuel oil source. This is accomplished by limiting the quantities of contaminants in diesel fuel oil. Parameters monitored include water, sediment, total particulate, biodiesel concentration, and levels of microbiological activity. Sampling is performed before the fuel oil is allowed to enter the fuel oil storage tanks. The program also requires periodic multi-level sampling of fuel oil storage tanks, where possible. Where multi-level sampling cannot be performed, a representative sample is taken from the lowest part of the tank. If biological activity is identified, biocides are added to prevent biological activity.

Effectiveness of the program is periodically verified by inspecting low flow areas where contaminants may collect, such as in the bottom of tanks. The tanks are periodically sampled, drained, cleaned, and internally inspected for signs of moisture, contaminants and corrosion. Internal tank inspections will be performed at least once during the ten-year period prior to the period of extended operation, and at least once every ten years during the period of extended operation. Where degradation is observed, a wall thickness determination will be made, and the extent of the condition is determined as a part of the Corrective Action Program. Applicable industry standards and guidance documents are used to establish inspection frequency, if not specified ~~in the Fermi 2 technical specifications~~ by the Fermi 2 Technical Specifications Surveillance Frequency Control Program. J

A.3 REFERENCES

A.3-1 DTE Electric Company to NRC, “Fermi 2 License Renewal Application,” NRC-14-0028, letter dated April 24, 2014 (ML14121A554).

A.3-2 ~~[NRC Safety Evaluation Report for Fermi 2 License Renewal—later]~~ NRC to DTE Electric, “Safety Evaluation Report with Open Items Related to the License Renewal of Fermi 2 (TAC No. MF4222),” letter dated January 28, 2016 (ML16020A457). P

A.3-3 DTE Electric Company to NRC, “License Amendment Request for Measurement Uncertainty Recapture (MUR) Power Uprate,” NRC-13-0004, letter dated February 7, 2013 (ML13043A659).

A.3-4 NRC to DTE Electric, “Fermi 2—Issuance of Amendment re: Measurement Uncertainty Recapture Power Uprate (TAC NO. MF0650),” letter dated February 10, 2014 (ML13364A131).

B.1.14 DIESEL FUEL MONITORING

Program Description

The Diesel Fuel Monitoring Program manages loss of material in piping, tanks, and other components exposed to an environment of diesel fuel oil by verifying the quality of the fuel oil source. This is accomplished by limiting the quantities of contaminants in diesel fuel oil. Parameters monitored include water, sediment, total particulate, biodiesel concentration, and levels of microbiological activity. Sampling is performed before the fuel oil is allowed to enter the fuel oil storage tanks. The program also requires periodic multi-level sampling of fuel oil storage tanks, where possible. Where multi-level sampling cannot be performed, a representative sample is taken from the lowest part of the tank. If biological activity is identified, biocides are added to prevent biological activity.

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Appendix C
Response to BWRVIP Applicant Action Items

Of the BWRVIP documents credited for Fermi 2 license renewal, the following have NRC safety evaluation reports (SERs) for license renewal.

BWRVIP-18~~-A~~	BWR Core Spray Internals Inspection and Flaw Evaluation Guidelines, Revision ~~1~~ 2	K
BWRVIP-76-A	BWR Core Shroud Inspection and Flaw Evaluation Guidelines, Revision 1	Q

Action Item Description	Response	
Common Action Items from BWRVIP-18~~-A~~ Rev.~~1~~ 2, -25, -26-A, -27-A, -38, -41 Rev. 3, -47-A, -48-A, -49-A, -74-A, -76-A Rev. 1		K Q
Additional Action Items		
BWRVIP-18~~-A~~ Rev.~~1~~ 2, Core spray Internals Inspection and and Flaw Evaluation Guidelines		K
BWRVIP-*18~~-A~~ Rev.~~1~~ 2* (4) Applicants referencing the BWRVIP-18 report for license renewal should identify and evaluate any potential TLAA issues which may impact the structural integrity of the subject RPV internal components.	Fermi 2 will incorporate all conditions in the BWRVIP-18, Rev. 2 Safety Evaluation without exception. TLAA issues identified for core spray components that are part of the reactor vessel internals have been evaluated for Fermi 2 in LRA Section 4.3.1.4.	K
BWRVIP-76-A Rev. 1, BWR Core Shroud Inspection and Flaw Evaluation Guidelines		Q
BWRVIP-76-A Rev. 1 (4)		
BWRVIP-76-A Rev. 1 (5)		
BWRVIP-76-A Rev. 1 (6)		
BWRVIP-76-A Rev. 1 (7)		
BWRVIP-76-A Rev. 1 (8)		